RSSI

6312 West Oakton Street
Morton Grove, IL 60053-2723
847-965-1999
Fax 847-965-1991

EPA Region 5 Records Ctr.
383779

June 7, 2001

U.S. Environmental Protection Agency
Debra Regel, Enforcement Specialist
Emergency Enforcement Support Section, SE-5J
77 West Jackson Boulevard
Chicago, IL 60604-3590

RE: REQUEST FOR INFORMATION REGARDING LINDSAY LIGHT BUILDING, 161 EAST GRAND AVENUE IN CHICAGO, IL

Dear Ms. Regel:

This letter is the response to your April 31, 2001 request for information concerning the 161 E. Grand Building. Documents believed to contain the answers to some of your questions are enclosed. Most of these documents are already in the hands of the U.S. EPA. To avoid redundancy, where I believe information is or may be contained in enclosed documents, I have referred you to the enclosed documents rather than reiterating what may be in them.

1. No persons were consulted in the preparation of these answers.

2. No documents were consulted, examined or referred to in the preparation of these answers. The answers are based upon my recollections of past activities.

3. To the best of my knowledge, the persons on the List of Parties enclosed to the request may have more detailed

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information than I have or are in the documents enclosed to this response.

4. The identity of these persons is contained in the enclosed documents.

5 Historical information is contained in enclosed documents.

6. The information in my possession is contained in the enclosed documents.

7. In 2000, material contained in the base of a chimney and brick from the base of the chimney was removed and disposed of at a waste site through ADCO, a radioactive waste broker. Detailed information regarding this activity and prior abatements are enclosed. Other information in my possession is contained in the enclosed documents.

8. The building management is believed to have served as project manager for most if not all removal activity. Other available information is in the enclosed documents.

9. The only known recent removal activity was the activity described in the answer to question 7. Available information regarding this activity and prior activities is in the enclosed documents.

10. Known available information is in the enclosed documents.

11. I do not know who Schmo LLC Brothers is. RSSI has consulted with Optimus on activities described in the enclosed documents. RSSI has consulted with Ronald Steele on activities described in the enclosed documents. RSSI has consulted with and calibrated instruments for and at Kerr-McGee Corporation. Kerr-McGee Corporation has supplied analysis software required by the U.S. EPA to RSSI. RSSI has served as a subcontractor to STS on a site believed to be developed by River East Chicago, L.L.C. Radiation Safety Services Inc. is the name under which RSSI was incorporated.

12. I have no detailed information regarding the condition of the 161 building other than what has contained in this letter and the enclosed documents.

13. In 2000, Ron Steele sought my advice regarding the removal of material at the base of a chimney. I recommended that ADCO

be used as a waste broker and served as a laision with ADCO to arrange for their services. I also recommended that reimbursement for disposal be sought from Kerr-McGee and served as a liaison for some communication with Kerr-McGee. Available information regarding prior dealings is contained in the enclosed documents.

14. In 2000, material contained in the base of a chimney was removed and disposed of. Available information about this action and other actions in the building is contained in enclosures to this letter and the response to other questions in this letter.

15. In mid 2000, the building arranged for removal of the contents of the base of the chimney and brick. RSSI recommended that reimbursement costs for disposal be sought from Kerr-McGee. RSSI recommended that disposal be through ADCO at a radioactive waste disposal site. RSSI served as a liaison with both firms. RSSI recommended that the enclosure and personal protective equipment practices used in asbestos abatement be used for this task. This task required one day.

RSSI performed air monitoring to demonstrate occupational exposure limits were met. RSSI performed an informal survey following the task to determine that radiation levels following removal did not exceed several times background. RSSI offered to perform a documented formal survey. RSSI discussed rebricking the chimney opening with the building representative. RSSI served as a liaison when the 4-5 55 gallon drums suspected to contain thorium series radionuclides in the removed material were picked up from the building by ADCO.

The drummed material was picked up by ADCO at a later date.

16. No.

17. To the best of my knowledge none other than those alleged in public documents have occurred.

RSSI

17. To the best of my knowledge none other than those alleged in public documents have occurred.

18. To the best of my knowledge, these persons have been identified in your request and in this letter and its enclosures.

19. To the best of my knowledge available documents are contained in the enclosure to this letter.

20. To the best of my knowledge described acts are contained in enclosures to this letter or are believe to be in public documents which I do not have.

Sincerely,

Eli A. Port

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

Enclosures

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

APR 30 2001

REPLY TO THE ATTENTION OF
Lindsay Light I

PROMPT REPLY NECESSARY
CERTIFIED MAIL: RETURN RECEIPT REQUESTED

Radiation Safety Services, Inc.
c/o Mr. Eli Port
6312 Oakton Street
Morton Grove, IL 60053

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

Dear Sir or Madam:

As you may be aware, the United States Environmental Protection Agency ("U.S. EPA") is investigating the management and disposal of radioactive material associated with the Lindsay Light Company thorium mantle manufacturing, warehousing, and office facilities formerly located at 161 East Grand Avenue ("161 Building"). This letter seeks your assistance in gathering information and documents relating to the operations and activities conducted at the 161 Building by Charles Lindsay, Lindsay Light Company, Lindsay Light & Chemical Company, and Lindsay Chemical Company ("Lindsay Light") that may aid U.S. EPA's investigation. U.S. EPA is seeking information about Lindsay Light's operations at this location and also post-Lindsay Light construction, renovation, maintenance and radiation abatement activities at this location.

U.S. EPA is investigating the release or threat of release of radioactive hazardous substances, pollutants, or contaminants at, to, or from the 161 Building. U.S. EPA is seeking to obtain information concerning the generation, storage, treatment, transportation, and methods used to dispose of such substances that have been, or threaten to be, released from the 161 Building. U.S. EPA believes that you might have information which may assist the Agency in its investigation of the 161 Building.

We encourage you to give this matter your immediate attention and request that you provide a complete and truthful response to this

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Information Request and attached questions (Attachment B) within twenty (20) business days of your receipt of this letter.

Description of Legal Authority

The federal "Superfund" law (the Comprehensive Environmental Response, Compensation, and Liability Act, 42 U.S.C. §9601, et seq., commonly referred to as "CERCLA" and "Superfund") gives U.S. EPA the authority to, among other things: (1) assess contaminated sites, (2) determine the threats to human health and the environment posed by each site, and (3) clean up those sites in the order of the relative threats posed by each.

Information Request

Under Section 104(e)(2) of CERCLA, 42 U.S.C. §9604(e)(2), U.S. EPA has broad information gathering authority which allows U.S. EPA to require persons to furnish information or documents relating to:

(A) The identification, nature, and quantity of materials which have been or are generated, treated, stored, or disposed of at a vessel or facility or transported to a vessel or facility.

(B) The nature or extent of a release or threatened release of a hazardous substance or pollutant or contaminant at or from a vessel or facility.

(C) Information relating to the ability of a person to pay for or to perform a cleanup.

While U.S. EPA seeks your cooperation in this investigation, compliance with the Information Request is required by law. Please note that false, fictitious, or fraudulent statements or representations may subject you to civil or criminal penalties under federal law.

Some of the information U.S. EPA is requesting may be considered by you to be confidential. Please be aware that you may not withhold the information upon that basis. If you wish U.S. EPA to treat the information confidentially, you must advise U.S. EPA of that fact by following the procedures outlined in Attachment A, including the requirement for supporting your claim for confidentiality.

If you have information about other parties who may have information which may assist the Agency in its investigation of the Site or may be responsible for the radioactive contamination at the Site, that information should be submitted within the time frame noted above.

This Information Request is not subject to the approval requirements of the Paperwork Reduction Act of 1995, 44 U.S.C. §3501 et seq.

Instructions on how to respond to the questions in Attachment B to this document are described in Attachment A. Your response to this Information Request should be mailed to:

U.S. Environmental Protection Agency
Debra Regel, Enforcement Specialist
Emergency Enforcement Support Section, SE-5J
77 West Jackson Boulevard
Chicago, Illinois 60604-3590

If you have additional questions about the history of the Site, the nature of the environmental conditions at the Site, or the status of cleanup activities, please contact either Verneta Simon at (312) 886-3601 or Fredrick Micke at (312) 886-5123. However, if you have specific questions about the Information Request, please contact Debra Regel at (312) 353-7632.

We appreciate and look forward to your prompt response to this Information Request.

Sincerely,

Richard C. Karl, Chief
Emergency Response Branch

Enclosures

CC: Mort P. Ames, Esq.
City of Chicago
Department of Law
30 North LaSalle Street, Room 900
Chicago, IL 60602-2580

Attachment A
Information Request Instructions and Definitions

Instructions

1. Answer Every Question Completely. A separate response must be made to each of the questions set forth in this Information Request. For each question contained in this letter, if information responsive to this Information Request is not in your possession, custody, or control, please identify the person(s) from whom such information may be obtained.

2. Number Each Answer. Precede each answer with the corresponding number of the question and the subpart to which it responds.

3. Provide the Best Information Available. Provide responses to the best of Respondent's ability, even if the information sought was never put down in writing or if the written documents are no longer available. You should seek out responsive information from current and former employees/agents. Submission of cursory responses when other responsive information is available to the Respondent will be considered non-compliance with this Information Request.

4. Identify Sources of Answer. For each question, identify (see Definitions) all the persons and documents that you relied on in producing your answer.

5. Continuing Obligation to Provide/Correct Information. If additional information or documents responsive to this Request become known or available to you after you respond to this Request, U.S. EPA hereby requests pursuant to Section 104(e) of CERCLA that you supplement your response to U.S. EPA. If you have previously submitted responsive information to U.S. EPA you do not need to re-submit the information; however, please identify the previous information.

6. Confidential Information. The information requested herein must be provided even though you may contend that it includes confidential information or trade secrets. You may assert a confidentiality claim covering part or all of the information requested, pursuant to Sections 104(e)(7)(E) and (F) of CERCLA, 42.U.S.C. §§9604(e)(7)(E) and (F), and Section 3007(b) of the Resource Conservation and Recovery Act ("RCRA"), 42 U.S.C. §6927(b), and 40 C.F.R. §2.203(b).

If you make a claim of confidentiality for any of the information you submit to U.S. EPA, you must prove that claim. For each document or response you claim confidential, you must separately address the following points:

1. the portions of the information alleged to be entitled to confidential treatment;

2. the period of time for which confidential treatment is desired (e.g., until a certain date, until the occurrence of a specific event, or permanently);

3. measures taken by you to guard against the undesired disclosure of the information to others;

4. the extent to which the information has been disclosed to others; and the precautions taken in connection therewith;

5. pertinent confidentiality determinations, if any, by U.S. EPA or other federal agencies, and a copy of any such determinations or reference to them, if available; and

6. whether you assert that disclosure of the information would likely result in substantial harmful effects on your business' competitive position, and if so, what those harmful effects would be, why they should be viewed as substantial, and an explanation of the causal relationship between disclosure and such harmful effects.

To make a confidentiality claim, please stamp or type "confidential" on all confidential responses and any related confidential documents. Confidential portions of otherwise non-confidential documents should be clearly identified. You should indicate a date, if any, after which the information need no longer be treated as confidential. Please submit your response so that all non-confidential information, including any redacted versions of documents, is in one envelope and all materials for which you desire confidential treatment are in another envelope.

All confidentiality claims are subject to U.S. EPA verification. It is important that you satisfactorily show that you have taken reasonable measures to protect the confidentiality of the information and that you intend to continue to do so, and that it is not and has not been obtainable by legitimate means without your consent. Information covered by such claim will be disclosed by U.S. EPA only to the extent permitted by Section 104(e) of CERCLA. If no such claim accompanies the information when it is received by U.S. EPA, then it may be made available to the public by U.S. EPA without further notice to you.

7. Disclosure to U.S. EPA Contractor. Information which you submit in response to this Information Request may be disclosed by U.S. EPA to authorized representatives of the United States, pursuant to 40 C.F.R. §2.310(h), even if you assert that all or part of it is confidential business information. Please be advised that U.S. EPA may disclose all responses to this

Information Request to one or more of its private contractors for the purpose of organizing and/or analyzing the information contained in the responses to this Information Request. If you are submitting information which you assert is entitled to treatment as confidential business information, you may comment on this intended disclosure within ten (10) business days of receiving this Information Request.

8. Personal Privacy Information. Personnel and medical files, and similar files, the disclosure of which to the general public may constitute an invasion of privacy, should be segregated from your responses, included on separate sheet(s), and marked as "Personal Privacy Information."

9. Objections to Questions. If you have objections to some or all the questions within the Information Request letter, you are still required to respond to each of the questions.

Definitions

The following definitions shall apply to the following words as they may appear in this Information Request.

1. The term "**arrangement**" means every separate contract or other agreement between two or more persons, whether written or oral.

2. The term "**documents**" includes any written, recorded, computer-generated, or visually or aurally reproduced material of any kind in any medium in your possession, custody, or control, or known by you to exist, including originals, all prior drafts, and all non-identical copies.

3. The term "**hazardous substance**" shall have the same definition as that contained in Section 101(14) of CERCLA, and includes any mixtures of such hazardous substances with any other substances, including mixtures of hazardous substances with petroleum products or other nonhazardous substances. In particular, relative to this Site and to this Information Request, "radioactive hazardous substance" shall mean, but not exclusively, radioactive rare earths, and radioactive thorium and all its associated decay products in the Thorium (Th-232) Decay Series, radioactive uranium and all associated decay products in both the Uranium (U-238) Decay Series and the Actinium (U-235) Decay Series and all its associated decay products, and hazardous chemicals associated with these radioactive materials as a result of processing or manufacturing actions.

4. The term "**identify**" means, with respect to a natural person, to set forth: (a) the person's full name; (b) present or last known business and home addresses and telephone numbers; (c)

present or last known employer (include full name and address) with title, position or business.

5. With respect to a corporation, partnership, or other business entity (including a sole proprietorship), the term "**identify**" means to provide its full name, address, and affiliation with the individual and/or company to whom/which this request is addressed.

6. The term "**material**" or "**materials**" shall mean any and all objects, goods, substances, or matter of any kind, including but not limited to wastes.

7. The term "**person**" shall include any individual, firm, unincorporated association, partnership, corporation, trust, or other entity.

8. The term "**pollutant or contaminant**" shall include, but not be limited to, any element, substance, compound, or mixture, including disease-causing agents, which after release into the environment will or may reasonably be anticipated to cause death, disease, behavioral abnormalities, cancer, genetic mutation, physiological malfunctions (including malfunctions in reproduction) or physical deformations; except that the term "pollutant or contaminant" shall not include petroleum. In particular, relative to this Site and to this Information Request, "pollutant or contaminant" shall mean, but not exclusively, radioactive rare earths, and radioactive thorium and all its associated decay products in the Thorium (Th-232) Decay Series, and radioactive uranium and all associated decay products in both the Uranium (U-238) Decay Series and the Actinium (U-235) Decay Series, and all its associated decay products.

9. The term "**real estate**" shall mean and include, but not be limited to the following: land, buildings, a house, dwelling place, condominium, cooperative apartment, office or commercial building, including those located outside the United States.

10. The term "**release**" shall mean any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment, including the abandonment or discharging of barrels, containers, and other closed receptacles containing any hazardous substance or pollutant or contaminant.

11. The term "**161 Building**" shall mean the Lindsay Light Building located at 161 East Grand Avenue, Chicago, Illinois, and in particular includes the inside and outside of the building itself and its physical property.

12. The term "**waste**" or "**wastes**" shall mean and include trash, garbage, refuse, by-products, solid waste, hazardous waste, hazardous substances, and pollutants or contaminants, whether solid, liquid, or sludge, including but not limited to containers for temporary or permanent holding of such wastes, and also by-products as specified in the Atomic Energy Act.

13. The term "**you**" or "**Respondent**" shall mean yourself. The term "you" also includes any officer, managers, employees, contractors, trustees, successors, assigns, and agents of or for the 161 Building.

Attachment B
Requests

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

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.

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.

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.

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

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.

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.

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.

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 Plans, 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.

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.

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.

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.

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.

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.

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 radionuclide and by total weight or volume of material involved.

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 investigations;

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

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

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 1900 to the present. In addition, identify:

a) When such releases occurred;

b) How the releases occurred;

c) The amount of each radioactive hazardous substance, pollutant, or contaminant so released, and the amount of waste by activity of each radionuclide 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

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

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

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.

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.

LINDSAY LIGHT I SITE
161 EAST GRAND AVENUE, CHICAGO, IL
LIST OF PARTIES RECEIVING REQUEST FOR INFORMATION LETTER

Schmo Brothers LLC
c/o Richard Hickey, Esq.
Hickey, Driscoll
77 West Washington Street
Suite 800
Chicago, IL 60602

Optimus
c/o Mr. Tom Duff, President
c/o Joseph Madonia, Esq.
Wildman, Harrold, Allen & Dixon
225 West Wacker Drive
Chicago, IL 60606

Mr. Ronald Steele
1025 North Jackson Avenue
River Forest, IL 60305

Kerr-McGee Corporation
c/o John T. Smith II, Esq.
Covington & Burling
1201 Pennsylvania Avenue NW
Washington, DC 20004-2401

River East Chicago L.L.C.
c/o Vincent S. Oleszkiewicz, Esq.
Baker & McKenzie
One Prudential Plaza
130 East Randolph Street
Chicago, IL 60601

Radiation Safety Services, Inc.
c/o Mr. Eli Port
6312 Oakton Street
Morton Grove, IL 60053

ADCO Services, Inc.
17650 Duvan Drive
Tinley Park, IL 60477

FAX TRANSMISSION

MARY L. FULGHUM
OFFICE OF REGIONAL COUNSEL
U.S. EPA REGION 5 C-14J
77 W. Jackson Blvd.
Chicago, Illinois 60604
(312) 886-4683
Fax (312) 886-0747

To: J.T. Smith Km ext
Tom Goresen Km int
Chris Zibart Km ext local
Mark Krippel 630 - 293 - 6331
Mort Ames w/o enc
Joe Madonia w/o enc
Rich Hickey w/o enc

Date: May 1, 2001

Fax #: 202-778-5555
405- 270-4101
312- 558-6538
630-231-3990
312-744-6798
312-201-2555
312-422-9410

Pages: 26 including this cover sheet.

From: Mary L. Fulghum

Subject: 161 E. Grand Chicago IL

COMMENTS:

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

VIA FAX AND EXPRESS MAIL

REPLY TO THE ATTENTION OF

May 1, 2001

John T. Smith II, Esq.
Covington & Burling
1201 Pennsylvania Av NW
Washington, D.C. 20004-2401

Re: Lindsay Light Building, 161 E. Grand, Chicago, Illinois

Dear Mr. Smith:

Recently, the City of Chicago and U.S. EPA conducted a radiological survey of the former Lindsay Light Building at 161 E. Grand, Chicago, Illinois. The survey results show that the thorium-contaminated ash and dust have spread from the chimney. It is U.S. EPA's understanding that the chimney was partially removed and left open with the Kerr-Gee Chemical L.L.C.'s knowledge and assent. The results also indicate that the open chimney is the likely source of elevated levels of radon 220 also known as thoron. These levels appear to significantly exceed Nuclear Regulatory Commission regulations regarding exposure to radon 220, with daughters present, at 10 CFR 20, Appendix B, Table 1, Col. 3 and at Appendix B, Table 2, Col.1. To their credit, the new owners of the building immediately cordoned off this area of the basement upon the discovery of the problem.

In addition to the chimney area, gamma levels as high as 800,000 counts per minute (FIDLER) against a background of 7,000 cpm and 130 micro rem per hour. Of particular concern is the area around the receptionist's desk where readings of 50 micro rem per hour were obtained.

As the corporate successor to Lindsay Light and Chemical Company, the former owner and operator of the thorium mantle manufacturing facility at 161 E. Grand, U.S. EPA would like to meet with you and the current building owner, at your earliest availability, to discuss temporary measures to safeguard the building occupants and long-term plans to further examine the condition of the building and determine the appropriate manner of managing the contaminated material.

I have enclosed the field notes from the March 24 gamma walkover survey conducted by U.S. EPA (Verneta Simon, OSC, Fred Micke OSC, and Larry Jensen, HP) and Chicago Department of Environment staff (Don Smith), the results of the March 24 through March 31 radon monitoring, and the March 27 smear tests and bootie sampling (Fred Micke and Larry

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Jensen). U.S. EPA is preparing a report containing this surveillance and monitoring data which will be presented to Kerr-McGee following the Chicago Department of Environment's review and approval.

Over the past decade, at other Lindsay Light sites in the Streeterville neighborhood and in the City of West Chicago and DuPage County, Kerr-McGee has publicly supported safety and environmental responsibility, I hope that Kerr-McGee will take a proactive approach to the safety and environmental issues remaining at the former Lindsay Light manufacturing facility in Chicago as well. Please call me as soon as you have had the opportunity to review this information and we can set up a meeting with the new owners of the Lindsay Light Building and the City of Chicago to take steps to immediately abate any threat to health and the environment.

Sincerely,

Mary L. Fulghum
Associate Regional Counsel

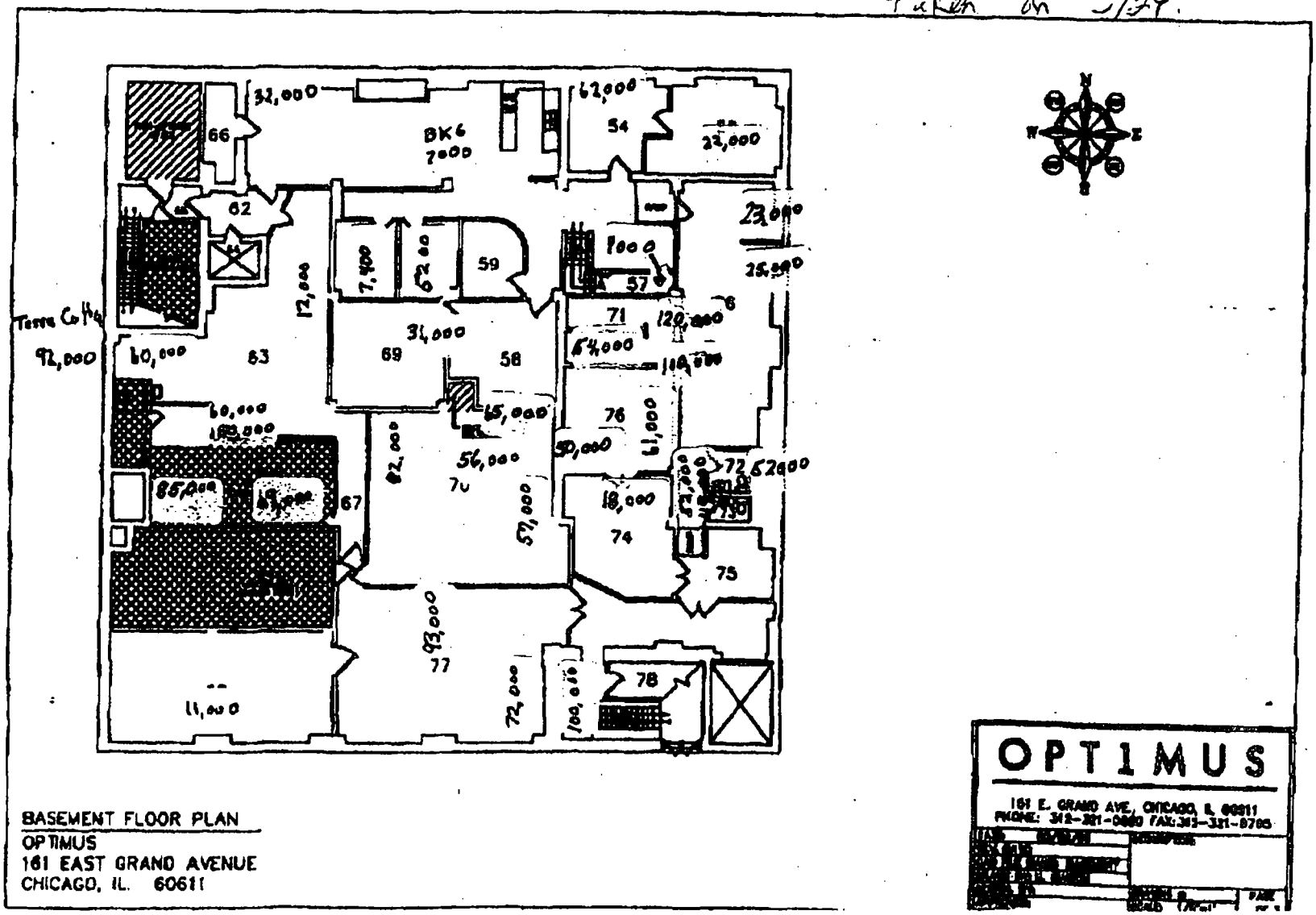
enclosures

cc: Thomas P. Goresen, Kerr-McGee Chemical LLC w/encl.
Christopher W. Zibart, Foley & Lardner w/encl.
Mark Krippel, Kerr McGee w/encl.
Mort Ames, City of Chicago Counsel
Joseph Madonia, Wildman, Harrold
Richard Hickey, Hickey, Driscoll
Cathleen Martwick, U.S. EPA

Appendix 1

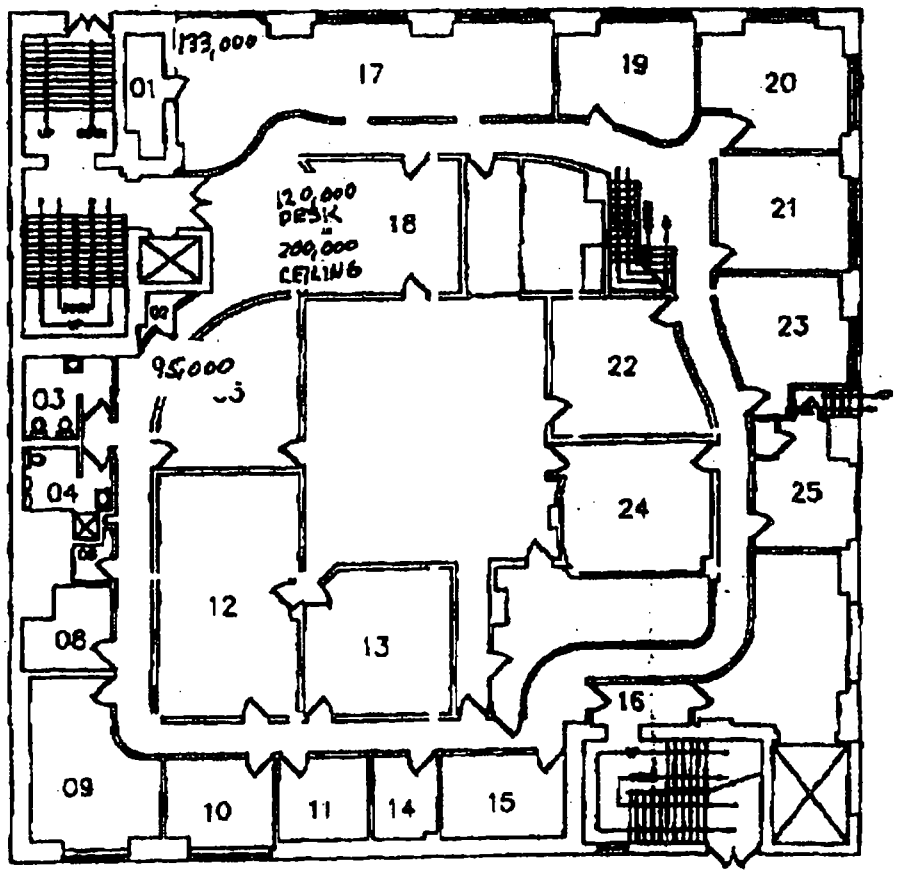
FIDLER MEASUREMENTS BY FLOOR

FIDLER Measurements
(counts per minute, cpm)
(on contact)
taken on 5/24.



BASEMENT FLOOR PLAN
OPTIMUS
161 EAST GRAND AVENUE
CHICAGO, IL. 60611

FIDLER Measurements
(counts per minute, cpm)
(on contact
taken on 3/24

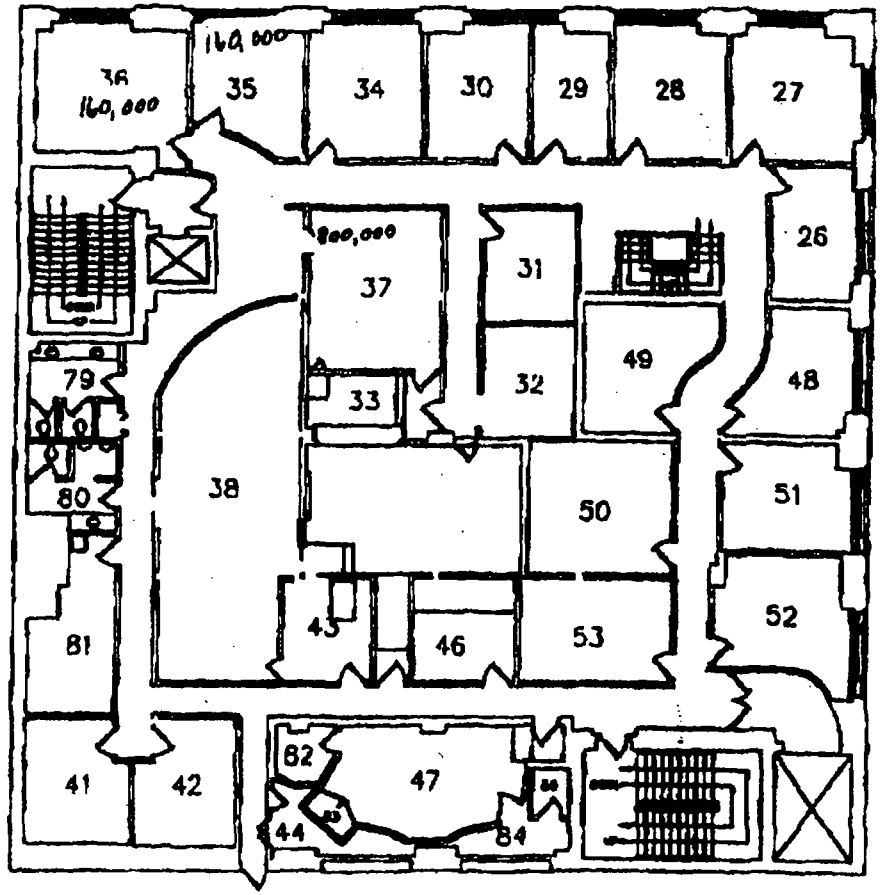


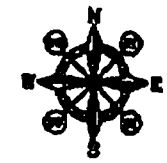
1st FLOOR PLAN

OPTIMUS
161 EAST GRAND AVENUE
CHICAGO, IL. 60611

OPTIMUS
161 E. GRAND AVE., CHICAGO, IL 60611
PHONE: 312-321-6880 FAX: 312-321-6766

FIDLER Measurements
(counts per minute, cpm)
(on contact)
Taken on 3/24





2nd FLOOR PLAN

OPTIMUS
161 EAST GRAND AVENUE
CHICAGO, IL 60611

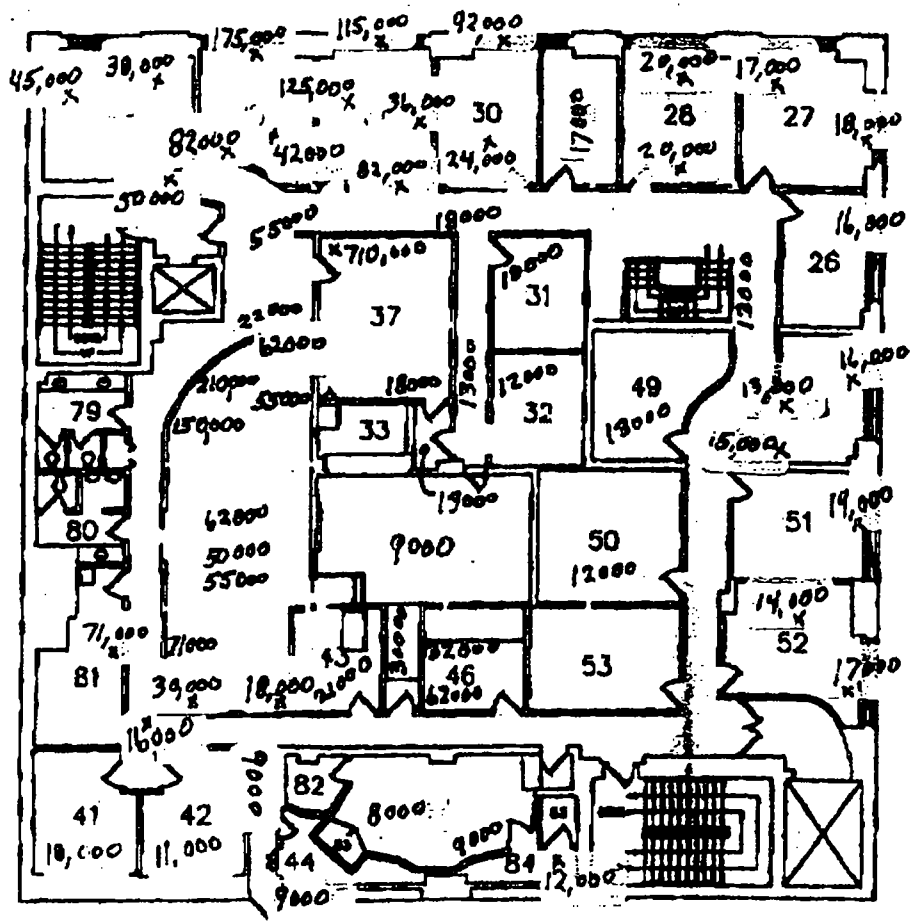
OPTIMUS
161 E. GRAND AVE., CHICAGO, IL 60611
PHONE: 312-321-0880 FAX: 312-321-9765

Appendix 2

SODIUM IODIDE 2 X 2 MEASUREMENTS

Sodium Iodide 2x2
((ounts per minute) cpm)
(on contact)

taken on 3/24

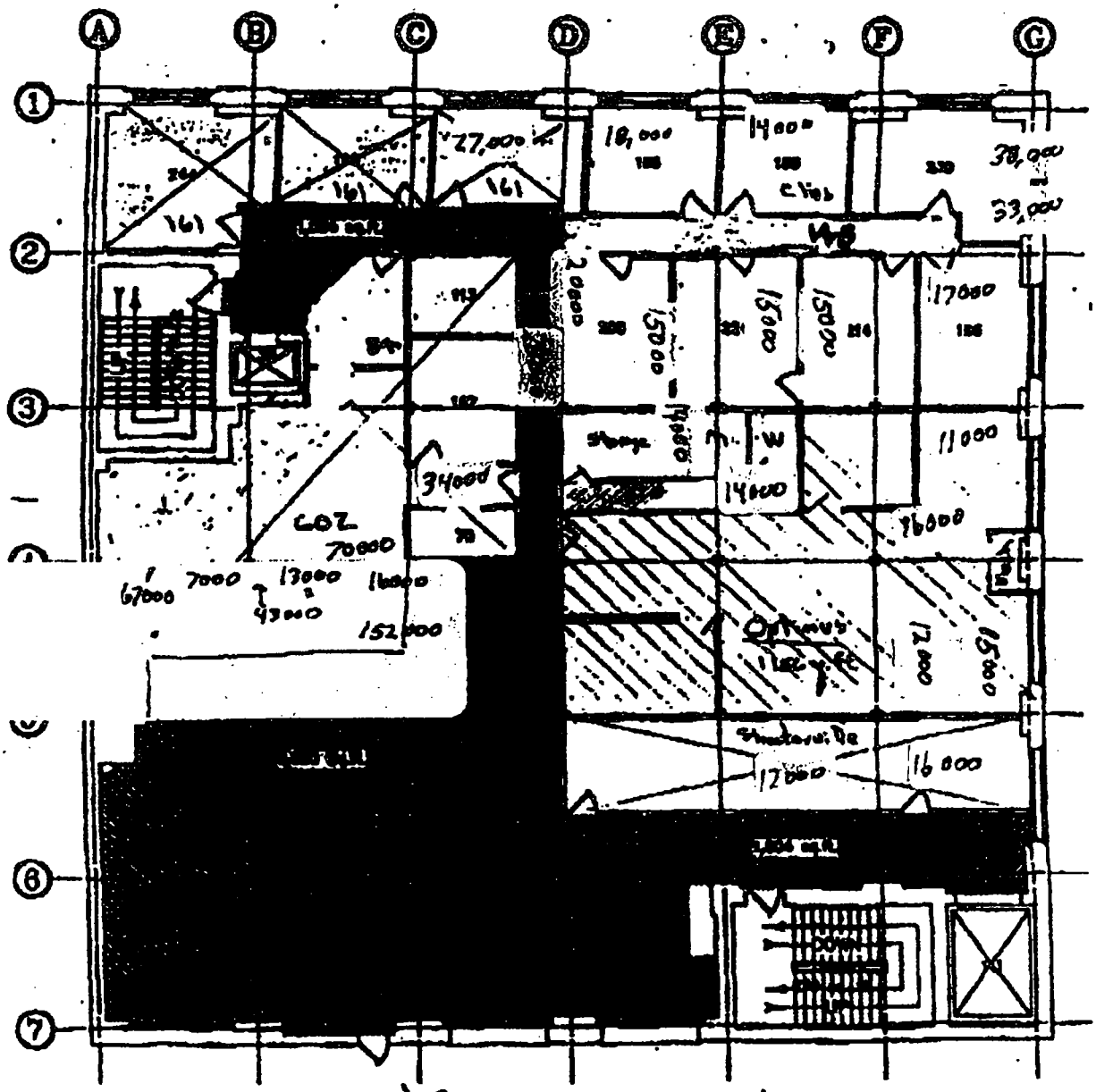


2nd FLOOR PLAN

OPTIMUS
161 EAST GRAND AVENUE
CHICAGO, IL. 60611

OPTIMUS
161 E. GRAND AVE., CHICAGO, IL 60611
PHONE: 312-321-0660 FAX: 312-321-9785

Sodium Iodide 2x2
Measurements
(counts per minute, cpm)
(on contact) Taken on 3/24

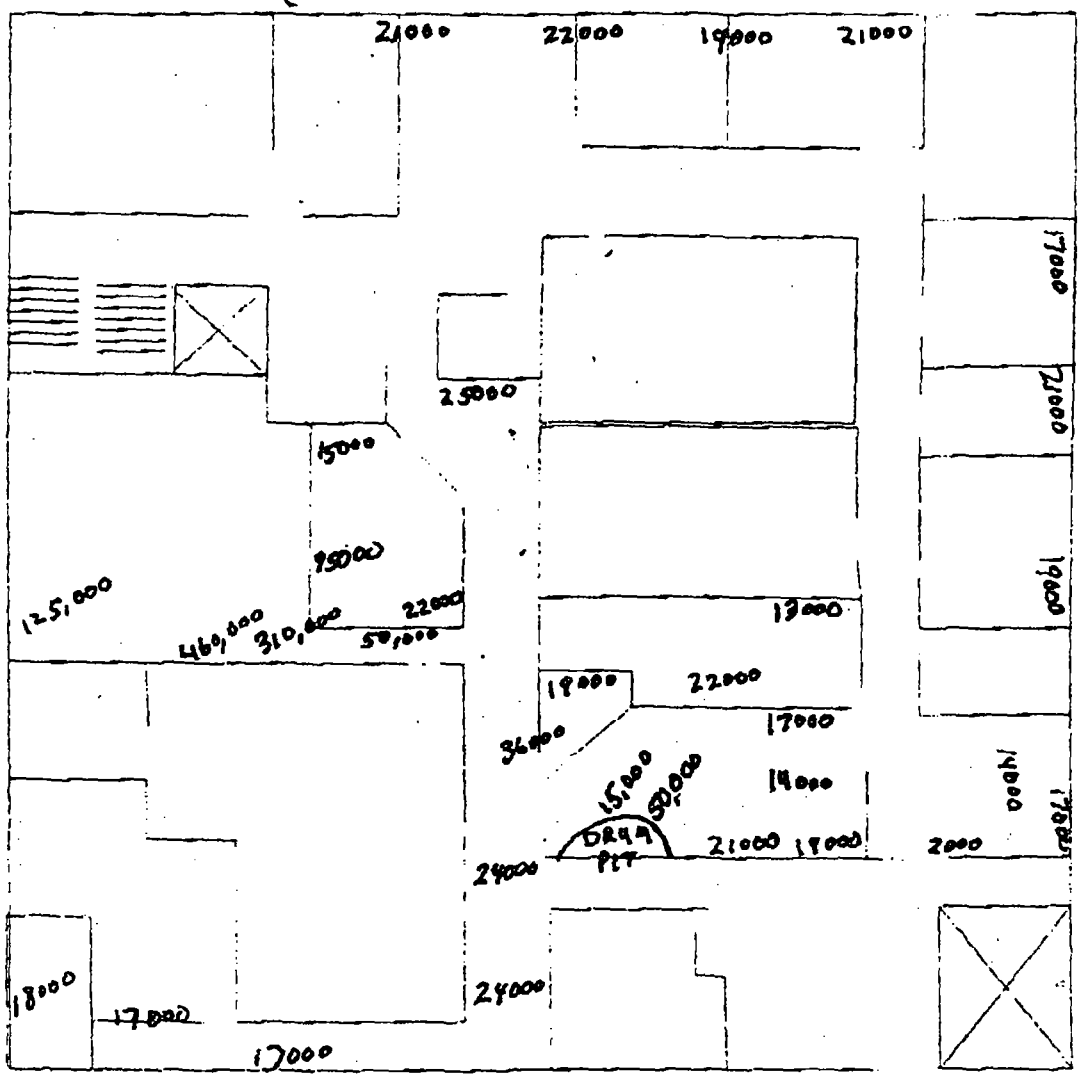


3rd Floor - 161 E. Grand Building

SCALE 1/16" = 1'-0"

Sodium Iodide 2x2
Measurements
(Counts per minute, cpm)
(on contact)

taken on 3/24



Floor Contact readings (unless indicated differently)

Readings include the correction factor

The instrument reads higher by a factor of 2.

LEGEND

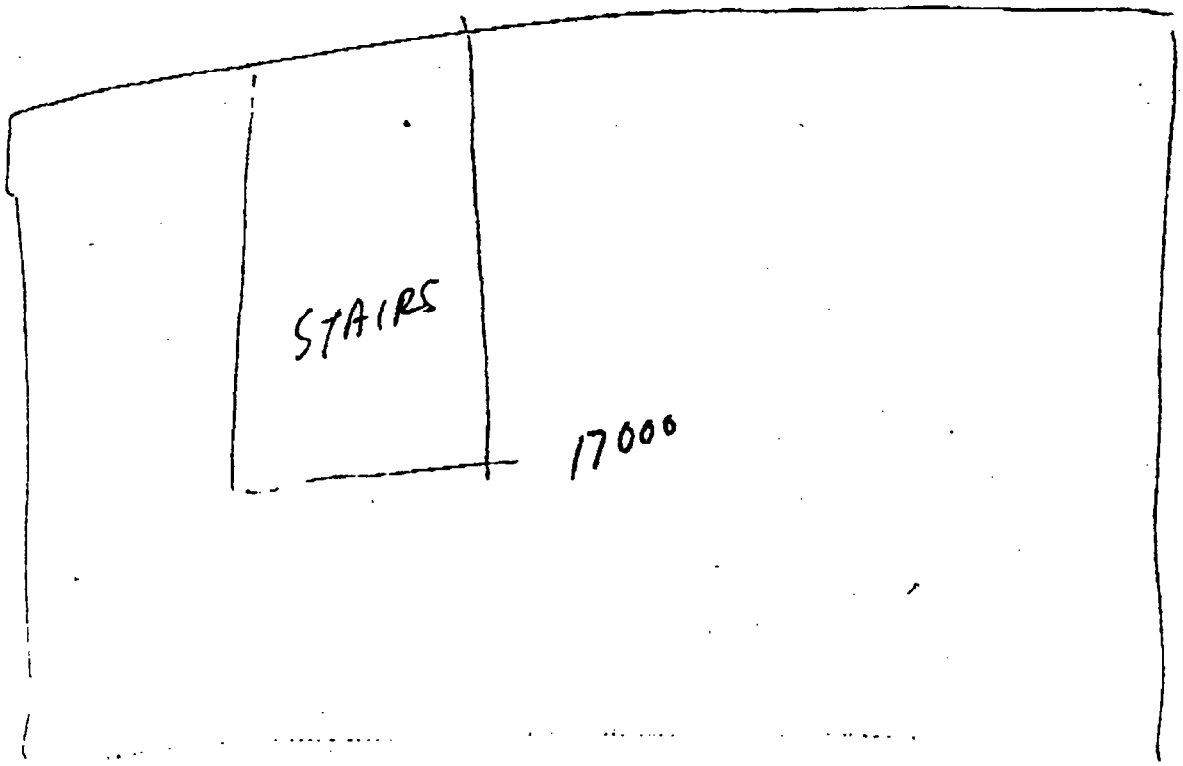
N

ecology and environment, inc.
Technical Assistance Team
Region V

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

Sodium Iodide 2x2
Measurements
(counts per minute, cpm)
(on contact)

taken on 3/24



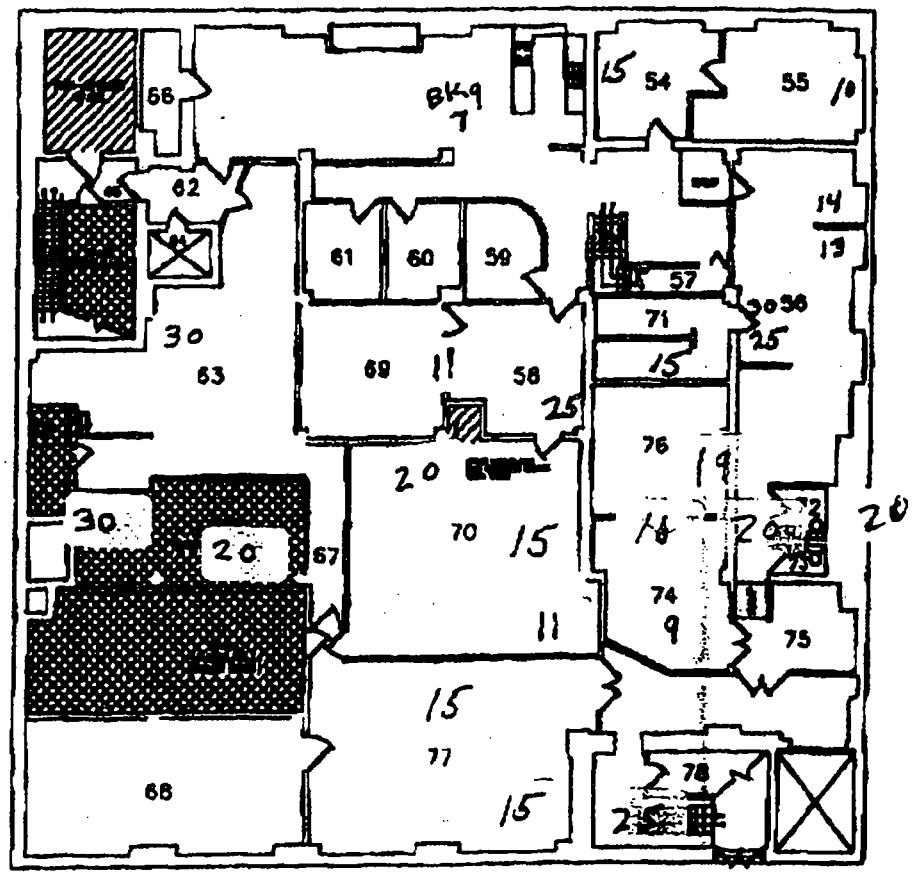
5TH Floor

Appendix 3

MICRO REM METER MEASUREMENTS

Bicron micro rem meter
(micro rem per hour, μrem/hr)
(1 meter off floor)

taken on 3/24

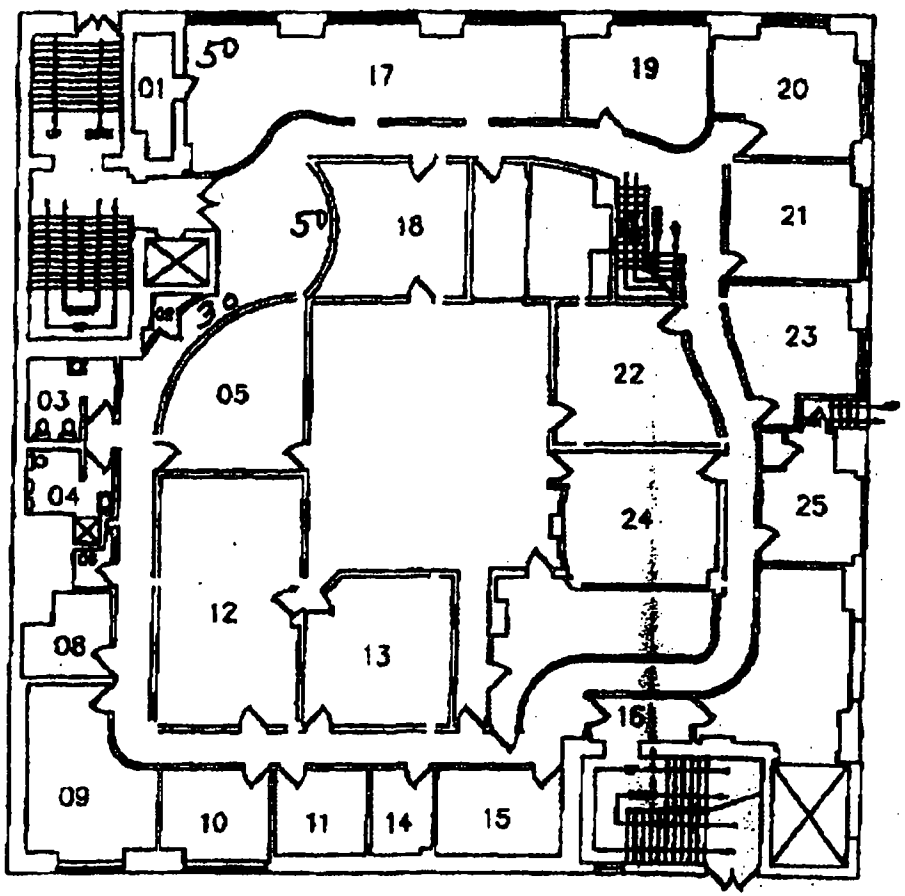


BASEMENT FLOOR PLAN
OPTIMUS
161 EAST GRAND AVENUE
CHICAGO, IL. 60611

OPTIMUS
161 E. GRAND AVE., CHICAGO, IL 60611
PHONE: 312-321-0880 FAX:312-321-8769

Bicron micro rem meter
(microrem per hour, μrem/hr)
(1 meter off floor)

taken on 3/24



1st FLOOR PLAN

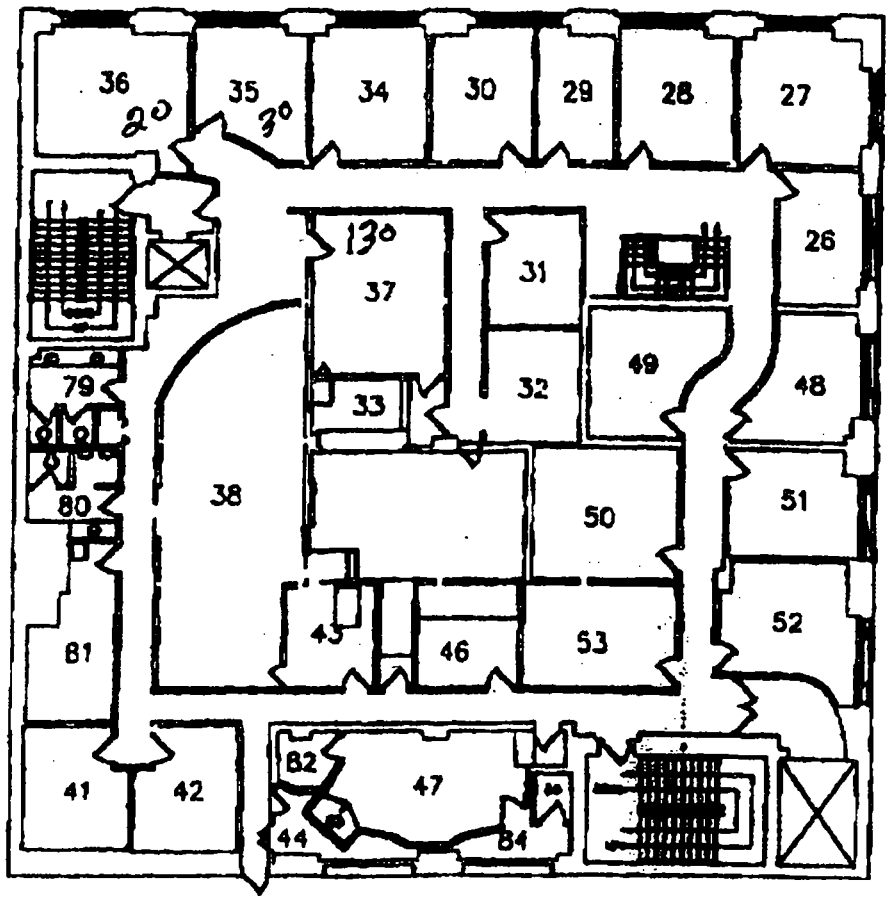
OPTIMUS
161 EAST GRAND AVENUE
CHICAGO, IL. 60611

OPTIMUS

161 E. GRAND AVE, CHICAGO, IL 60611
PHONE: 312-321-0660 FAX:312-321-9716

Bicron micro rem meter
(micro rem per hour, μrem/hr)
(1 meter of floor)

taken on 3/24

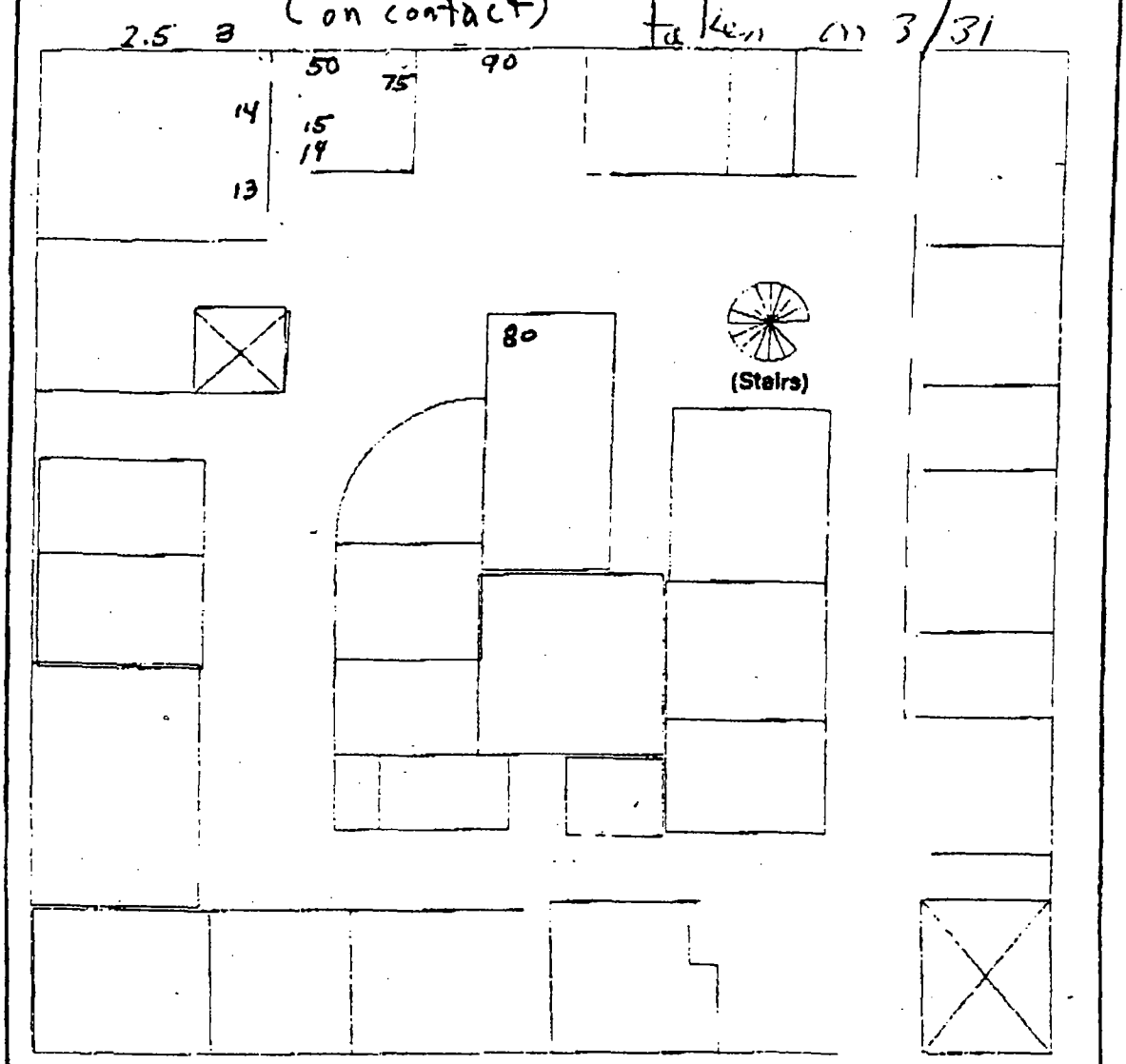


2nd FLOOR PLAN

OPTIMUS
161 EAST GRAND AVENUE
CHICAGO, IL 60611

OPTIMUS
161 E. GRAND AVE., CHICAGO, IL 60611
PHONE: 312-321-9760 FAX: 312-321-9765

Ludlum micro-R meter
(micro roentgen per hour, μR/hr)
(on contact)



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

N

ecology and environment, inc.
Technical Assistance Team
Region V

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

Appendix 4

MICRO R METER MEASUREMENTS

Appendix 5

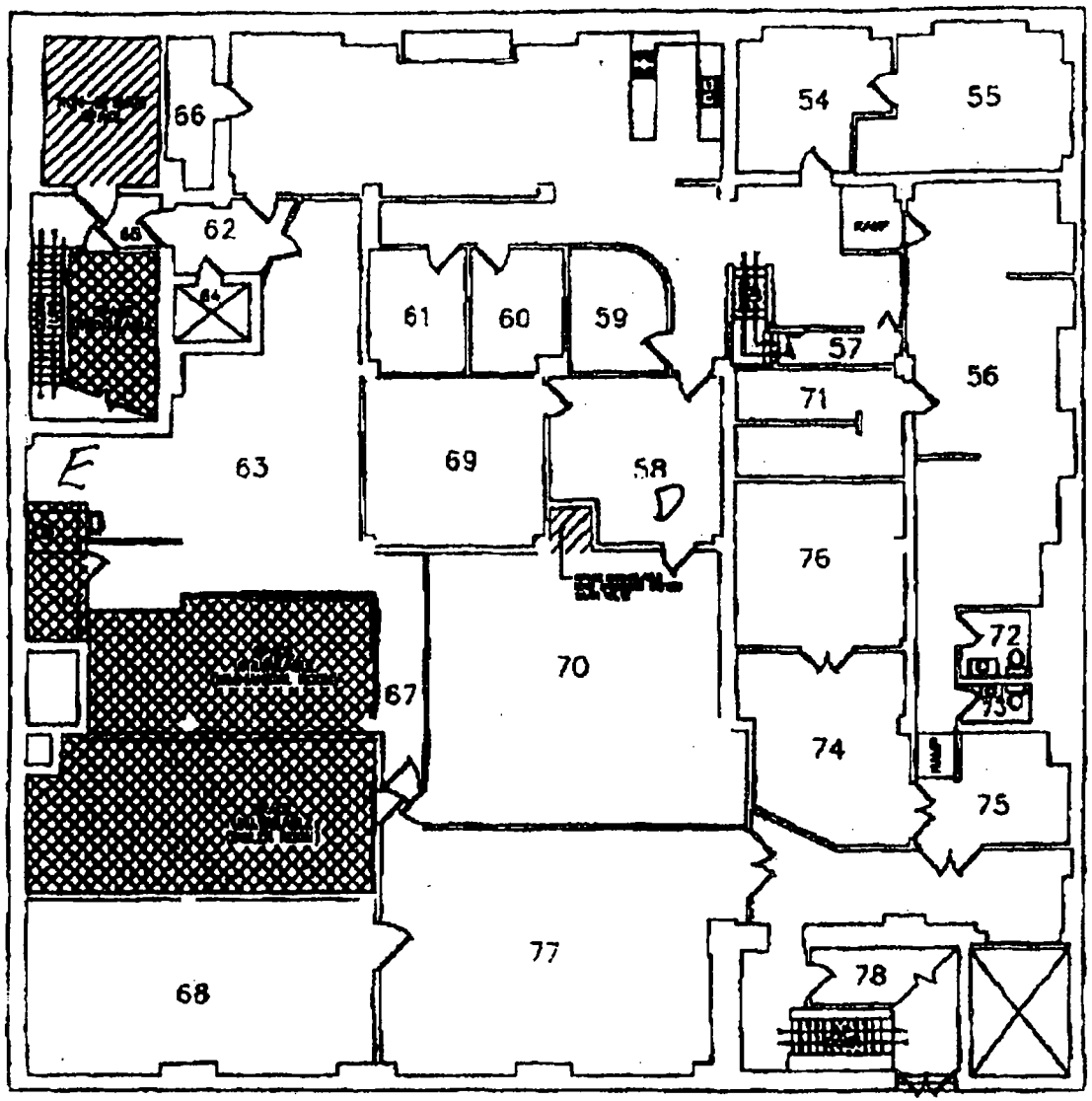
RADON AND THORON MEASUREMENTS (GAS AND DECAY PRODUCTS)

Concentrations of radon-220 gas, radon-220 decay products, radon-222, and radon-222 decay products

Area	Description	Radon-220 gas (pCi/L)	Radon-220 decay products (WL)	Radon-222 gas (pCi/L)	Radon-222 decay products (WL)	Radon/Thoron Rule of Ratios
E	Basement Chimney	89.5	0.361	0.0	0.000	18
D	Basement PC Workstation	2.0	0.008	0.9	0.004	0.6
F	1st Floor Reception	4.9	0.020	-0.7	-0.003	1.0
B	2nd Floor Room 35	#	#	#	#	#
A	2nd Floor Room 36	2.8	0.011	1.3	0.005	0.8
C	2nd Floor Room 37	0.6	0.002	0.3	0.001	0.2
I	3rd Floor Room 84	4.8	0.019	-1.1	-0.004	1.0
G	4th Floor Sound Mixing Room	2.0	0.008	0.5	0.002	0.5
H	5th Floor Ledge over couch	3.6	0.015	0.7	0.003	0.9

- data lost when electret accidently discharged

Negative concentrations treated as zero



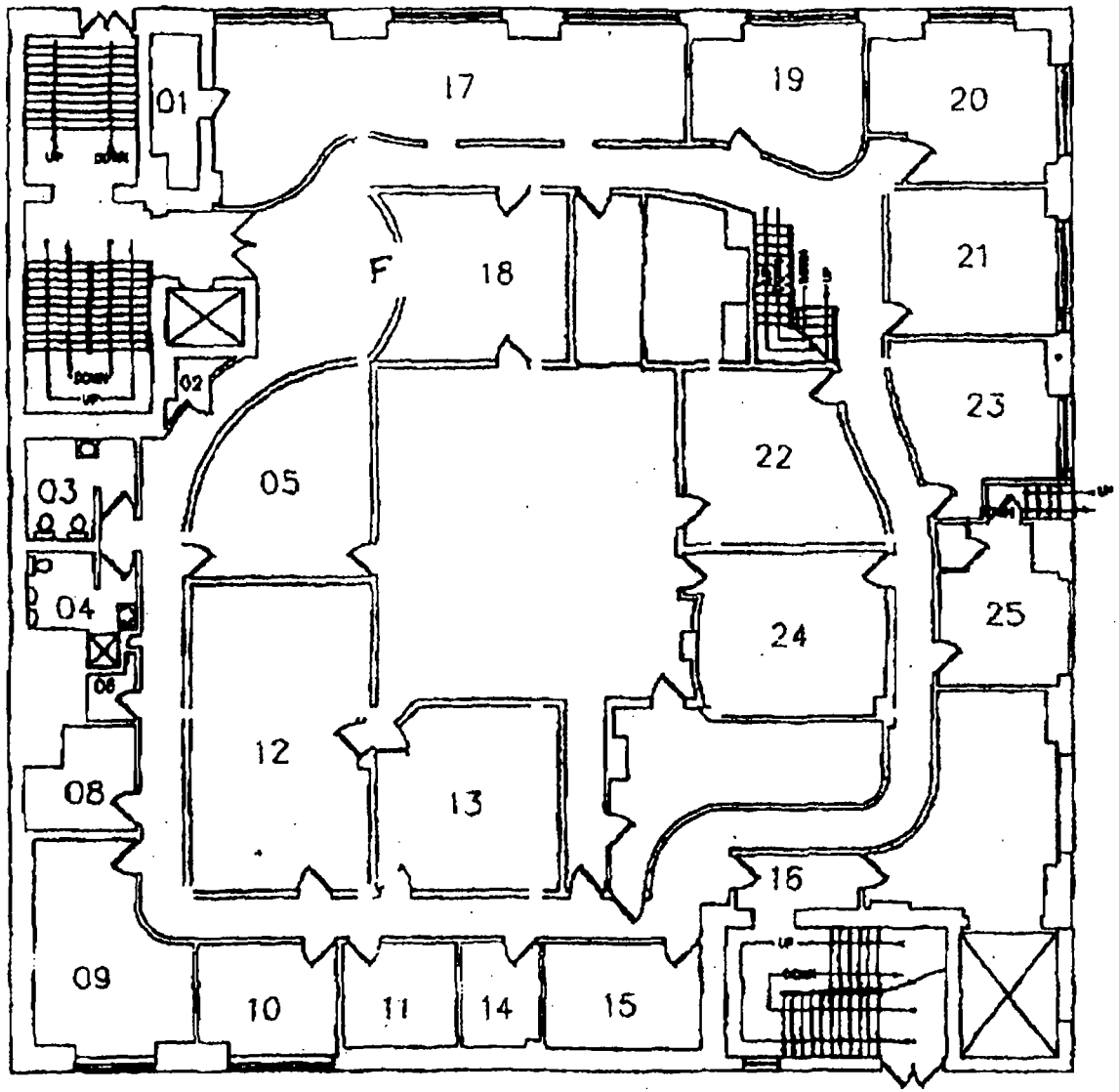
BASEMENT FLOOR PLAN
OPTIMUS
161 EAST GRAND AVENUE
CHICAGO, IL. 60611

E-perms
Monitoring locations

OP

161 E. GRA
PHONE: 312-3

DATE: 00/00/0
REV. DATE:
CAD FILE NAME: BAS
DRAWN BY: M. BARC
DESIGN. BY:
APPROVED:



1st FLOOR PLAN

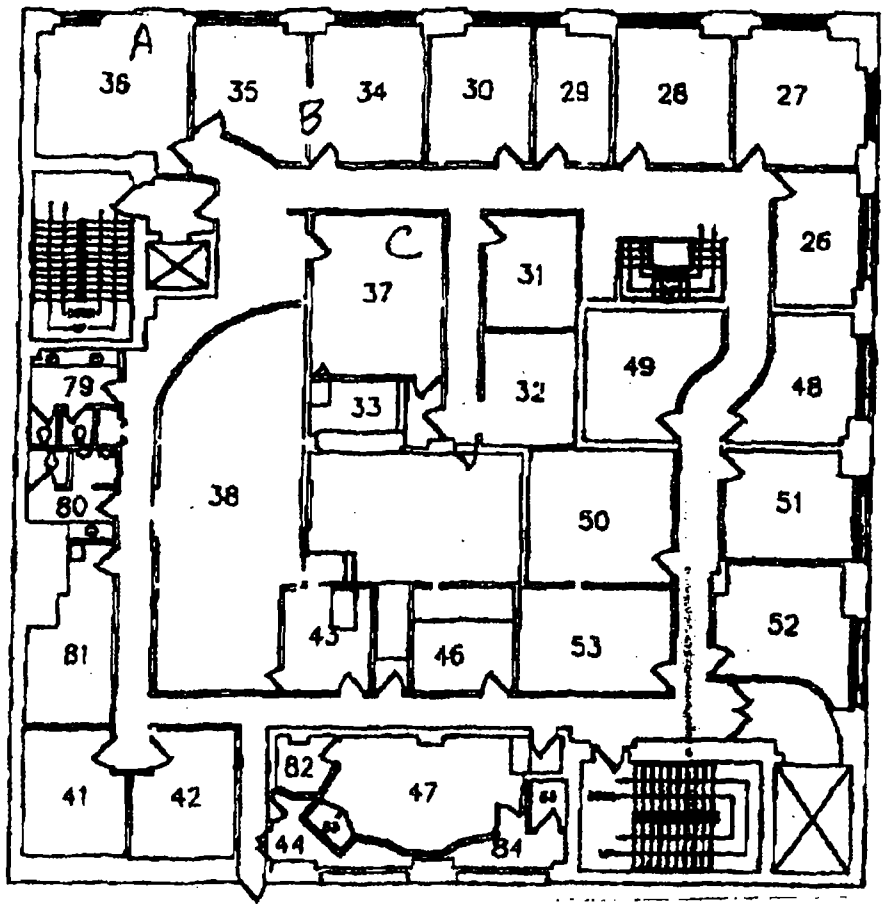
OPTIMUS
161 EAST GRAND AVENUE
CHICAGO, IL. 60611

E-parms
Monitoring locations

OPT1

161 E. GRAND AVE, CHI
PHONE: 312-321-0880 FA

DATE: 00/00/00	DESCRI
REV. DATE:	
CAD FILE NAME: 1TURPLN	
DRAWN BY: M. BABICH	
DESIGN BY:	DRAWN
APPROVED:	



2nd FLOOR PLAN

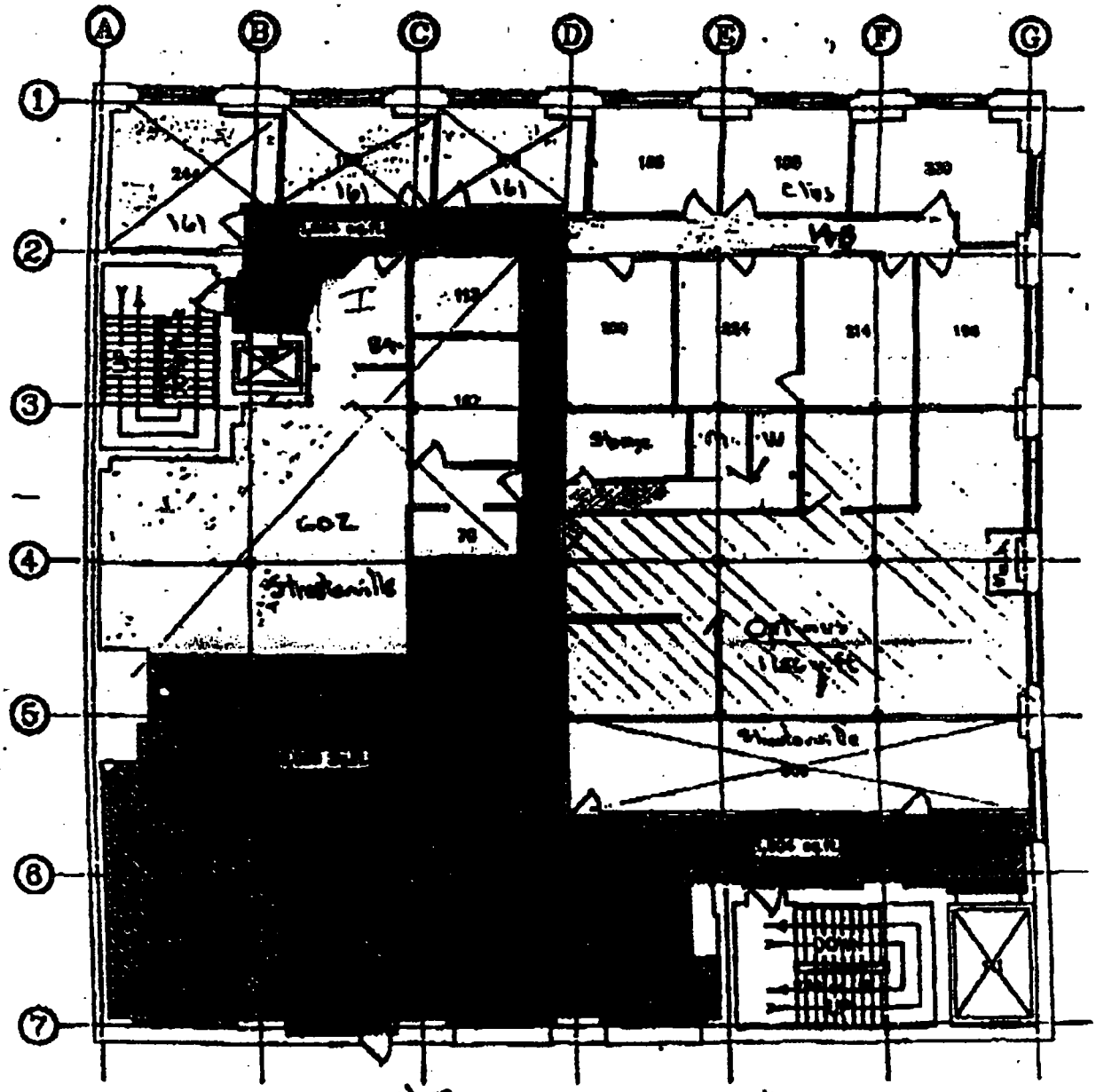
OPTIMUS
161 EAST GRAND AVENUE
CHICAGO, IL 60611

E-perms
Monitoring locations

OPTIMUS
161 E. GRAND AVE., CHICAGO, IL 60611
PHONE: 312-321-0880 FAX: 312-321-0785

E-perms

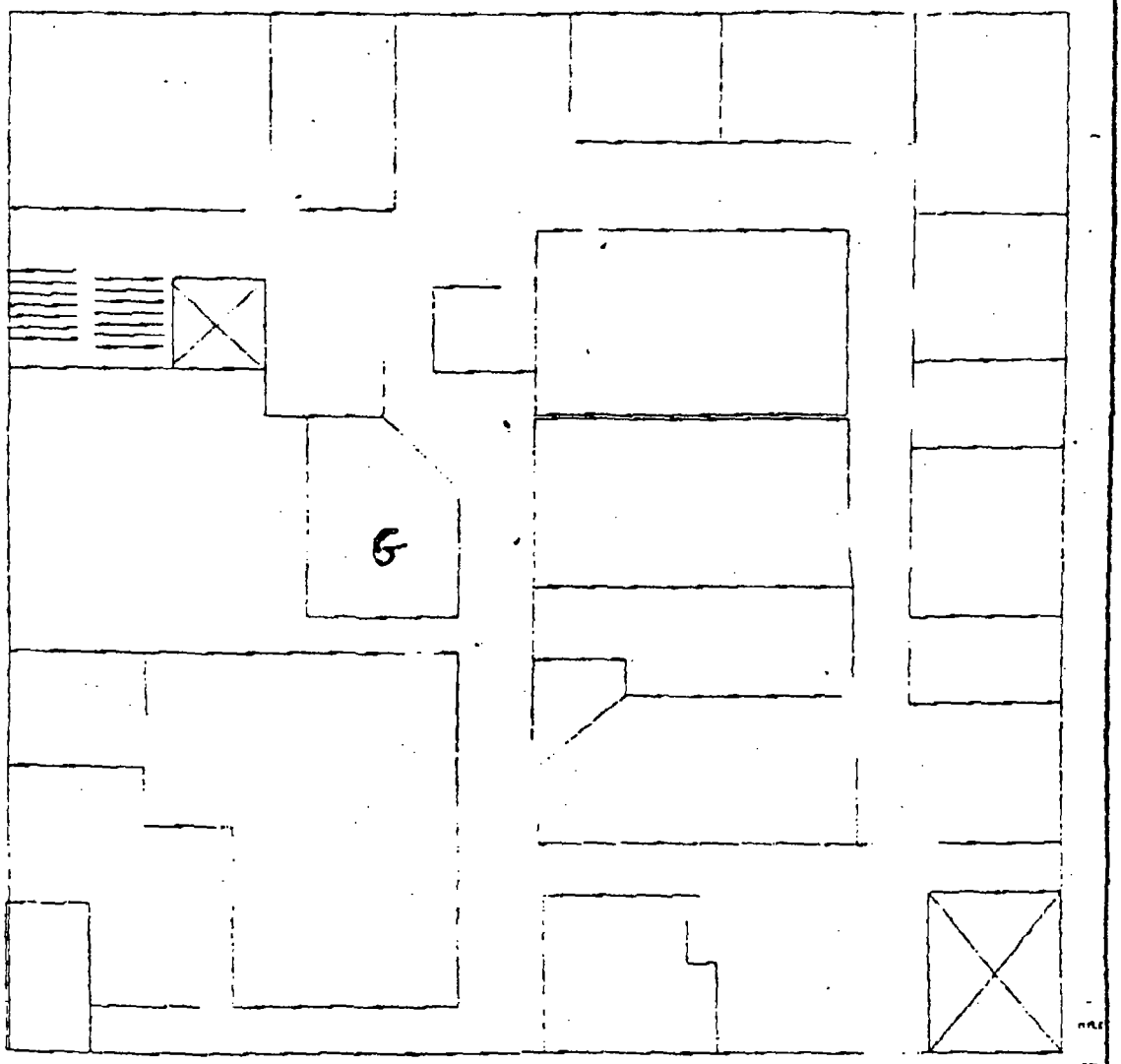
Monitoring locations



3rd Floor - 161 E. Grand Building

SCALE 1/16" = 1'-0"

E-perms
Monitoring locations



Floor Contact readings (unless indicated differently)

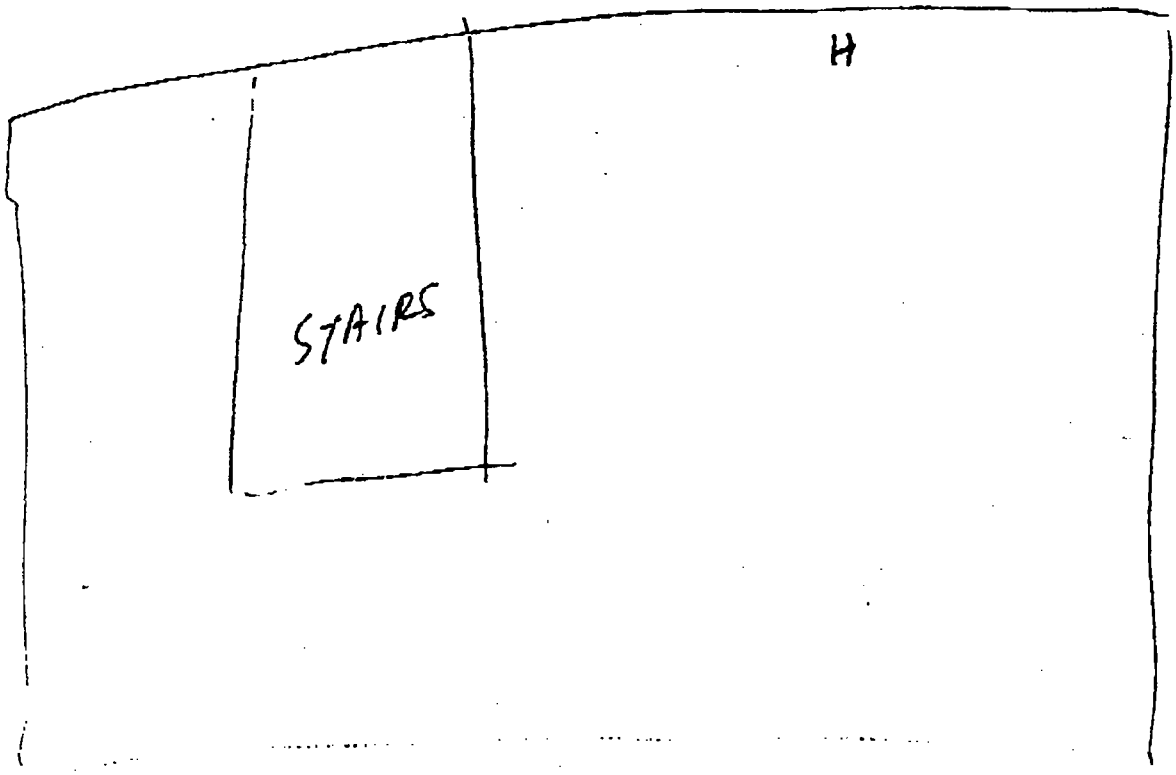
Readings include the correction factor
The instrument reads higher by a factor of 2.

LEGEND

ecology and environment, inc.
Technical Assistance Team
Region V

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

E-perms
Monitoring locations



5TH Floor

Appendix 6

GROSS BETA, GROSS ALPHA SMEAR MEASUREMENTS

Smears from basement floor near chimney

	Gross beta (pCi)	Gross alpha (pCi)
At base of wall	37.8	75.9
2 feet from wall	41.1	61.6
4 feet from wall	26.0	53.7
6 feet from wall	21.5	33.8
8 feet from wall	22.2	39.9
10 feet from wall	16.6	36.9

Appendix 6

GROSS BETA, GROSS ALPHA SMEAR MEASUREMENTS

Material from in and around chimney

Thorium Decay Series	At wall (pCi/g)	Duplicate At wall (pCi/g)	2 feet from wall (pCi/g)	4 feet from wall (pCi/g)	6 feet from wall (pCi/g)	8 feet from wall (pCi/g)	10 feet from wall (pCi/g)
Th-232 Ra-228 Ac-228		14.3		10.3			
Th-228 Ra-224 Rn-220	16.4	18.2					
Po-216 Pb-212 Bi-212	16.4	15.7	14.0	9.8	8.23	6.98	5.43
Po-212 Tl-208	4.21	4.80	2.98	3.4	2.84	1.38	0.946

Uranium Decay Series	At wall (pCi/g)	Duplicate At wall (pCi/g)	2 feet from wall (pCi/g)	4 feet from wall (pCi/g)	6 feet from wall (pCi/g)	8 feet from wall (pCi/g)	10 feet from wall (pCi/g)
U-238							
Th-234							
Pa-234m							
U-234							
Th-230							
Ra-226							
Rn-222							
Po-218							
Pb-214							
Bi-214							
Po-214							
Pb-210							
Bi-210							
Po-210							

Other	At wall (pCi/g)	Duplicate At wall (pCi/g)	2 feet from wall (pCi/g)	4 feet from wall (pCi/g)	6 feet from wall (pCi/g)	8 feet from wall (pCi/g)	10 feet from wall (pCi/g)
K-40	11.4			9.4	15.7		

Appendix 7

IDENTITY, CONCENTRATION ON SMEARS

APPENDIX

Material from in and around chimney

Thorium Decay Series	Concentration (pCi/g)	Duplicate Concentration (pCi/g)	Average Concentration (pCi/g)
Th-232			
Ra-228	90.5	84.3	87.4
Ac-228			
Th-228	101	84.4	92.7
Ra-224	105	93.7	92.7
Rn-220	211	90.8	99.4
Po-216			
Pb-212	97.6	90.9	94.3
Bi-212	87.4	82.2	84.8
Po-212			
Tl-208	30.2	27.5	28.9

Uranium Decay Series	Concentration (pCi/g)	Duplicate Concentration (pCi/g)	Average Concentration (pCi/g)
U-238			
Th-234	11.0	7.87	9.44
Pa-234m		8.07	
U-234			
Th-230			
Ra-226			
Rn-222			
Po-218			
Pb-214	0.835	0.953	0.894
Bi-214			
Po-214			
Pb-210			
Bi-210			
Po-210			

Other	Concentration (pCi/g)	Duplicate Concentration (pCi/g)	Average Concentration (pCi/g)
K-40	18.0	17.6	17.8
Tl-201		1.80	

MAY-03-2001 10:01 P 026/026 F-710
T-024
312 886 7160
630 231 3990
From-USEPA Region 5 ORC
11:27am
95%
05-10-01
P.26
026

Appendix 8

REMOVABLE CONTAMINATION ON BOOTIES

Removable material on booties

			Gross Alpha (cpm)
Blank bootie			2.4
Fred's booties			
	Bootie 1	**Side 1**	5.2
	Bootie 1	**Side 2**	5.0
	Bootie 2	**Side 1**	7.2
	Bootie 1	**Side 2**	4.6
Larry's booties			
	Bootie 1	**Side 1**	10.8
	Bootie 1	**Side 2**	4.0
	Bootie 2	**Side 1**	9.6
	Bootie 1	**Side 2**	3.8

RSSI

6312 West Oakton Street
Morton Grove, IL 60053-2723
847-965-1999
Fax 847-965-1991

March 28, 2001

Tom Duff
Optimus
161 E. Grand Ave.
Chicago, IL 60611

RE: 161 E. Grand Building

Dear Mr. Duff:

I have enclosed relevant reports. Please call me at 847-965-1999

Sincerely,

Eli A. Port, CHP, CIH, P. E.
Enclosures
Pc: Joe Madonia
400001\161\duff01.doc

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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III. BACKGROUND INFORMATION ON GAS LIGHT MANTLE MANUFACTURE

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V. GENERAL SURVEY RESULTS WITHOUT DISCUSSION

- A. Building Surveys
  - a. Preliminary Survey
  - b. Comprehensive Survey
- B. Gamma Energy Spectrums
- C. Thermoluminescent Dosimeter Data
- D. Smears
- E. Air Samples

VI. RESULTS

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- B. Contaminated Areas
- C. Identification of the Contamination
- D. Smear Results
- E. Air Sample Results
- F. Thermoluminescent Dosimeter Results

VII. CONCLUSIONS

VIII. RECOMMENDATIONS

IX. TECHNICAL APPENDIX

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.

---

*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)*

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% $^{212}_{84}Po$	Thorium C' $^{212}_{84}Po$	304ns	8.78 (100%)	---	---
36.0% $^{208}_{81}Tl$	Thorium C'' $^{208}_{81}Tl$	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.*

---

*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%)
$^{218}_{86}At$	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.

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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 , Contact With Floor , in Basement

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

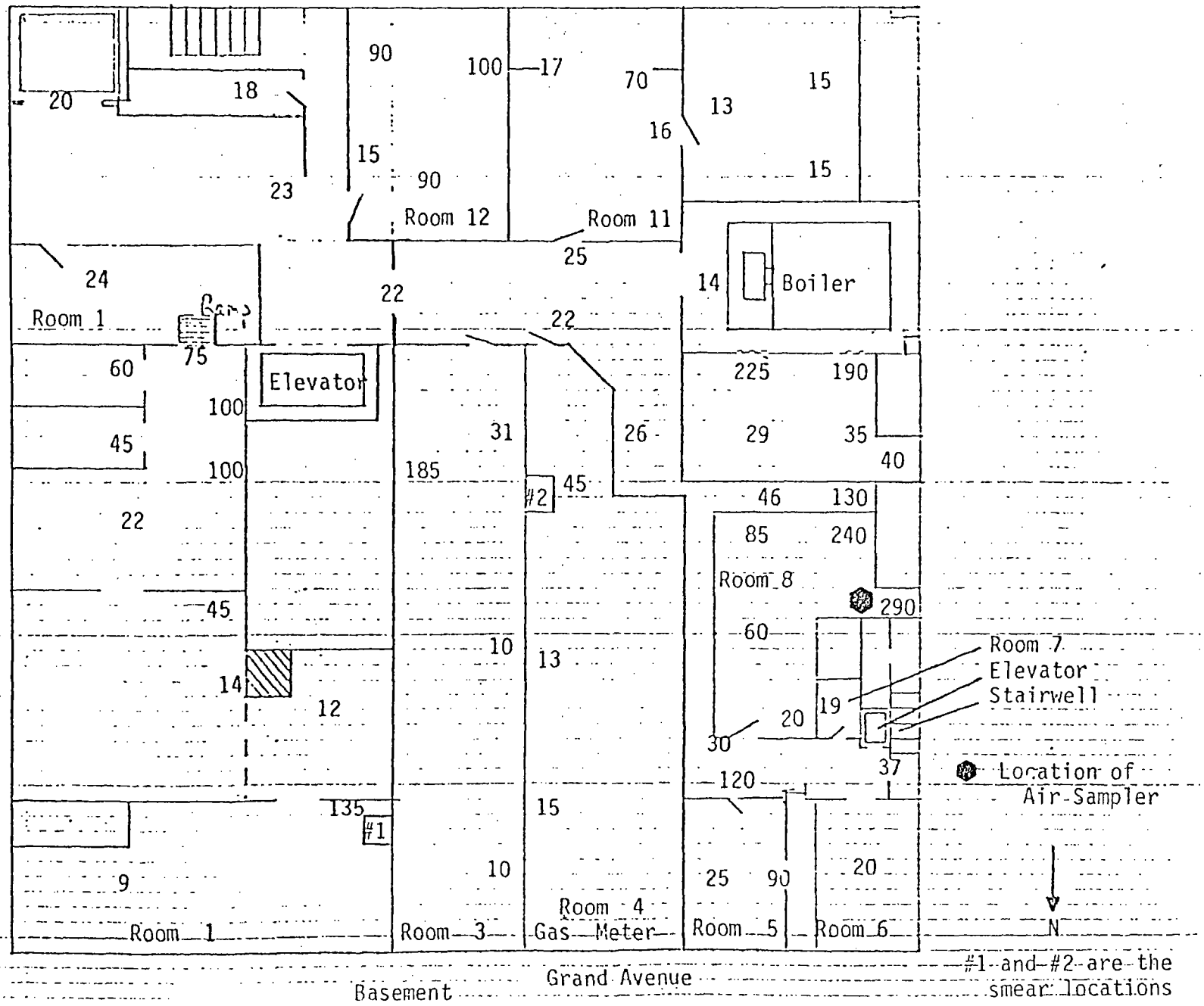


Figure 1. Micro - Roentgen Meter Readings at One Meter Above Floor in the Basement

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

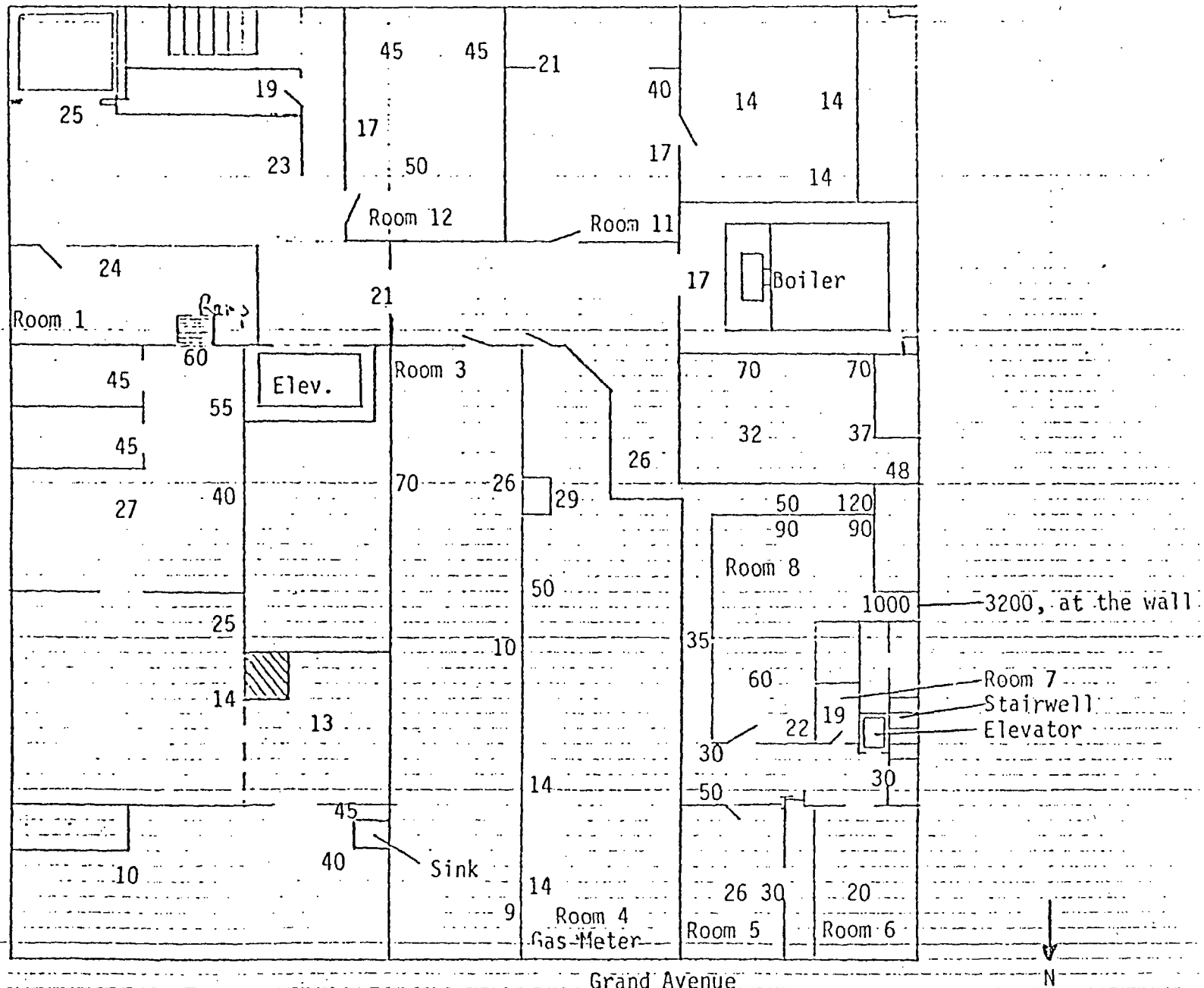


Figure 5 : Micro - Roentgen Meter Readings , Contact With Floor

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

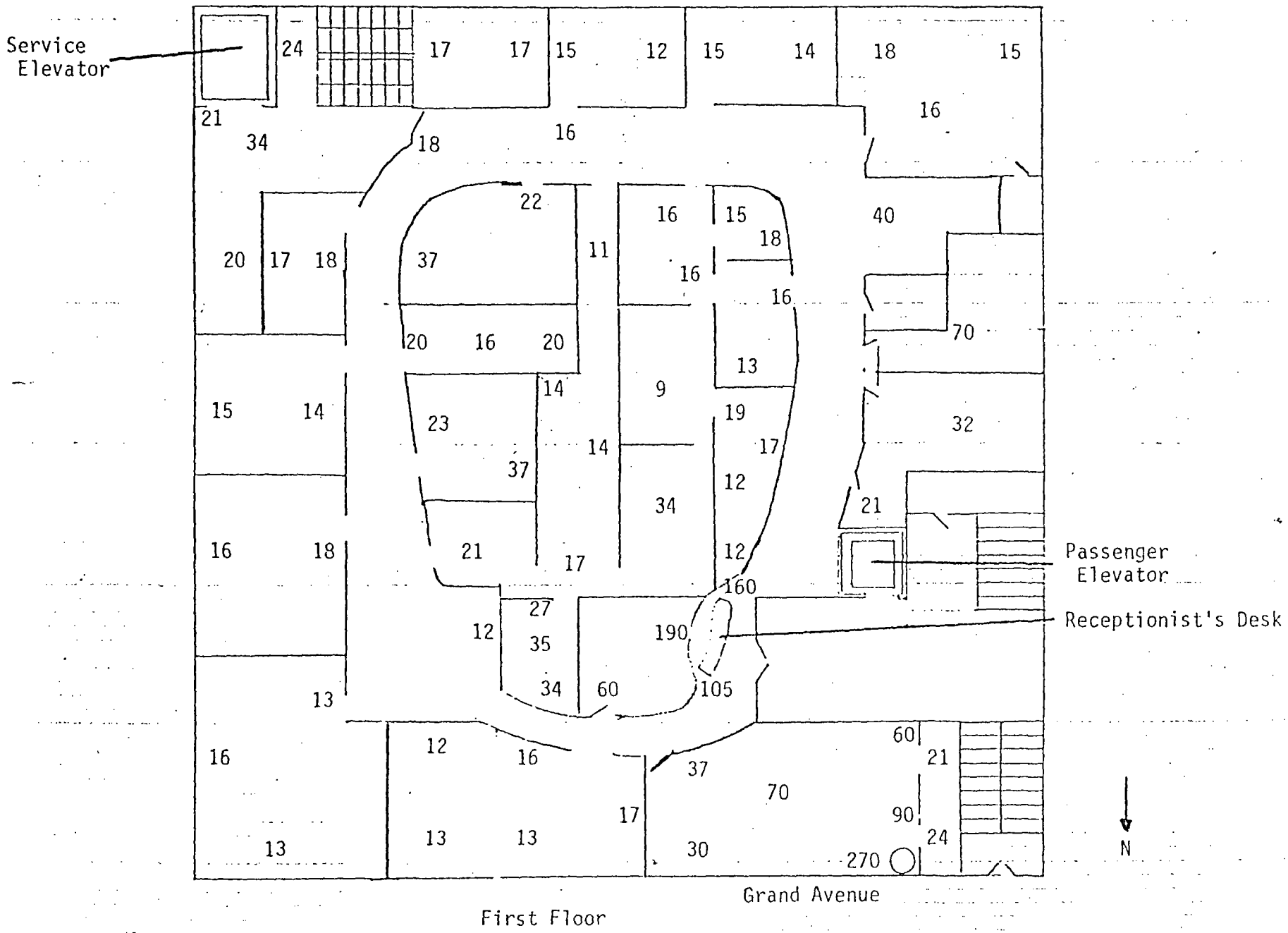
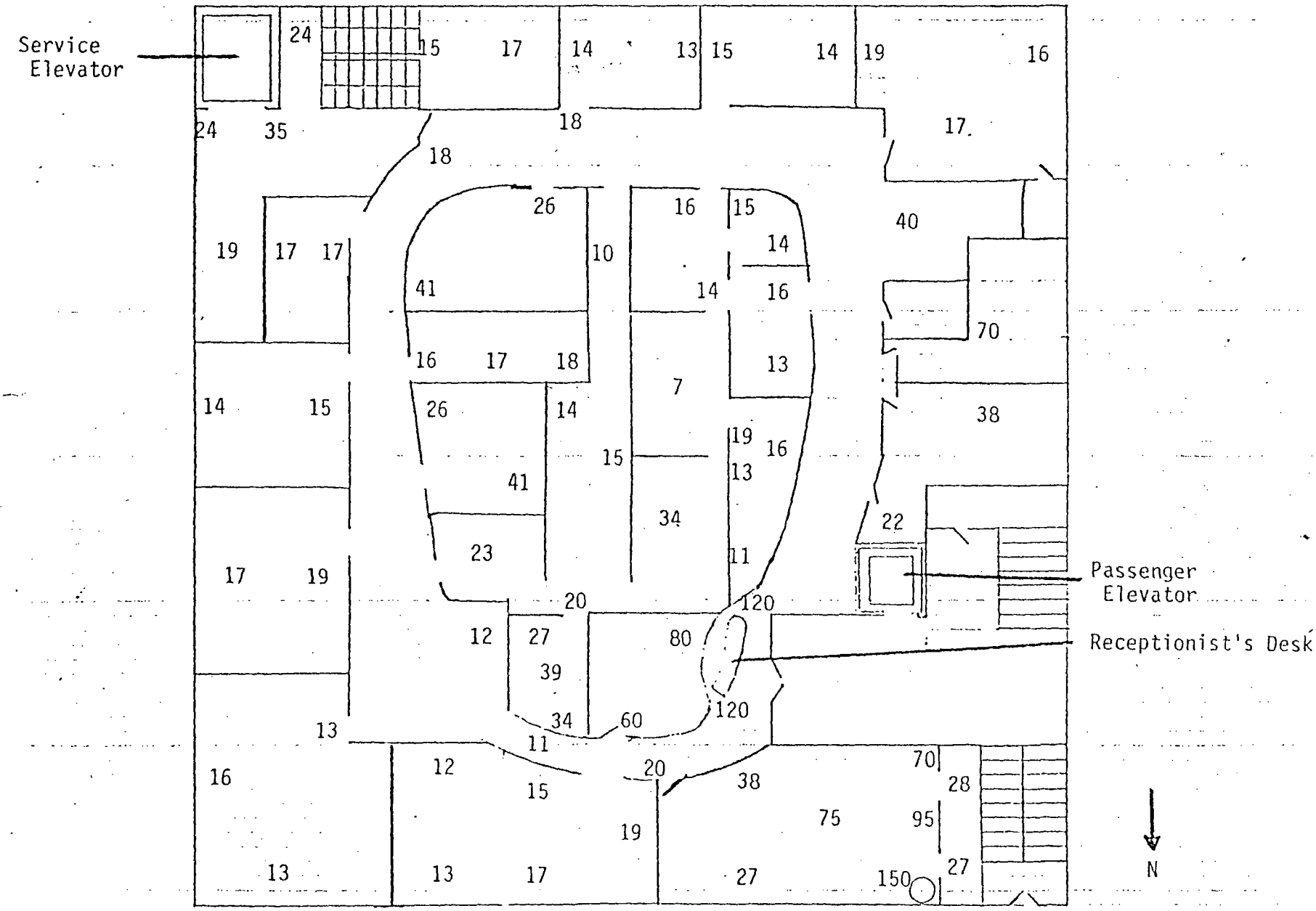
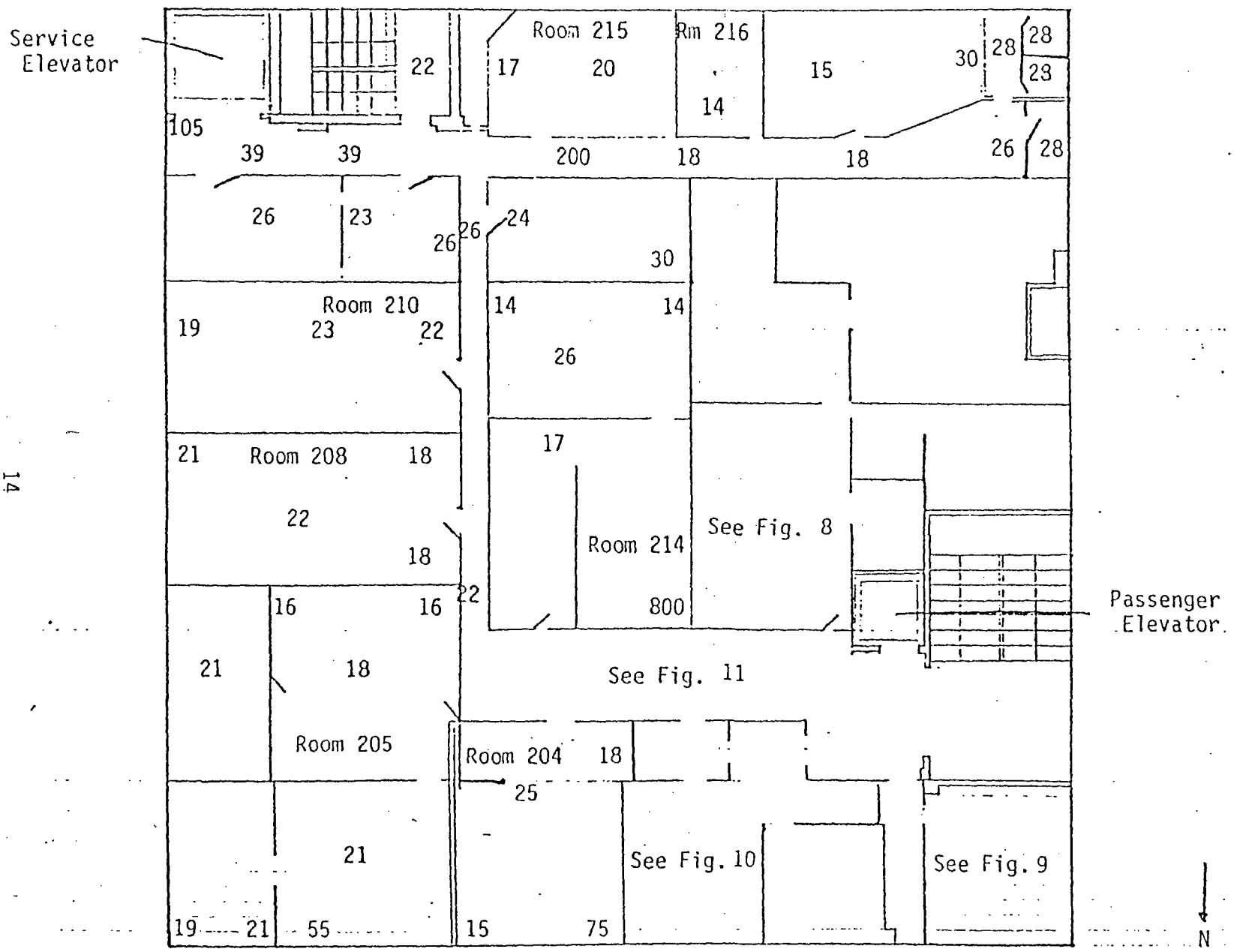


Figure 6 : Micro-Roentgen Meter Readings at One Meter Distance
(All readings are in micro-roentgens per hour , uR/hr .)



First Floor

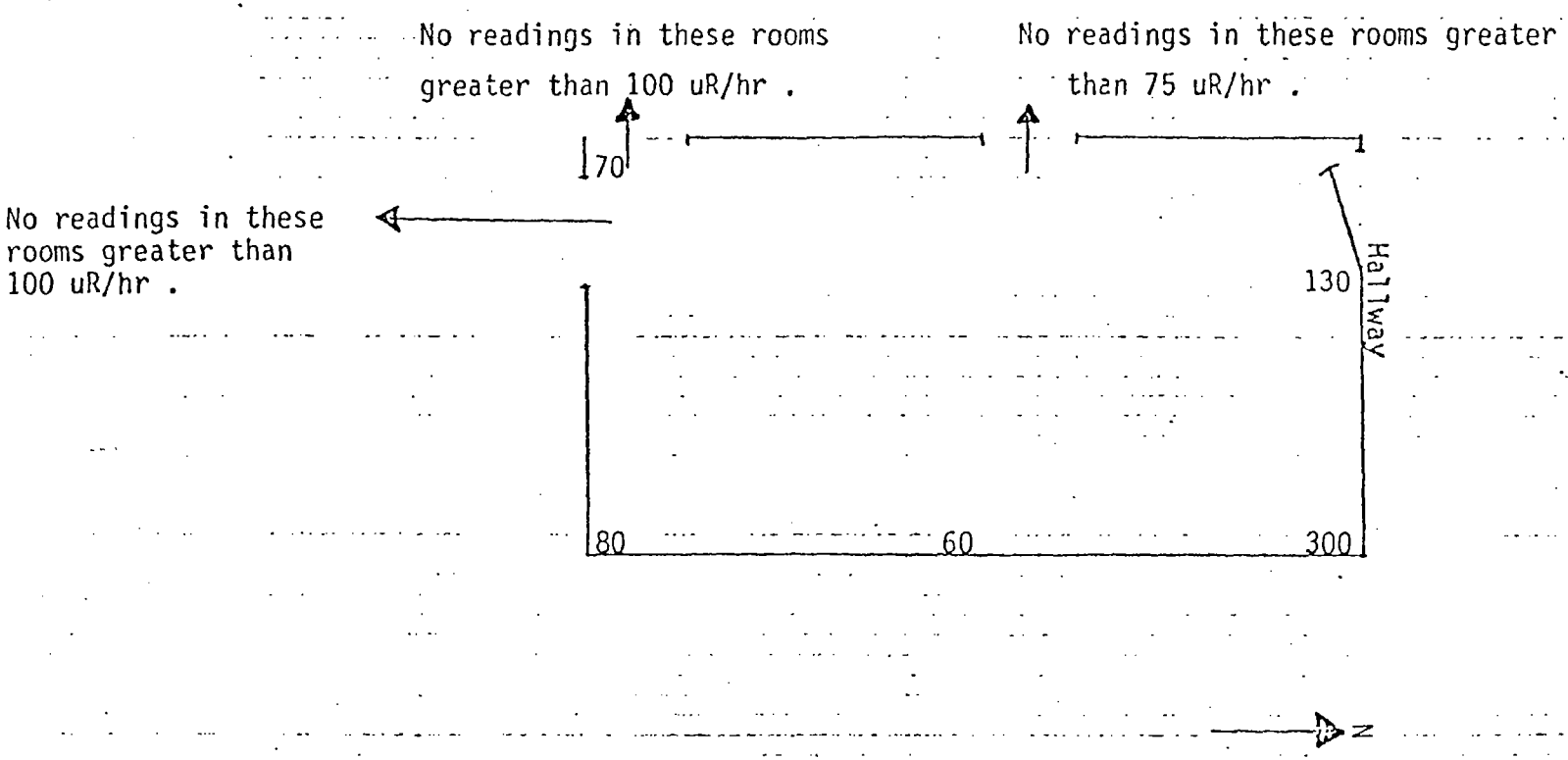
Roentgen Meter Readings , Contact With Floor
(All readings are in micro-roentgens per hour, uR/hr.)



Second Floor

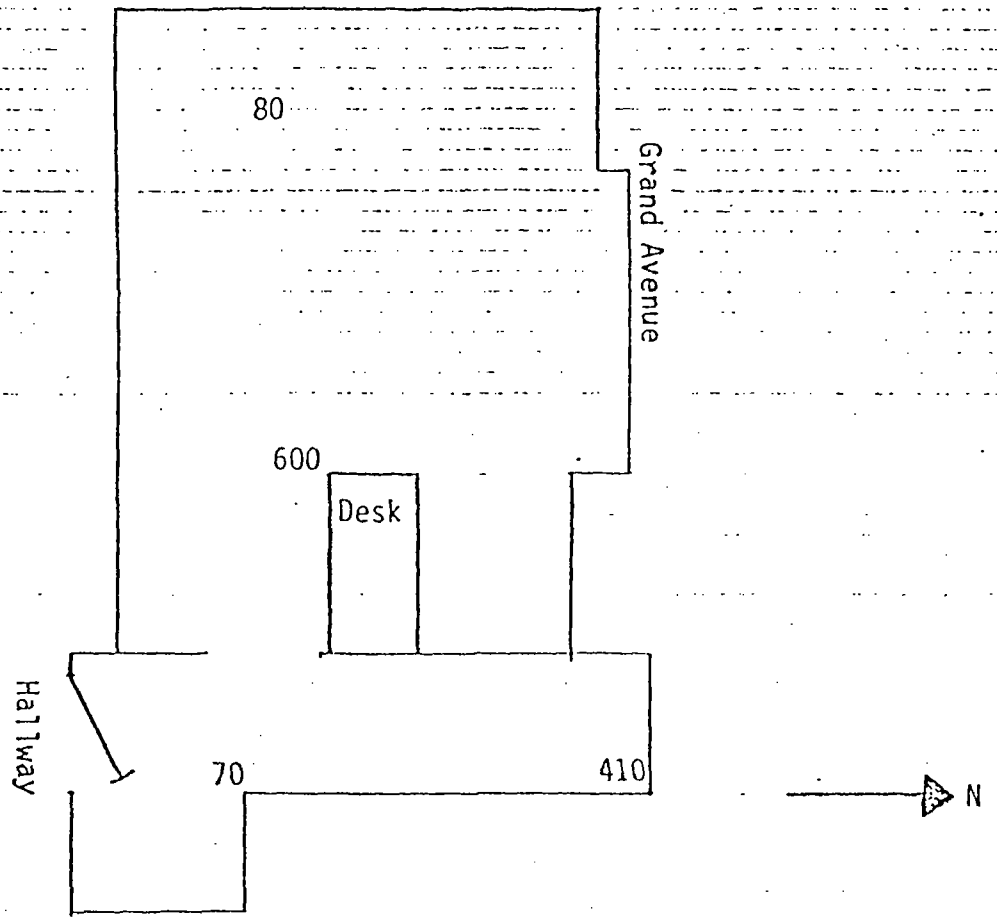
Figure 8 : Micro - Roentgen Meter Readings , Contact With Floor , in Room 200

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



Second Floor - Room 200 (Glen McGowean and Son)

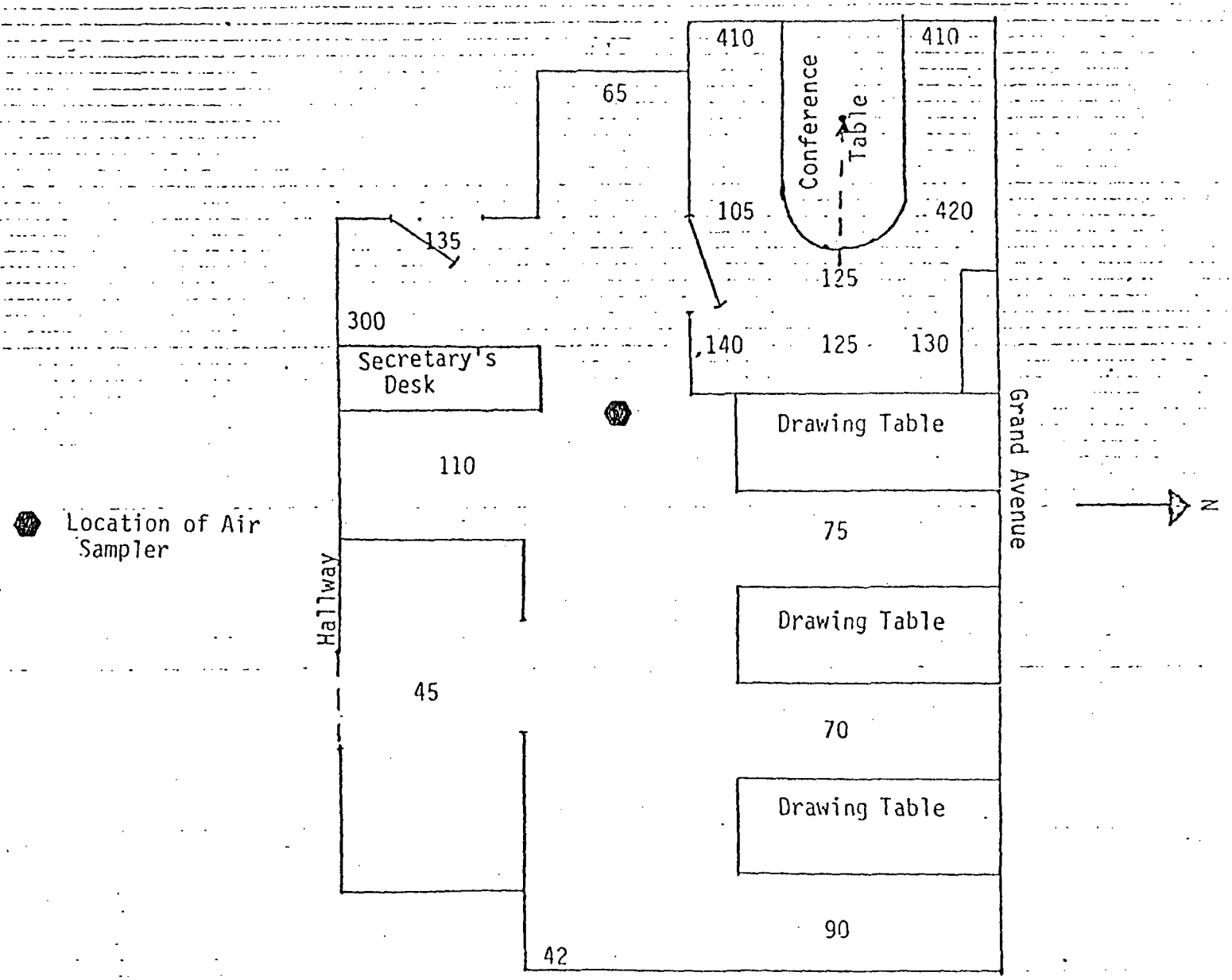
Figure 9: Micro - Roentgen Meter Readings, Contact With Floor, in Room 201
(All readings are in micro - roentgens per hour, uR/hr.)



Second Floor - Room 201 (Ascot Products)

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

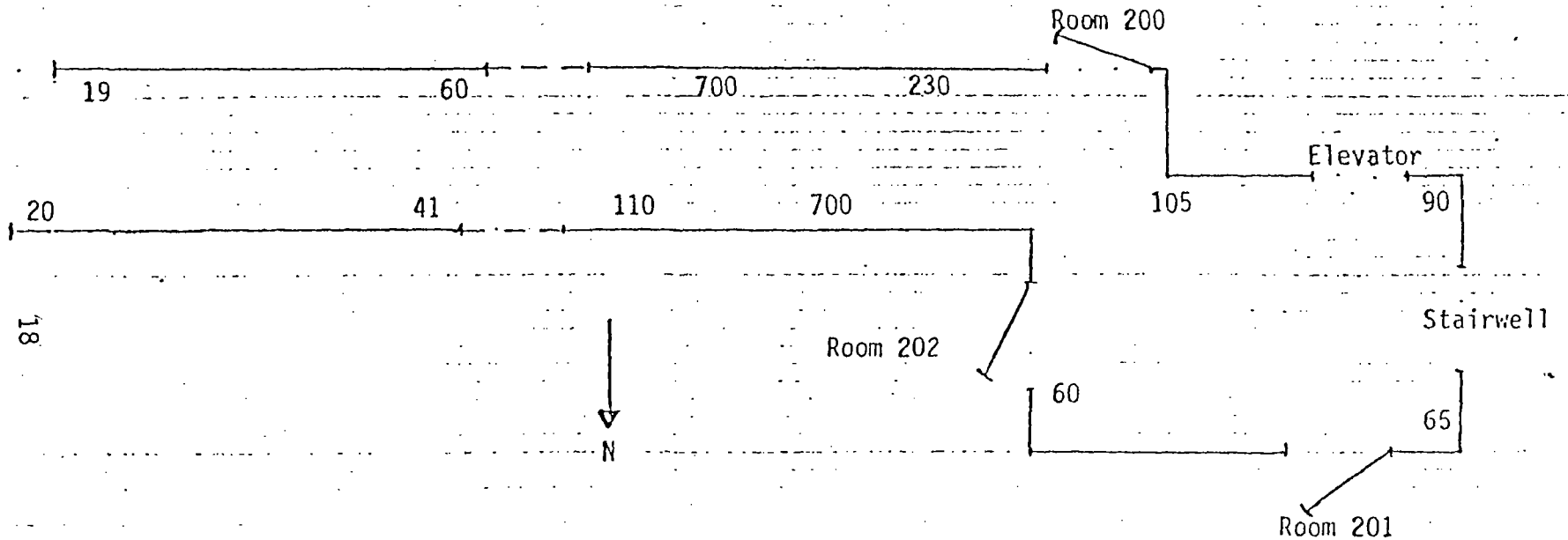
(All readings are in micro - roentgens per hour , uR/hr)



Second Floor - Room 202 (Meisel Munson LTD)

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 - roentgens per hour, uR/hr.)

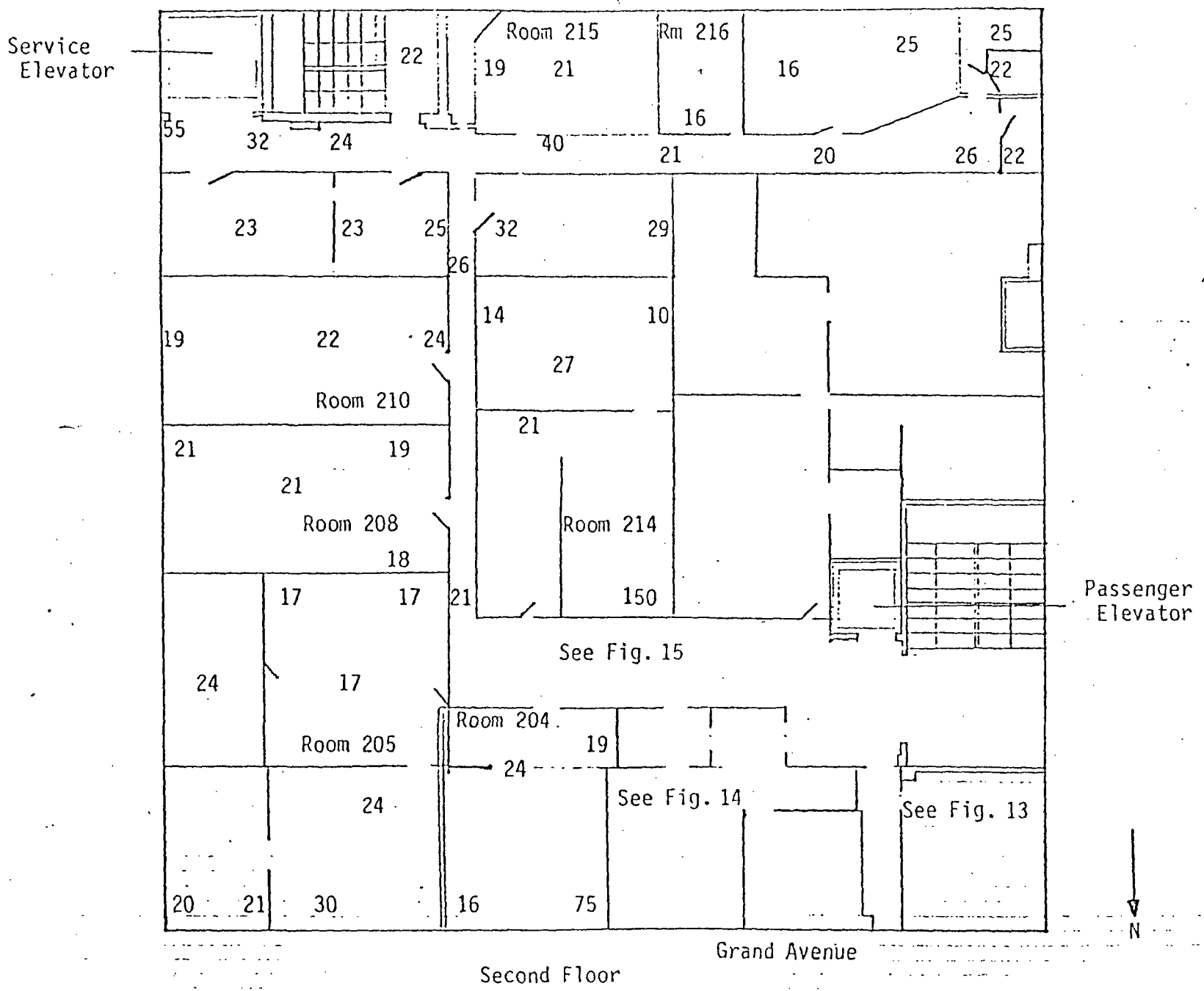
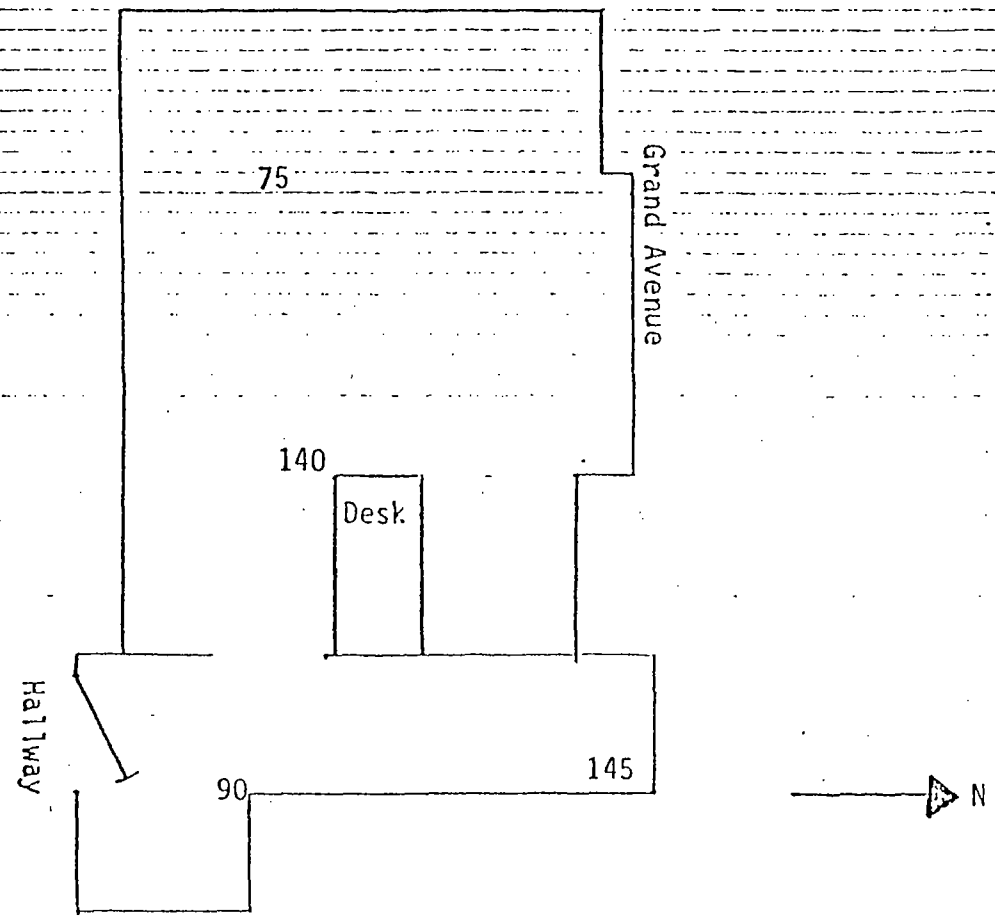


Figure 13 :

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

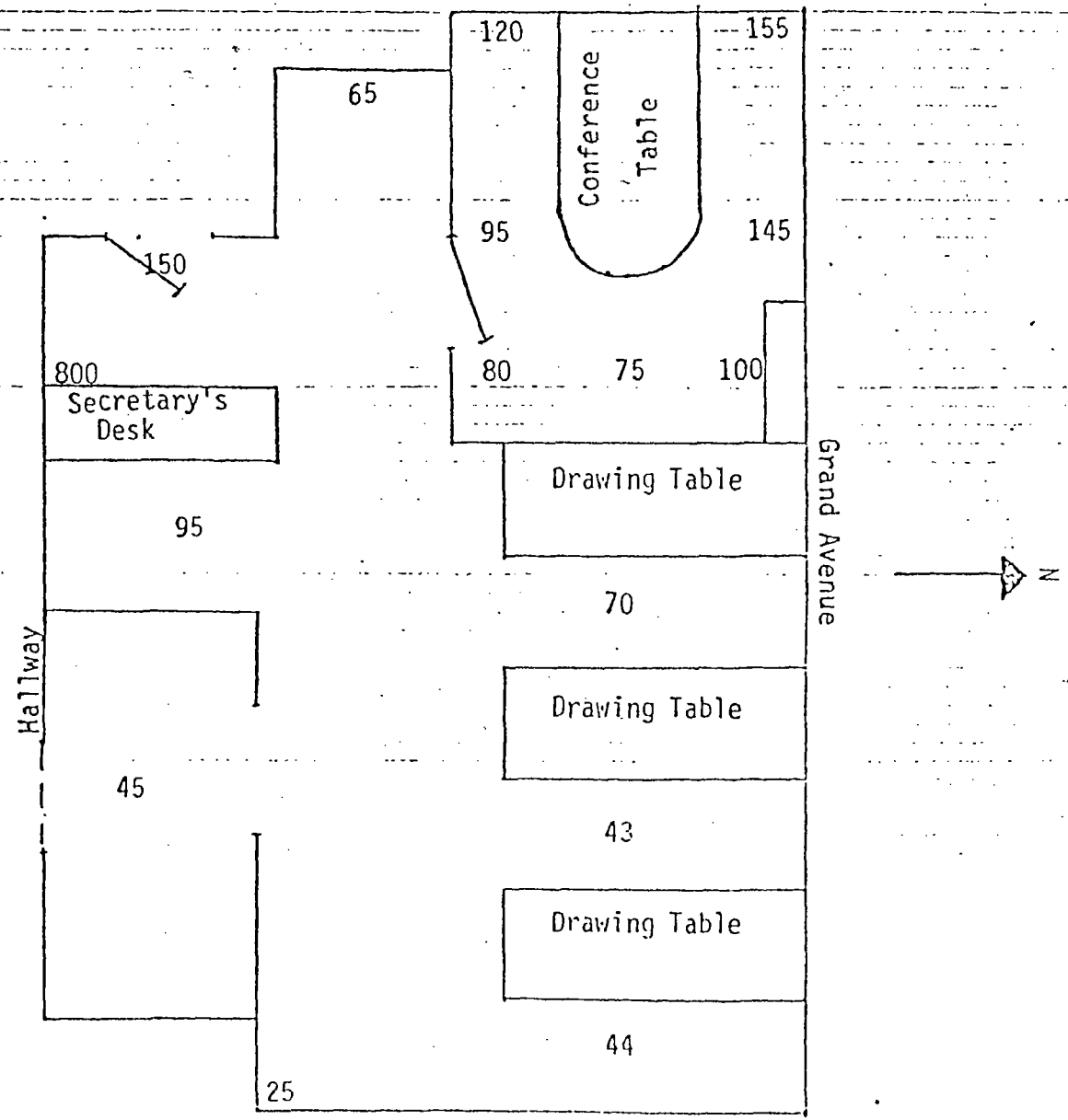
(All readings are in micro - roentgens per hour , uR/hr .)



Second Floor - Room 201 (Ascot Products)

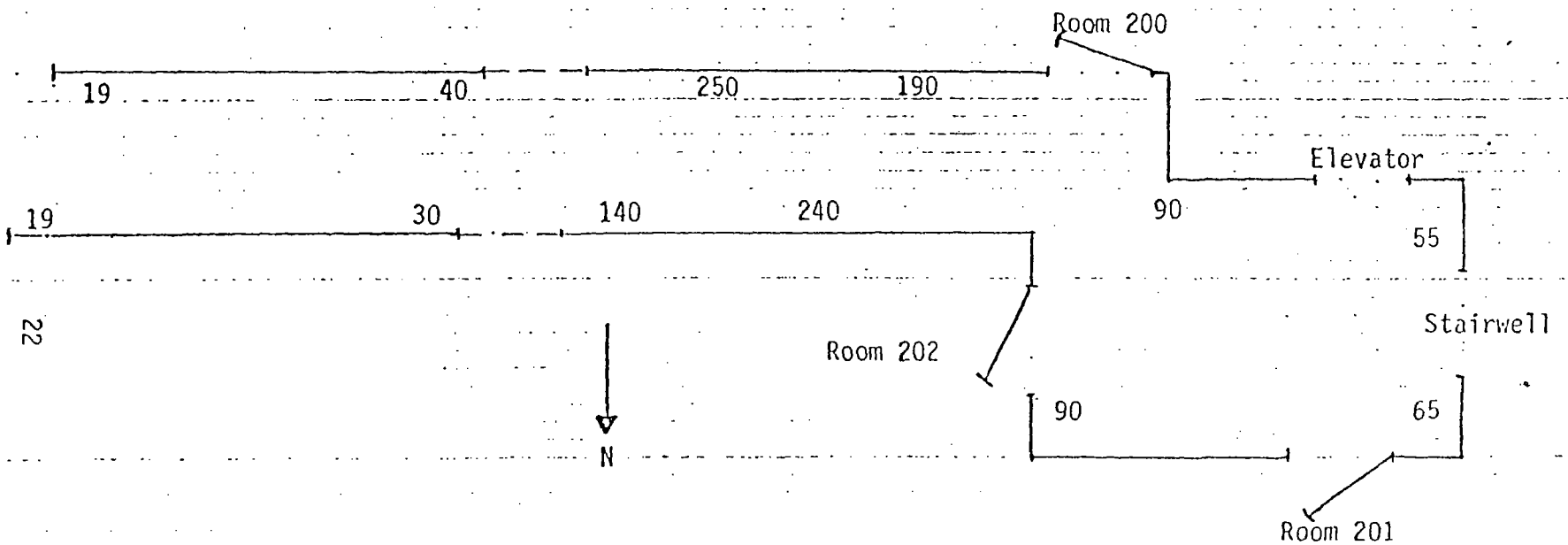
Figure 14 : Micro - Roentgen Meter Readings at One Meter Above Floor in Room 202

(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

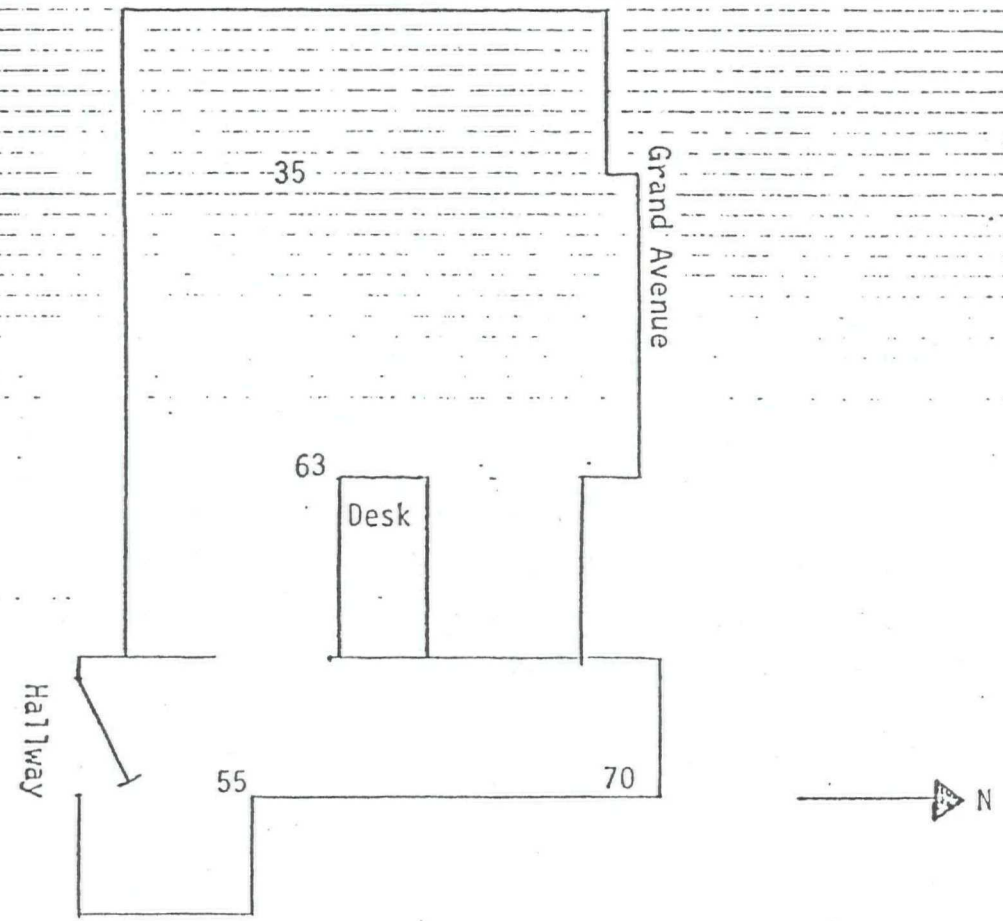
In Rooms 200, 201, and 202 along with the adjoining hallway, dual readings with the micro-R meter and a pressurized ion chamber (PIC) were made (See Figs. 16-18). The micro-R meter is handy for surveys because it is small, light and sensitive, but it can give exaggerated readings where low energy gamma 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

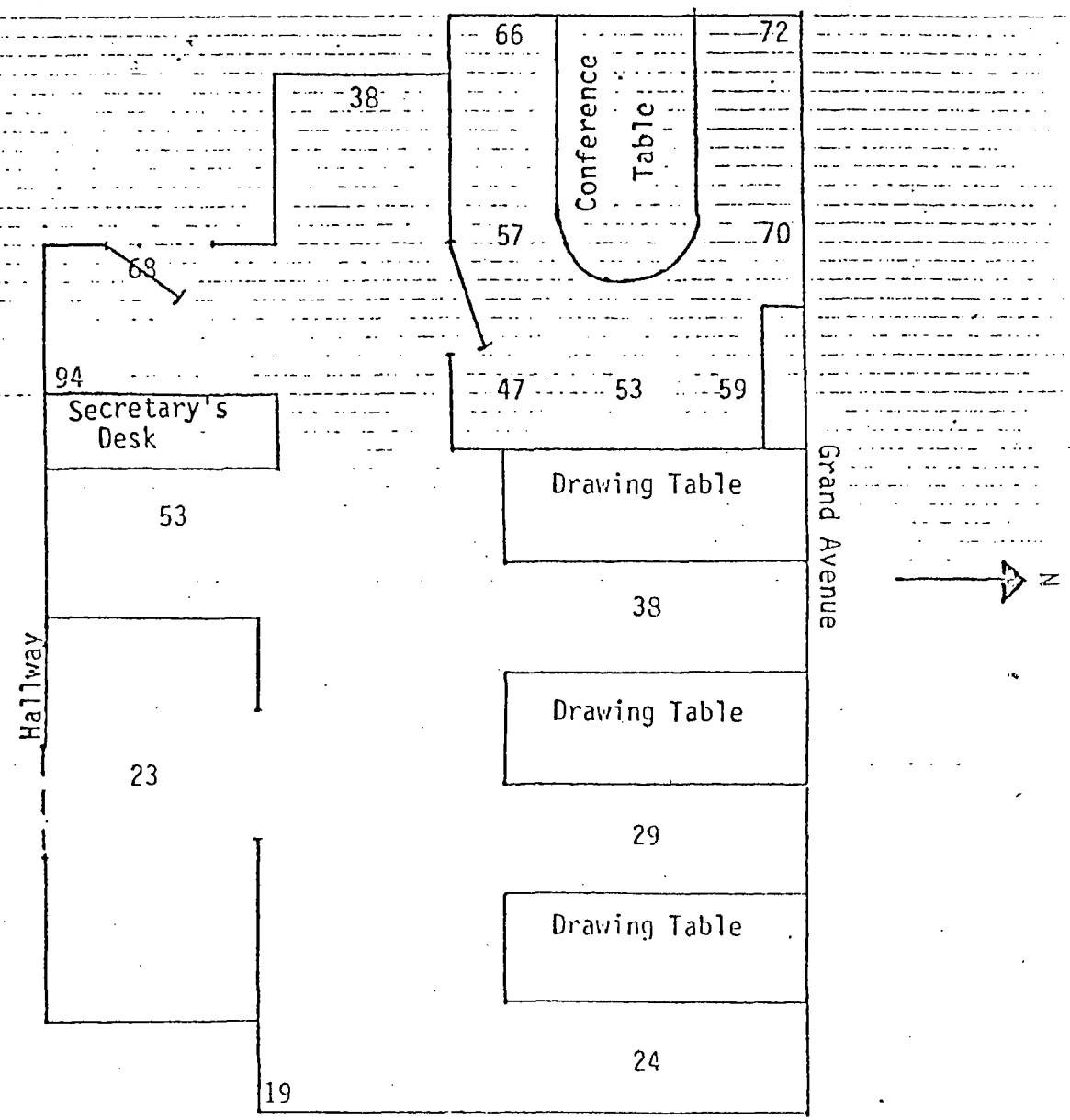
(All readings are in micro - roentgens per hour , uR/hr .)



Second Floor - Room 201 (Ascot Products)

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

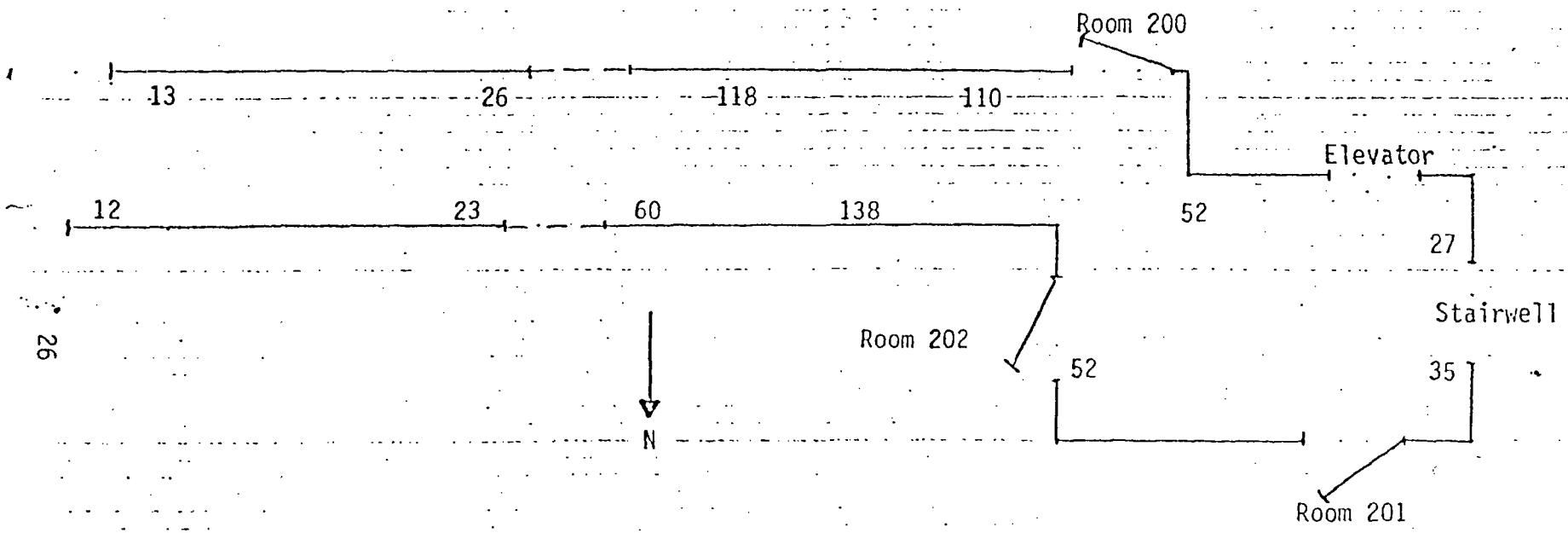
(All readings are in micro - roentgens per hour , uR/hr)



Second Floor - Room 202 (Meisel Munson LTD)

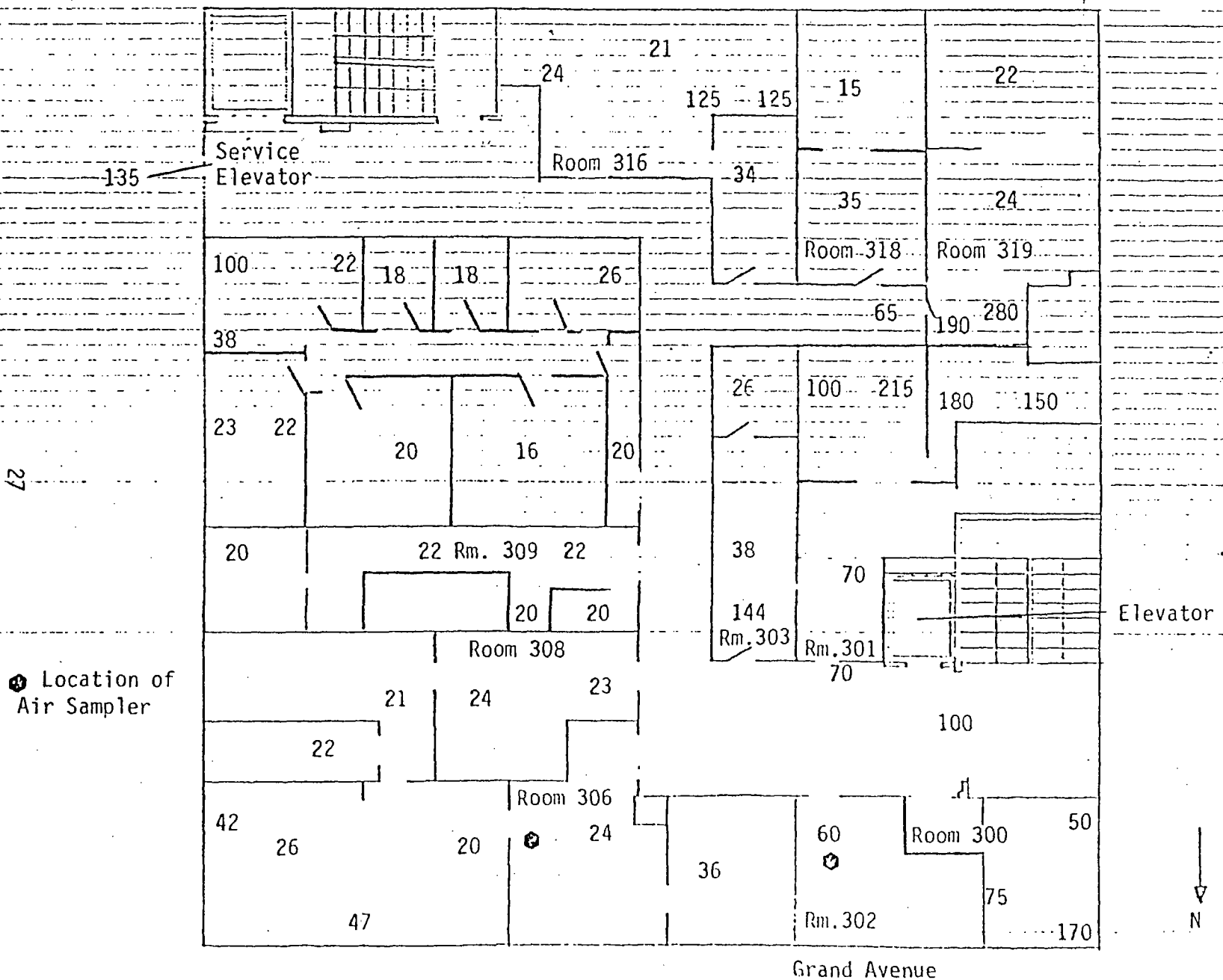
Figure 18 : Pressurized Ion Chamber Readings at One Meter Above Floor in Hallway Near Room 202

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



Second Floor - Hallway

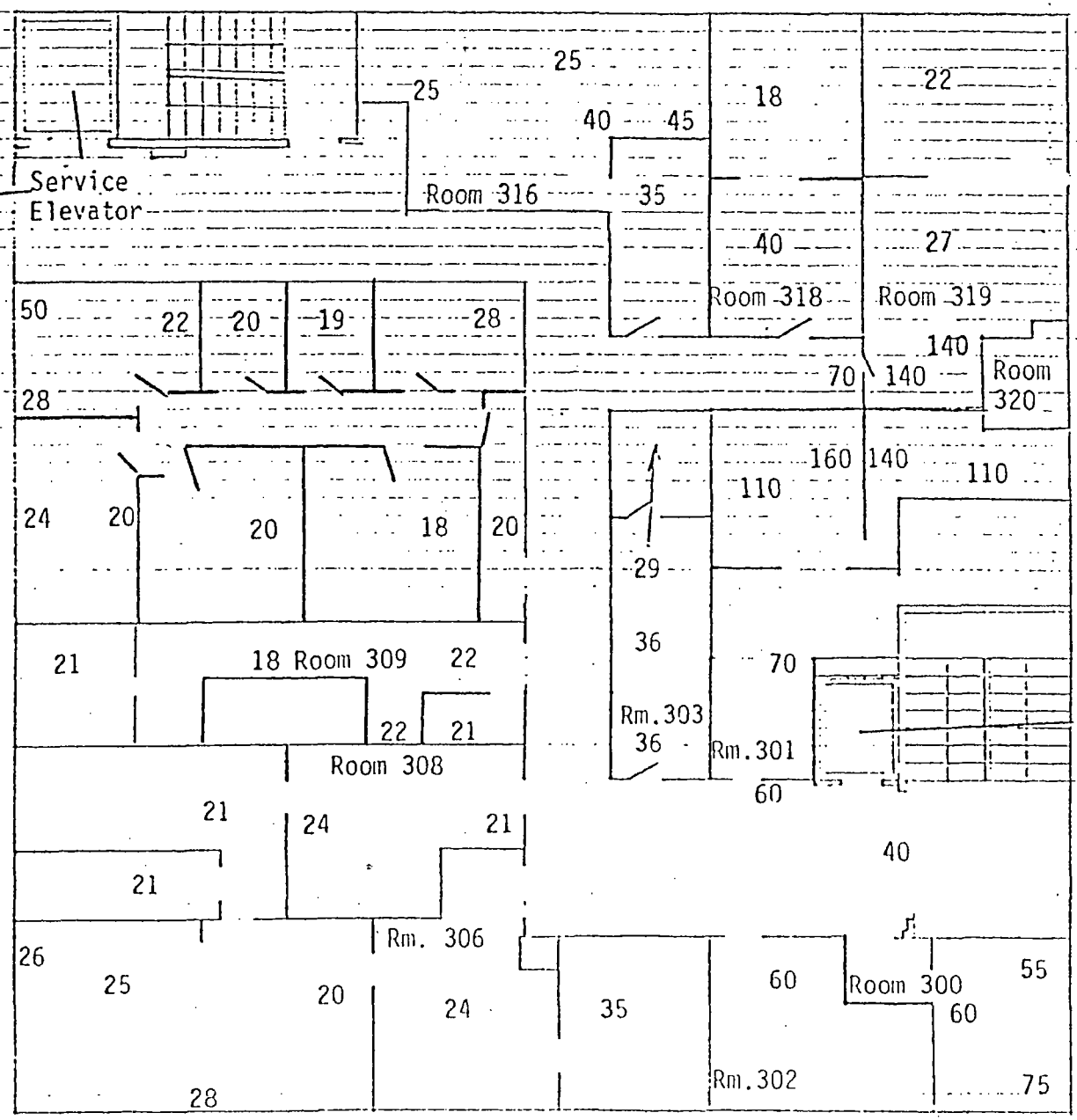
Figure 19 : Micro - Roentgen Meter Readings , Contact With Floor , on the Third Floor
(All readings are in micro - roentgens per hour , uR/hr .)



3rd Floor

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

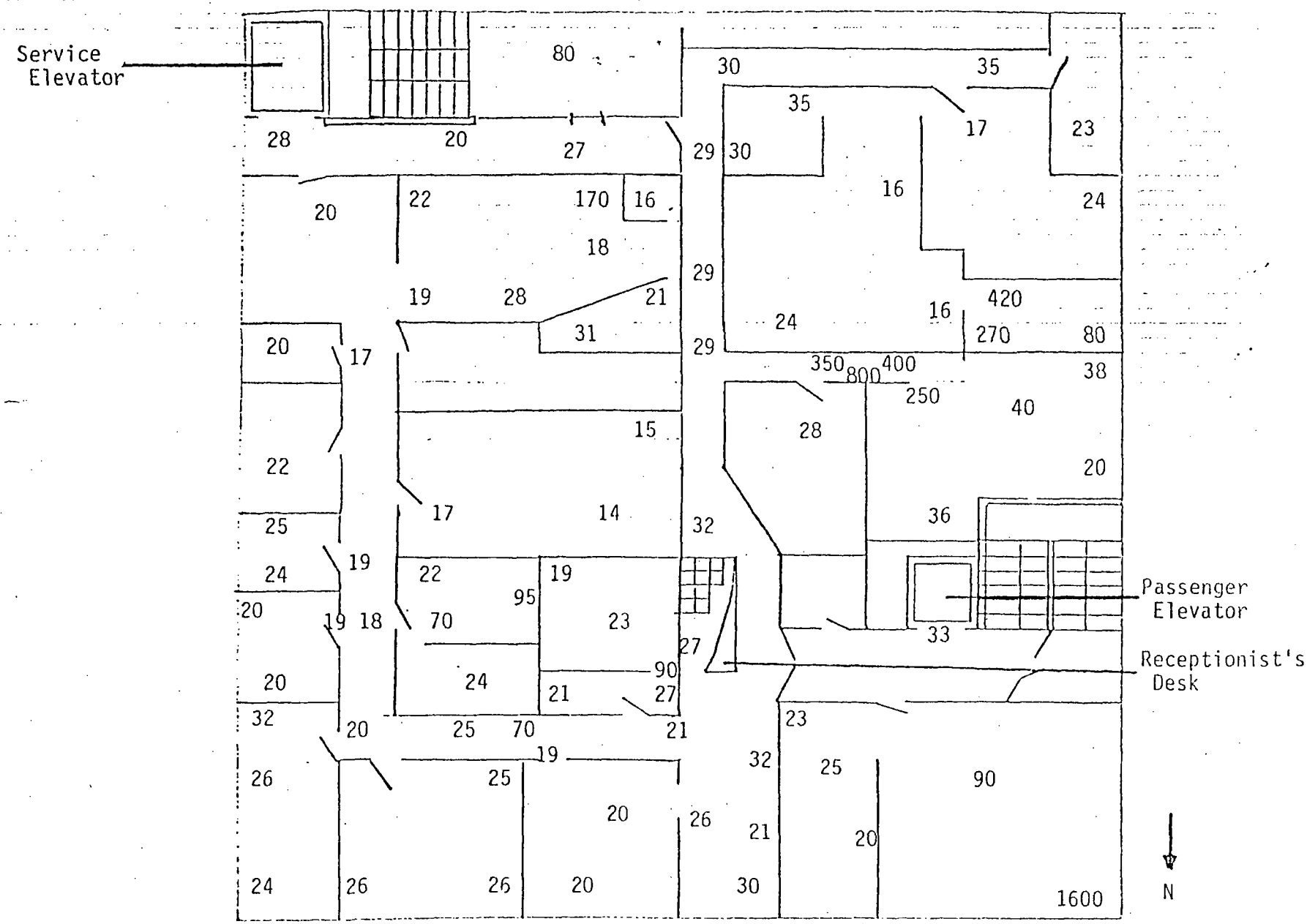
(All readings are in micro - roentgens per hour, uR/hr.)



3rd Floor

Figure 21 : Micro - Roentgen Meter Readings , Contact With Floor

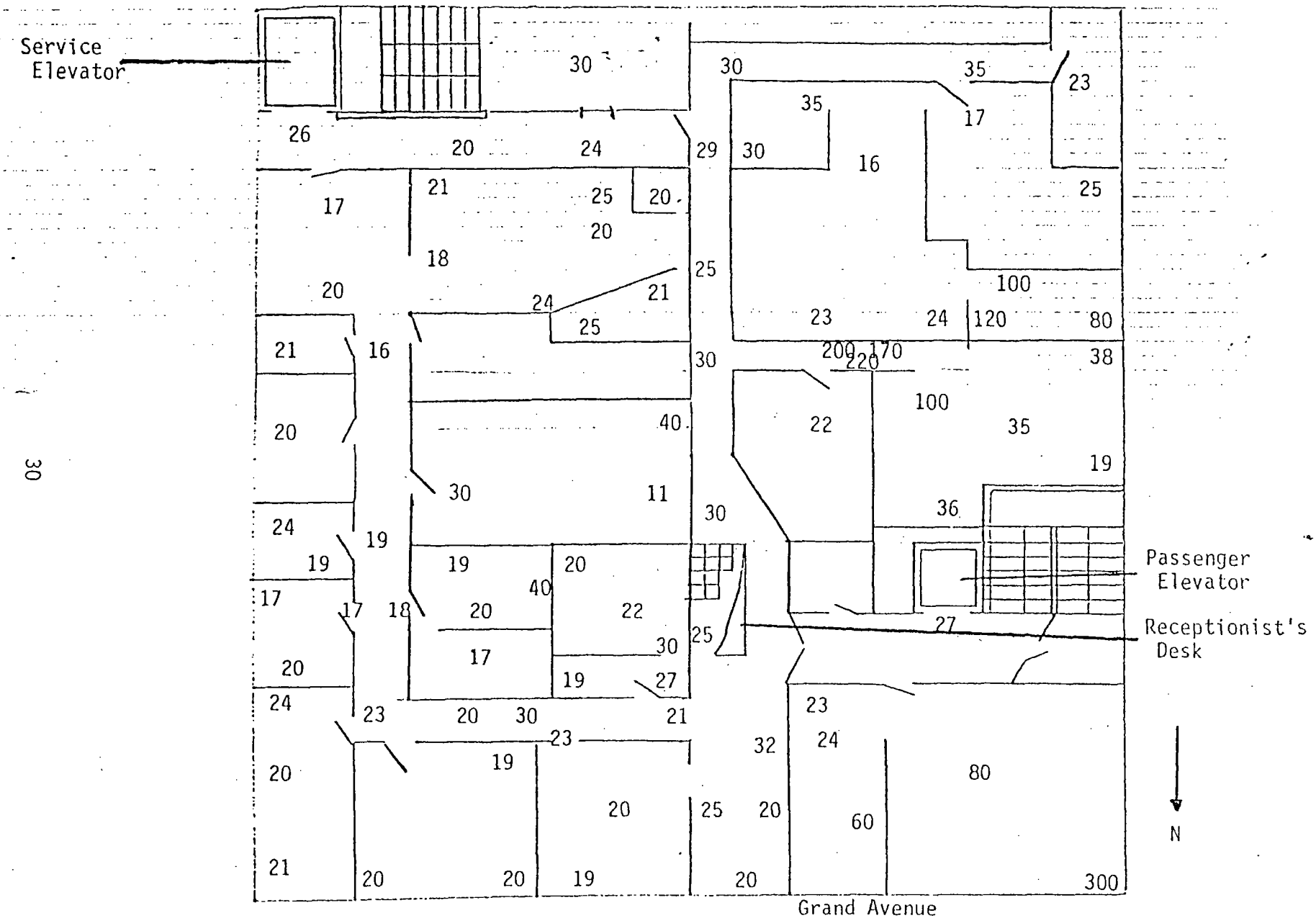
(All readings are in micro - roentgens per hour,uR/hr.)



Fourth Floor

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

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



Fourth Floor

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).

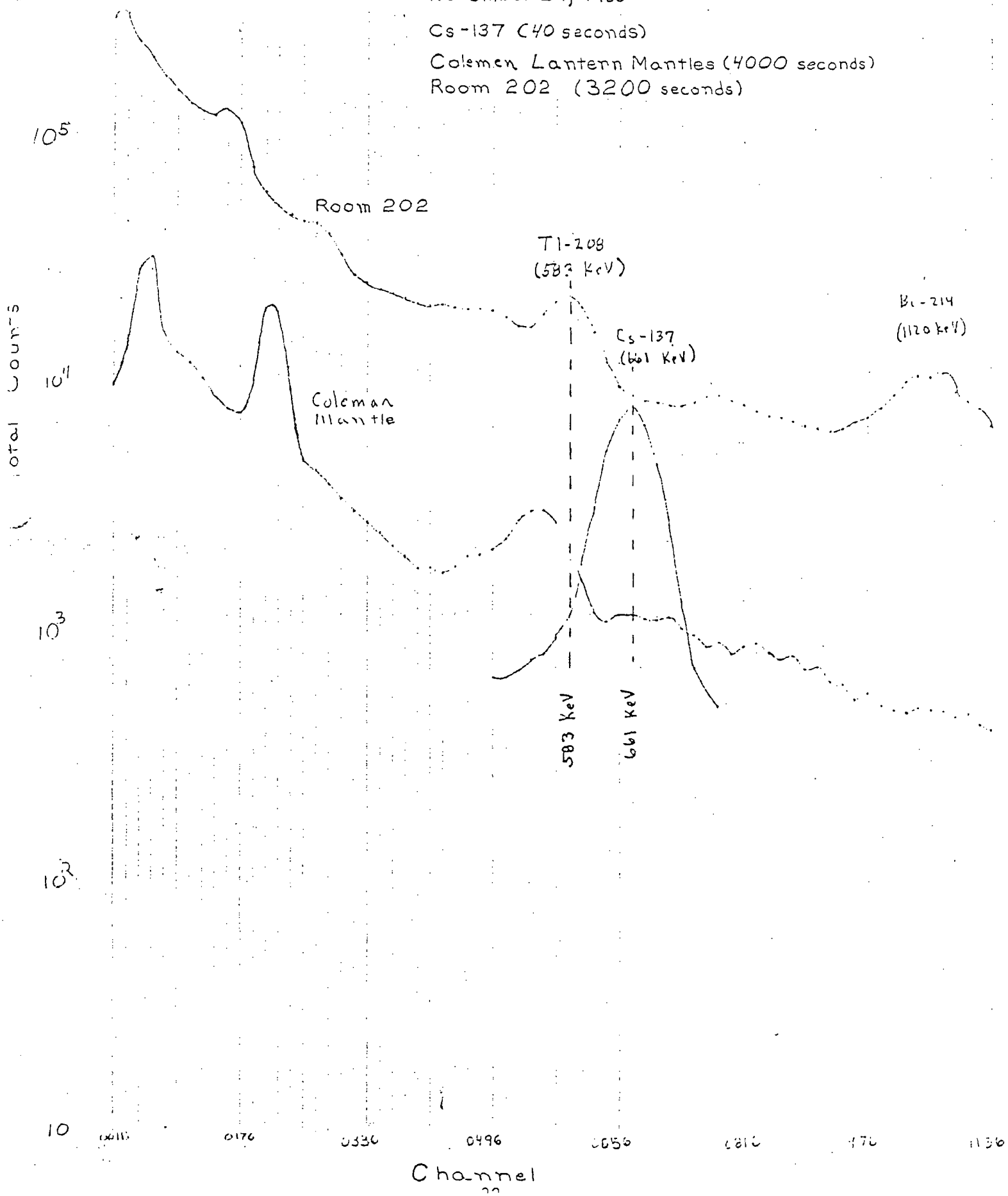
C. Thermoluminescent Dosimeter Data

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.

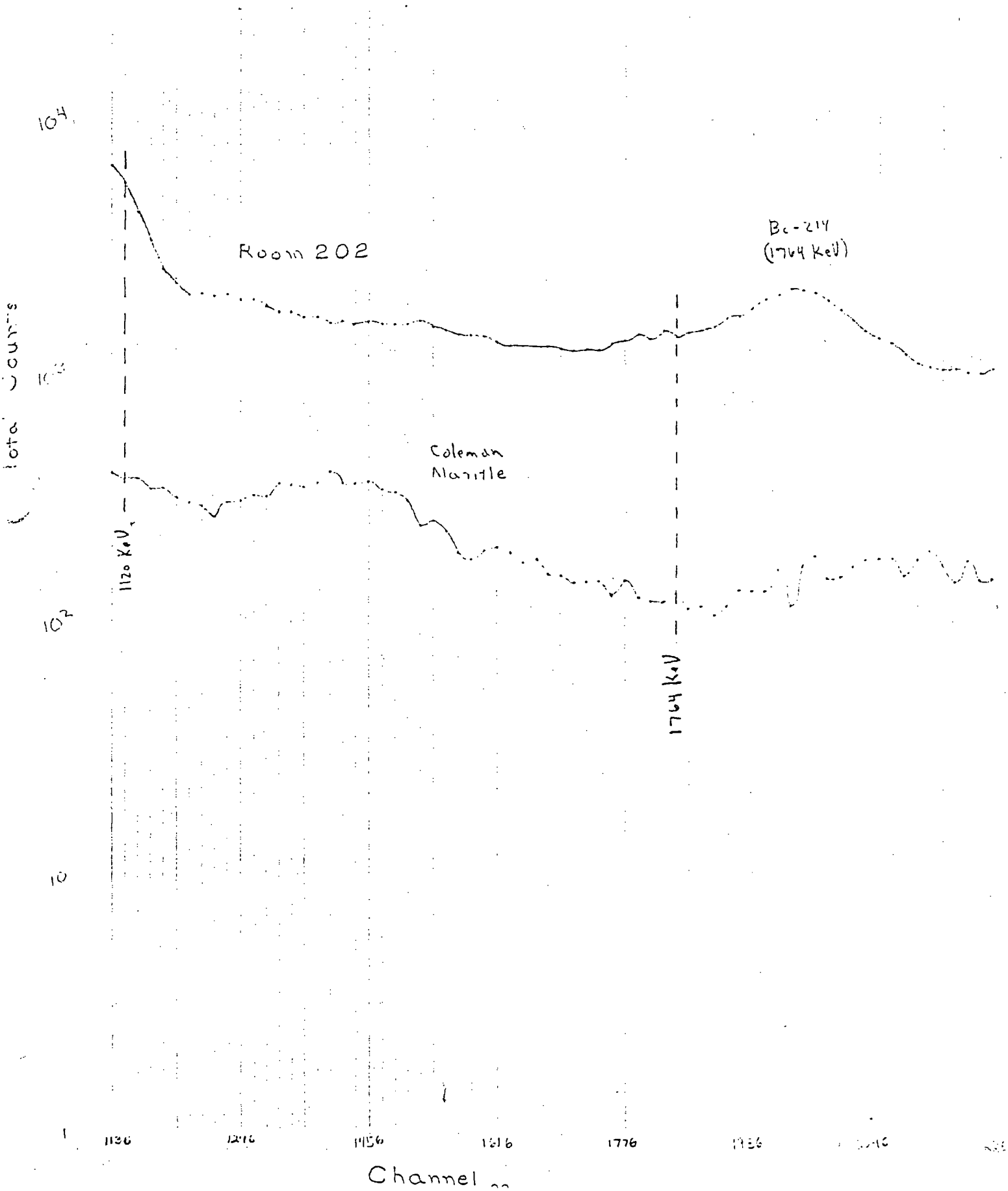
---

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

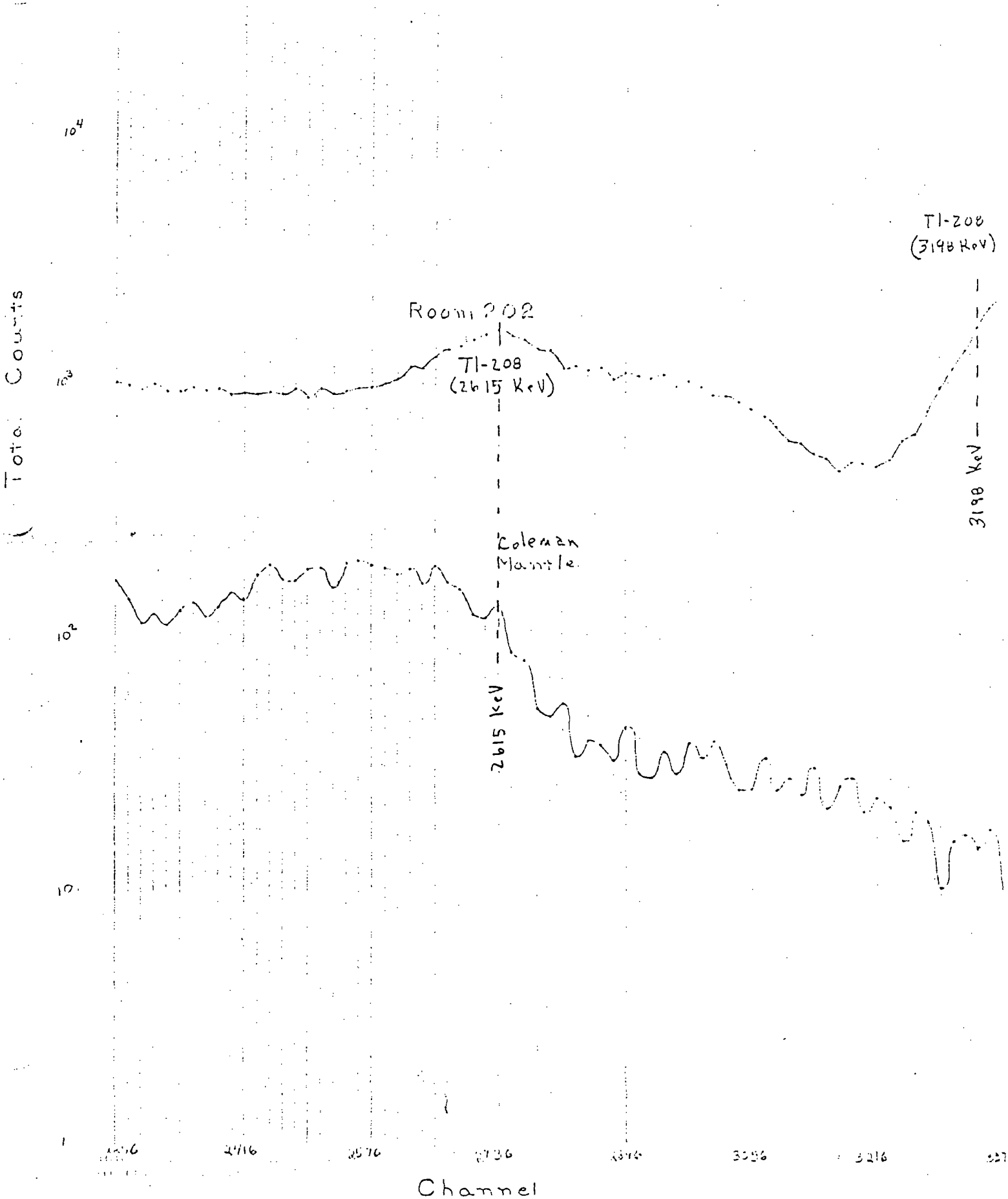
Figure 23 : Multi-Channel Gamma Ray Spectrum
161 East Grand - Chicago, Illinois
November 24, 1980
Cs-137 (40 seconds)
Coleman Lantern Mantles (4000 seconds)
Room 202 (3200 seconds)



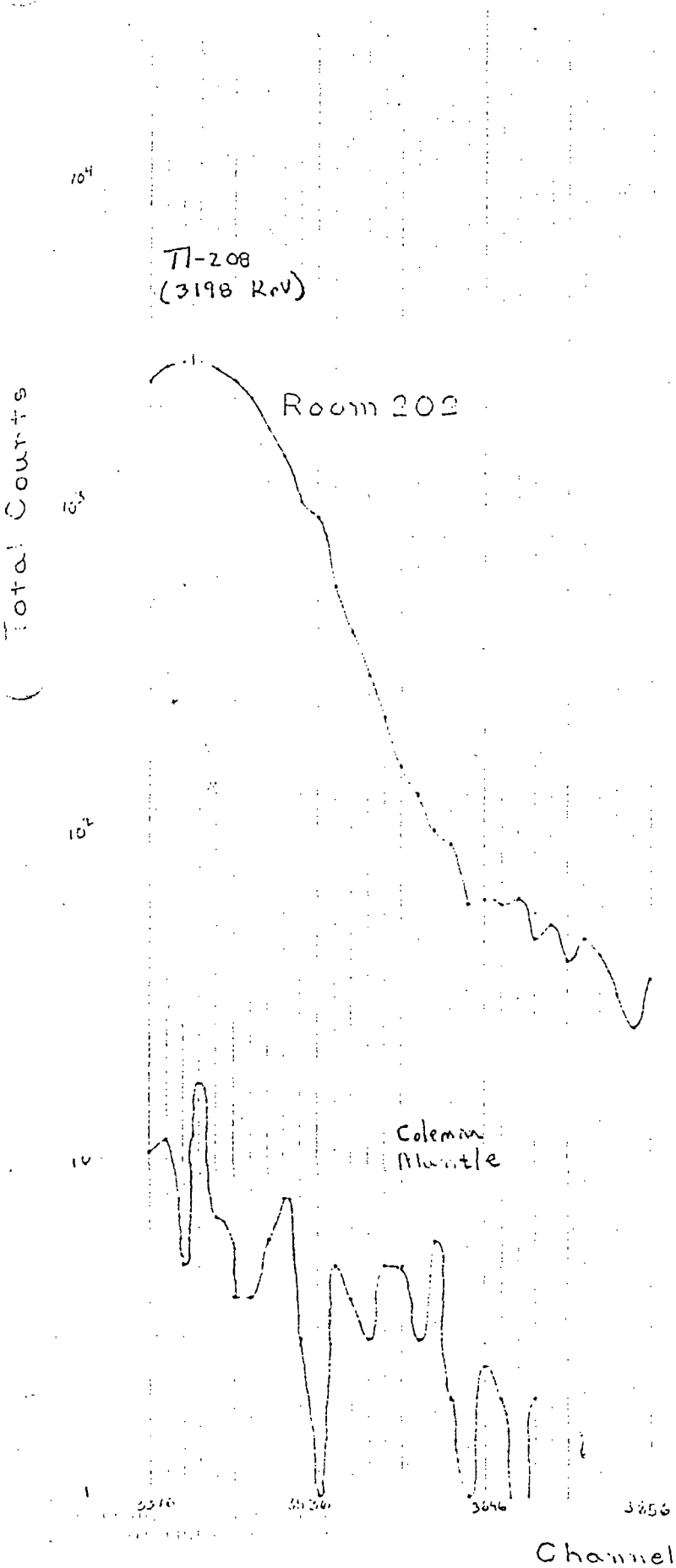
Multi-Channel Gamma Ray Spectrum
(Cont.)



Multi-Channel Gamma Ray Spectrum
(Cont.)



Multi-Channel Gamma Ray Spectrum
(Cont.)



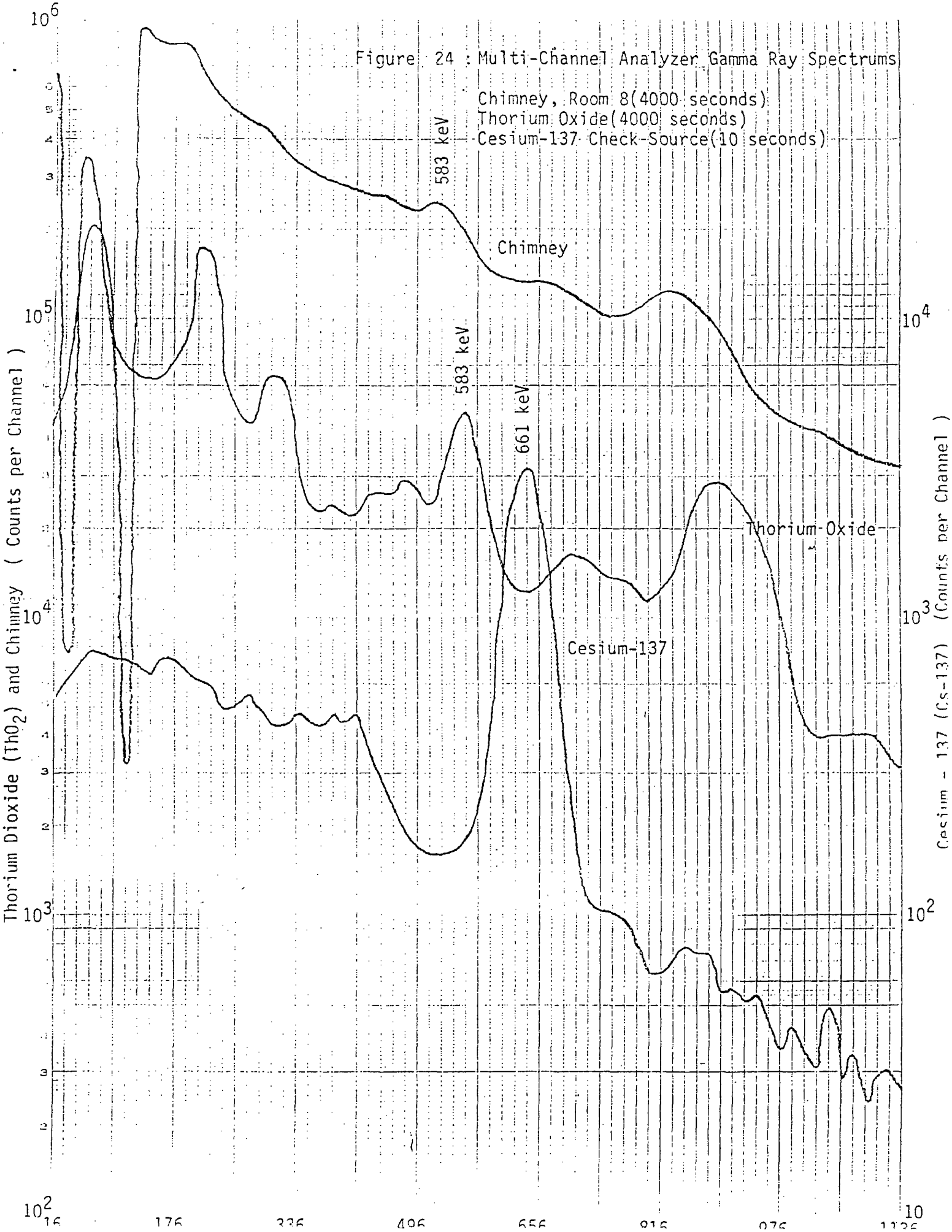
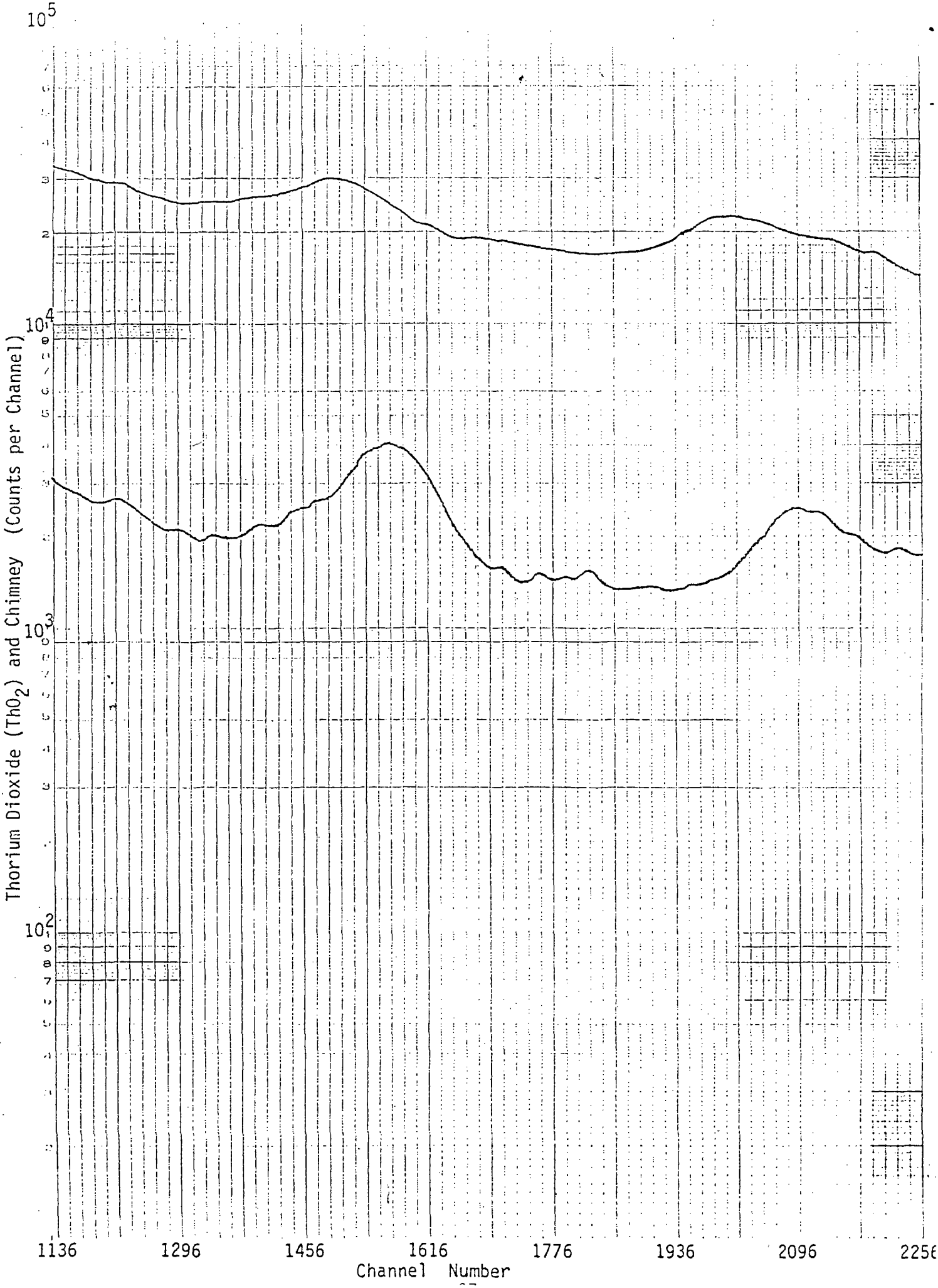


Figure 24 : Multi-Channel Analyzer Gamma Ray Spectrums


10^5
10^4
10^3
10^2
Thorium Dioxide (ThO_2) and Chimney (Counts per Channel)
1136
1296
1456
1616
1776
1936
2096
2256
Channel Number

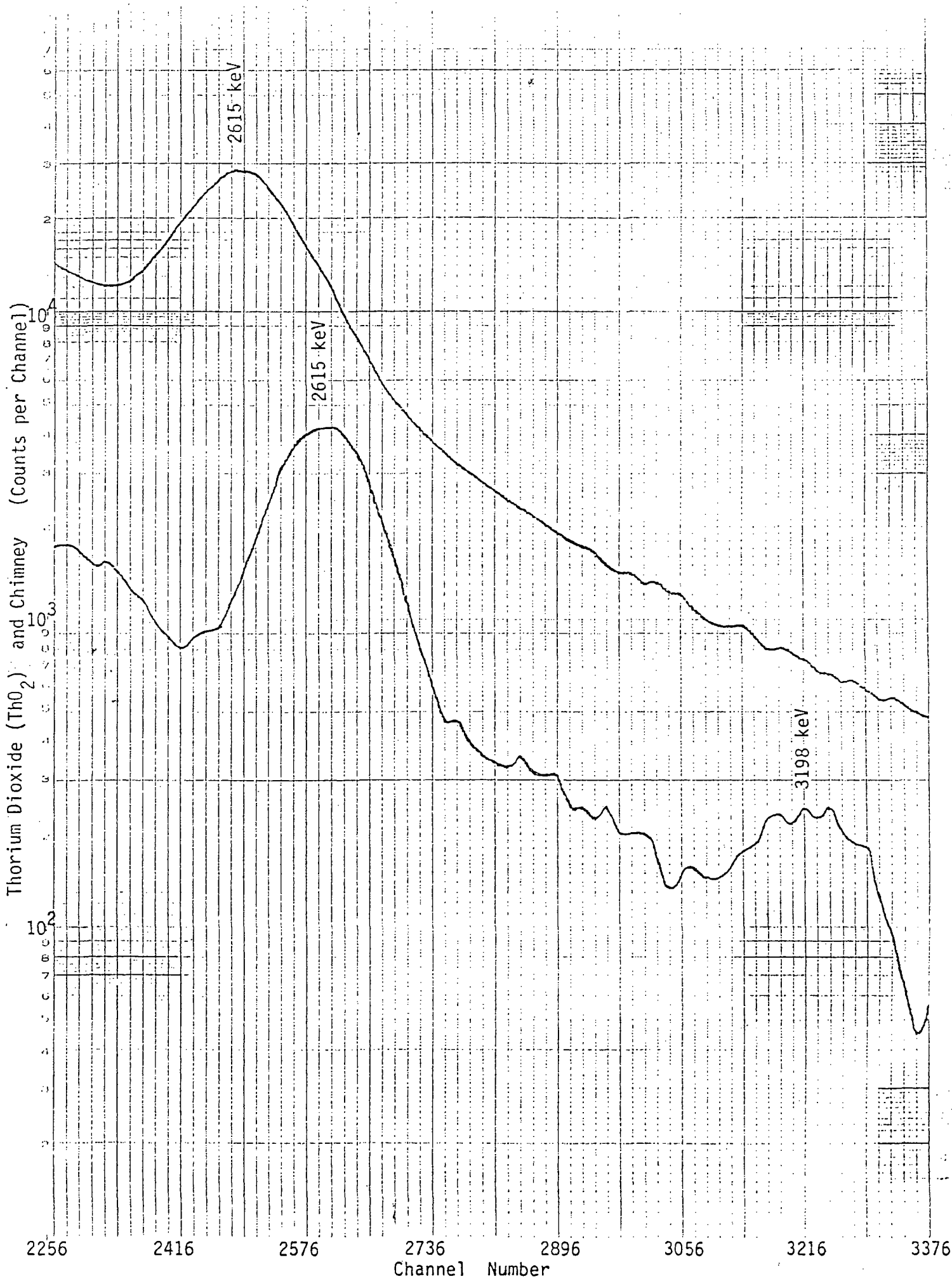
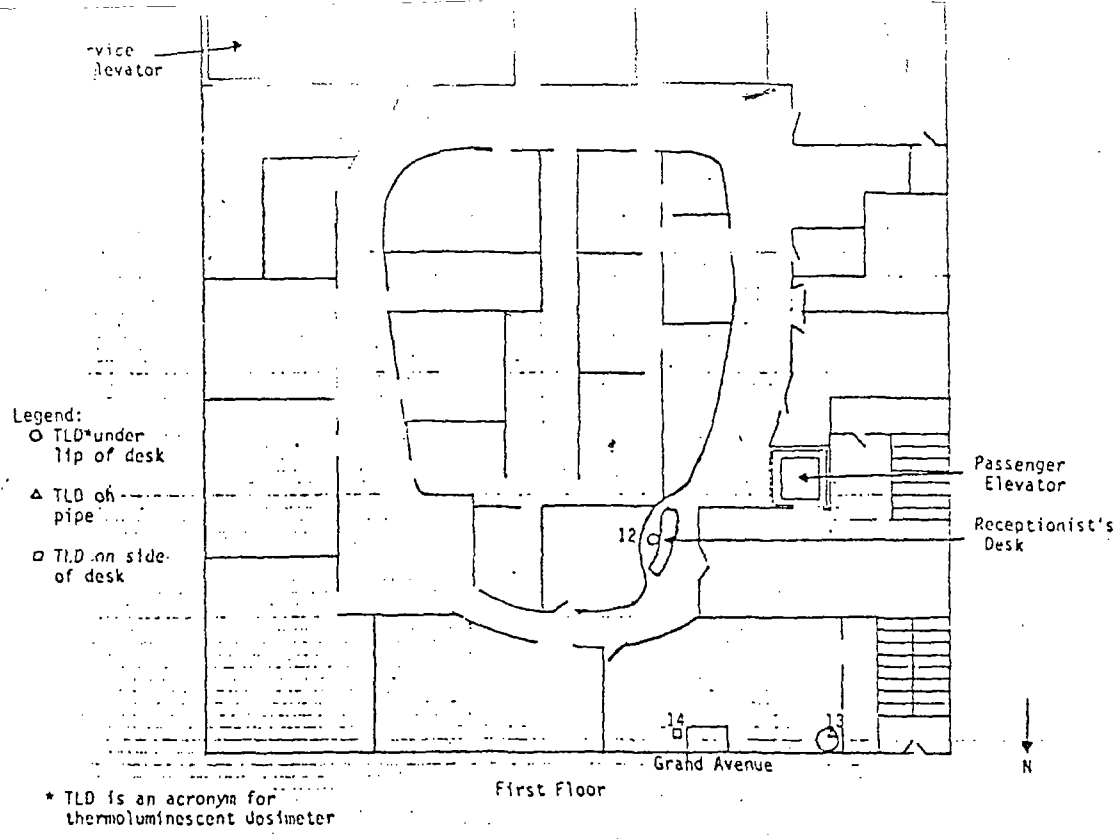
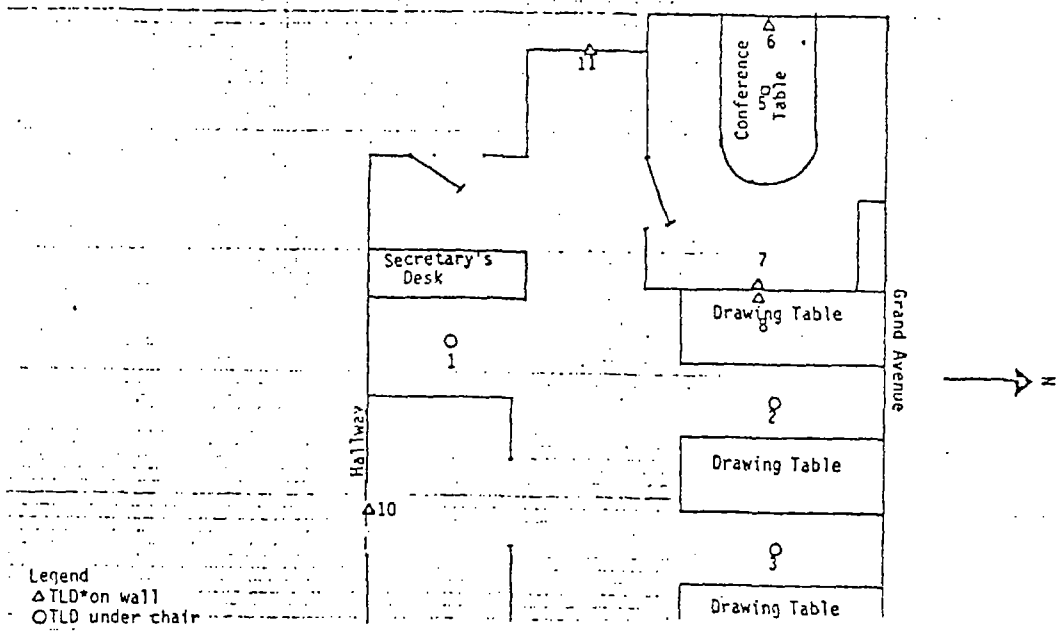

2615 keV
2615 keV
3198 keV
10^4
10^3
10^2
Thorium Dioxide (ThO_2) and Chimney (Counts per Channel)
2256
2416
2576
2736
2896
3056
3216
3376
Channel Number

Figure 25



Location of Thermoluminescent Dosimeters in Room 202



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.

---

*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

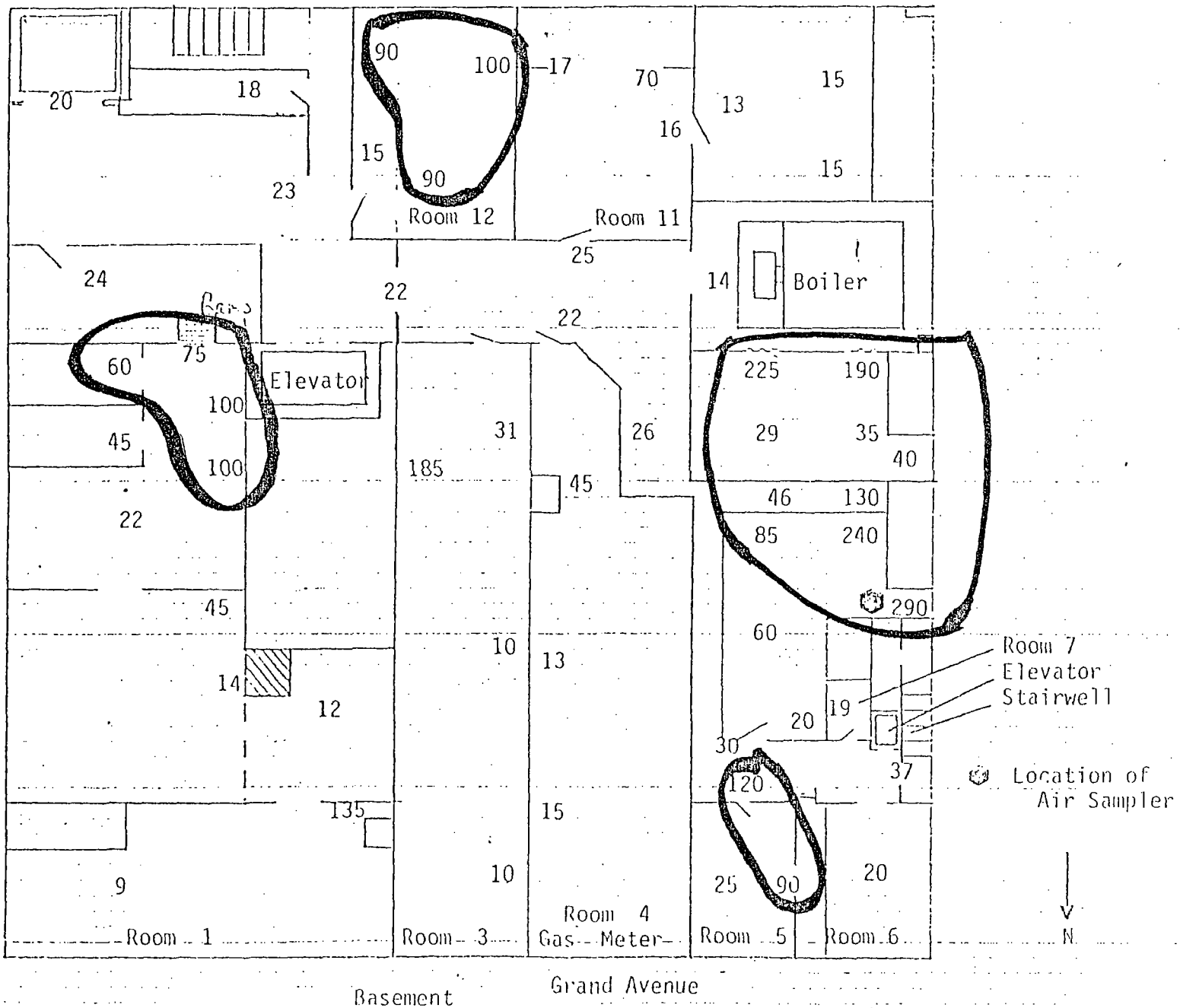


Figure 27 : First Floor Regions of Contamination

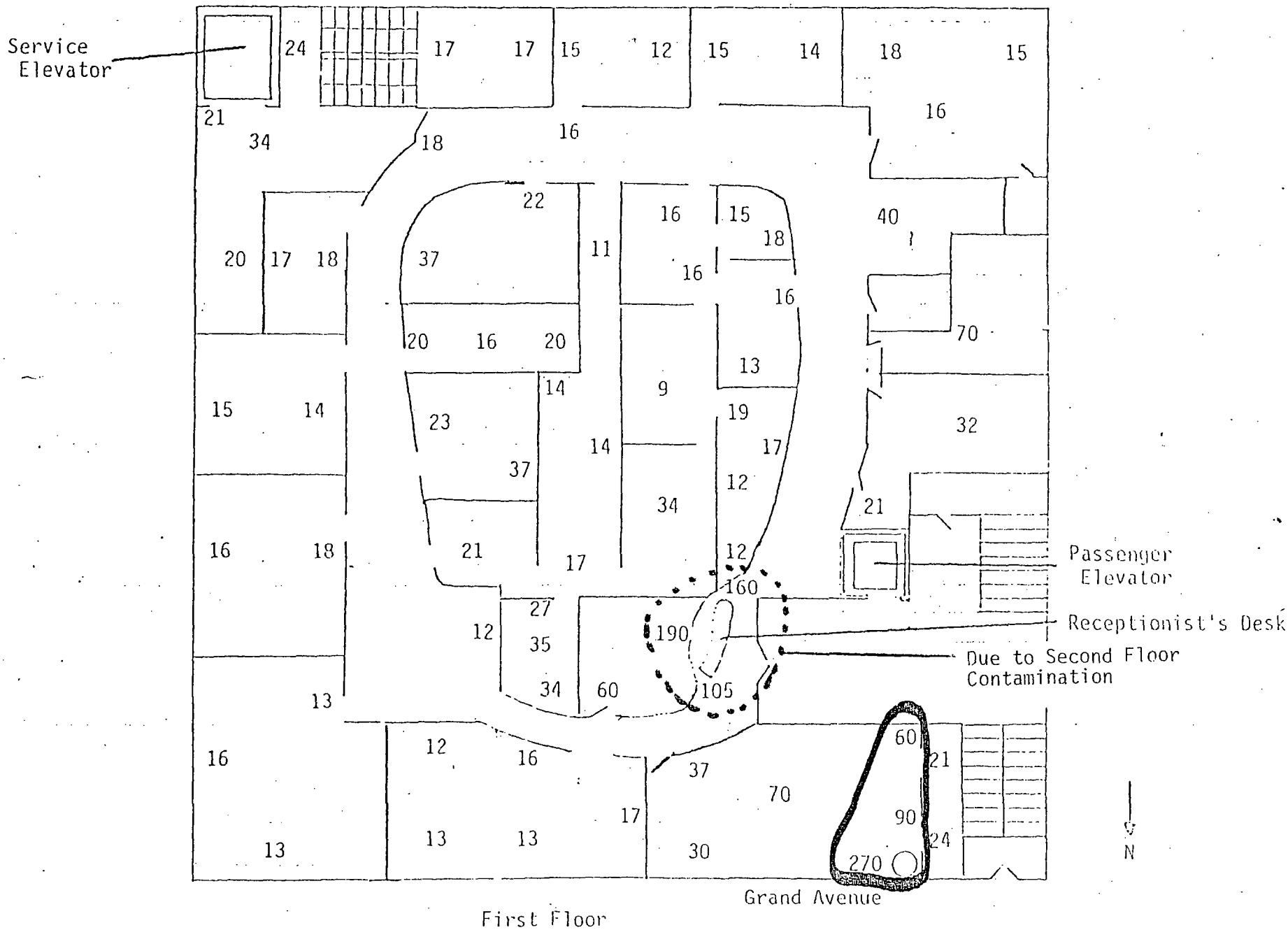


Figure 28 : Second Floor Regions of Contamination

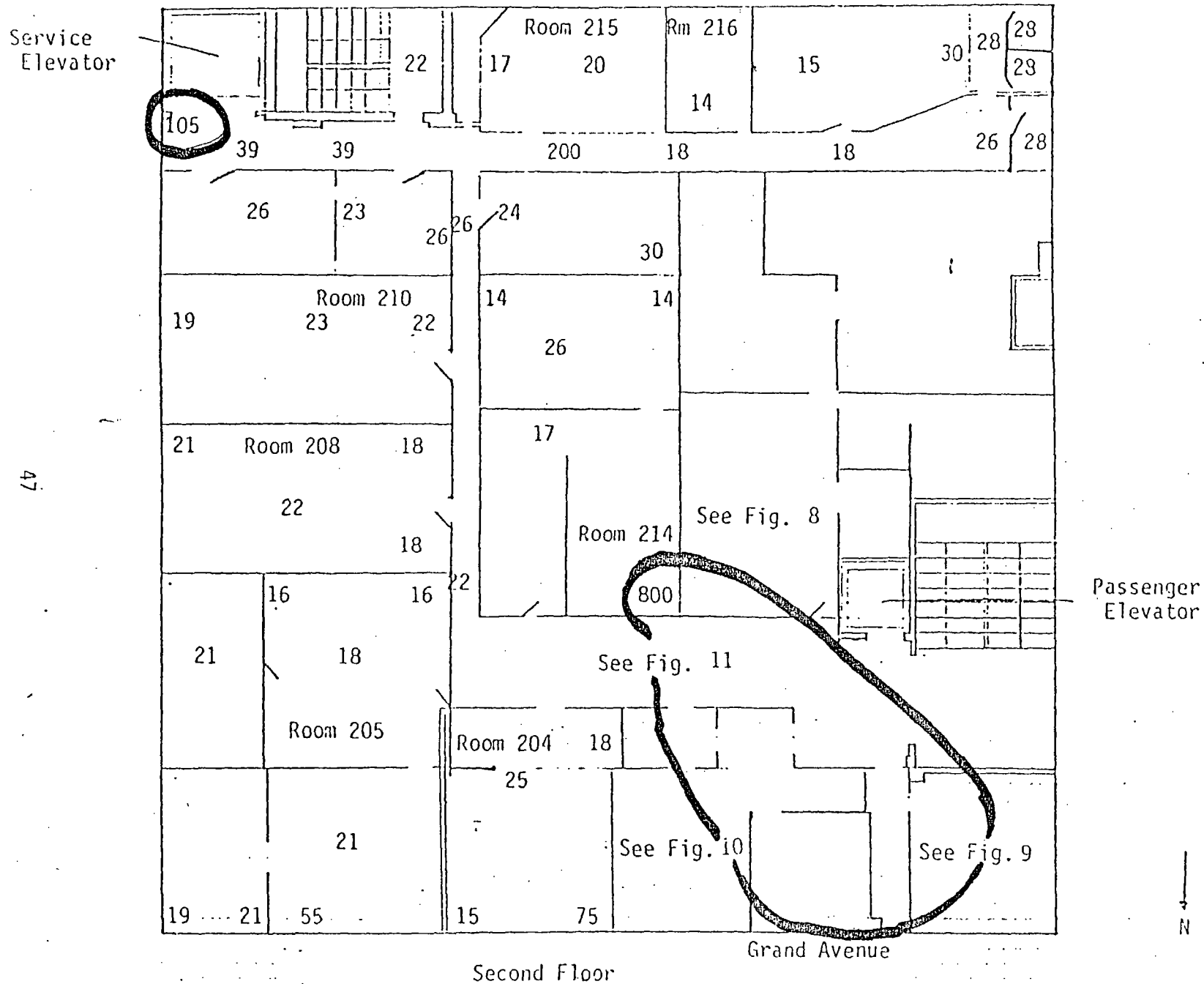
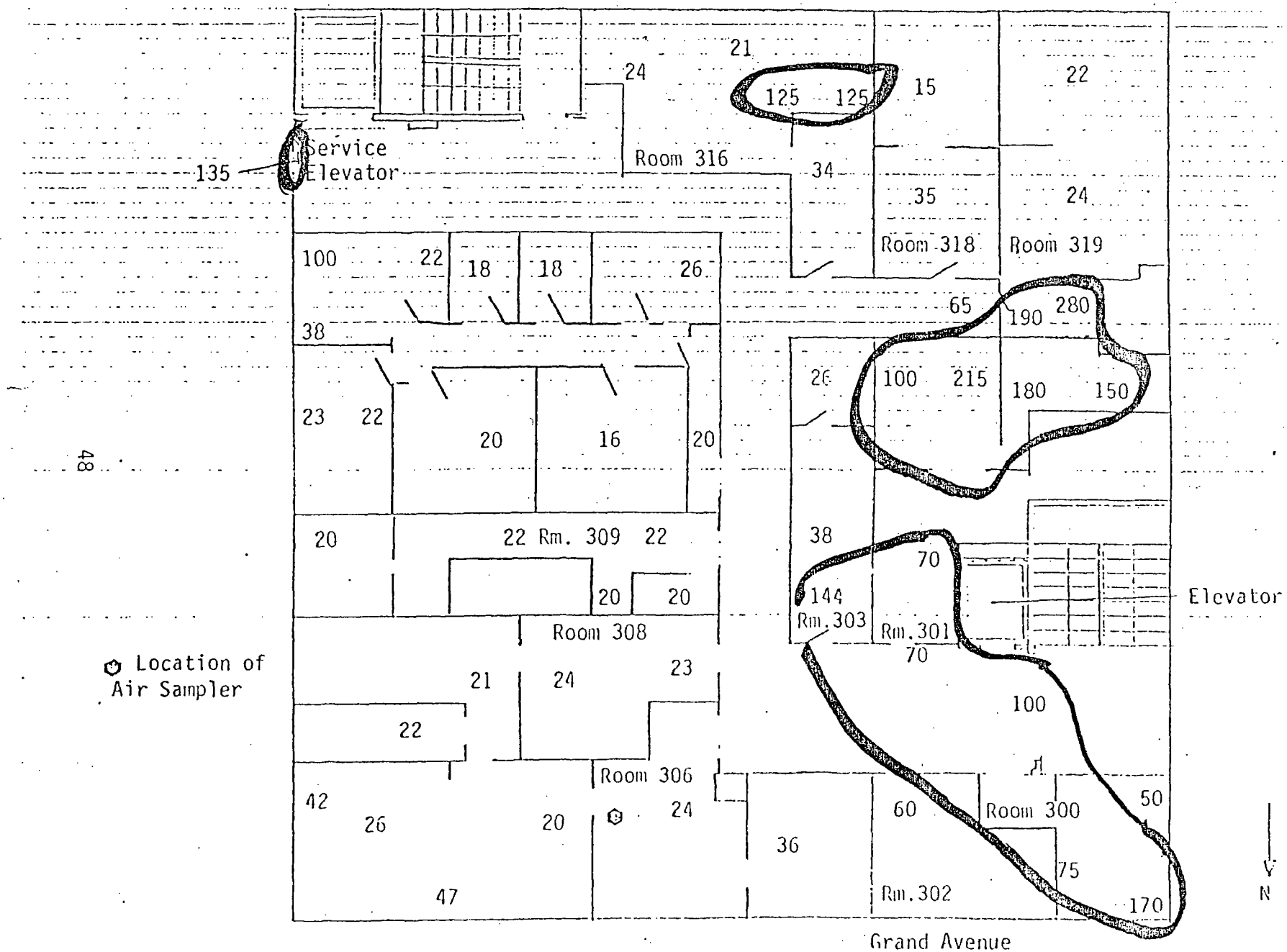
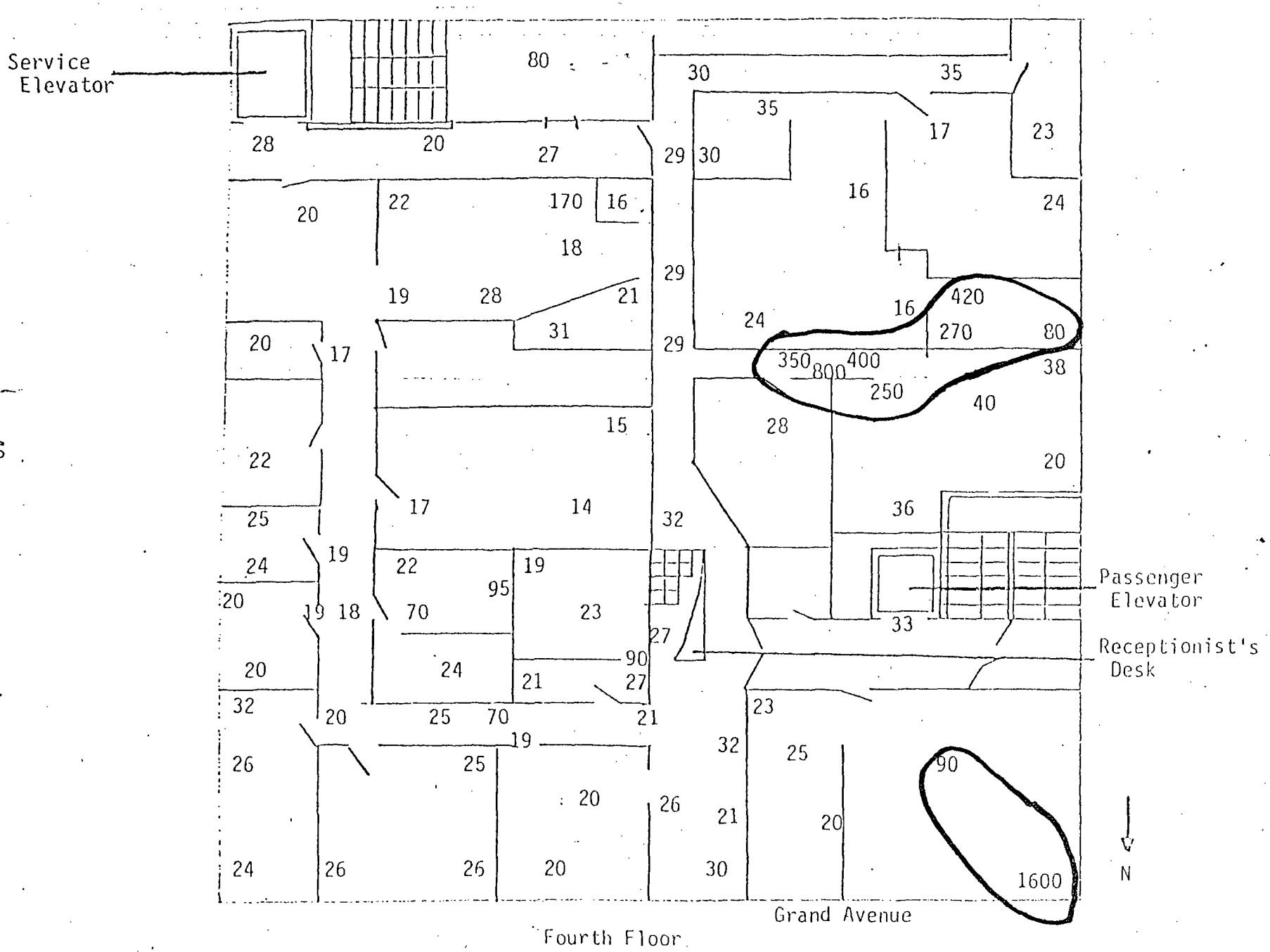


Figure 29 : Third Floor Regions of Contamination



3rd Floor

Figure 30 : Fourth Floor Regions of Contamination



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

TLD Chip 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. Recommendat s

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. Exposure Sites
- C. Exposure Data and Results

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- B. Ogden Method
- C. Air Sample Results

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

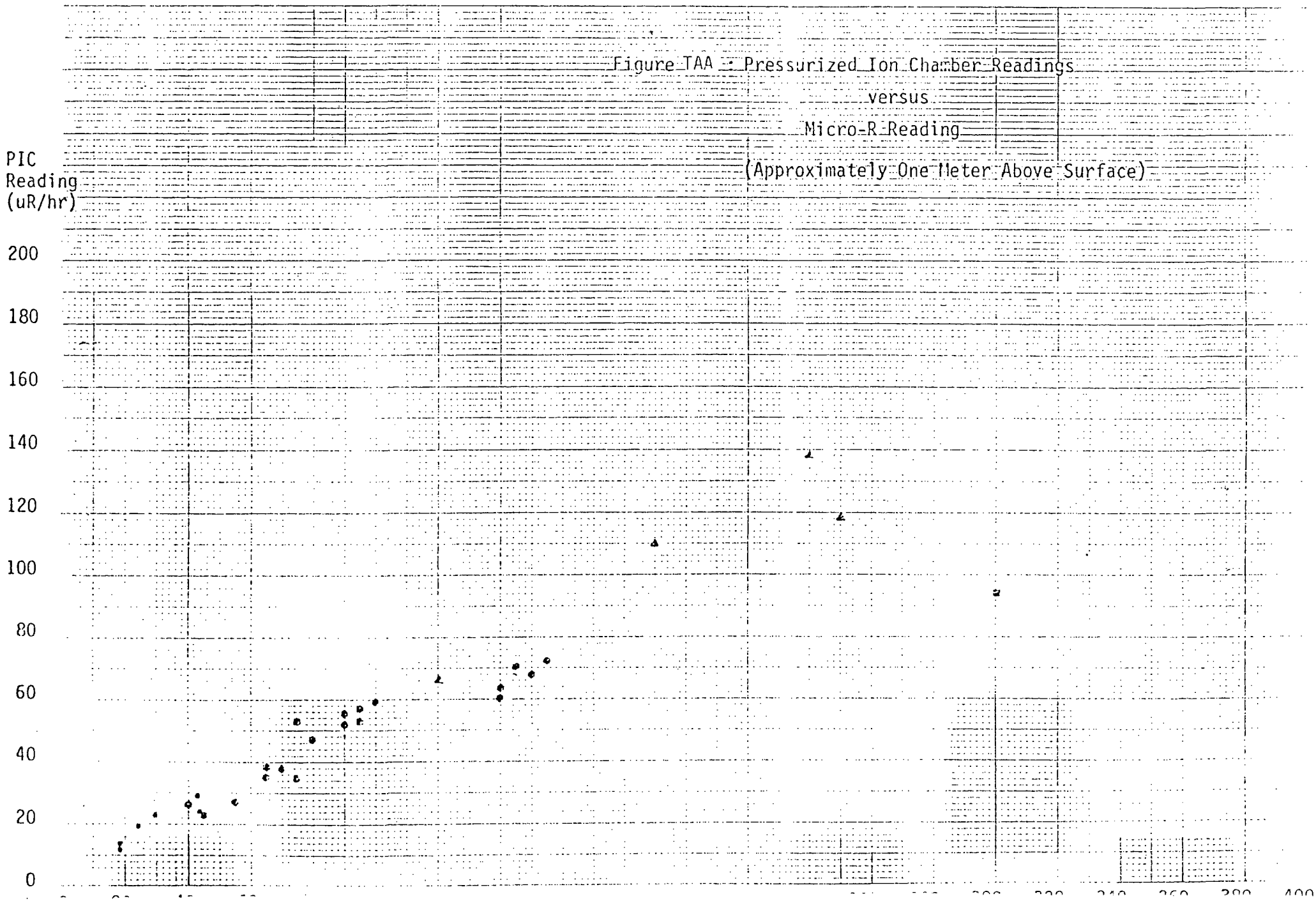

Figure TAA - Pressurized Ion Chamber Readings
versus
Micro-R Reading
(Approximately One Meter Above Surface)

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	2.28×10^{-7} - 1.93×10^{-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	2.41×10^{-6} - 5.00×10^{-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 ----

CDOCF017 LABORATORY INPUT SHEET FOR RADIOLOGICAL SAMPLES PAGE 4

TRAN CODE 45
SAMPLE KEY 80358450 59 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)

DATE 1/21/81 MICROFILM ----

CDGCF017 LABORATORY INPUT SHEET FOR RADIOLOGICAL SAMPLES PAGE 5

TRAN CODE 45
SAMPLE KEY 8035845067 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)

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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.

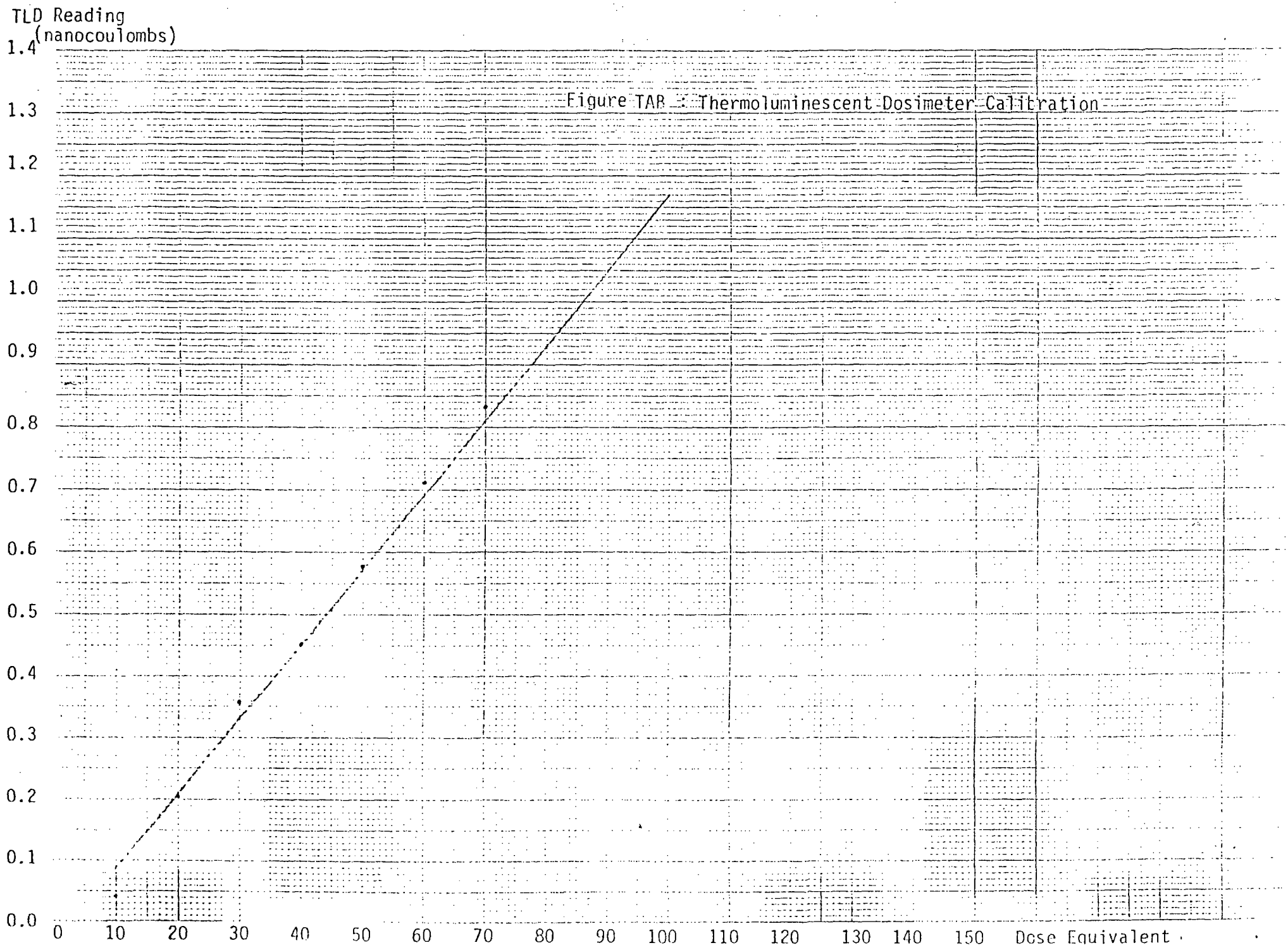

Figure TAB : Thermoluminescent Dosimeter Calibration

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

Table TA4

TLD Chip 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. 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

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

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

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

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 1. VALUES OF a, b, c, AND d FOR SUBSTITUTIONS IN EQUATION (1)

Sampling time T (min)		Wait time t_0 (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	10.36	11.65	13.12	14.79	16.67	18.81	21.23	23.97	27.08	30.61
	b	1.39	1.37	1.35	1.34	1.32	1.31	1.30	1.29	1.27	1.26	1.26	1.25	1.24	1.23	1.22
	c	22.74	22.27	21.86	21.49	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	5.68	6.50	7.37	8.27	9.28	10.43	11.74	13.21	14.88	16.77	18.91	21.34	24.09	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	1.23	1.22
	c	21.37	20.93	20.54	20.20	19.89	19.62	19.38	19.16	18.96	18.78	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	16.55	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	9.40	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	15.85	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	10.85	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	21.98	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	28.28	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	15.83	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	1.18	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	6.78	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	7.56	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
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.

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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

$$a = 10^5 K/(JM - LK)$$
$$b = M/K$$
$$c = 10^5 L\,(1 + 0.0949\gamma)/(JM - LK)$$

$$d = J/L$$
$$J = 3.859\times10^{4}\exp(-4.310\times10^{-4}\,t_Q) - 1.821\times10^{4}\exp(-5.862\times10^{-4}\,t_Q)$$
$$K = 1.972\times10^{3}\,k_{Ts}\exp(-1.809\times10^{-5}\,t_Q) - 309.6\,(1.105-\gamma)k_{Tc}\exp(-1.906\times10^{-4}\,t_Q)$$
$$L = 4.499\times10^{3}\exp(-4.310\times10^{-4}\,t_Q) - 940.6\exp(-5.862\times10^{-4}\,t_Q)$$
$$M = 2.197\times10^{3}\,k_{Ts}\exp(-1.809\times10^{-5}\,t_Q) - 131.7\,(1.105-\gamma)k_{Tc}\exp(-1.906\times10^{-4}\,t_Q)$$
(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.

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

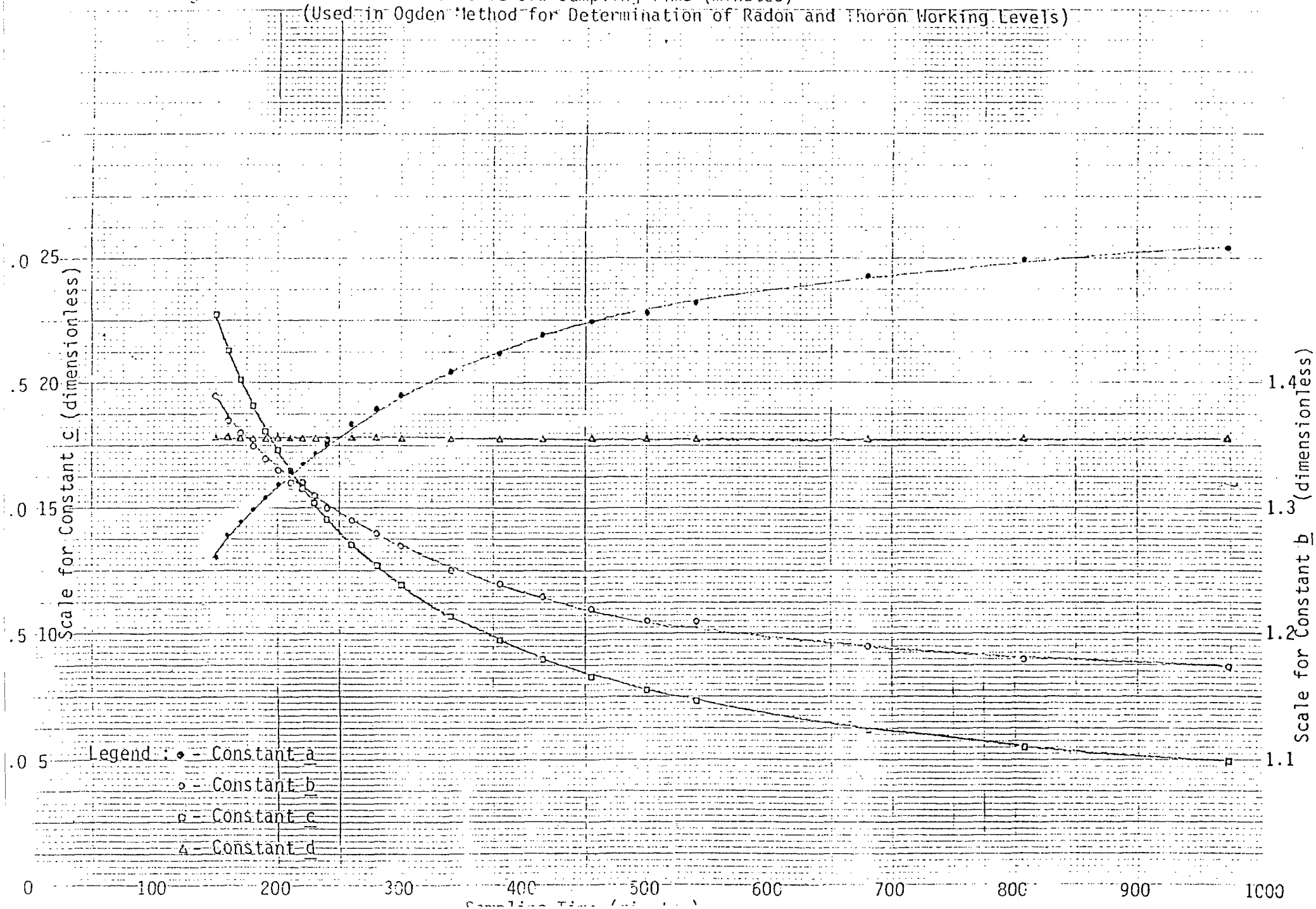


Table TA6: Air Sample (Filter) Collection and Background Counting Periods

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

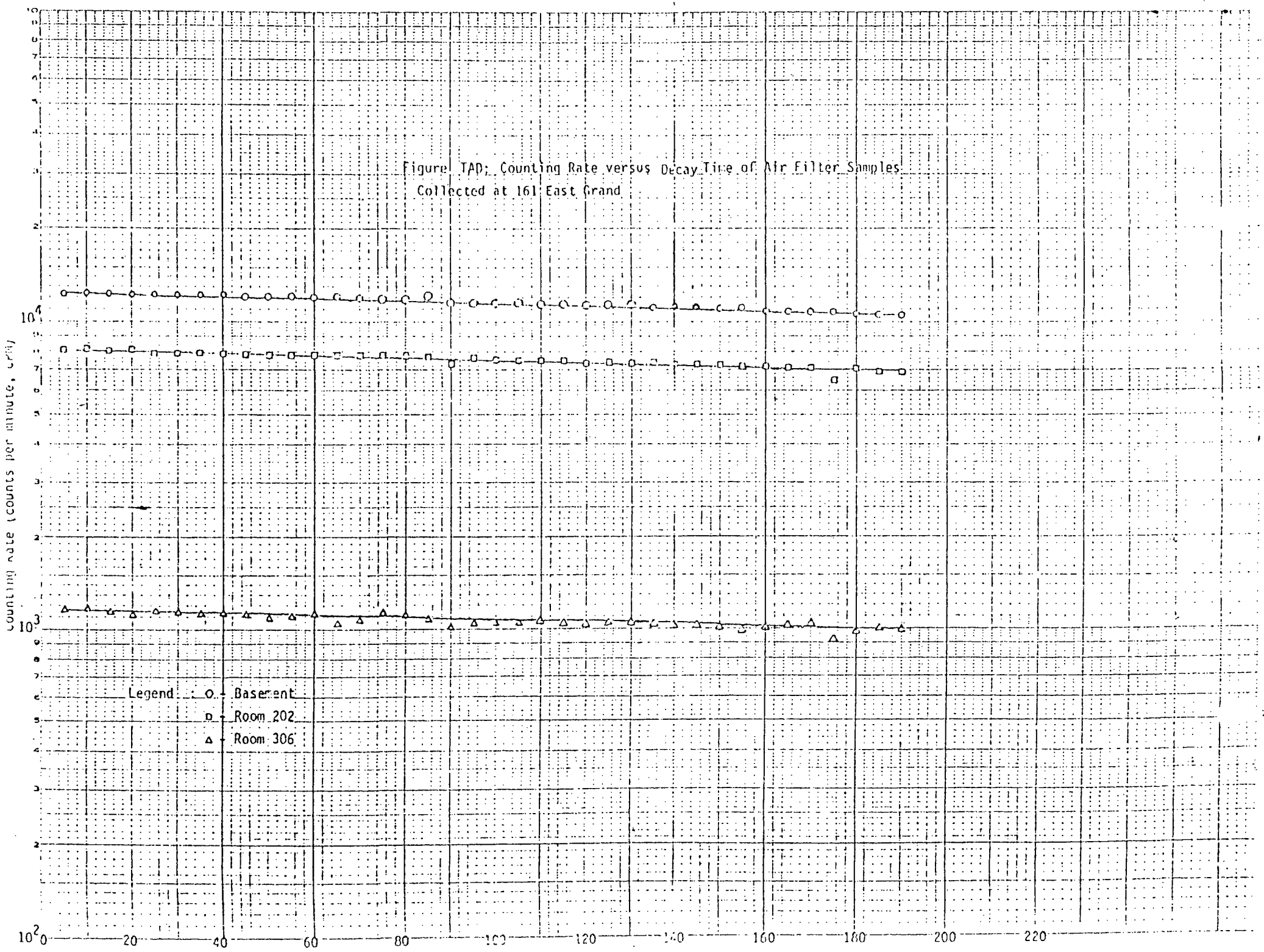


Figure TAD: Counting Rate versus Decay Time of Air Filter Samples Collected at 161 East Grand

Th-Nat

$\Gamma = 0.7$ Rhm

1.1×10^{-7} Ci/g

Larry Jensen
Ken Barat
Dave Derenzo
Ron Kuyber
Chester

387.6
20 | 7753
60
175
160
153
140
130
120
100

1st Air Sample - Start 12:06 - 20 min

	Wipe	# Probe
Wipe # 1 BKG	162	300 - ~~[illegible]~~ 250
# 2	131	
# 3	125	

BG -

1st air Sample 20m. 1 min count 318c
2nd air Sample 25 min 1 min count

Jung Sh. Probe

Change of counter Location
1:17pm 2nd air sample - 1 min count - 472
2nd BG = 680 counts in 6 min
4th Brd Sample Started: 2:18 2nd ended 2:17
(1 hr exactly) Count Start: 2:20pm 6,429
Immediate Next 5 min count: 6453

	Sample 1	Sample 2	Sample 3	Sample 4
Sample Start Time	12:06	12:50	1:17	2:18
End of Sampling	12:36	1:16	2:17	2:43
Δt	30	26 min	60 min	25 min
Sampling rate				
Volume Sampled				
Initial Count Rate	318c / m	477c / m	12882c / 10m = 1288.2 cpm	7753c / 20min = 387.65 cpm
5hr count	5:36 - 5:51 1903c/15m = 127	6:16 - 6:31 3267/15 = 217	7:17 - 7:32 11048/15 = 737	8:00 - 8:15 2921/15 = 195

Standard prep.

50mgm $Th(NO_3)_4\ 4H_2O$ FW = 552.12

$$N = \left(\frac{6.023\times10^{23}}{552.12g}\right)(0.05g) = 5.45\times10^{19} \text{ molecules (Th atoms)}$$

$$A_s = \lambda N = \left[\left(\frac{\ln 2}{1.41\times10^{10}y}\right)\left(\frac{1y}{365d}\right)\left(\frac{1d}{24h}\right)\left(\frac{1h}{60min}\right)\right]\left(5.45\times10^{19}\right)\left(\frac{1\mu Ci}{2.22\times10^{6}dpm}\right)$$

$$A_s = \left(9.353\times10^{-17}m^{-1}\right)\left(5.45\times10^{19}\right)\left(\frac{1\mu Ci}{2.22\times10^{6}dpm}\right)$$

$$A_s = 2.296\times10^{-3}\mu Ci \qquad R_s = \left(\frac{38,442c}{10min}\right) - \left(\frac{176c}{5m}\right) = 3809cpm$$

Efficiency Determination

$$\epsilon = \frac{R_s}{A_s} = \frac{3809cpm}{2.2961\times10^{-3}\mu Ci} = 1.6589\times10^{6}\ cpm/\mu Ci$$

$$\epsilon = \left(\frac{1.65\times10^{6}cpm}{\mu Ci}\right)\left(\frac{1\mu Ci}{2.22\times10^{6}dpm}\right) = 0.7473\ \frac{c}{d}$$

$$C = q / F t_s$$

q = activity of sample
F = Flow rate thru sampler
t_s = Sampling time
q_m = M.D.A.
r_b = bg. count rate
L_c = Critical Level
ϵ = efficiency of counting system
K = 1.65 at 95% C.L.

$$q = \frac{q_m}{\epsilon} = \frac{r_b + L_c}{\epsilon}$$

$$q = \frac{r_b + k\sigma_b\left(1 + \frac{t_b}{t_t}\right)^{1/2}}{\epsilon}$$

$$C_{\substack{min \\ detectable}} = \frac{r_b + k\sigma_b\left(1 + \frac{t_b}{t_t}\right)^{1/2}}{\epsilon \; F \; t_s}$$

$\epsilon = 0.747$ c/d
or
$\epsilon = 1.659 \times 10^6 \frac{cpm}{\mu Ci}$

$$C_{min} = \frac{\frac{1766}{5m} + (1.65)\left(\frac{\sqrt{1766}}{5m}\right)\left(1 + \frac{5m}{5m}\right)^{1/2}}{\left(1.659 \times 10^6 \frac{cpm}{\mu Ci}\right)\left(5500 \, ml/min\right)\left(60 \, min\right)} = \frac{41.3913}{5.474 \times 10^{11}}$$

$C_{min} = 7.56 \times 10^{-11}$ $\mu Ci/ml$, with one hr sampling period, 55 lpm.

BTICI

$Th_{nat} = 6 \times 10^{-11}$ $\mu Ci/ml$

After 5 hr assume only ^{212}Pb is left in equilibrium with its daughters.

$$^{212}Pb \xrightarrow{\beta\,(\cancel{75\%}\ 100)} {}^{212}Bi$$

2β, 1α for each dis of ^{212}Pb.

$\therefore$ use $(.30) \times 3 = 0.9$ or less for eff.

using 0.5 efficiency

$C =$

Sample 1

Time Sample Started 12:06
Time Sample Ended 12:36 — 30 min

Counted 5:36 - 5:51 (15 min) 1903 cnts

Sample 2

Time Started ~~1:72~~ 12:50
Time Ended ~~2:17~~ 1:16 — 25 min

Counted ~~5:50~~ - 6:16 to 6:31 (15 min) 3267

Sample 3

Time Started ~~2:18~~ 1:17
Time Ended ~~3:18~~ 2:17
7:17 - 7:30 1048

Sample 4

Time Started ~~3:19~~ 2:18
Time Ended 2:45
~~7:45~~ - 8:00

BG

15 min - 1101 counts

Sample 1) start 4:31 Counts 4138
Stop 4:46

Sample 2) Time Start Counts
Time Stop

Sample 3 Time Start Counts
Time Stop

Filter 1 {

Filter 2 { 1:17
2:17

Filter 3 { 2:18

Filter 4 {

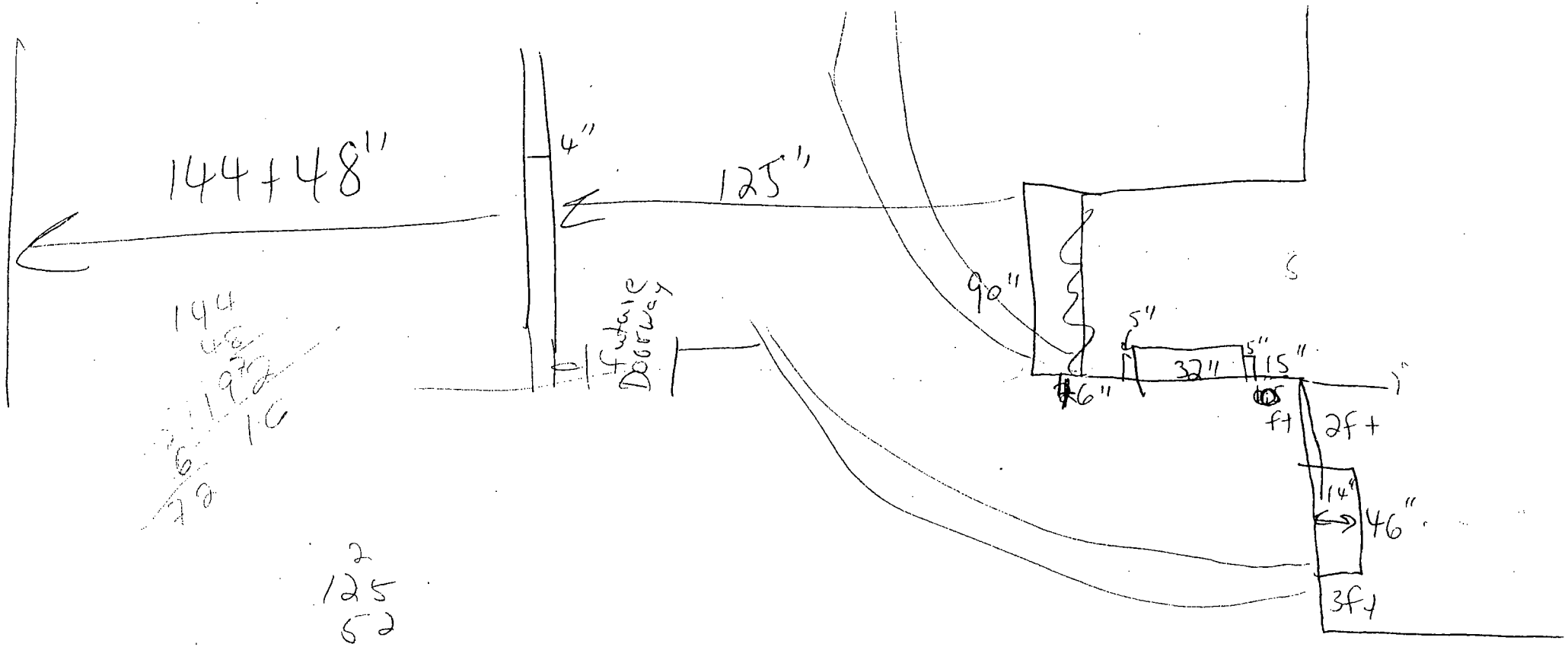
4th Counted 25 min
20 min 2:46 - Last count start - Fin 3:06
7753 counts

Samples 8:46:30 Start Pump
10:21:30 Stop Pump
55 lpm Total Time 1 hr 35 min — Down to (45) lpm

1 bag Garbage γ - B.G w 2220/crystal
1000 to 1200 cpm BG)
1, 2, 3, 4

2nd Sample:
Start 10:23:30
End 1:52:30.

[illegible]
x cpm [illegible]



144
48
192
16
6
72

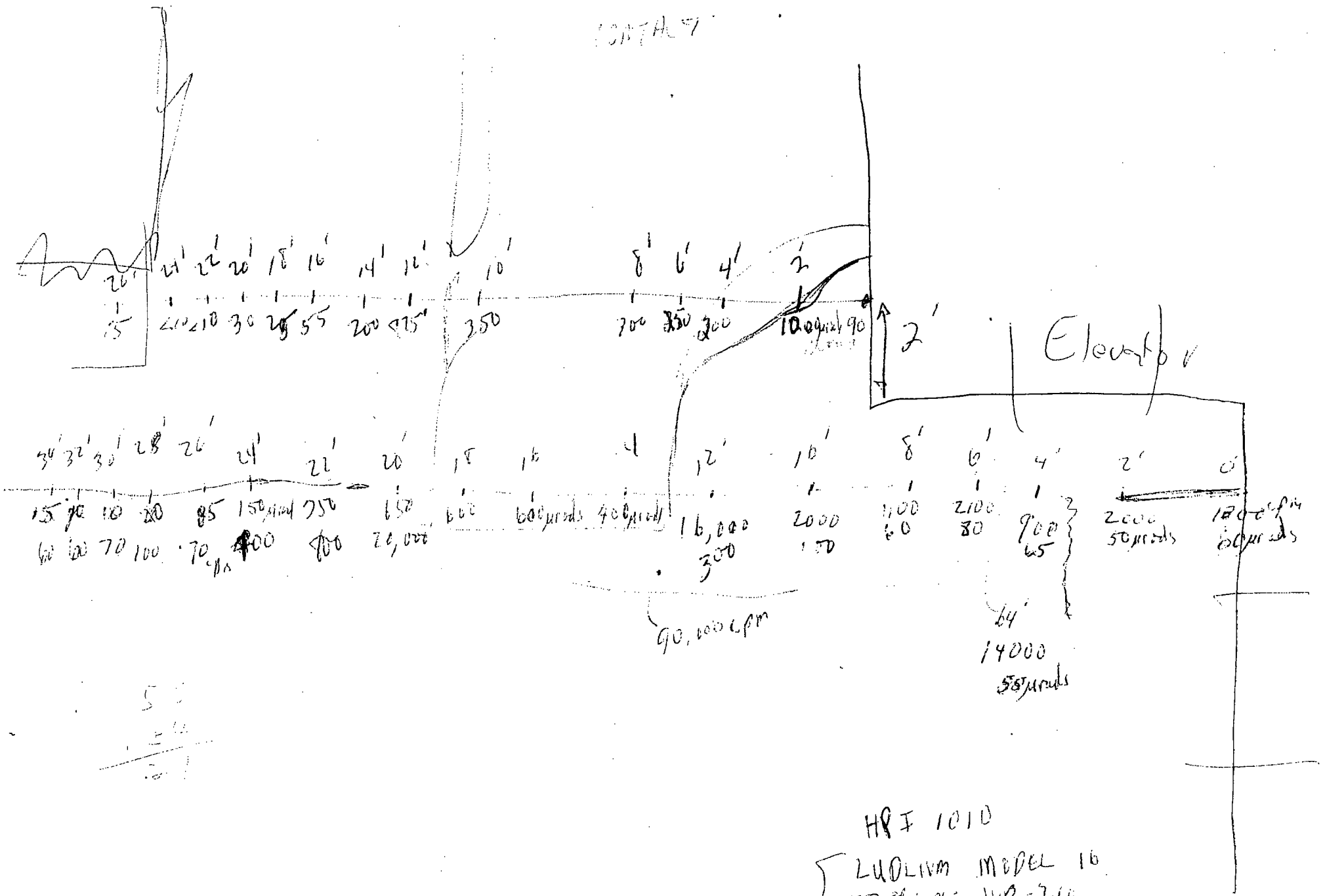
2
125
52
144
46
32
15
12 | 414
34.5ft

105
12 | 125
12
5

88
15
103 70
12 | 8.7/12
8
96

46
10
32
12 | 88 40
7
84
7.3/3

7.5
12 | 90.00
7
84
60



HPI 1010

LUDLUM MODEL 16
EBERLINE HP-210

50 μgrams of $Th(NO_3)_4 4H_2O$
F.W. 552.12

38,442 c/10 min

$$\chi^2 = \frac{\Sigma(X_i - \bar{X})^2}{\bar{X}_e/t} = \frac{(N-1)s^2}{\bar{X}_e}$$

	X_i	$X - X_i$	$(X - X_i)^2$
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			

2057
2009
1921
1833
1790

$$\frac{(25-1)(36.2175)^2}{\bar{X}_e = 1920.96}$$

$\chi^2 = 16.3881$

$\frac{\chi^2}{24} = 0.6828$

∴ Satisfactory

$\sigma = \sqrt{1920.96}$

$\sigma = 43.83 \approx 44$

WL = ±87.6 = 88

Control Limit = ±131.5

1 2038
2 2047
3 2040
4 2026
5 2013
6 2041
7 1981
8 2014
9 2059
10 2089

11 1997
12 2032
13 2015
14 2065
15 1982
16 2058
17 2027
18 2050
19 1997
20 1896

21 1960
22 1952
23 1923
24 1940
25 - 1885
26 - 1972
27 - 1959
28 - 1900
29 - 1896
11 30 - 1956

12 1914
13 1938
14 1884
15 1886
16 - 1873
17 1906
18 - 1984
19 - 1904
20 - 1930
21 - 1977
22 - 1921
23 - 1855
24 - 1870
25 - 1943

1920.9600

$\bar{x} \pm s$ 1921, ± 36

$s = 36.2175$

$\sigma = \sqrt{1921} = 43.8$

1950

± 44

973
0305
Canal

$60 | - | Goldish

4 $60.00

$1861.68 \quad \frac{\sigma}{s} = 1.2$

$n = 25$

$\Sigma_x = 48,024.00$

$\Sigma x^2 = 92,283,664$

$$x^2 = \frac{\Sigma (x_i - \bar{x})^2}{\bar{x}/t} = \cancel{\Sigma x_i^2 - 2\Sigma \bar{x} + \Sigma \bar{x}^2}$$

$n = 25$

5min Sample Counts	Long Lived component
03/16/84	
Sample 1	188 counts
Sample 2	187 counts
sample 3	171
Sample 4	238 and 248
~~Sample~~ -BG/5min	~~274~~ 176

Eberline
^{230}Th Source
8900 dpm
1/13/75
#10540

24,838 c/5min

$$\epsilon = \frac{4,967.6 \text{ cpm}}{8900 \text{ dpm}} = 0.5581$$

12:52

$$C = q / F t_s$$

$$C = q / (55\ \text{lpm})(60\ \text{min}) = \left(\frac{q}{3.3 \times 10^3\ \ell}\right)\left(\frac{1\ \ell}{1000\ \text{ml}}\right)$$

$$C = 3.03 \times 10^{-7}\ q/\text{ml}$$

$$\epsilon_{^{230}Th} = \left(\frac{24838\ \text{count}}{5\ \text{min}}\right) \Big/ (8900\ \text{dpm}) = 0.5582\ \frac{c}{d}$$

$$q = \left(\frac{176}{5} + L_c\right)\frac{1}{\epsilon} = (\cancel{8.7}\ 43.9)\ \frac{1}{0.5582} = \cancel{15.66}\ 78.73\ \text{dpm}$$

$$L_c = k\,\sigma_b \left[1 + \frac{T_b}{T_t}\right]^{1/2} = 2.33\left(\frac{\sqrt{176}}{5}\right)\left[1 + \frac{5}{5}\right]^{1/2} = (8.7)$$

The Longer the better

$$C_{\substack{\text{min}\\ \text{detectable}}} = (3.03 \times 10^{-7})(78.73\ \text{dpm})\left(\frac{1\ \mu\text{Ci}}{2.22 \times 10^6\ \text{dpm}}\right)/\text{ml}$$

$$C_m = 1.075 \times 10^{-11}\ \mu\text{Ci}/\text{ml}$$

$$\left(\frac{552.12\,g}{6.02\times10^{23}\,a}\right)^{-1}(0.05\,g) = 5.45\times10^{19}\ \text{atoms}\ \frac{Th}{}$$

50 mg thorium .00005g

$$232\,Th - T_{1/2} = 1.41\times10^{10}\,y$$

$$\lambda\ \frac{\ln 2}{1.41\times10^{10}\,y} = \frac{\ln 2}{(1.41\times10^{10}\,y)\left(\frac{365\,d}{y}\right)\left(\frac{24\,h}{d}\right)\left(\frac{3600\,s}{h}\right)}$$

$$\lambda = 1.559\times10^{-18}\ sec^{-1}$$

$$\lambda N = (1.56\times10^{-18}\ sec^{-1})(5.45\times10^{19}) = 84.98\,dps$$

$$84.98 = (85\,dps)\left(\frac{1\,\mu Ci}{3.0\times10^{4}\,dps}\right) = \underline{0.0028\,\mu Ci}$$

$$\frac{3,844.2}{0.0028\,\mu Ci}$$

$$(85)(60) = 5,100\,dpm$$

$$= \cancel{1.37}\,3\times10^{6}\ \frac{cpm}{\mu Ci}$$

1.4

$$\frac{cpm}{\mu Ci}$$

38,442 c/10 min

$$\boxed{\frac{3.8}{5.1} = 74.5\%}$$

Standard Preparation

50 mgm $Th(NO_3)_4\ 4H_2O$ F.W. = 552.12

$$\left(\frac{6.02\times10^{23}}{552.12g}\right)(0.05g) = 5.45\times10^{19} \text{ molecules}$$

$$A = \lambda N = \left[\left(\frac{\ln 2}{1.41\times10^{10}y}\right)\left(\frac{365d}{y}\right)^{-1}\left(\frac{1d}{24hr}\right)\left(\frac{1hr}{3600sec}\right)\right]\left[5.45\times10^{19}\right]$$

$$A = \left(1.559\times10^{-18}\ sec^{-1}\right)\left(5.45\times10^{19}\right) = \left(84.95\ dps\right)\left(\frac{1\mu Ci}{3.7\times10^{4}dps}\right) = \cancel{0.0028\mu Ci}\ 0.0023\mu$$

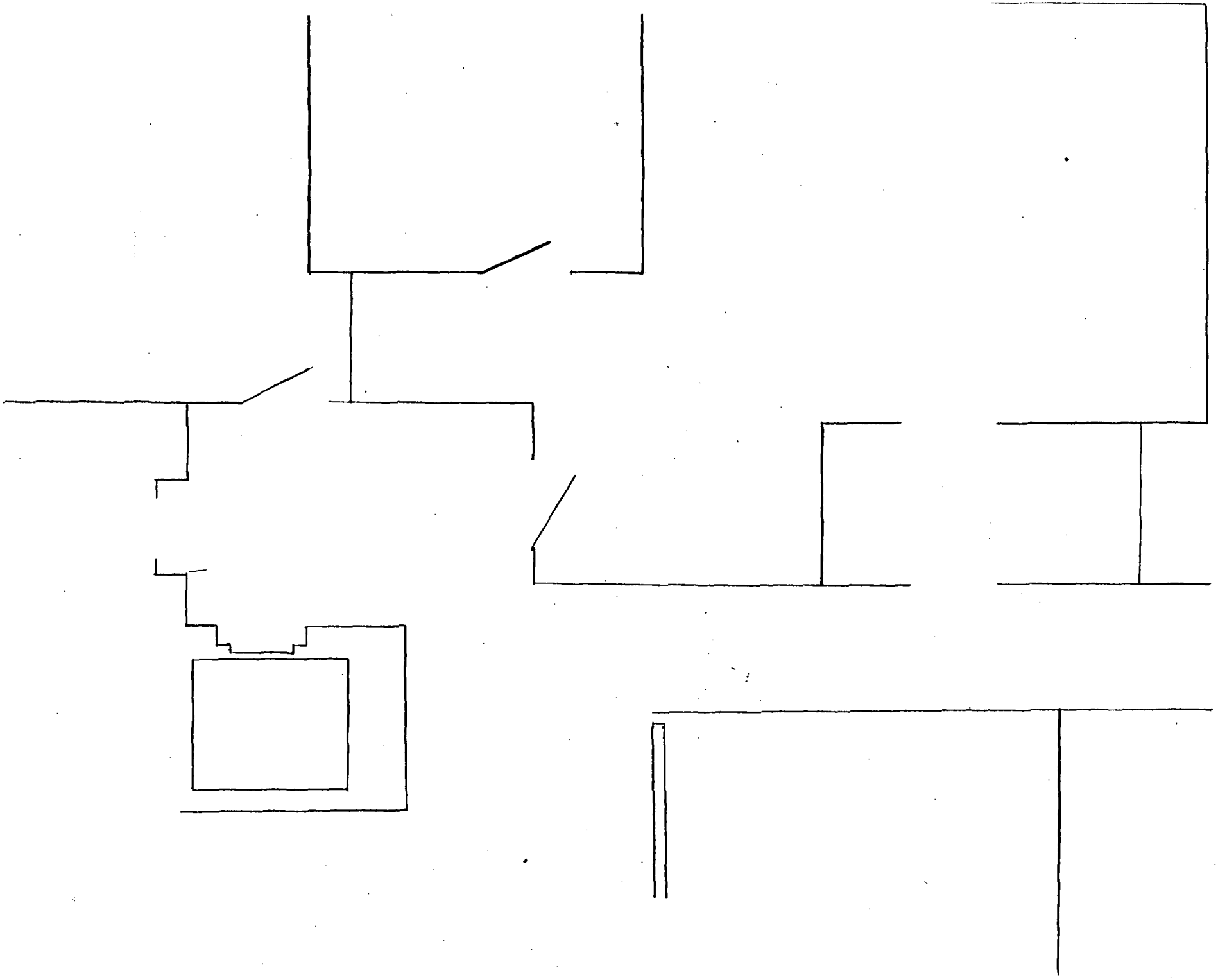
$$\cancel{\epsilon = \frac{38,442c}{10\ min} / 0.0028\mu Ci = 1.373\times10^{6}\ \frac{cpm}{\mu Ci}}$$

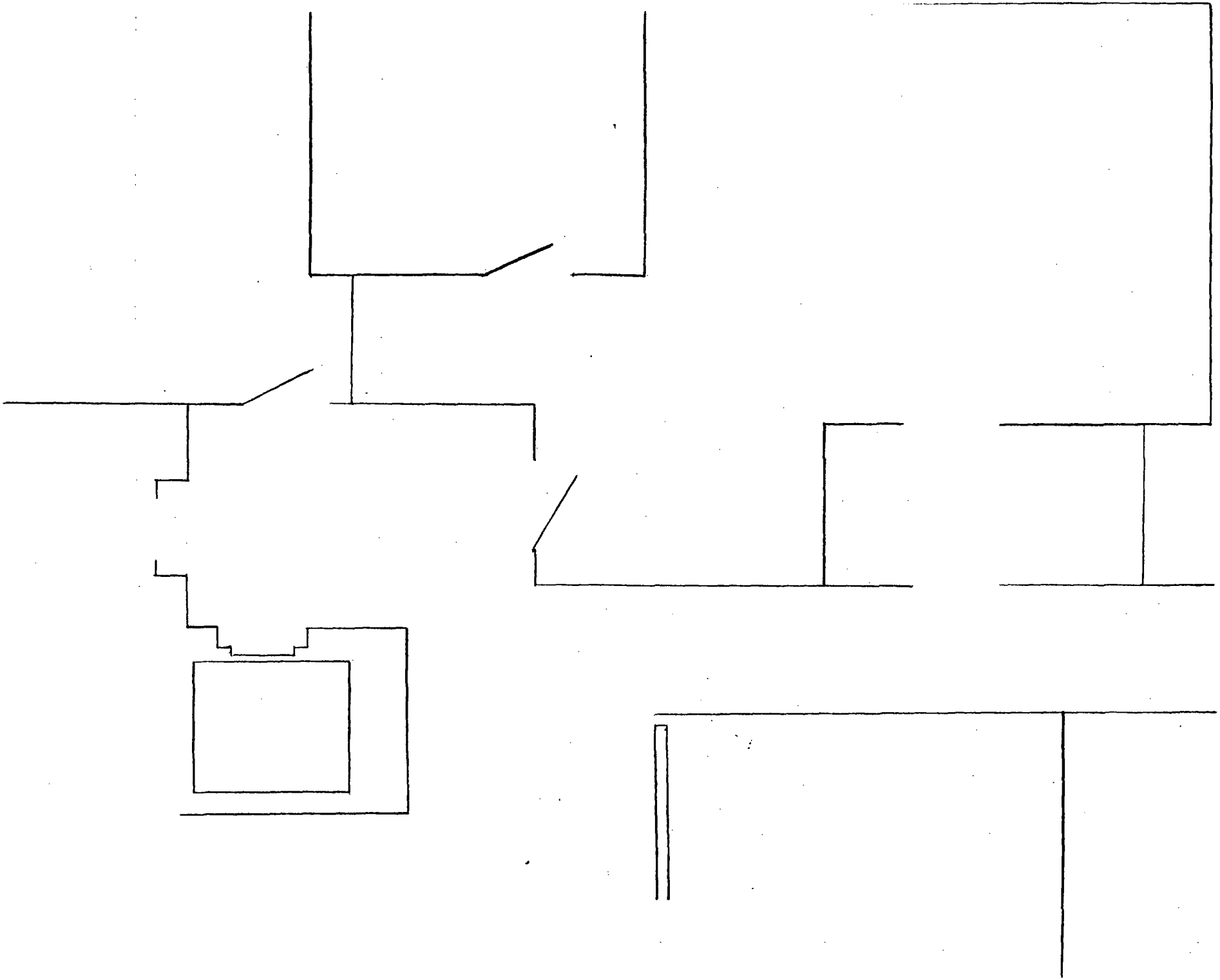
$$\cancel{\epsilon = \left(1.373\times10^{6}\ \frac{cpm}{\mu Ci}\right)\left(\frac{1\mu Ci}{2.22\times10^{6}dpm}\right) = 0.}$$

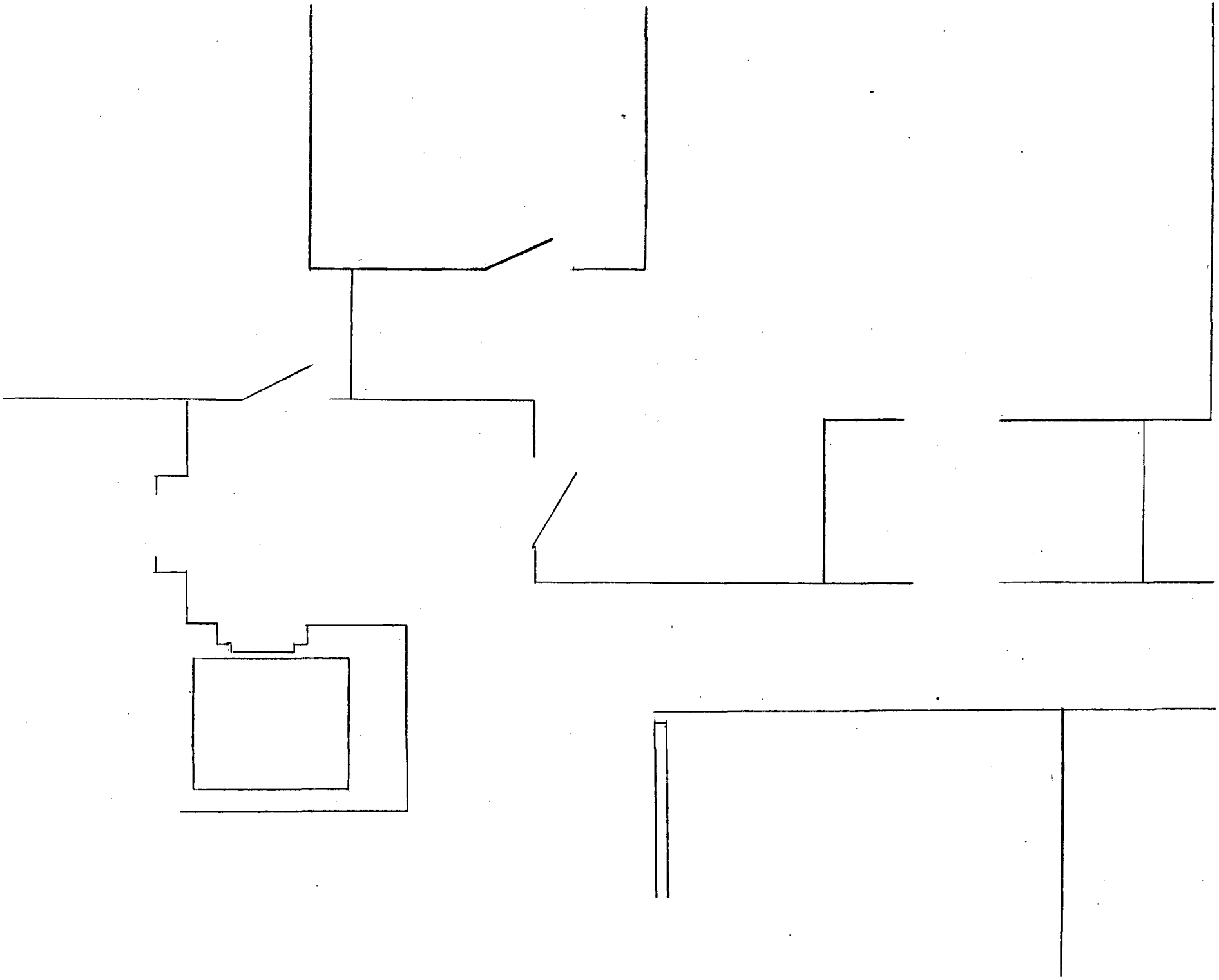
$$\epsilon = \frac{\left(\frac{38442c}{10m}\right)\left(\frac{1m}{60s}\right)}{84.95\ dps} = \cancel{0.6561}\ 0.7542\ \frac{cpm}{dpm}$$

$$\epsilon = \left(0.7542\ \frac{cpm}{dpm}\right)\left(\frac{2.22\times10^{6}dpm}{\mu Ci}\right) = 1.674\times10^{6}\ \frac{cpm}{\mu Ci}$$

Sample Analysis for Long Lived Th nat.





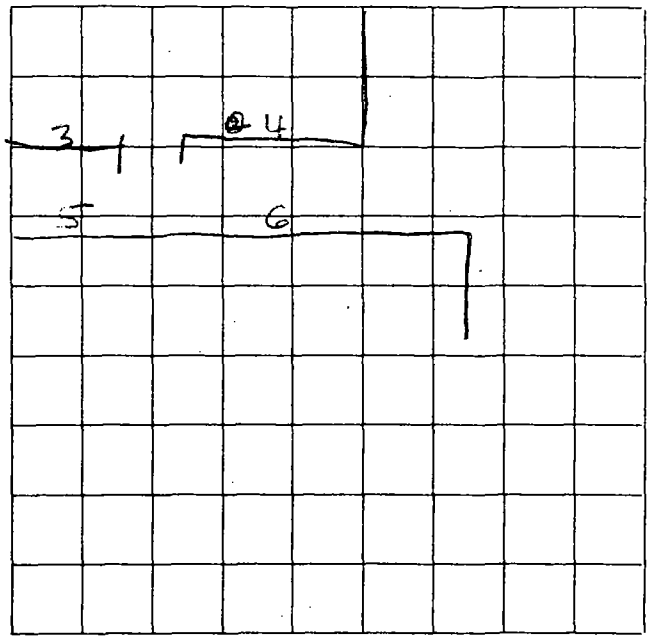


SURVEY REPORT

BUILDING: _____ ROOM: _____ DATE: _____ BY: _____

Routine ☐ Spot Check ☐ Special ☐ Equipment ☐

Survey Instrument _____ Source of Ionizing Radiation



TYPE	FORM	ACTIVITY

Ventilation: _____

Comments: _____

SURVEY FINDINGS

AREA		Wipe	AC21		
	2	131	2500 mrad		
	3	125	↓		
Orig Floor After Removal	4	158	None		
	5	118	Detected		
	6	45			

Background #1 = 161 cpm → 1 BG = 0

RECOMMENDATIONS: _____

Radiation Safety Services, Inc.
827 Simpson, Evanston, IL 60201 (312) 866-7744

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.

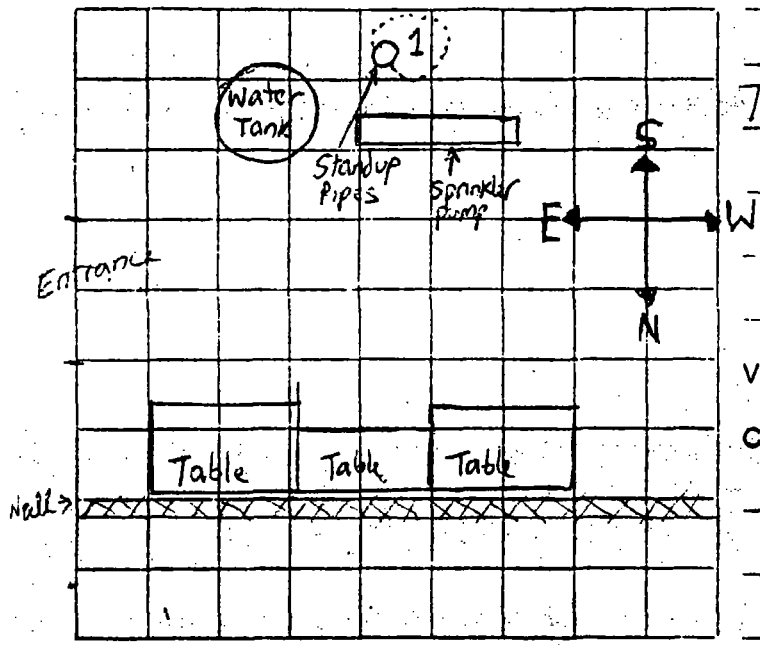
Although decontamination was terminated before completion, the most important occupied areas demonstrated a significant dose reduction consistent with the decontamination effort. Changing space utilization, particularly in the basement, may dictate further decontaminations to the levels recommended by 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

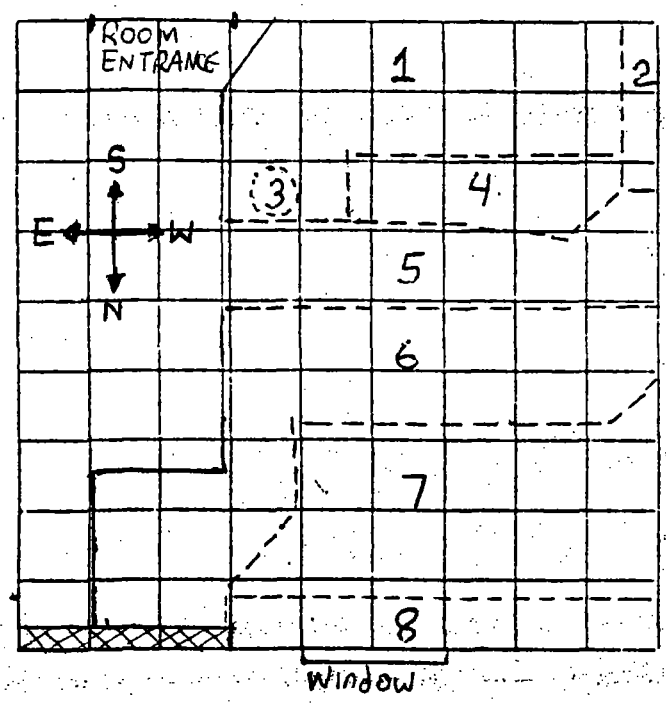
RECOMMENDATIONS:

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

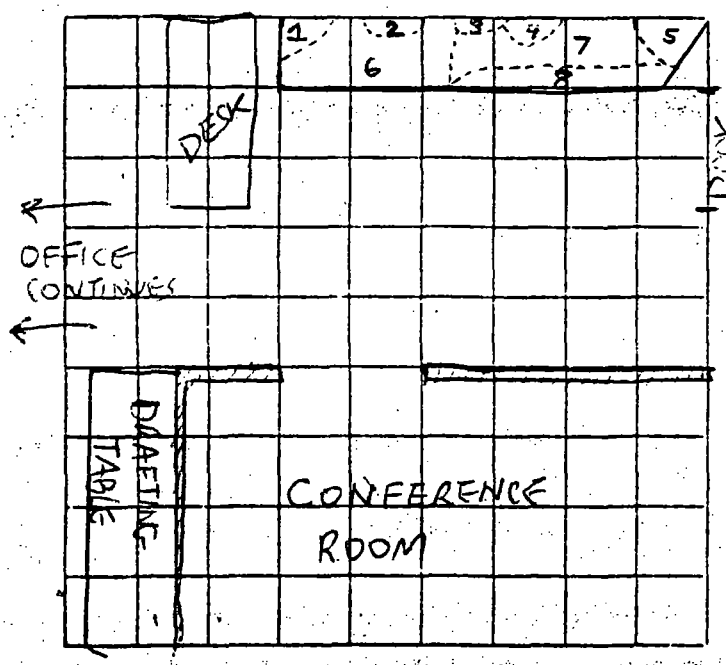
RECOMMENDATIONS:

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

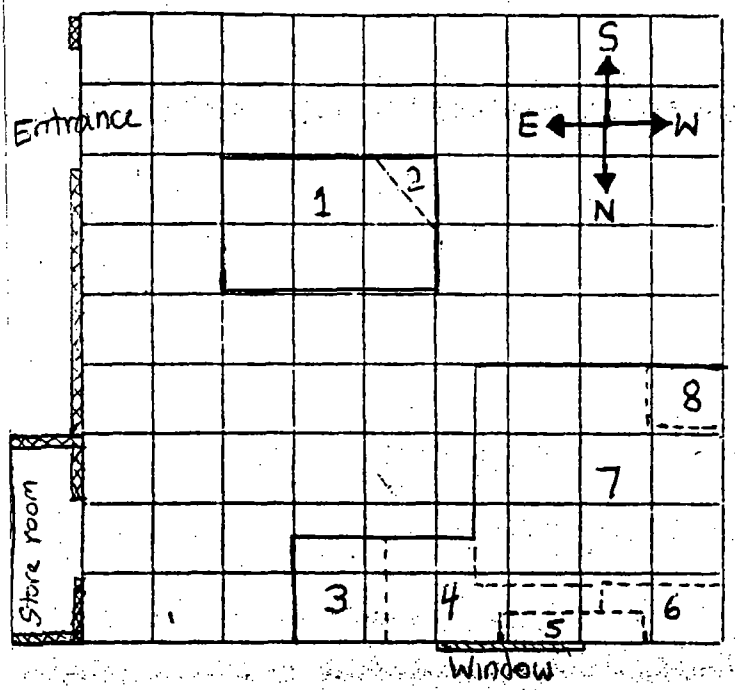
RECOMMENDATIONS:

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:

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)—

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. ~~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 I for survey result

- 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 collecter for disposal.

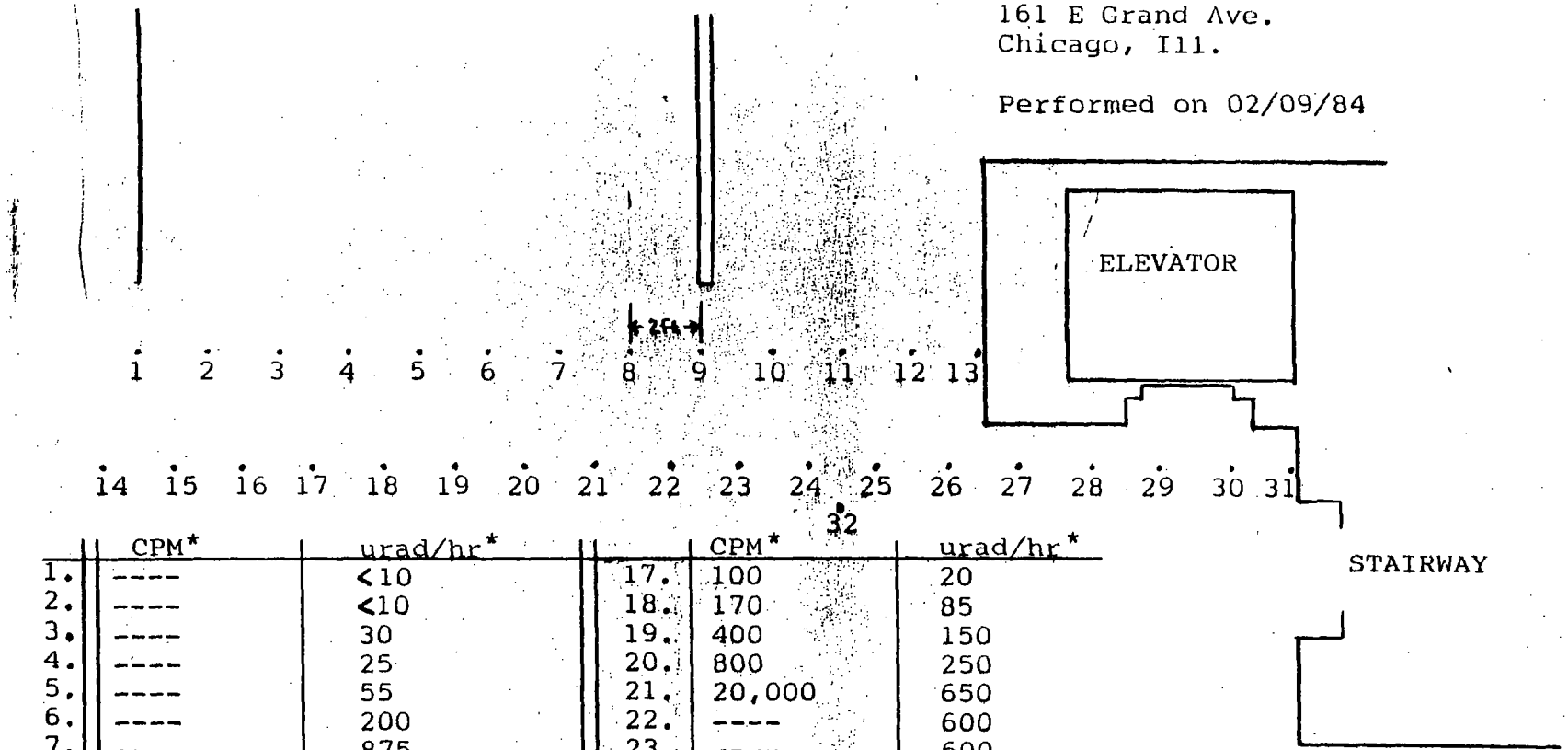
No contamination was detected on protective apparel or tools used during the construction. Results of air sampling by the EPA and RSSI did not indicate an increase in airborne radioactivity levels in the work area.

Appendix A

Radiation Survey Results

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.

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 ☐

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	680c/6min = 113cpm		

RECOMMENDATIONS:

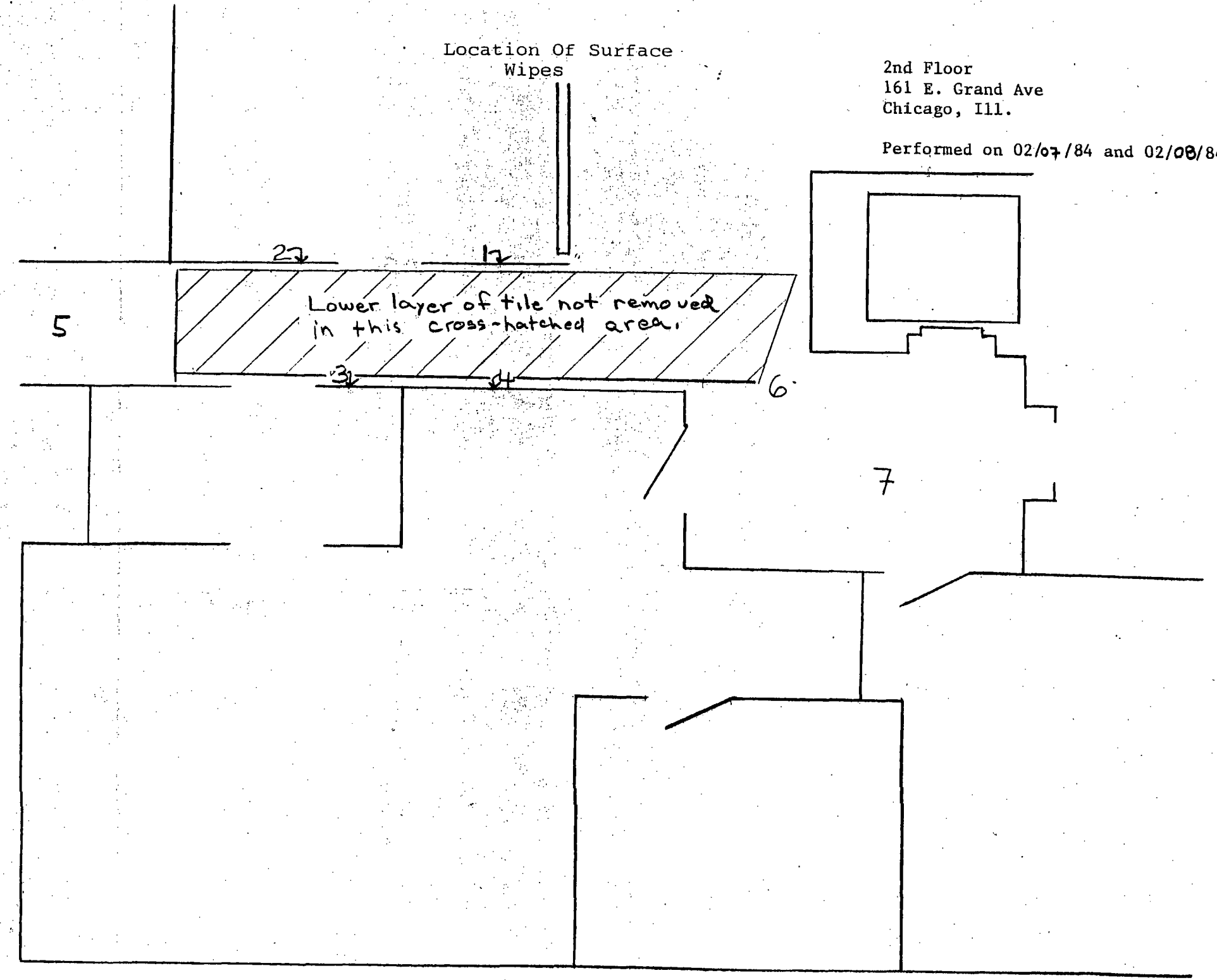
Ld 95% = 40.5cpm ∴ Activity detected at 95% confidence level if 113 + 40.5 = 154 cpm is exceeded.

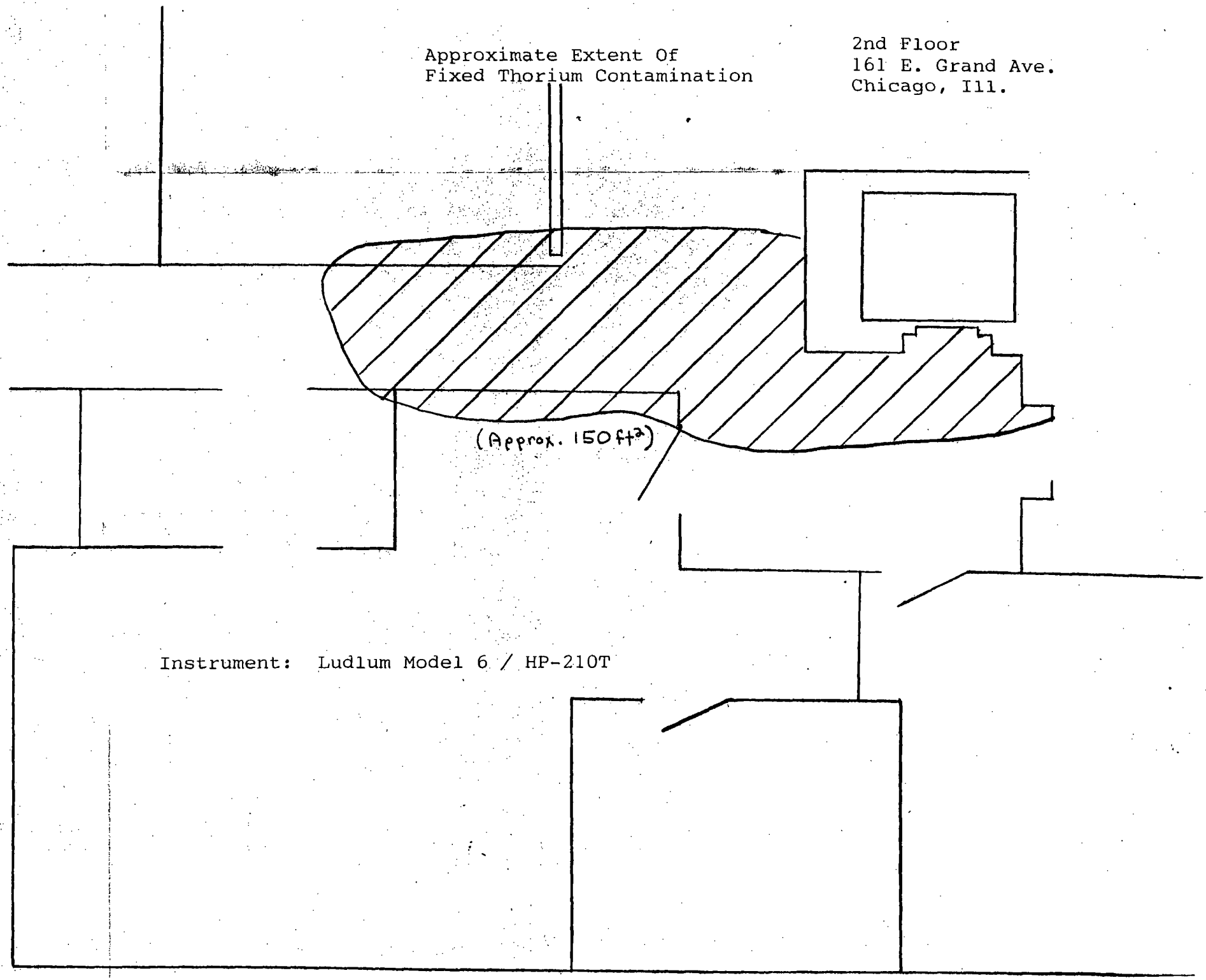
Radiation Safety Services, Inc.
827 Simpson, Evanston, IL 60201 (312) 866-7744

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

Appendix B.

USNRC Guidelines for the Release of Facilities for Unrestricted Use.

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

cc: Eli Port
Steve Rothblatt
Paul D. Eastvold
Bernadine Wright
James Barrett
George Wienold
John Evanoff

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

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.

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 mrem 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.

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
Certified, American Board of
Health Physics
Registered Professional Engineer

EAP:ws

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

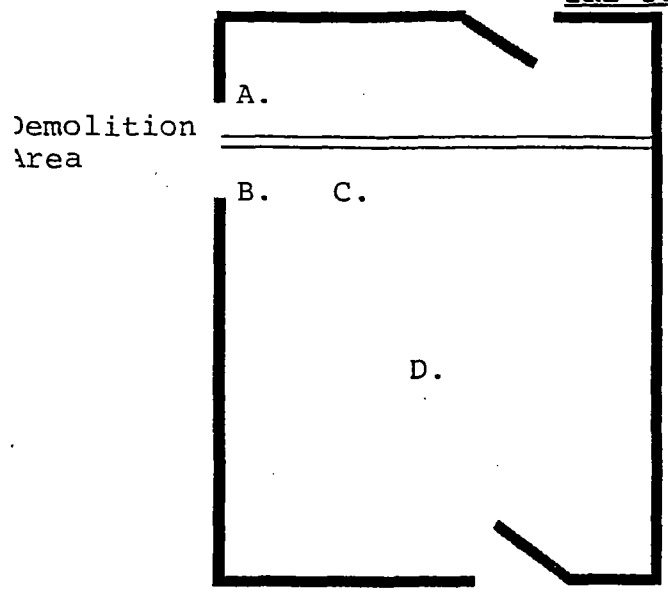
Bryan J. Bagg

Enclosures

h:\400002\2222

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	-

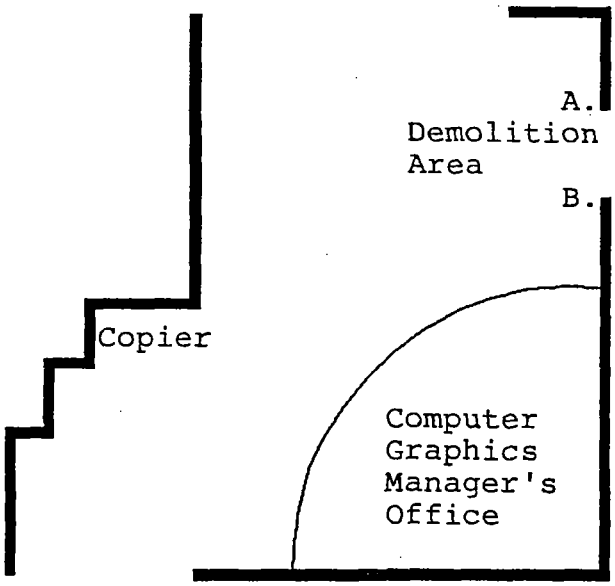
* Increases as floor is approached.

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

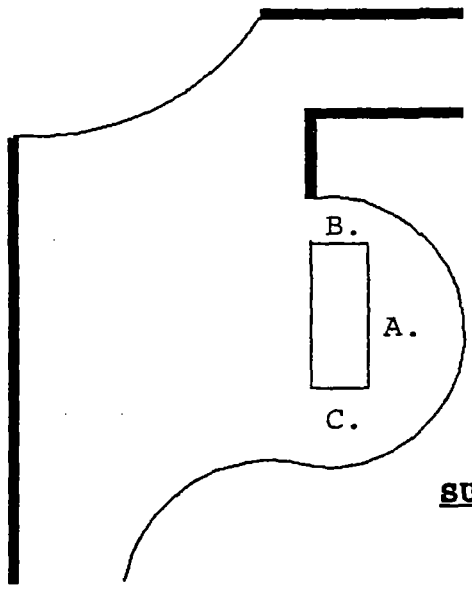
* Increases as floor is approached.

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.

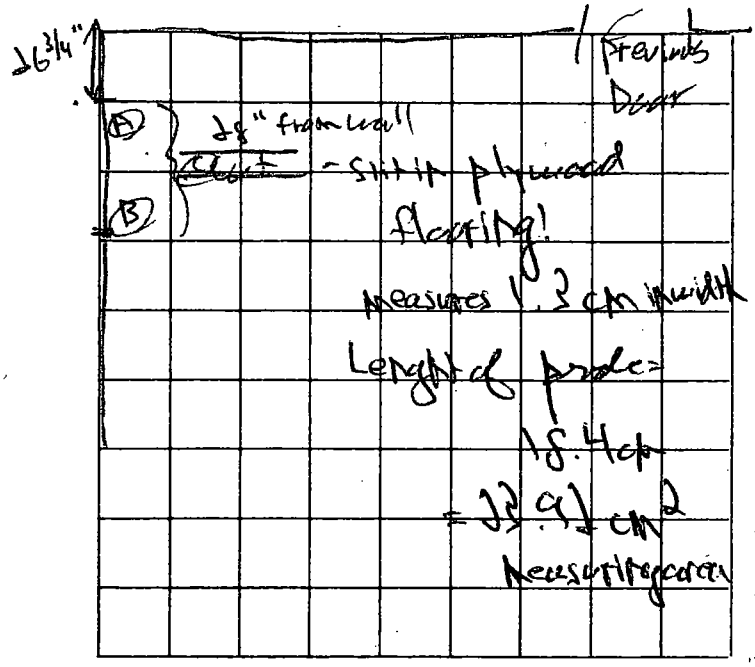
2nd floor Conference Room

SURVEY REPORT

BUILDING: _____ ROOM: _____ DATE: _____ BY: _____

Routine ☐ Spot Check ☐ Special ☐ Equipment ☐

Survey Instrument _____ Source of Ionizing Radiation



TYPE	FORM	ACTIVITY
r		

Ventilation: _____

Comments: _____

SURVEY FINDINGS

AREA	mRlh HIPPI 1010	Rascal w/ Ludlum 43-5	
A - Floor	.7	≈ 2	
B Floor	.4	↓	
1 Meter above A & B	.2	↓	
1 Meter above A & B	.2	↓	
Areas Between A & B up length of wall	.06 - increasing as floor is approached	≈ 2	
C: Small cut in plywood flooring ~~wall~~ ~~28 inches~~ 28 inches from wall		1670	

Background HIPPI 1010 = 20 w Rad/hr in cont Room
Rascal = 2 cpm = outside cont. room

Rascal Eff w 43-5 probe = 8.6 - Th - 230 source

RECOMMENDATIONS:

Notes: George Sdomirski wants statement in report re: area beneath plywood flooring.

Radiation Safety Services, Inc.

Bob Ciske - Benz Construction

Larry Benz - " "

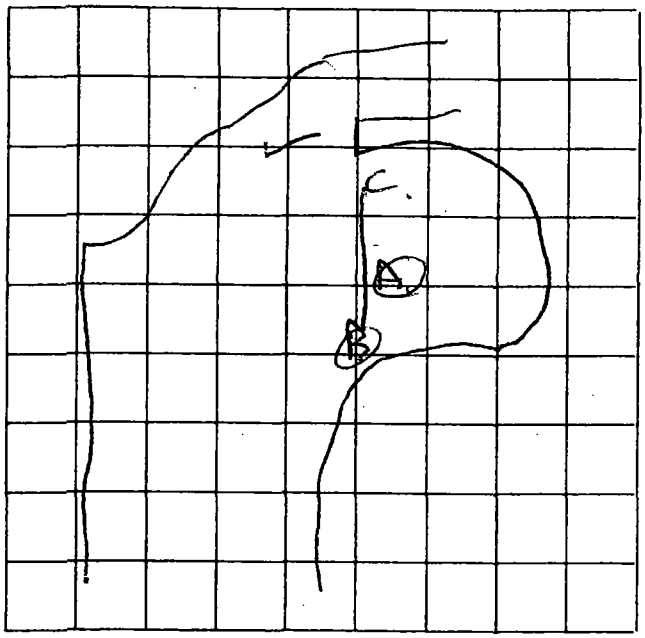
1st Floor Reception area

SURVEY REPORT

BUILDING: _____ ROOM: _____ DATE: _____ BY: _____

Routine ☐ Spot Check ☐ Special ☐ Equipment ☐

Survey Instrument HIPPI 100 Source of Ionizing Radiation



TYPE	FORM	ACTIVITY

Ventilation: _____

Comments: _____

SURVEY FINDINGS

AREA	Floor	4' above floor	8' above floor
A	.2	.08	.1
B	↓	.06	.06
C	↓	.06	.06

Background = .06 mR/hr

RECOMMENDATIONS: _____

- Notes: George Skawinski requested survey!

Radiation Safety Services, Inc.

8/8/92

Optimus

George Slominski

Matt Babich 312 - 321 - 0880 x 306

161 E. Grand Ave (Grand & St Clair)

Enter on St. Clair side of building

4 pm 8/17

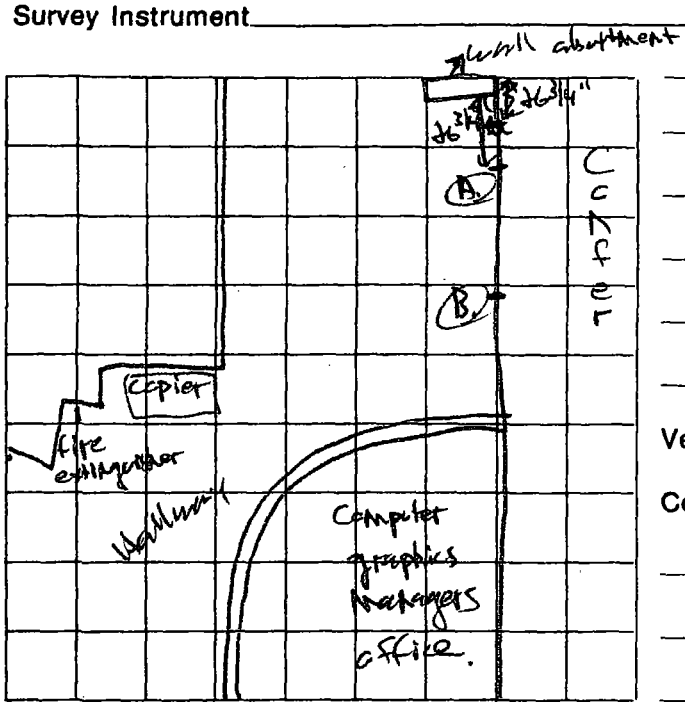
Computer graphics client waiting area.

SURVEY REPORT

BUILDING: _____ ROOM: _____ DATE: _____ BY: _____

Routine ☐ Spot Check ☐ Special ☐ Equipment ☐

Survey Instrument _____ Source of Ionizing Radiation



TYPE	FORM	ACTIVITY

Ventilation: _____

Comments: _____

SURVEY FINDINGS

AREA	mRad/hour HIPPI 1010	Rascal 45-3 3-5	
A) Floor	.5	≈ 1 cpm	
B) Floor	.2	↓	
A) B) Area Between A & B up length of wall	= .06 at 8'	↓	
	↓	↓	
	increases as floor is approached		

Background

RECOMMENDATIONS: _____

Radiation Safety Services, Inc.

Client: Optimus
Accounting Code: 4000-02
Project Number: 2222
Billing Rate: $500 /day

Date	Hours	Comments	Billing Date
8/8/17	2	Prep work	
8/17	1	Driving - 1:00 → 2:30	
8/17	3	Site work 4-7	
8/17	1	Report Preparation	
8/31	2		
Total	8		

Busch Creative Services Corporation
ONE OF THE ANHEUSER-BUSCH COMPANIES

Busch Creative Services Corporation
Accounts Payable Department
5240 Oakland Avenue

7/30/92 BCS 10416

REQUISITION NO.	DEPARTMENT	ACCOUNT TO BE CHARGED
	V#63010	1098 (10/158)

REQUISITIONER

APPROVED BY	DATE	AUTHORIZED BY	DATE

CONTRACTOR ●

Mr. Terry Liaboe
Radiation Safety Services, Inc.
6312 West Oakton
Morton Grove, IL 60053

~~312~~-965-1999
708-965-1991 Fax

The Terms and Conditions printed on the reverse side hereof constitute an integral part of this contract.

SCOPE: CONTRACTOR SHALL PERFORM THE FOLLOWING

COMPENSATION: CONTRACTOR SHALL BE PAID ON THE FOLLOWING BASIS:

Monitoring and possible removal of radiation material...from the Conference Room. Two days for job... possible three days required.

$500.00 per day

Conditions on both sides hereof apply to this order. A signed copy of this order must be returned to Optimus.

Invoices and documentation shall be addressed and submitted to Optimus, Inc., 161 E. Grand Ave., Chicago, IL 60611

Insurance certificate indicating coverage for Workmen's Compensation and for Public Liability and Property Damage of at least $100,000 in a company acceptable to Optimus shall be presented prior to commencement of the work.

(1) The term "BCSC" in this document shall refer to Optimus, Inc.
(2) The terms of this contract shall be governed by Illinois law and the Illinois Uniform Commercial Code.

☐ CHECK BOX IF: Article IV "Work for Hire" is void _____ BCSC _____ Contractor (Initial)

TOTAL AMOUNT OF $ _____
SERVICE ORDER

IN WITNESS WHEREOF, THE PARTIES HAVE EXECUTED THIS CONTRACT, AS OF THE LATER OF THE ORDER DATE OR MODIFICATION DATE SET OUT ABOVE.

XXXXXX OPTIMUS, INC.

BY: George E. Slomin

TITLE: Director of Engineering

CONTRACTOR: _____

BY: _____

TITLE: _____

If Contractor (1) commences to perform the work which is the subject matter of this contract or (2) fails to object in writing to this contract within ten (10) days after its receipt hereof, then this contract will be enforceable as to Contractor and BCSC in accordance with its terms. BCSC shall have no obligation to pay Contractor until Contractor returns a fully executed copy of the contract to BCSC.

CONTRACTOR COPY

P. 2
8.10.1992 13:46
FROM OPTIMUS * FILM

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

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.

MAIN REPORT

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II. RECOGNITION OF A POSSIBLE RADIATION PROBLEM

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- B. Comprehensive Survey

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  - a. Preliminary Survey
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- B. Gamma Energy Spectrums
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I. SPECIFICATION OF THE SITE

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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)*

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% $^{212}_{84}Po$	Thorium C' ^{212}Po	304ns	8.78 (100%)	---	---
36.0% $^{208}_{81}Tl$	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.*

---

*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%) 0.242 (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 (.0000002%)	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.

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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.

---

*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 , Contact With Floor , in Basement

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

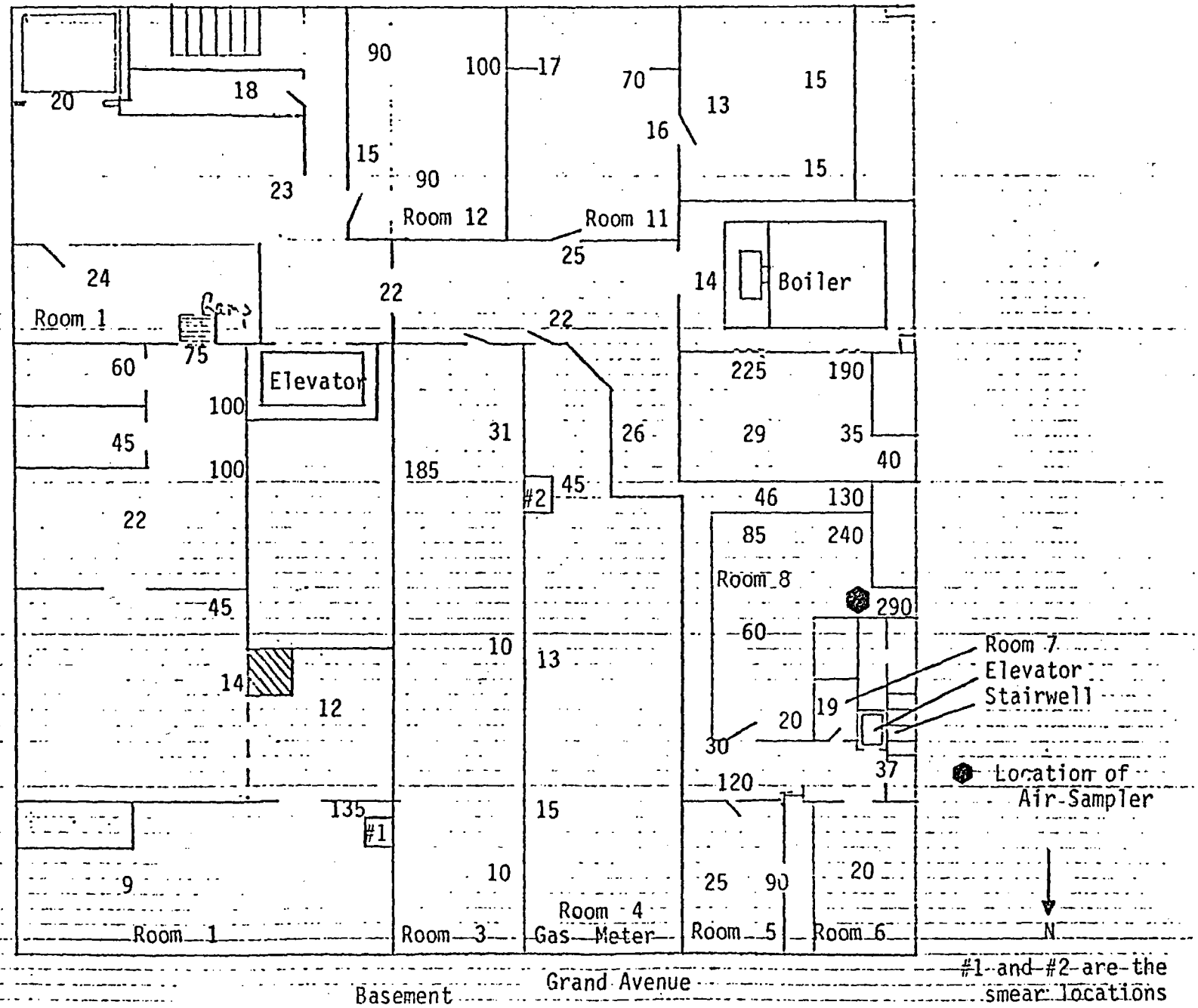


Figure 4: Micro - Roentgen Meter Readings at One Meter Above Floor in the Basement

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

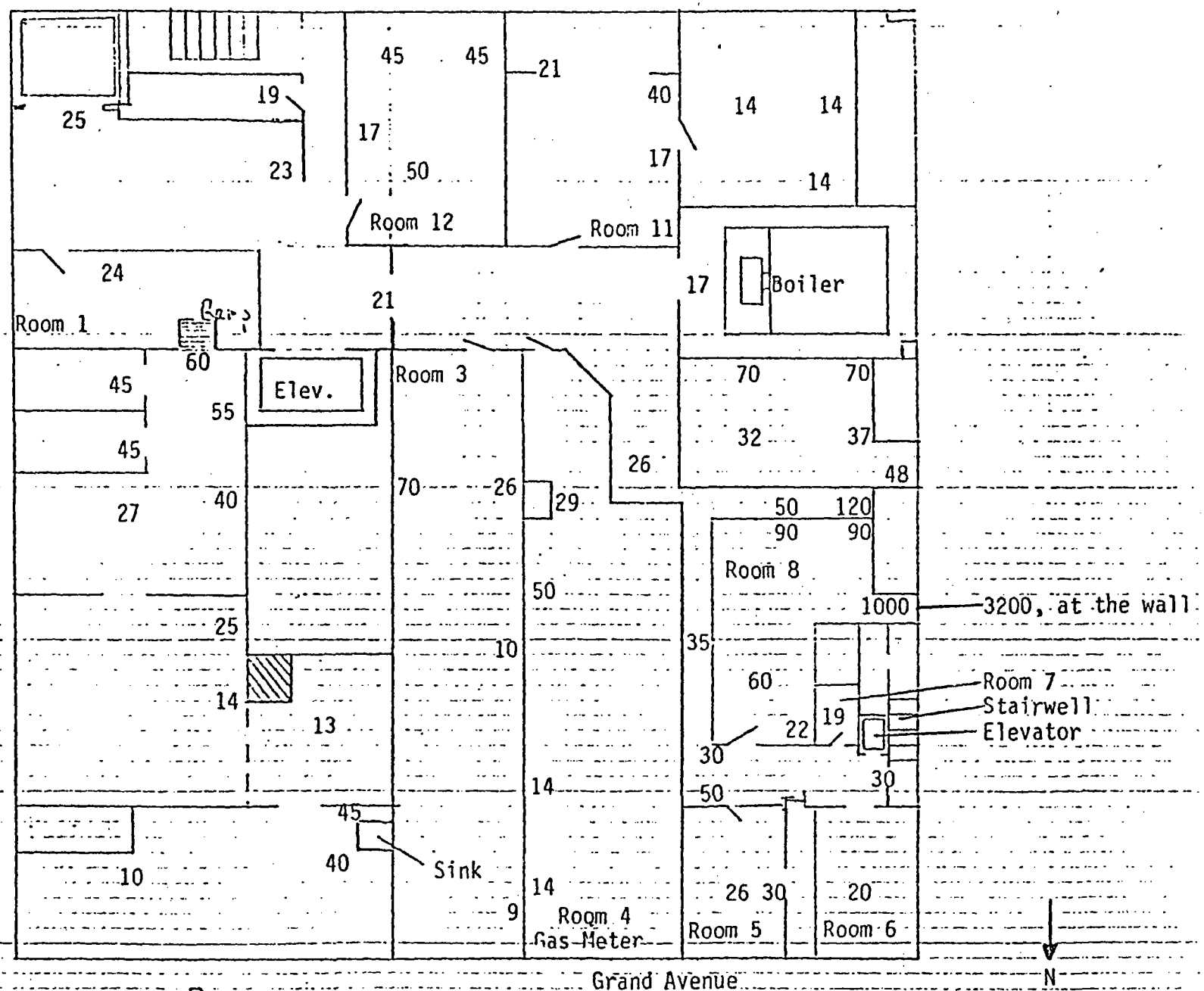


Figure 5 : Micro - Roentgen Meter Readings , Contact With Floor

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

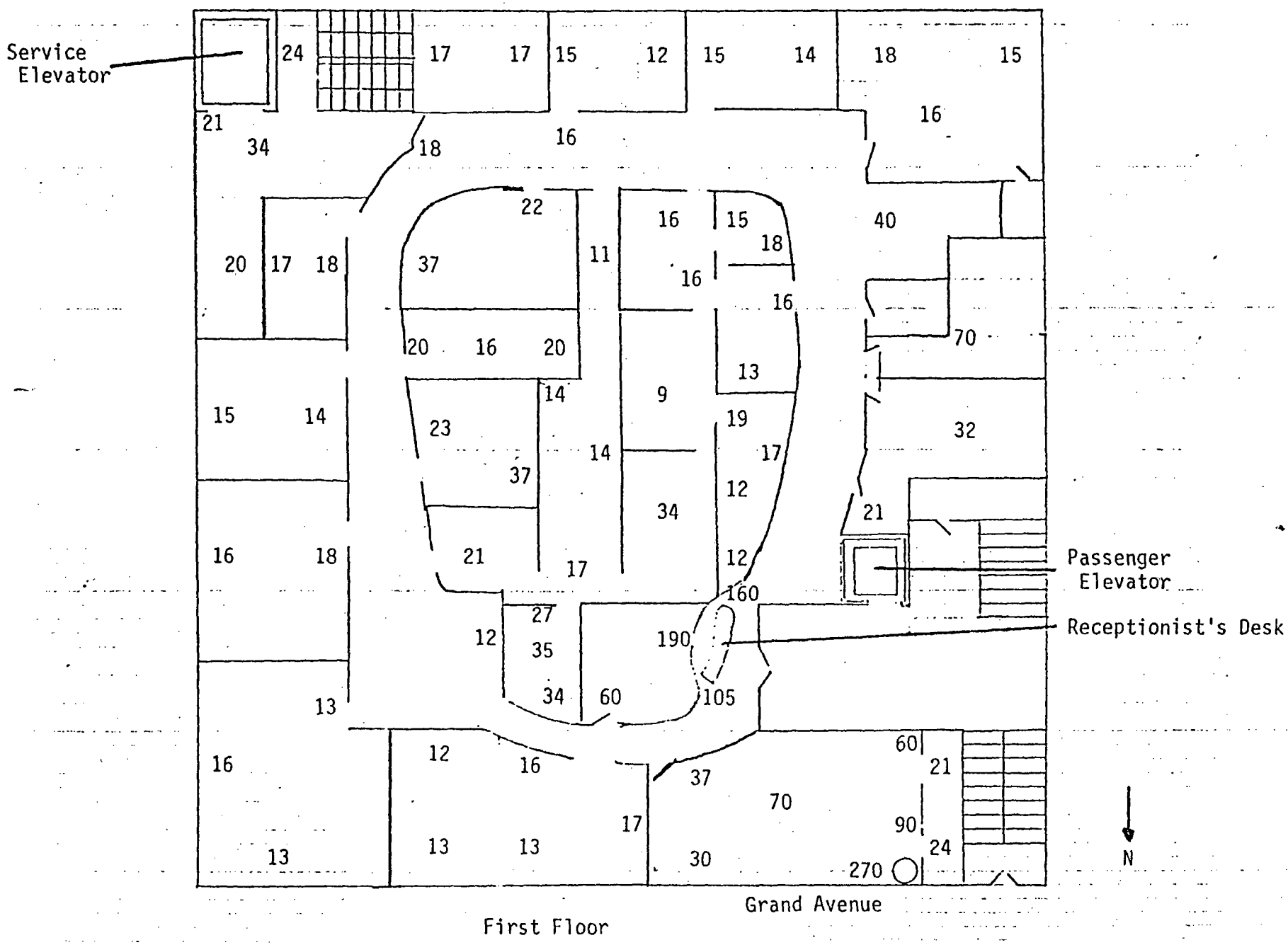
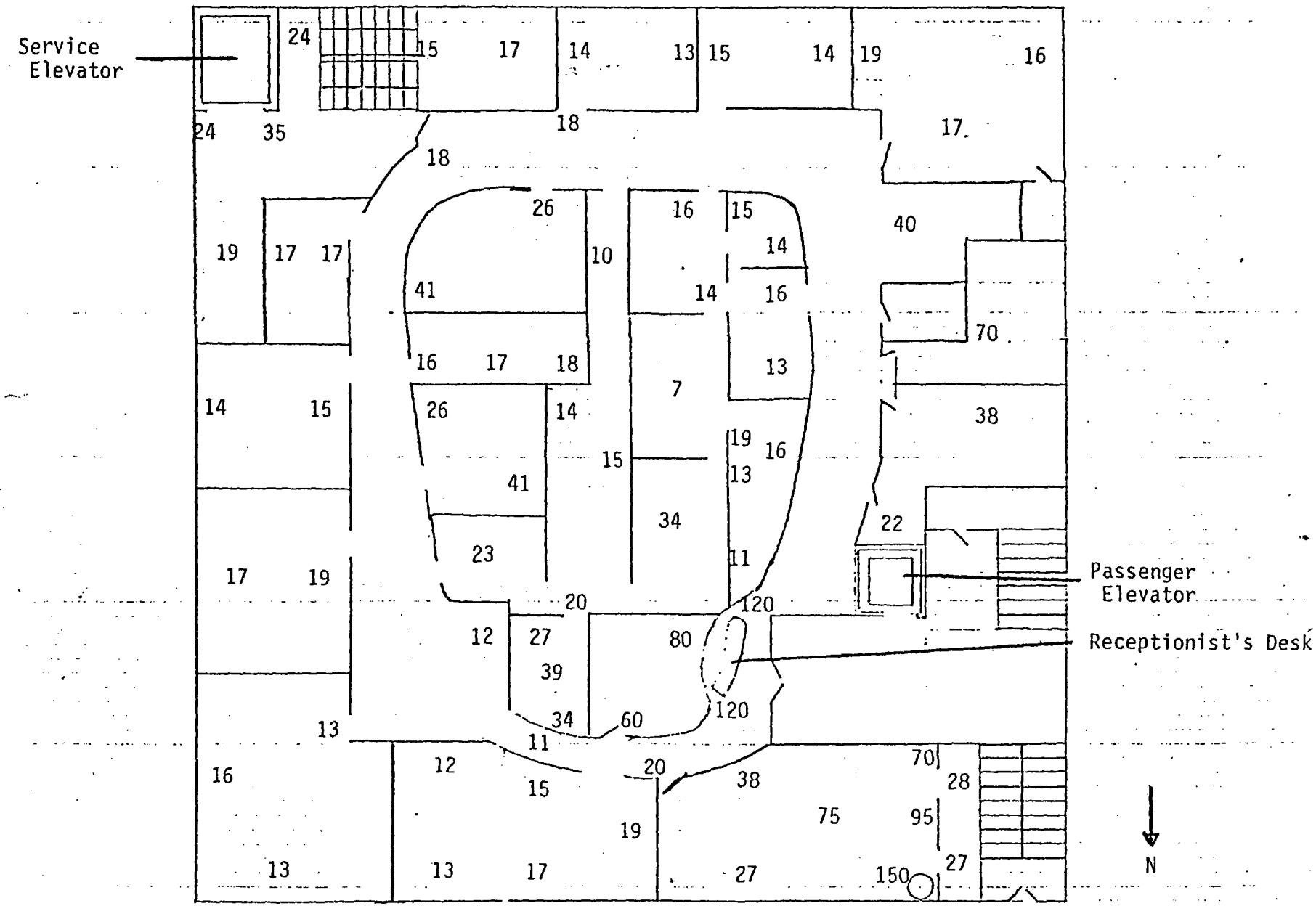


Figure 6 : Micro-Roentgen Meter Readings at One Meter Distance
(All readings are in micro-roentgens per hour , uR/hr .)



First Floor

... Meter Readings , Contact With Floor
(All readings are in micro-roentgens per hour, uR/hr.)

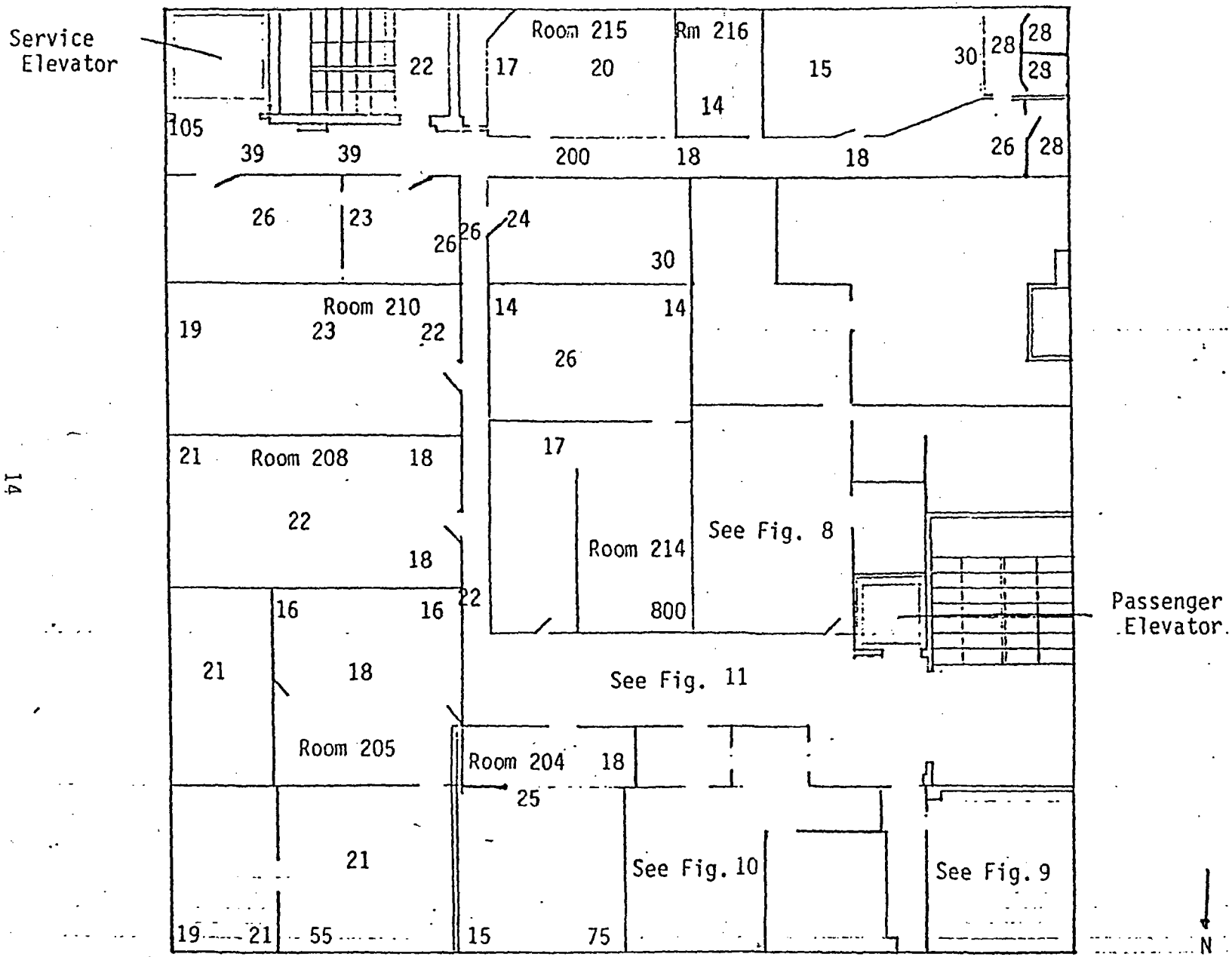
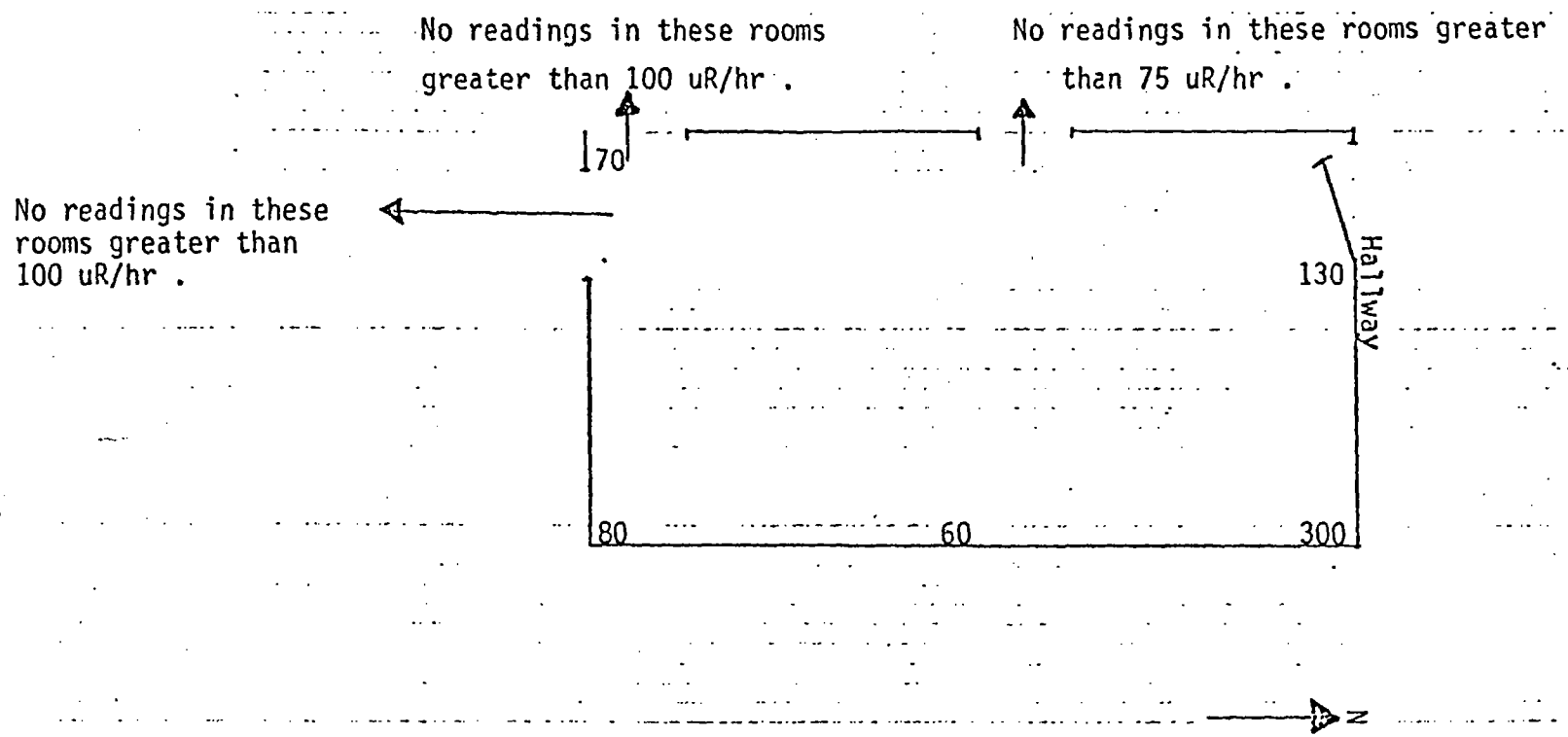


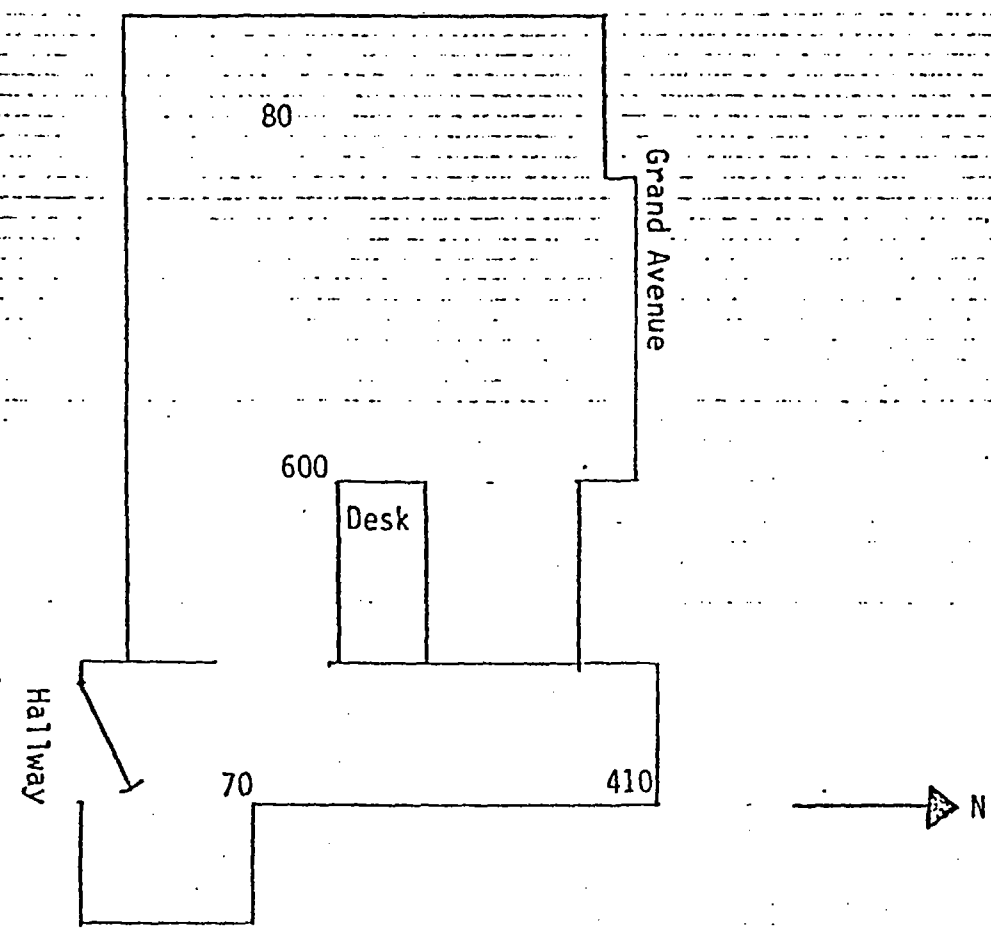
Figure 8 : Micro - Roentgen Meter Readings , Contact With Floor , in Room 200

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



Second Floor - Room 200 (Glen McGowean and Son)

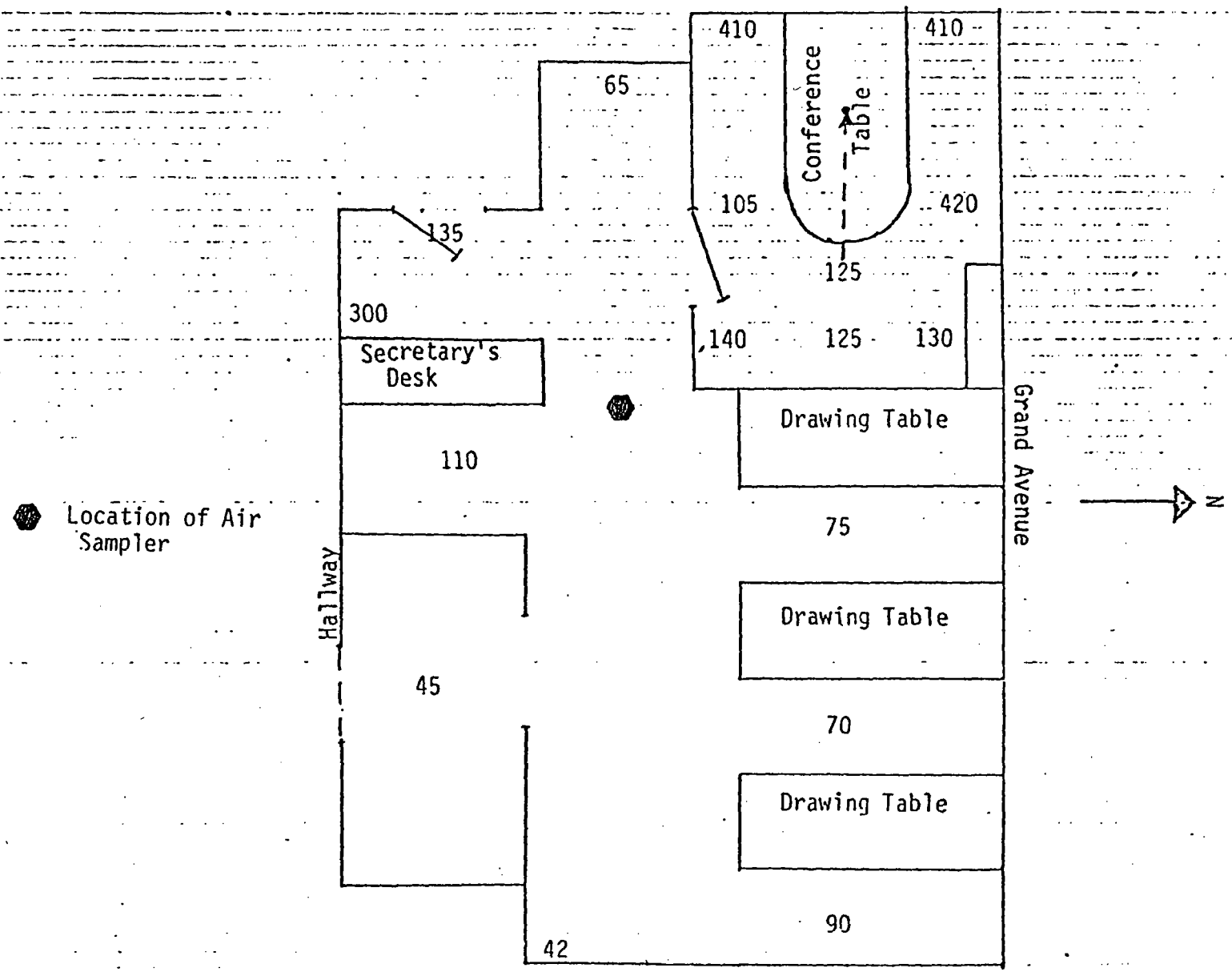
Figure 9: Micro - Roentgen Meter Readings , Contact With Floor , in Room 201
(All readings are in micro - roentgens per hour , uR/hr .)



Second Floor - Room 201 (Ascot Products)

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

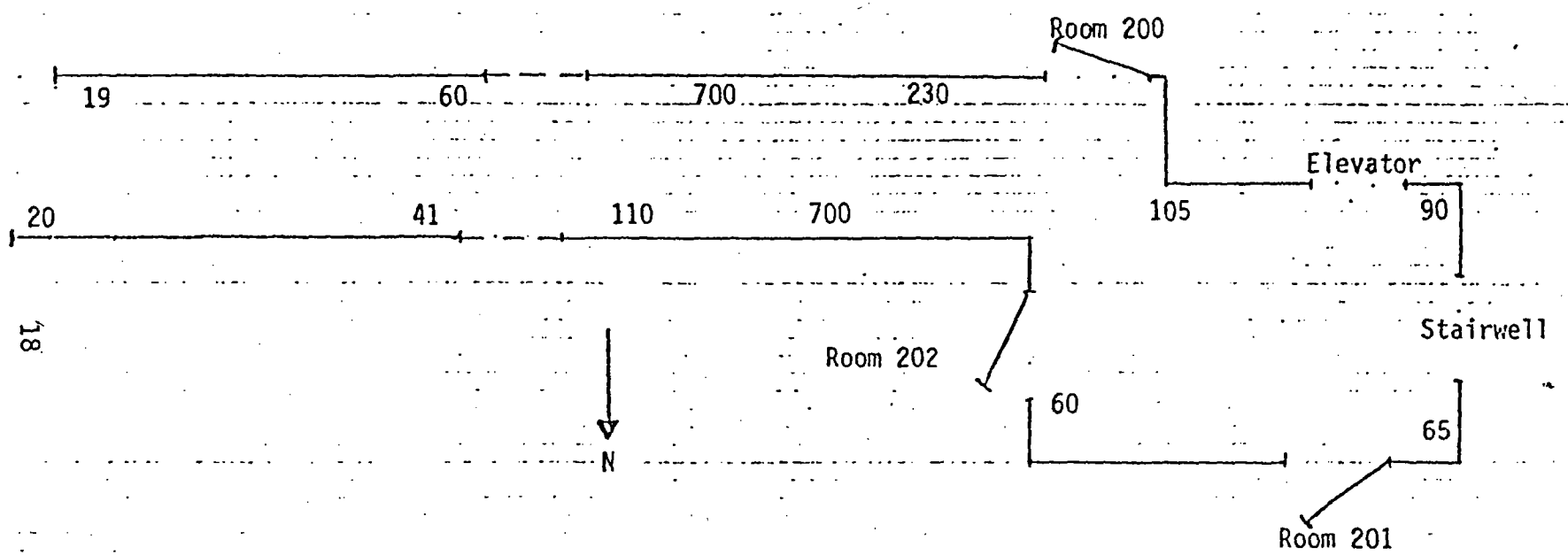
(All readings are in micro - roentgens per hour , uR/hr)



Second Floor - Room 202 (Meisel Hunson LTD)

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

Roentgen Meter Readings at One Meter From Floor

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

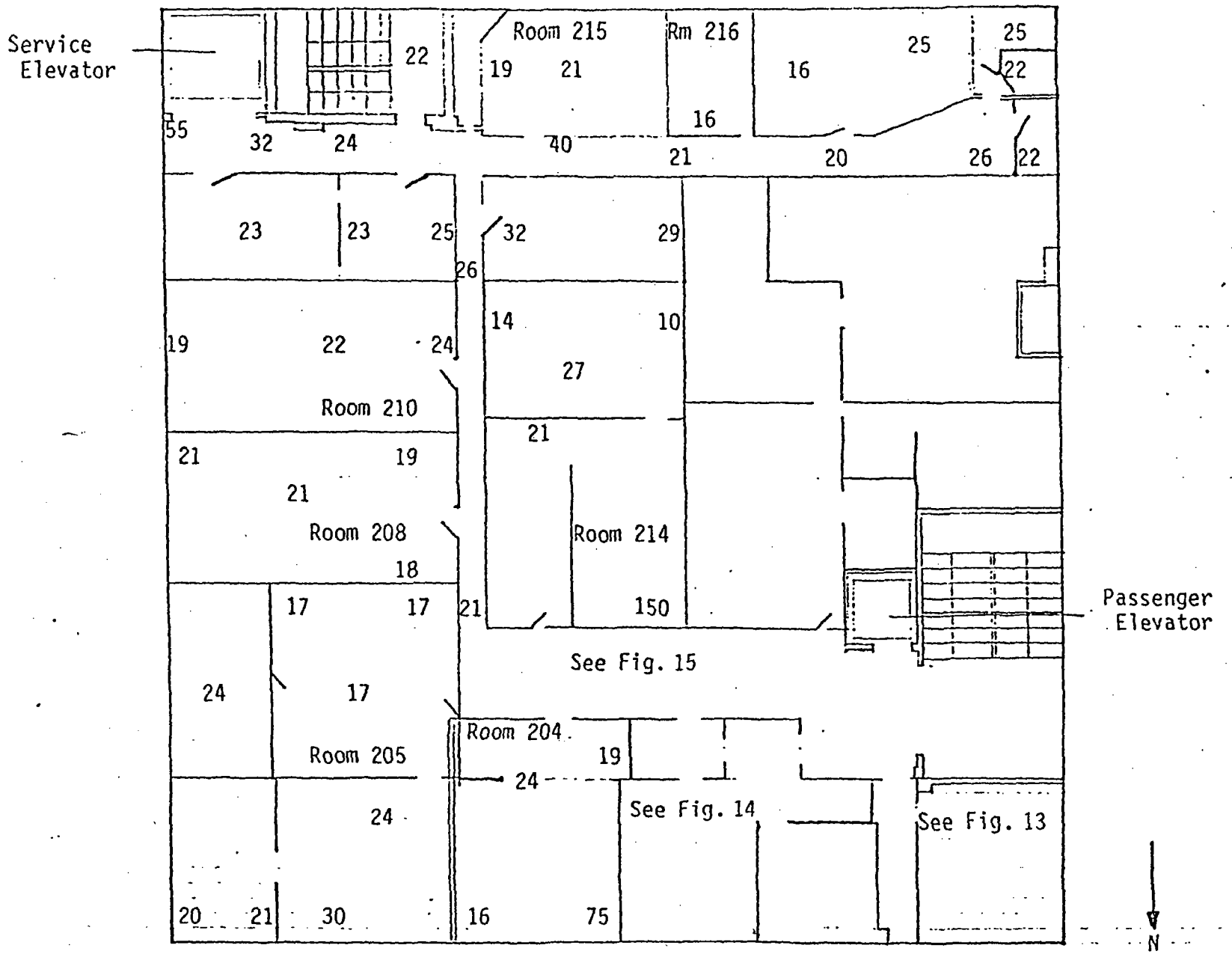
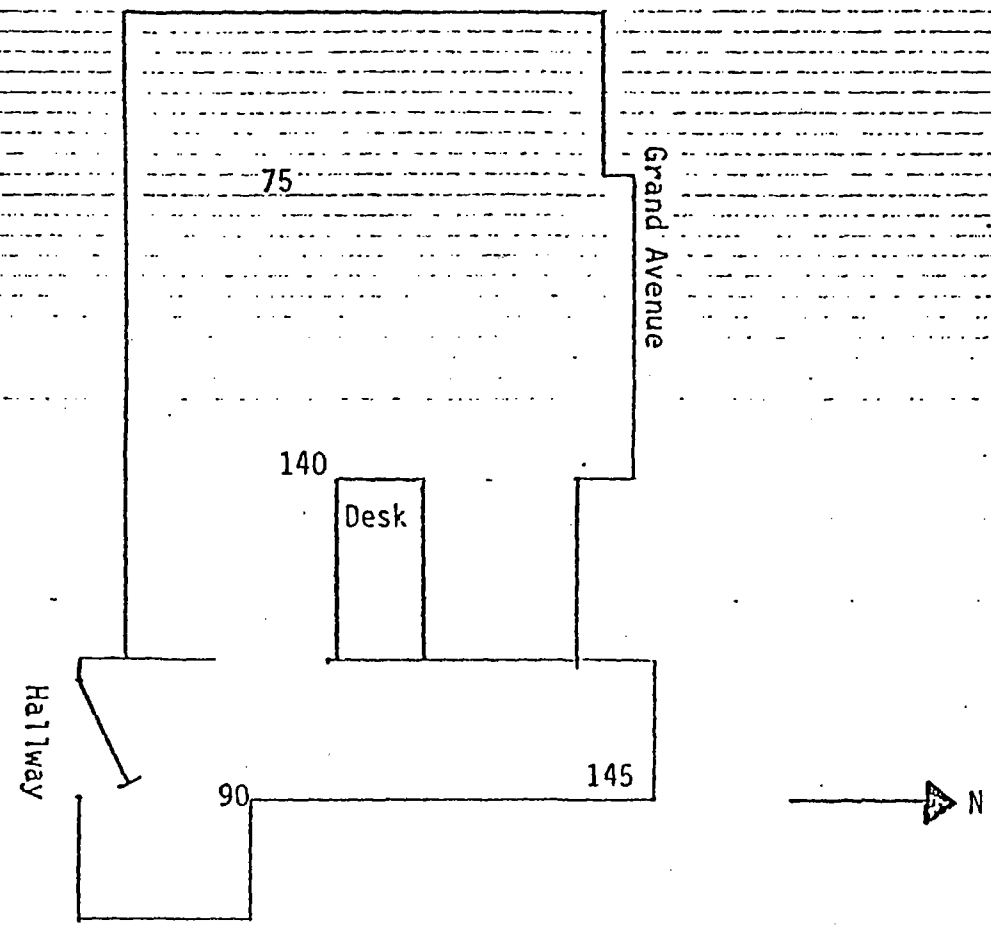


Figure 13 :

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

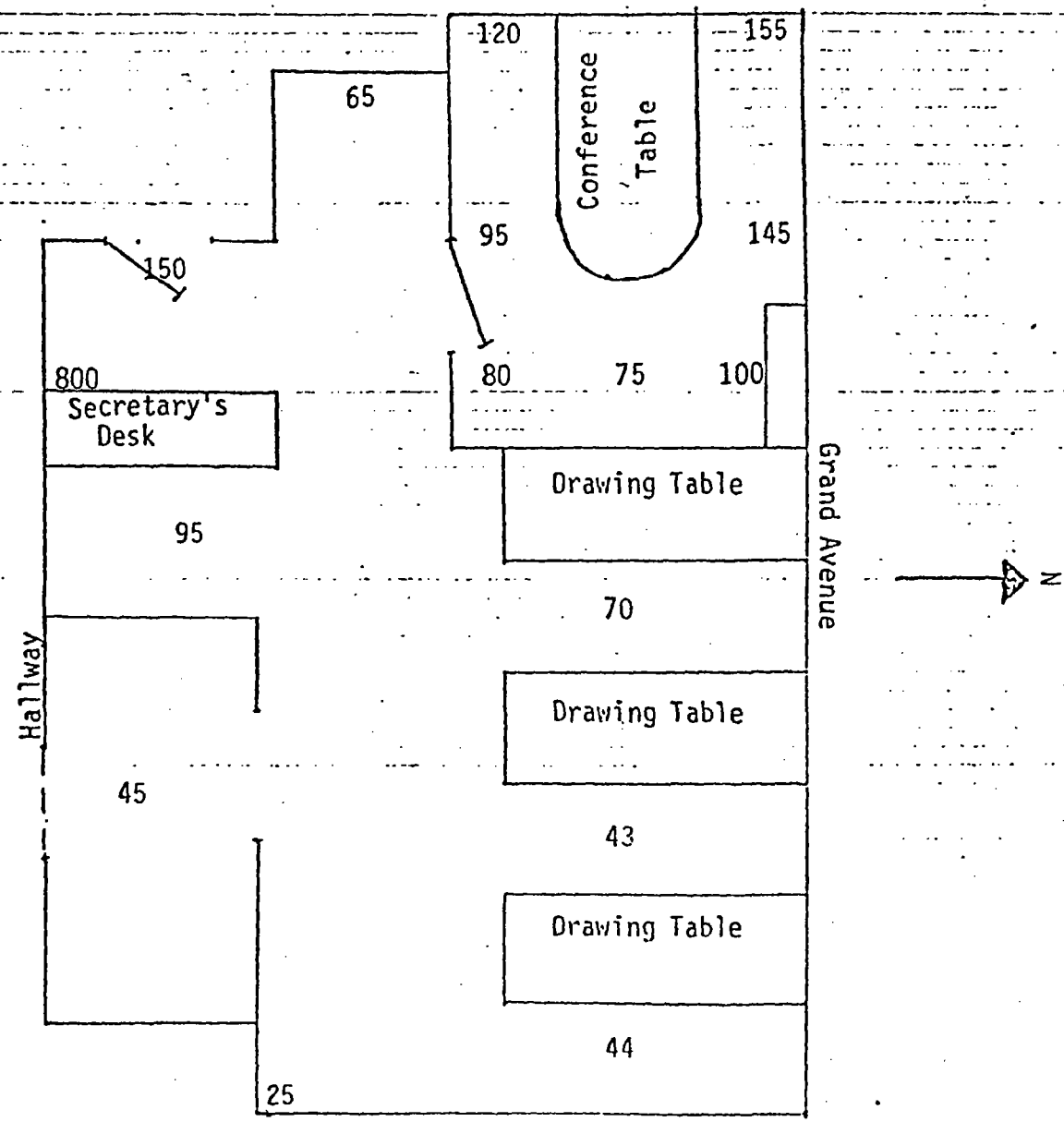
(All readings are in micro - roentgens per hour , uR/hr .)



Second Floor - Room 201 (Ascot Products)

Figure 14 : Micro - Roentgen Meter Readings at One Meter Above Floor in Room 202

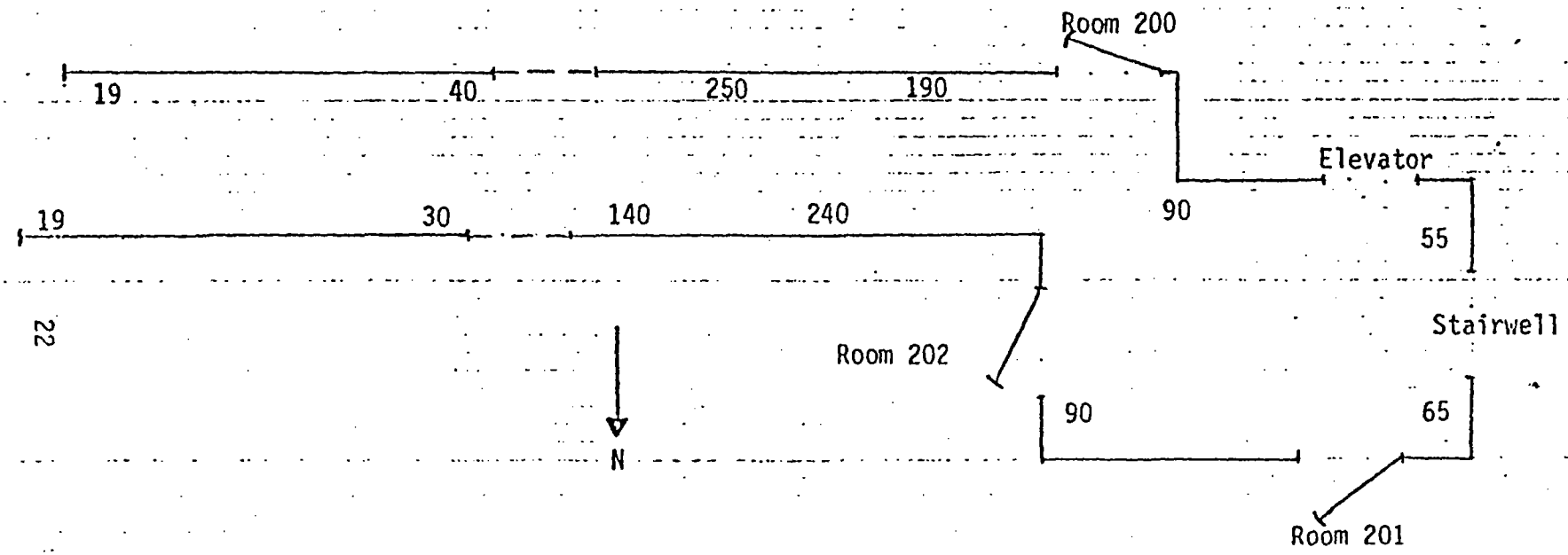
(All readings are in micro - roentgens per hour , uR/hr)



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

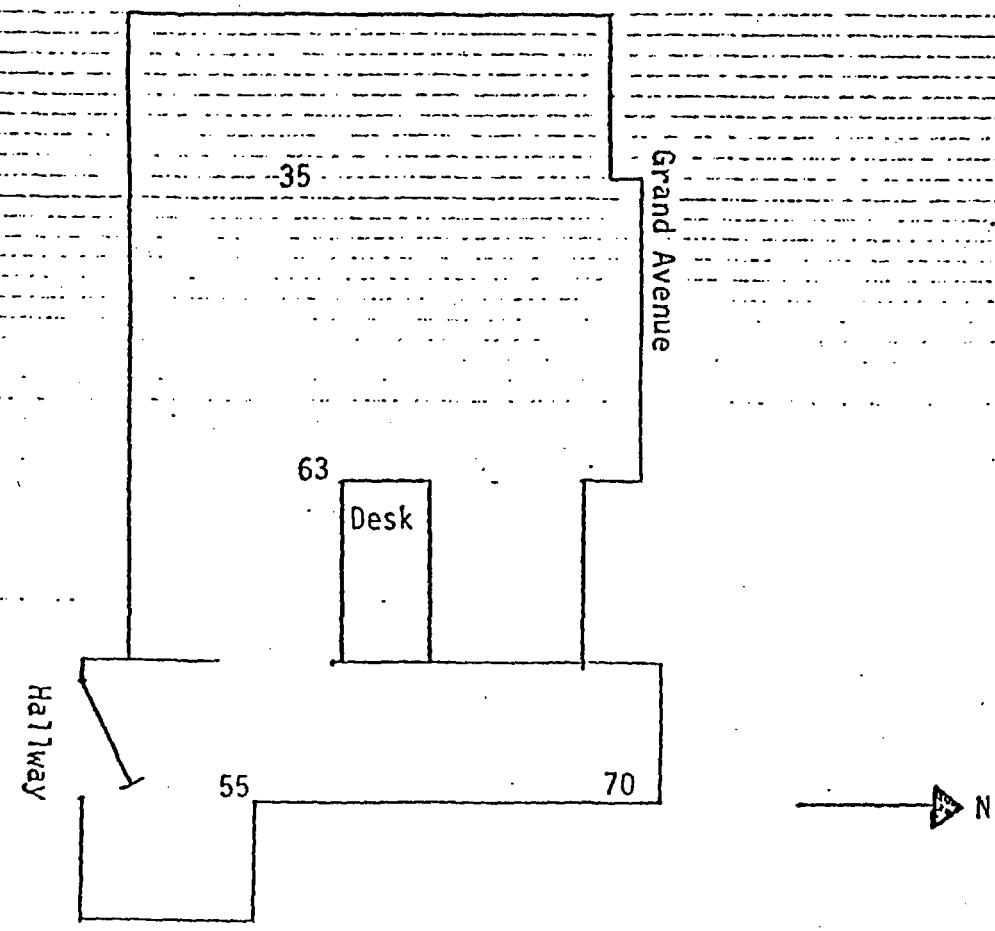
In Rooms 200, 201, and 202 along with the adjoining hallway, dual readings with the micro-R meter and a pressurized ion chamber (PIC) were made (See Figs. 16-18). The micro-R meter is handy for surveys because it is small, light and sensitive, but it can give exaggerated readings where low energy gamma 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

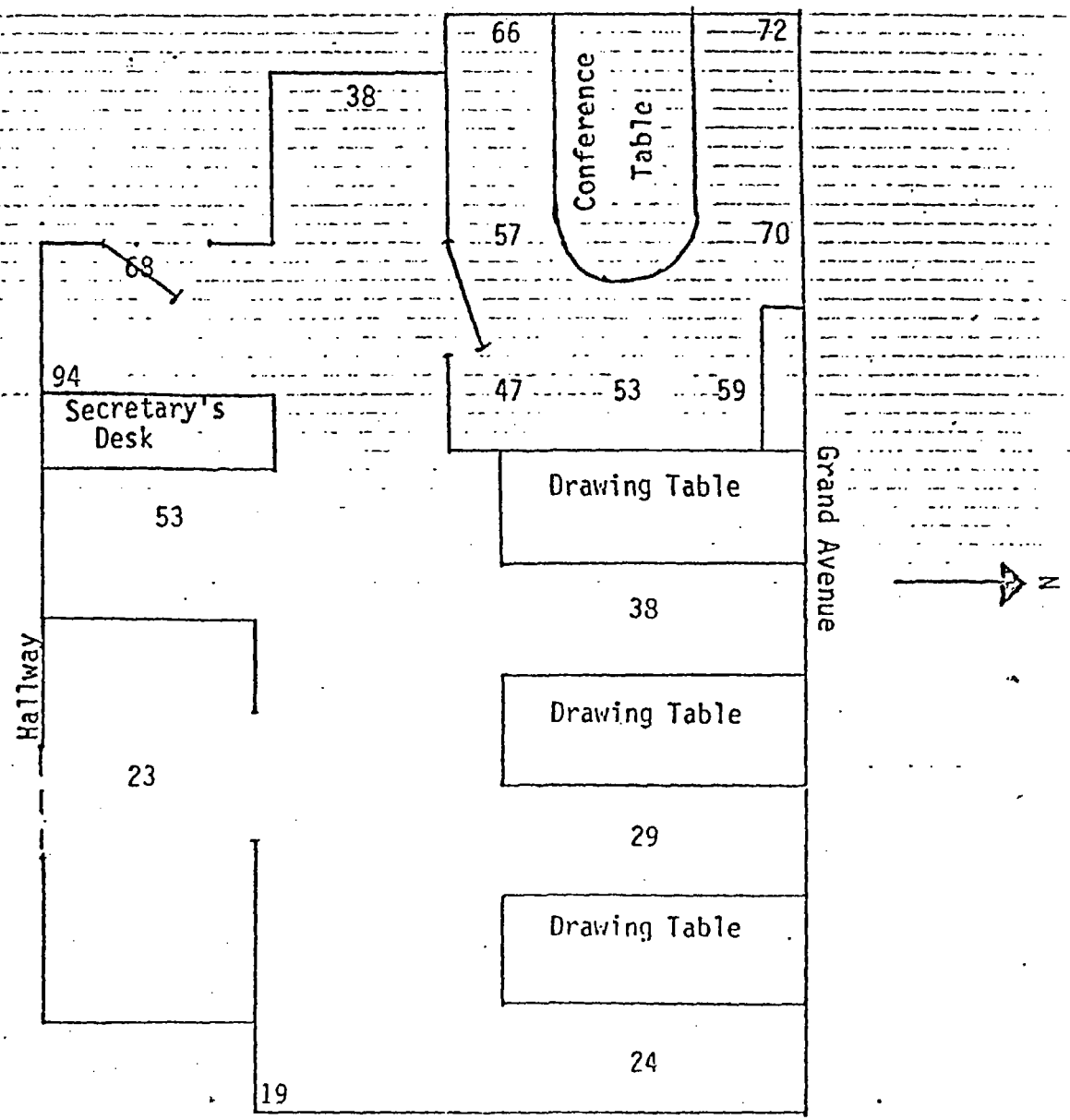
(All readings are in micro - roentgens per hour , uR/hr .)



Second Floor - Room 201 (Ascot Products)

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

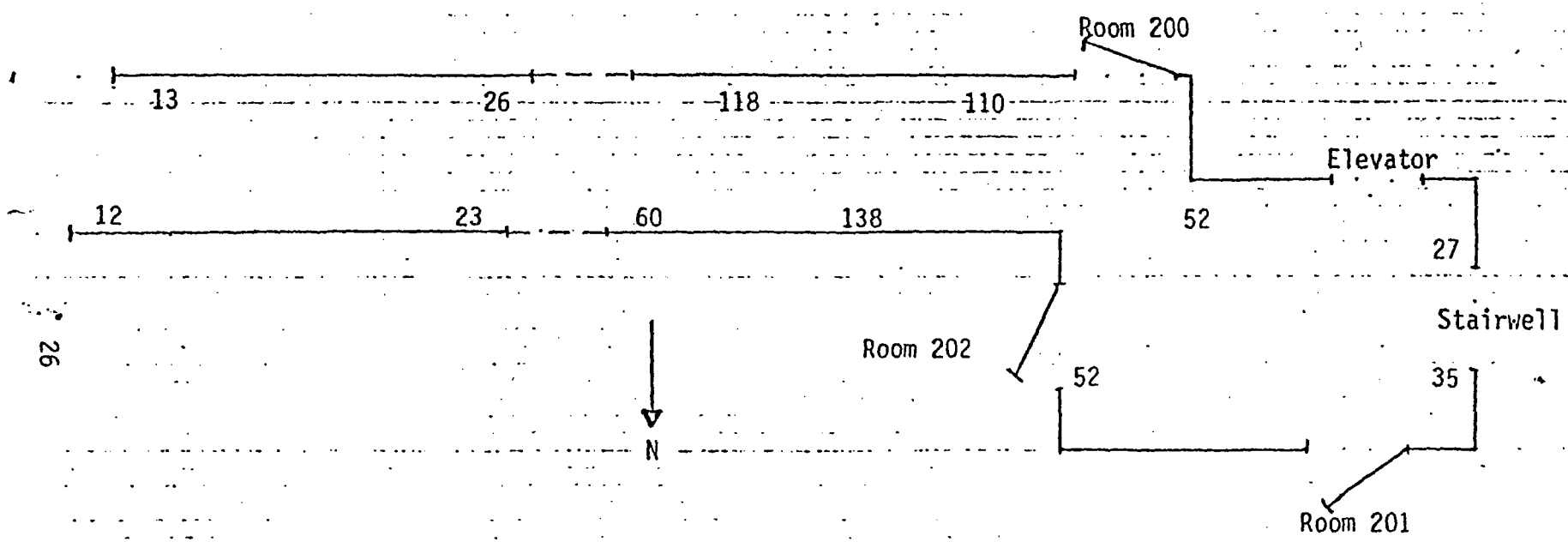
(All readings are in micro - roentgens per hour , uR/hr)



Second Floor - Room 202 (Meisel Munson LTD)

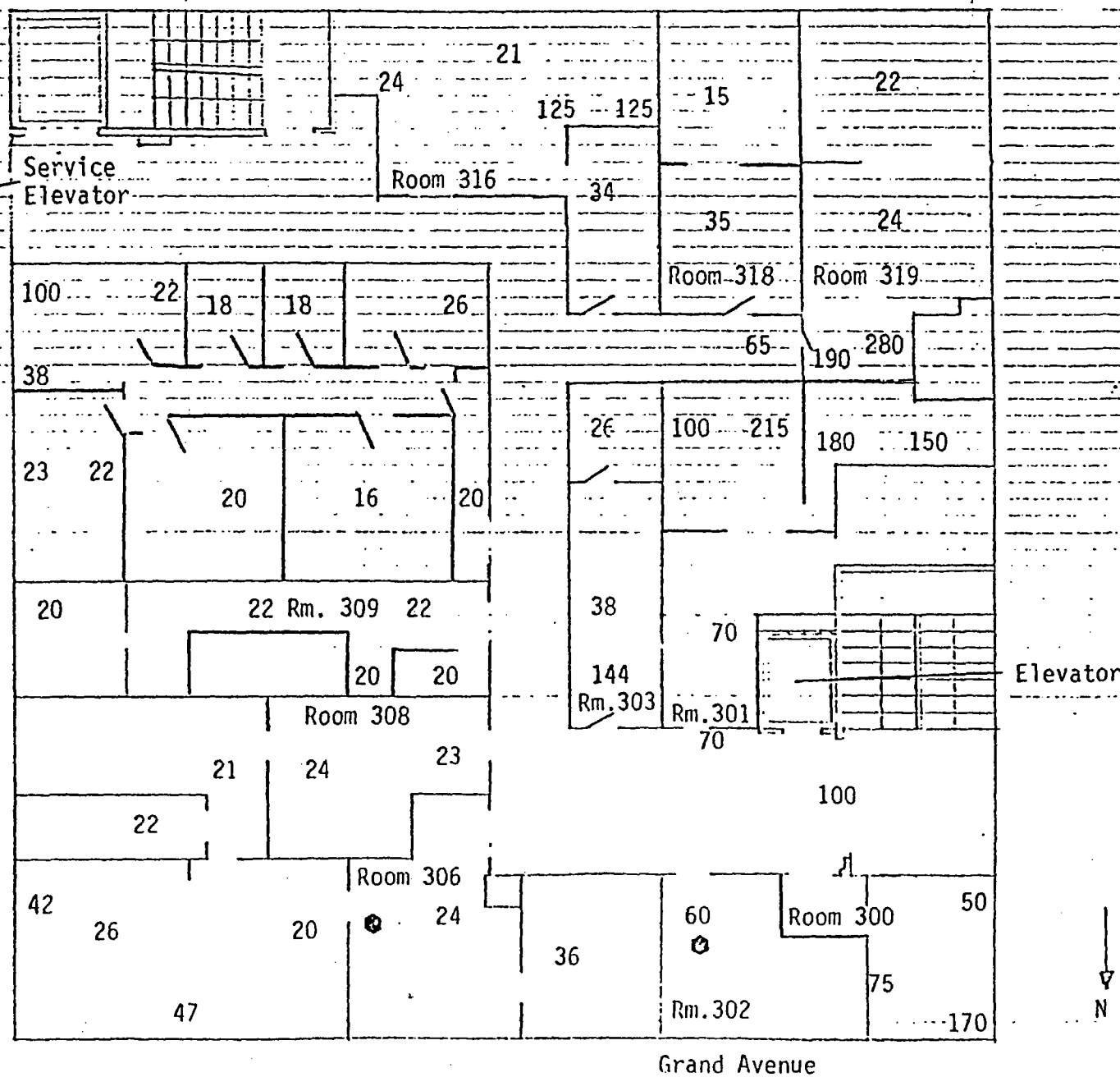
Figure 18 : Pressurized Ion Chamber Readings at One Meter Above Floor in Hallway Near Room 202

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



Second Floor - Hallway

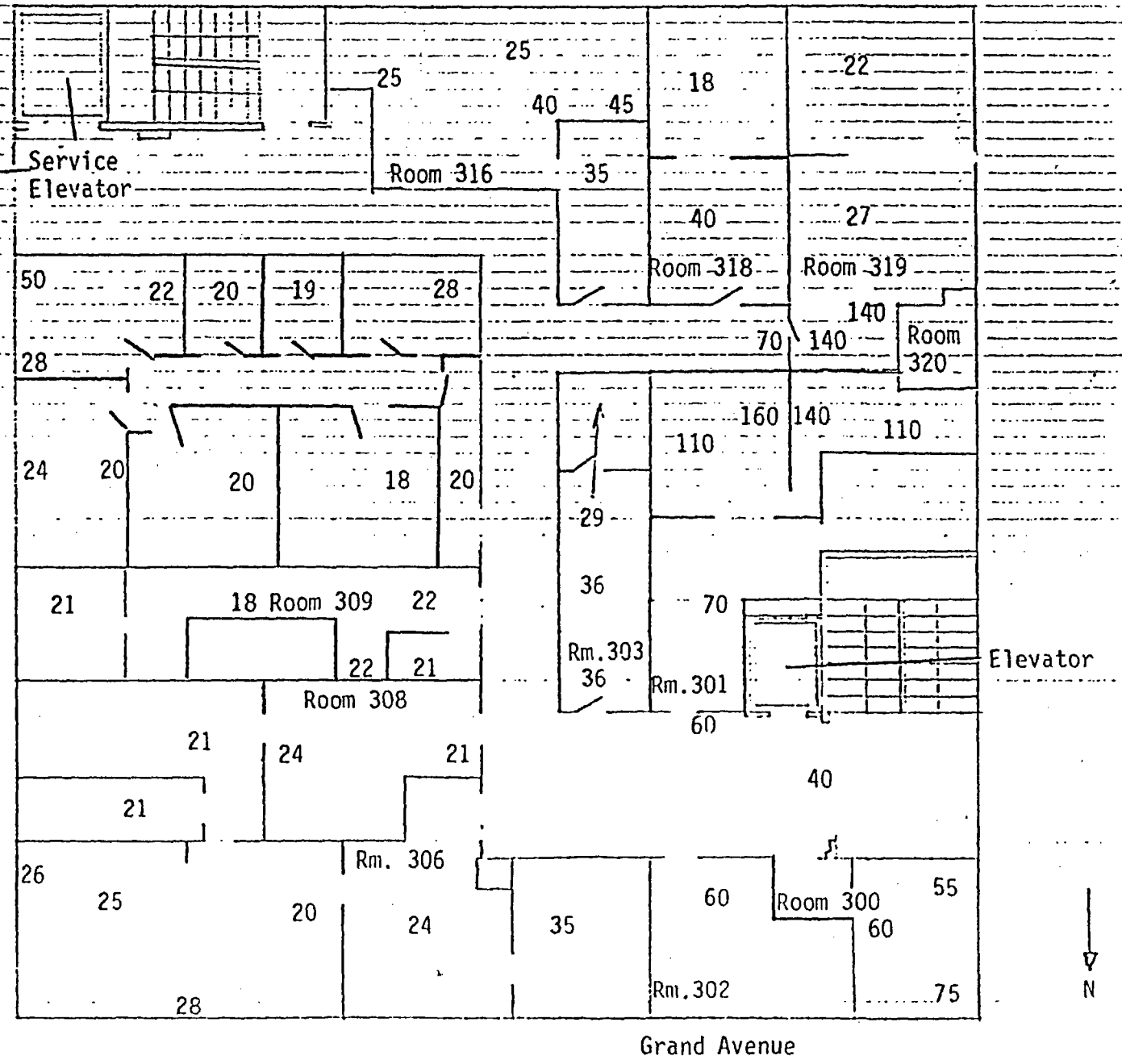
Figure 19 : Micro - Roentgen Meter Readings , Contact With Floor , on the Third Floor
(All readings are in micro - roentgens per hour , uR/hr .)



3rd Floor

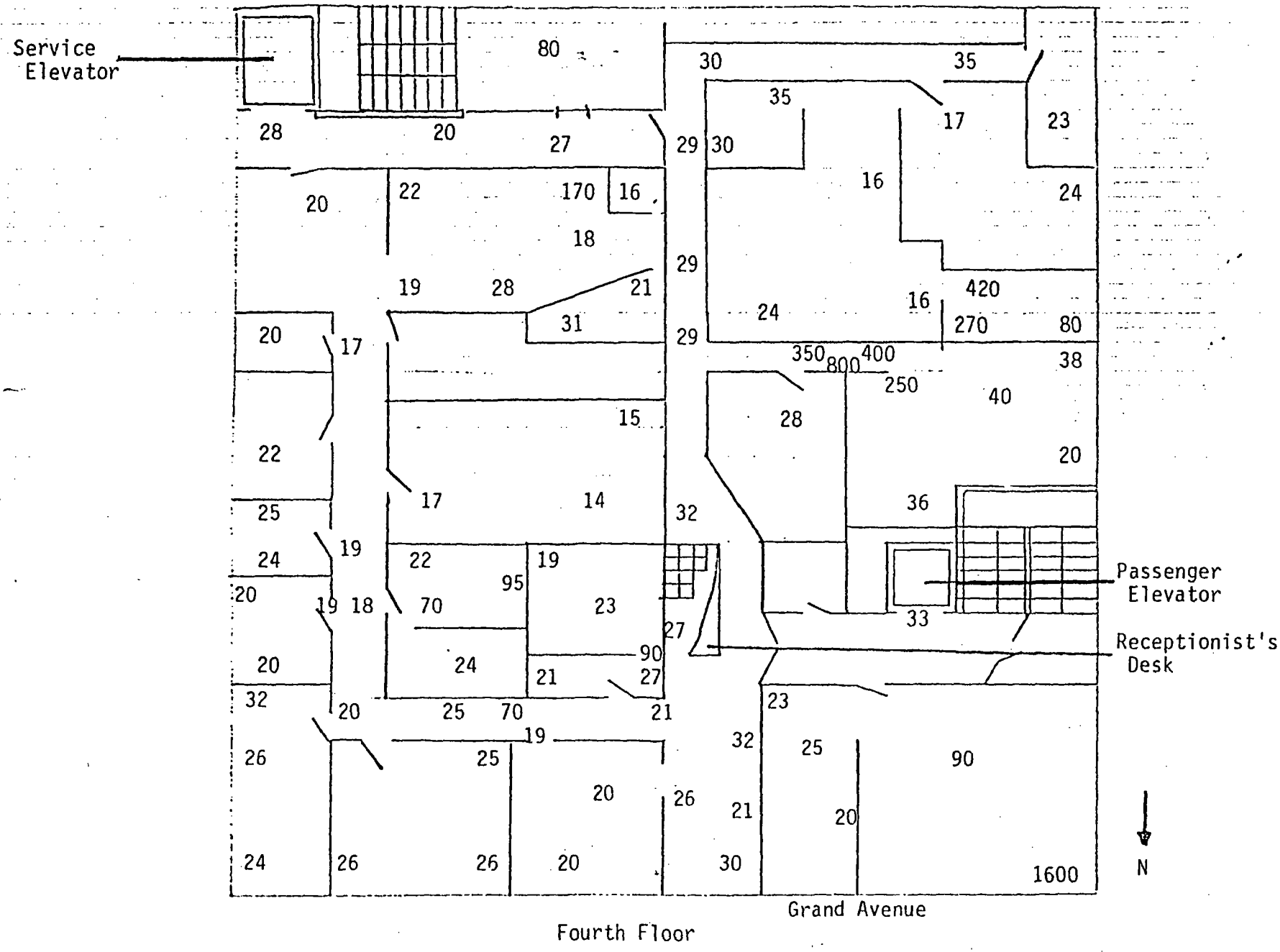
Figure 20 : Micro - Roentgen Meter Readings at One Meter Above Floor on Third Floor

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



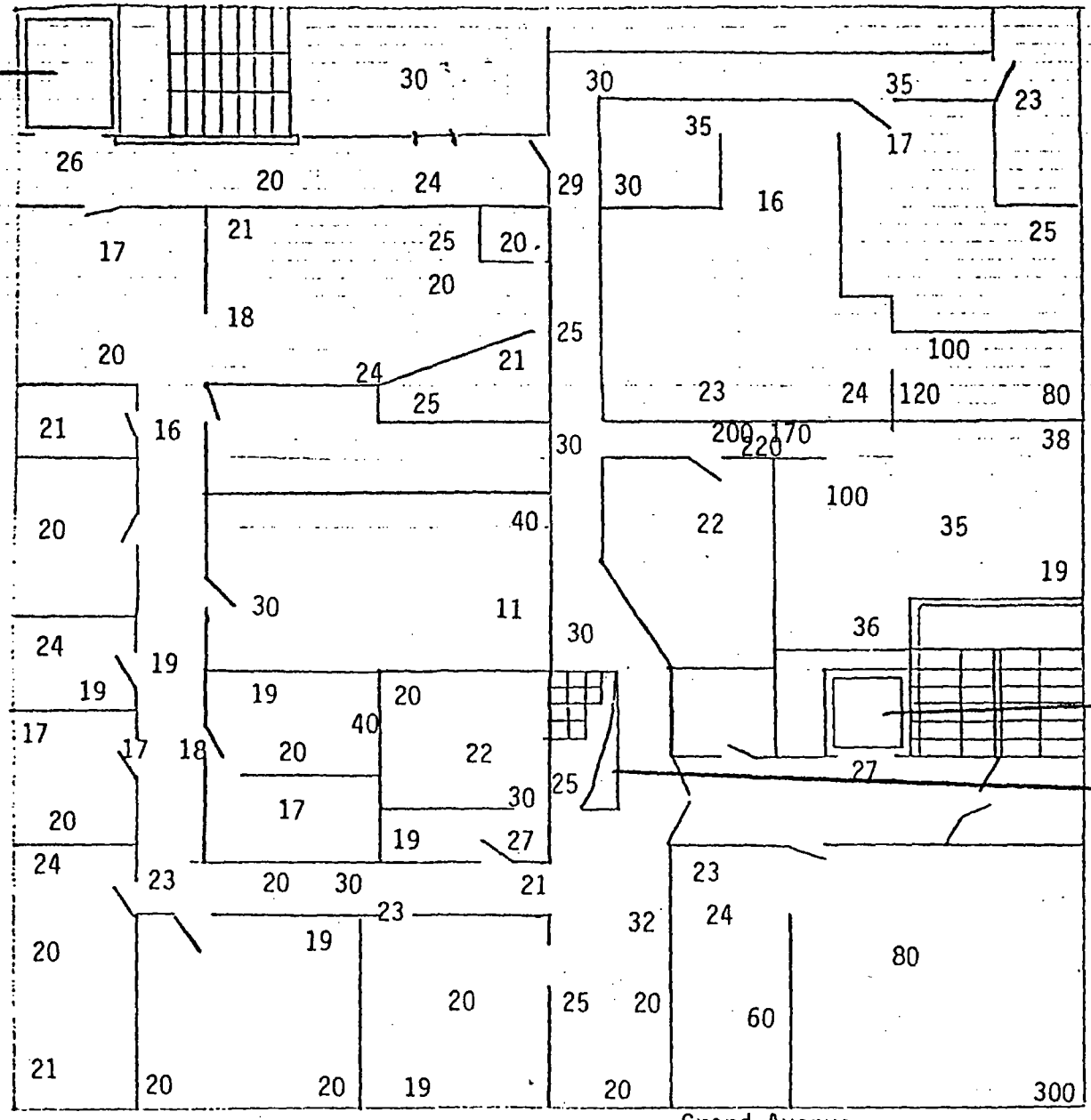
3rd Floor

Figure 21 : Micro - Roentgen Meter Readings , Contact With Floor
(All readings are in micro - roentgens per hour,uR/hr.)



micro - Roentgen Meter Readings at One Meter Distance

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



Fourth Floor

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

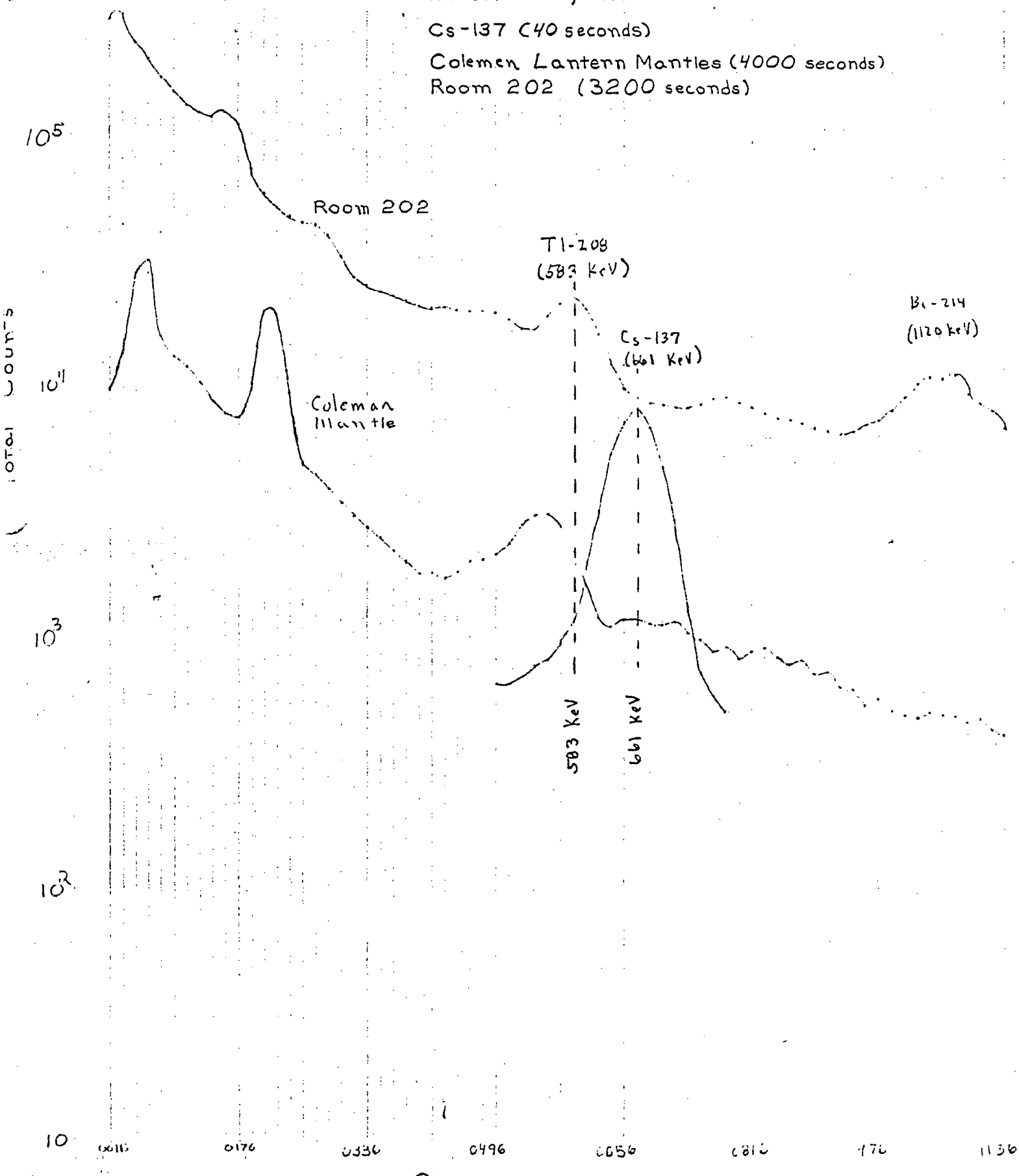
161 East Grand - Chicago, Illinois

November 24, 1980

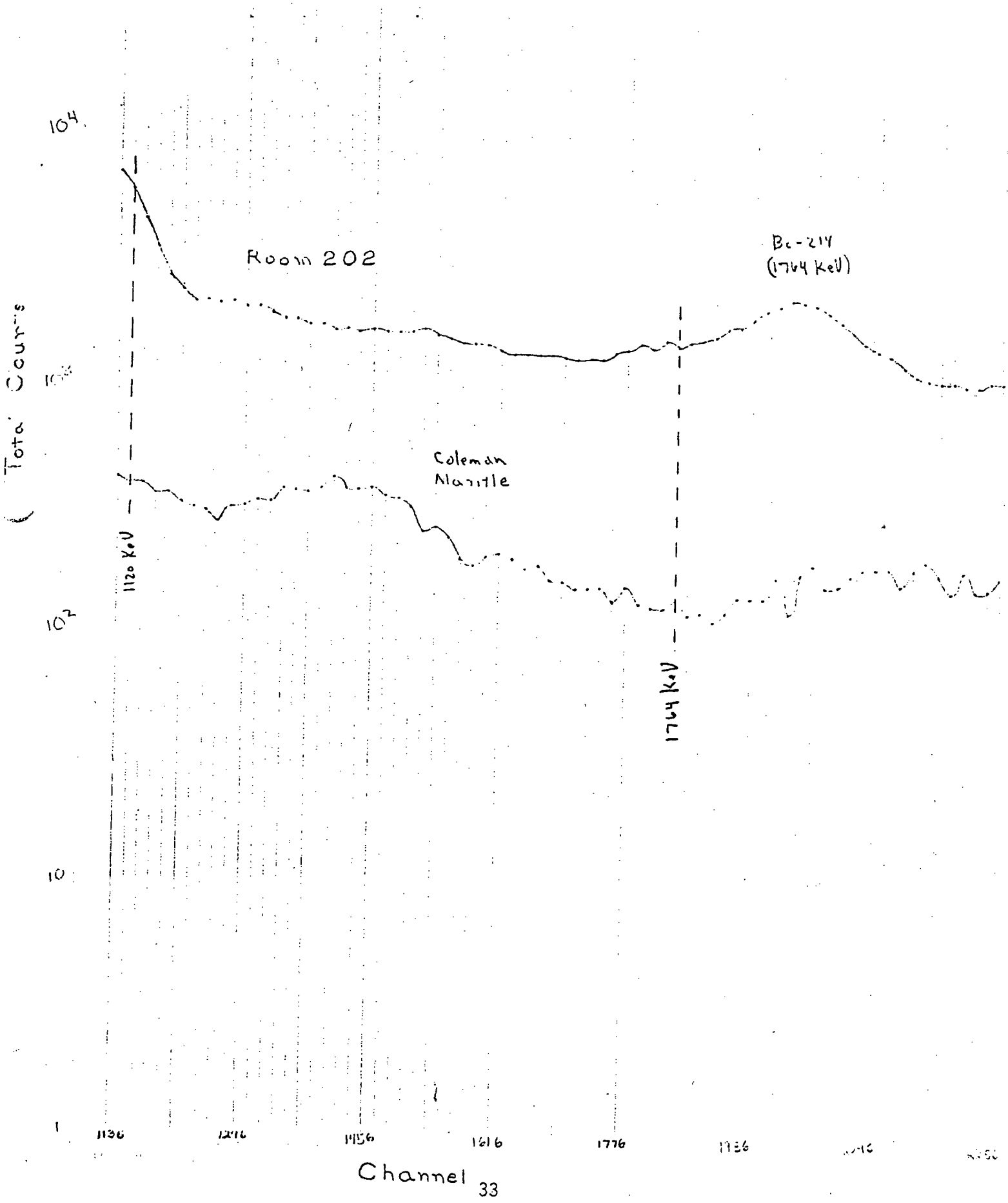
Cs-137 (40 seconds)

Coleman Lantern Mantles (4000 seconds)

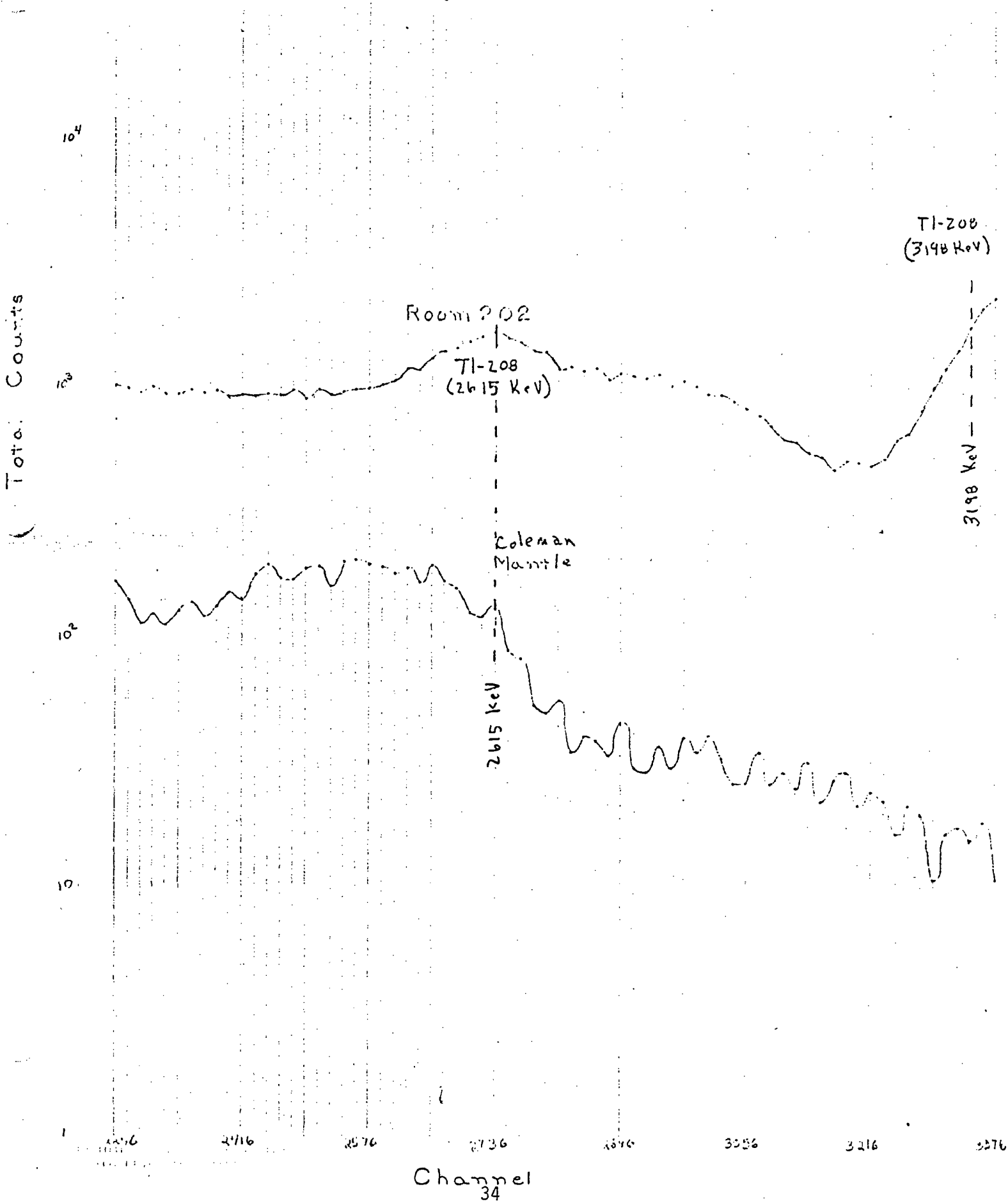
Room 202 (3200 seconds)



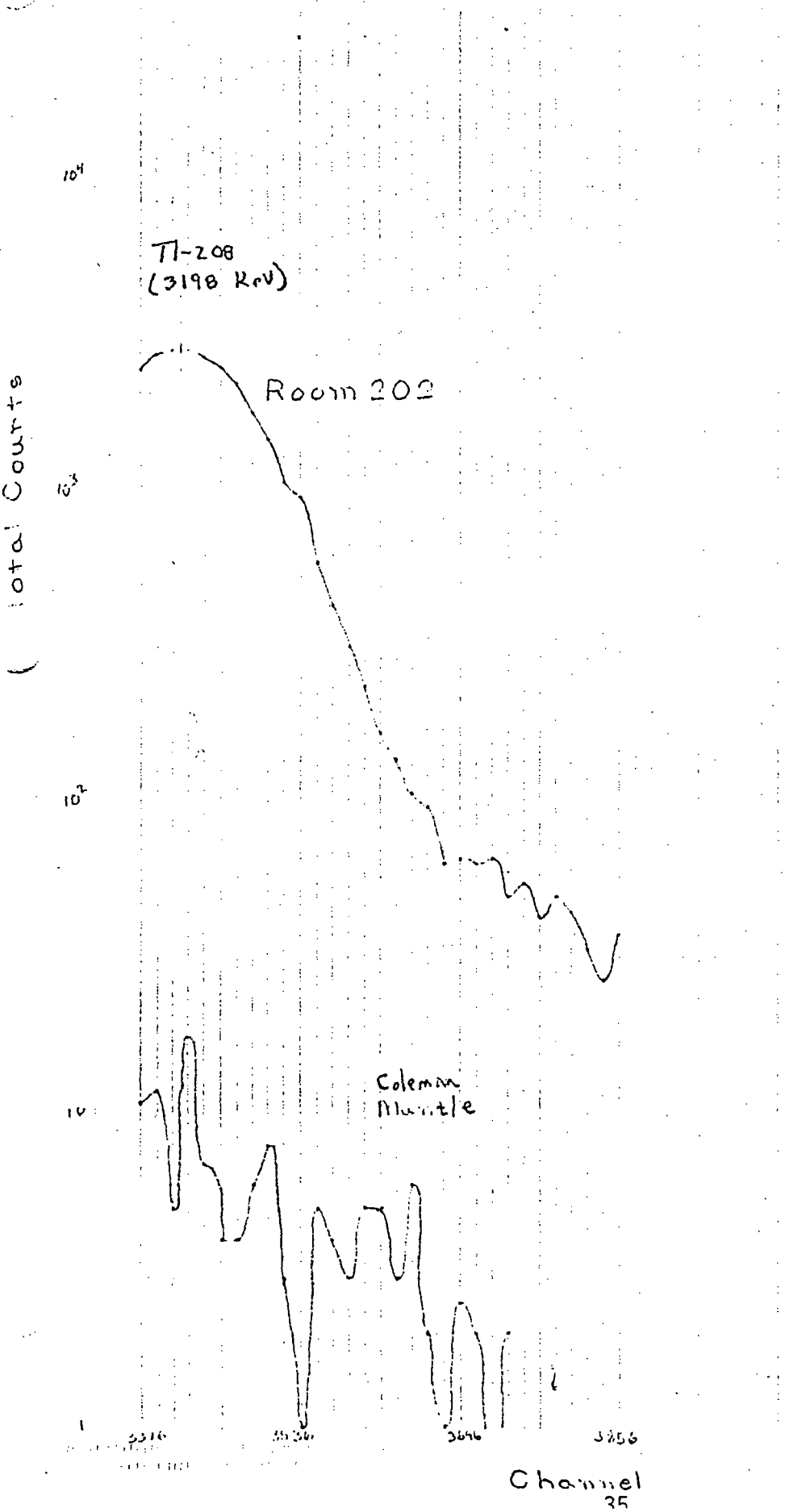
Multi-Channel Gamma Ray Spectrum
(Cont.)



Multi-Channel Gamma Ray Spectrum
(Cont.)



Multi-Channel Gamma Ray Spectrum
(Cont.)



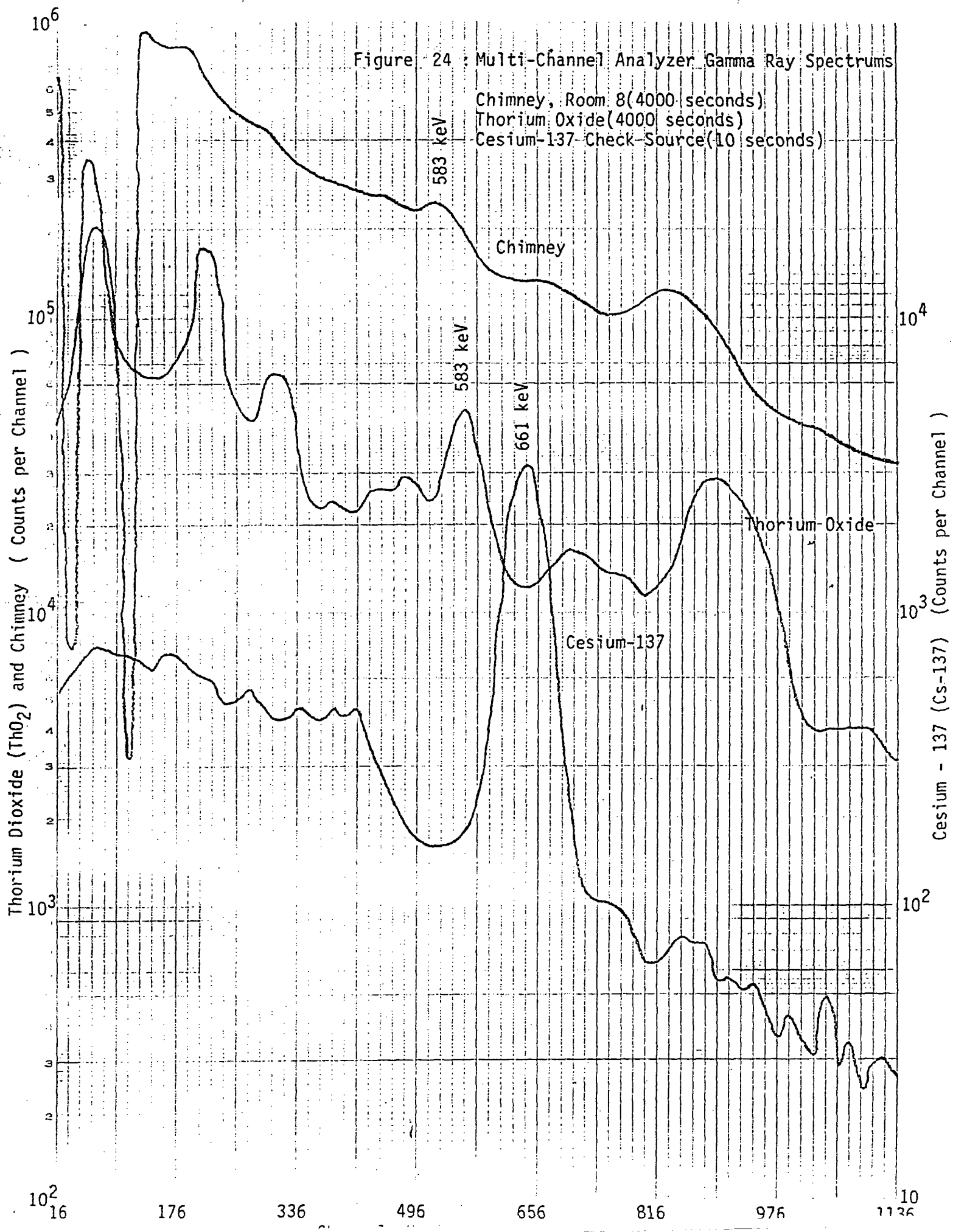
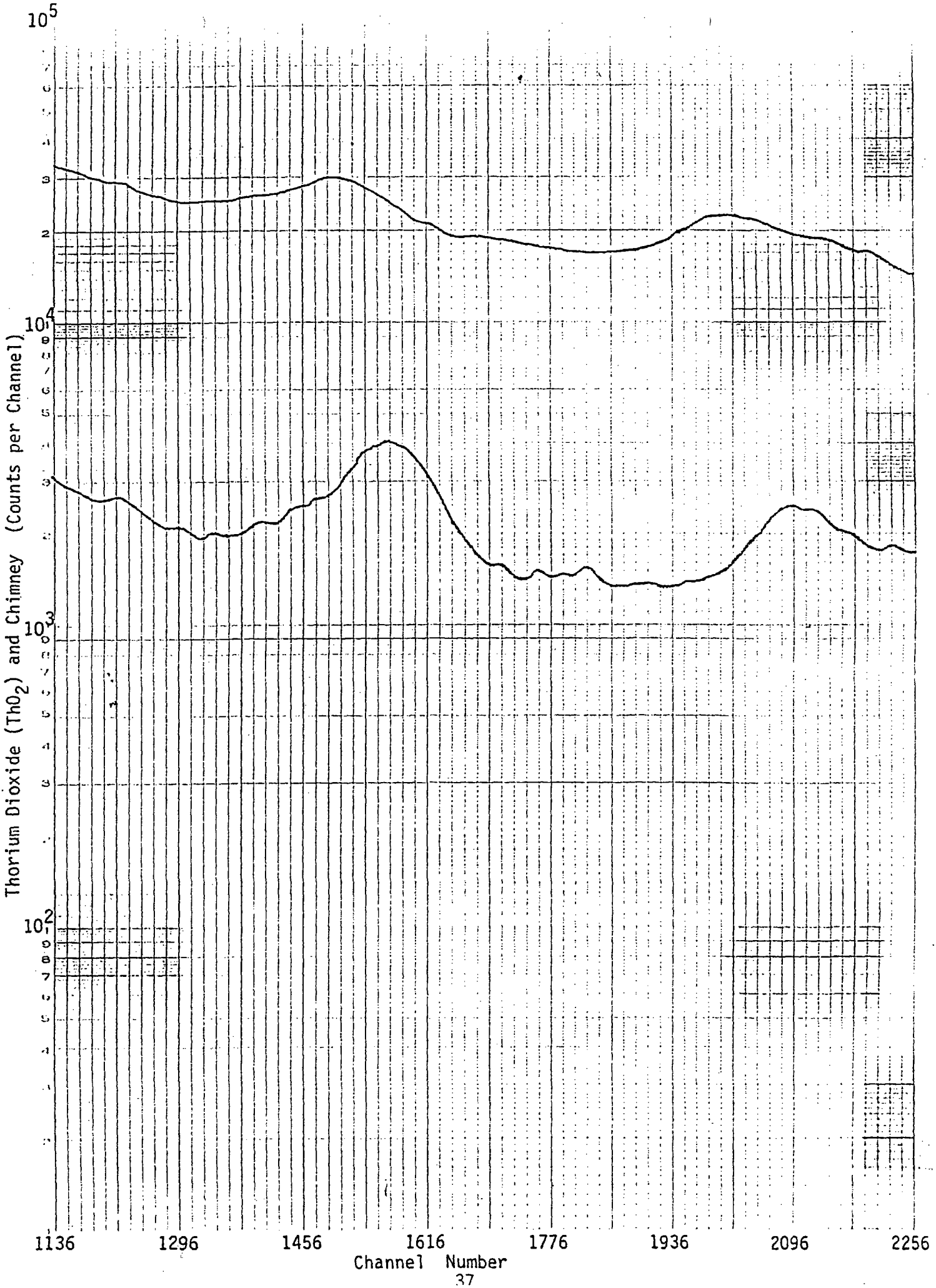


Figure 24 : Multi-Channel Analyzer Gamma Ray Spectrums


10^5
10^4
10^3
10^2
Thorium Dioxide (ThO_2) and Chimney (Counts per Channel)
1136
1296
1456
1616
1776
1936
2096
2256
Channel Number

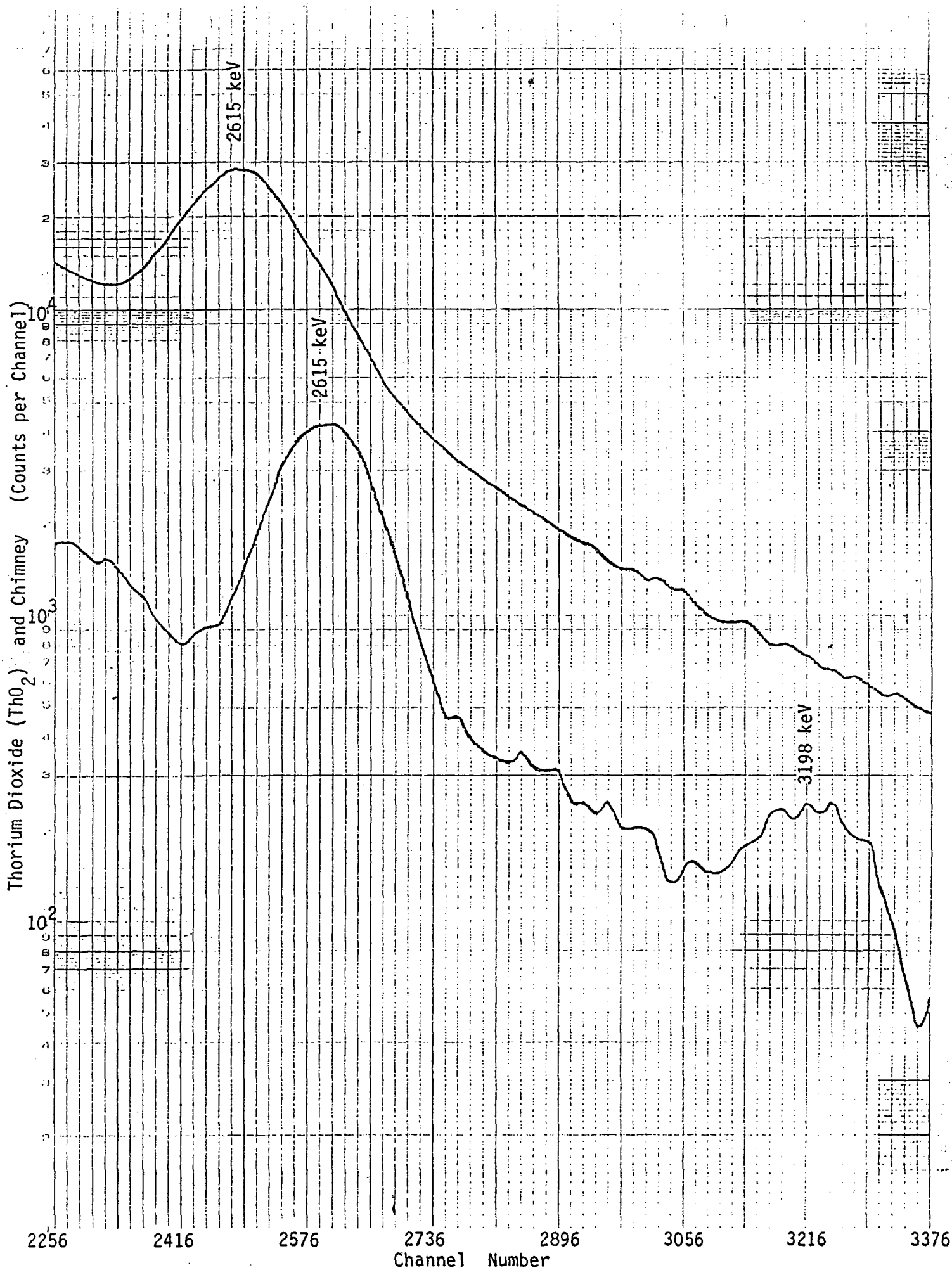
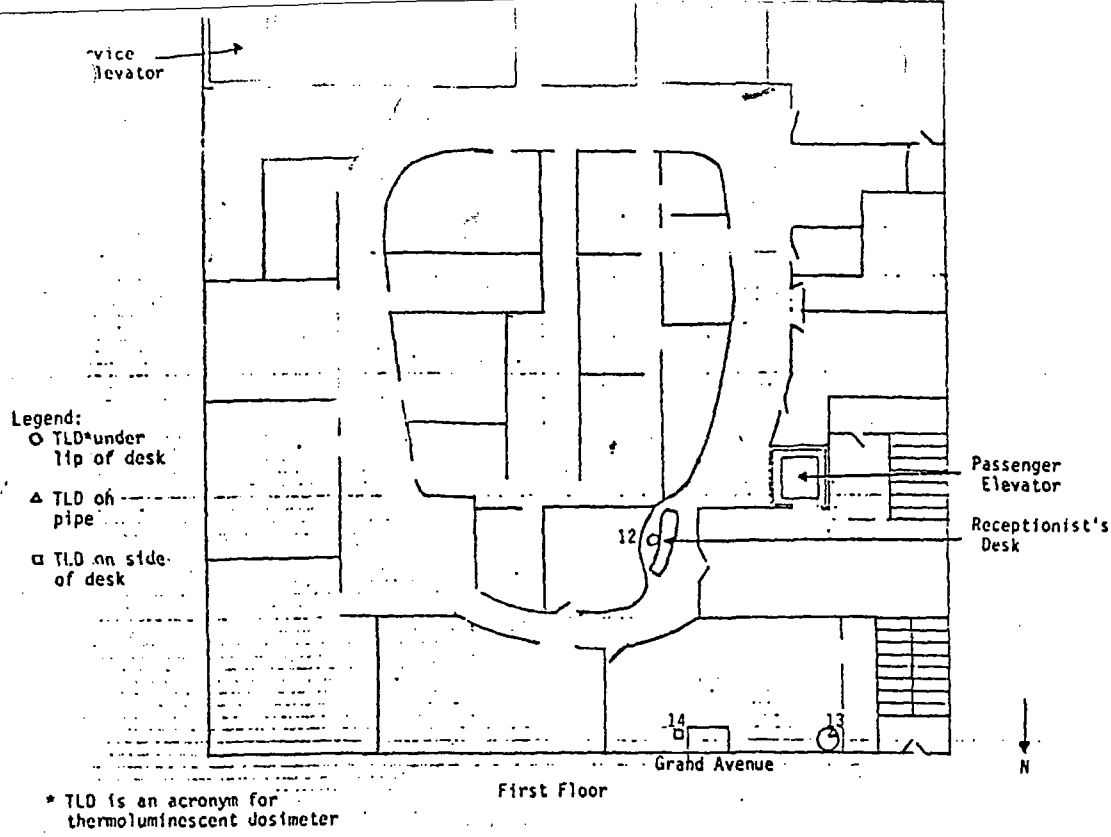
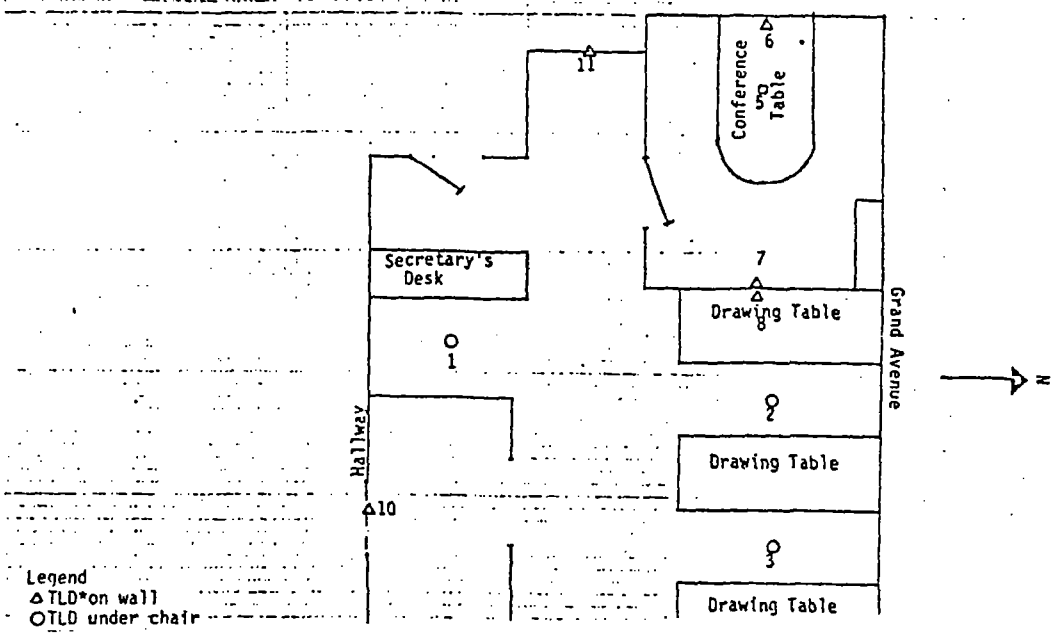

2615 keV
2615 keV
3198 keV
Thorium Dioxide (ThO_2) and Chimney (Counts per Channel)
10^4
10^3
10^2
2256
2416
2576
2736
2896
3056
3216
3376
Channel Number

Figure 25



Location of Thermoluminescent Dosimeters in Room 202



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.

---

*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

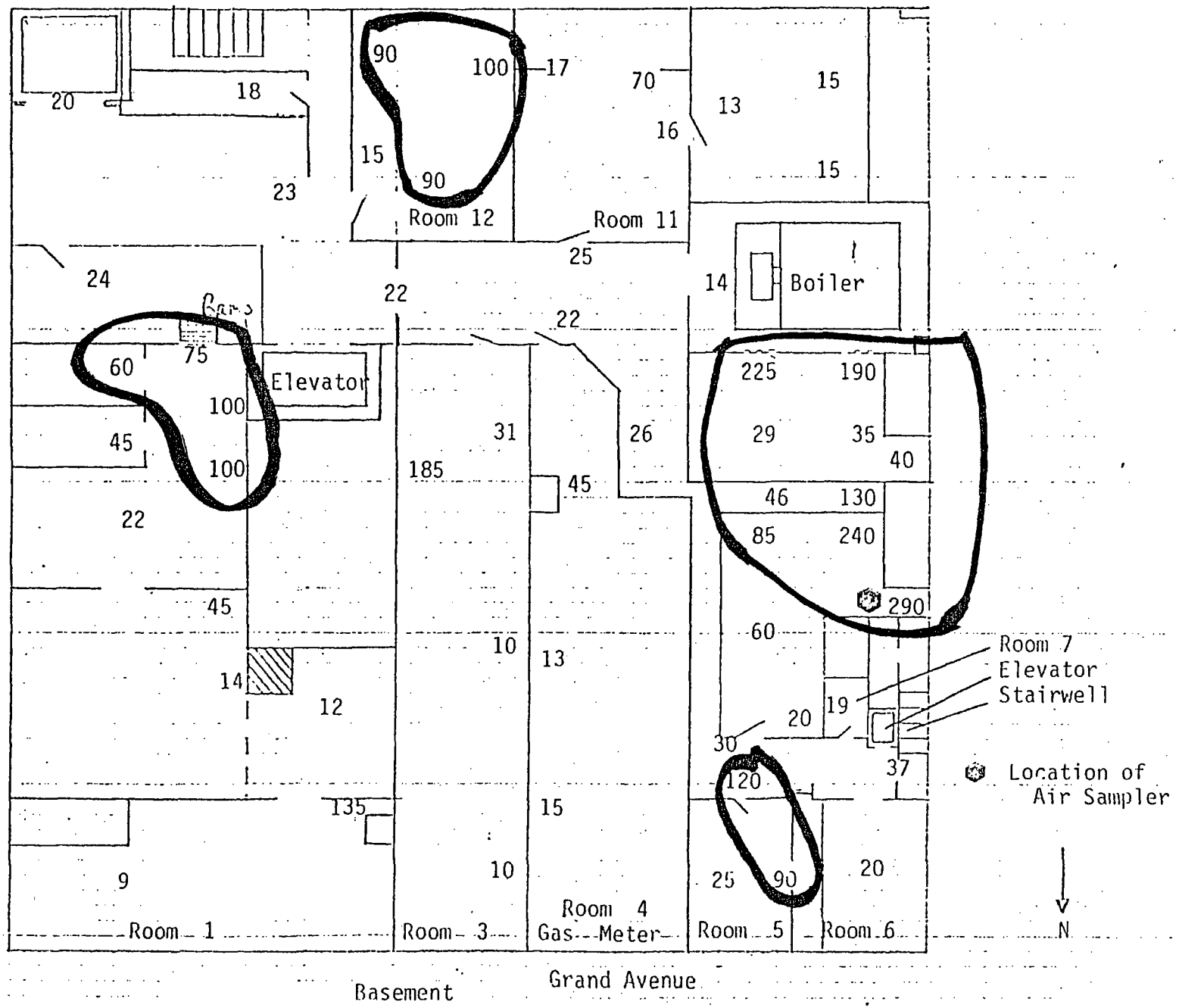


Figure 27 : First Floor Regions of Contamination

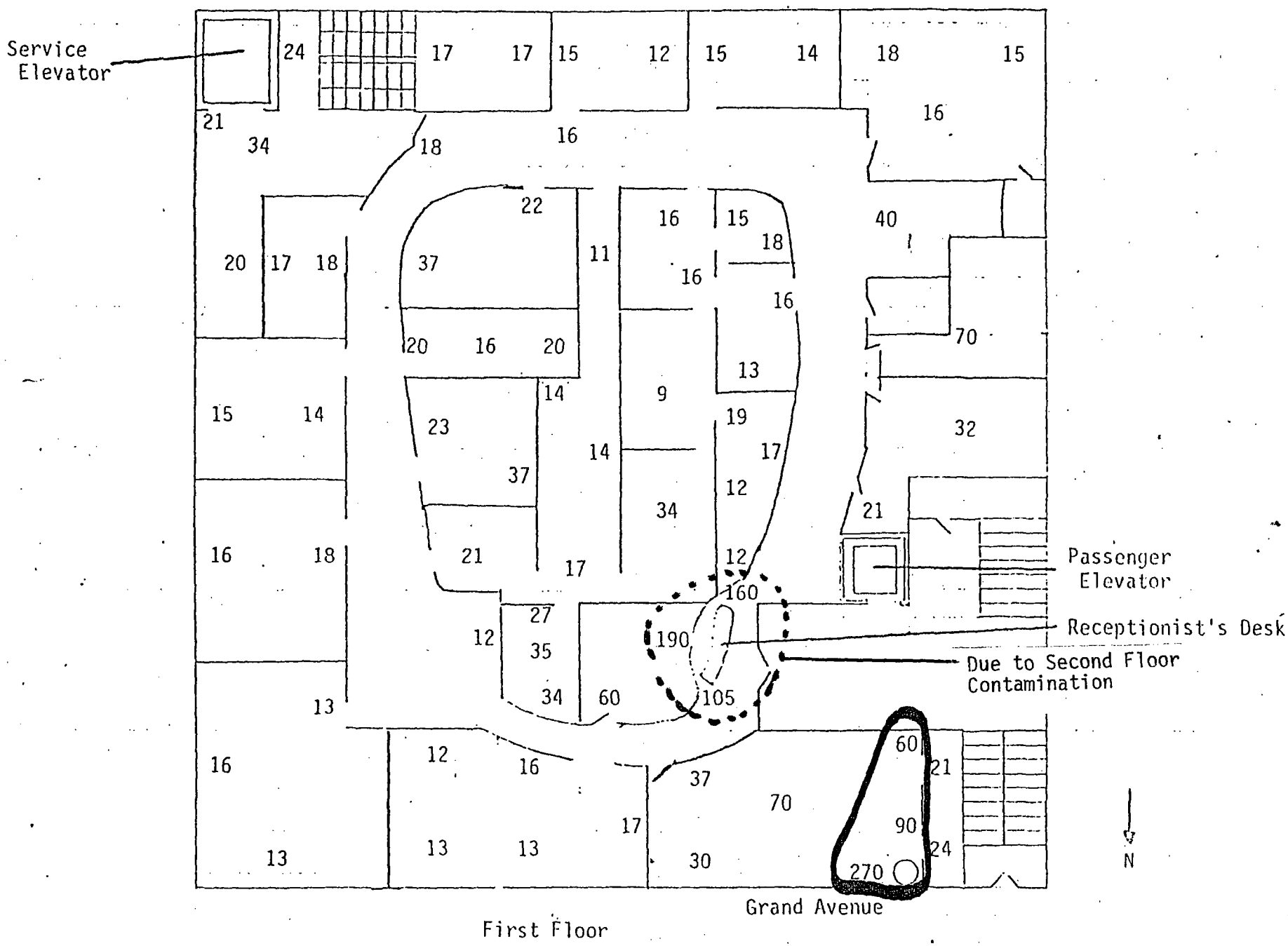
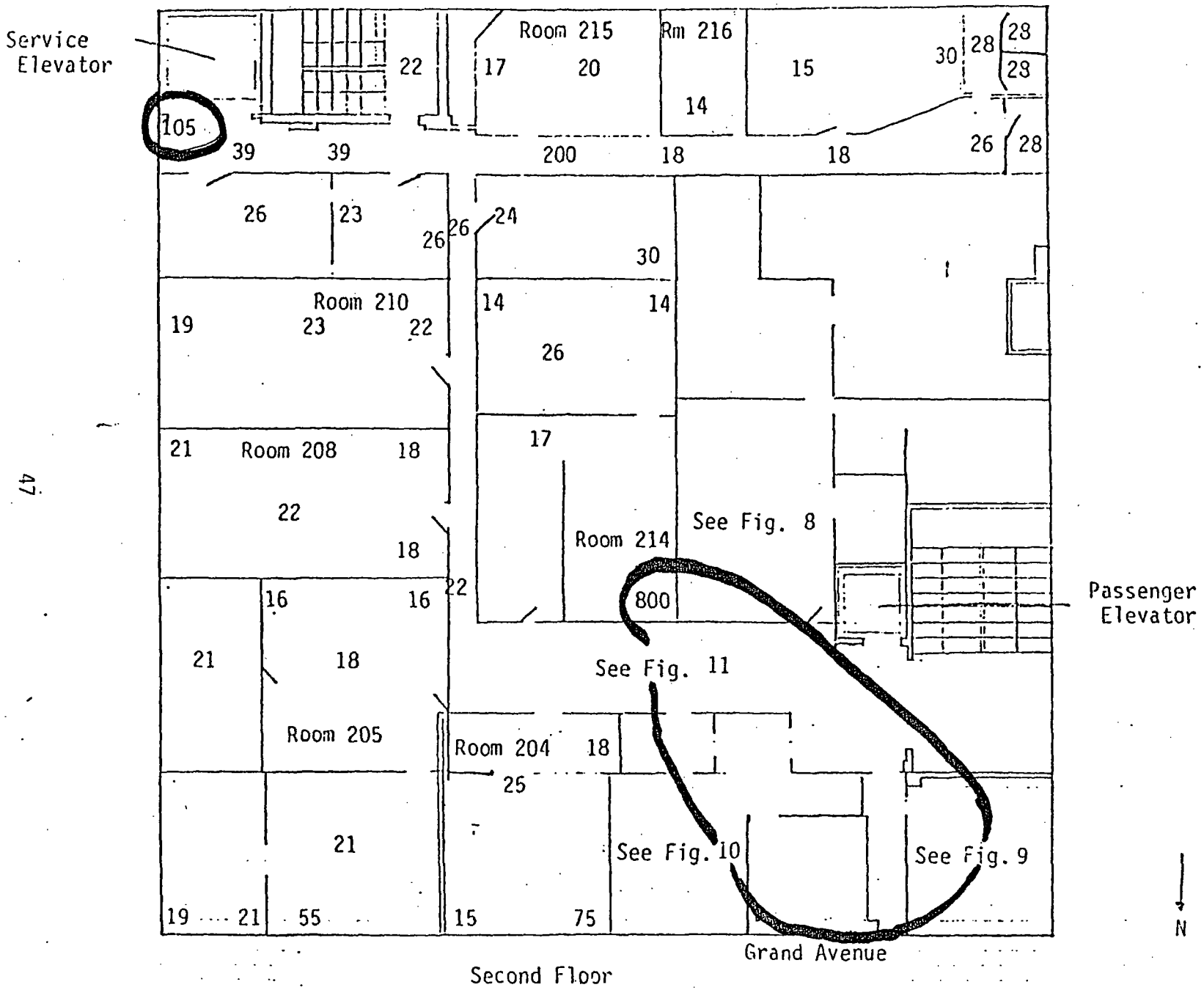
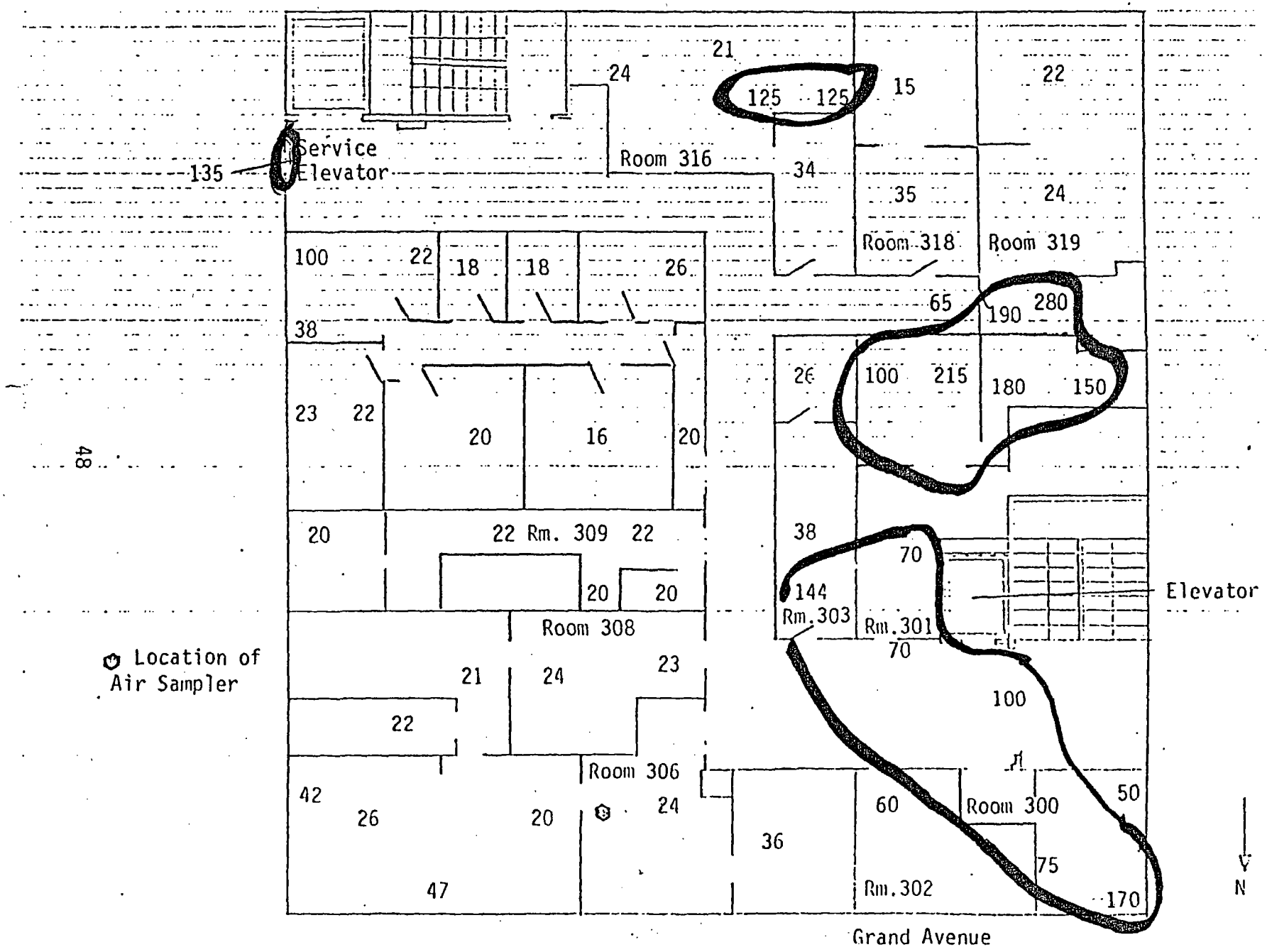


Figure 28 : Second Floor Regions of Contamination



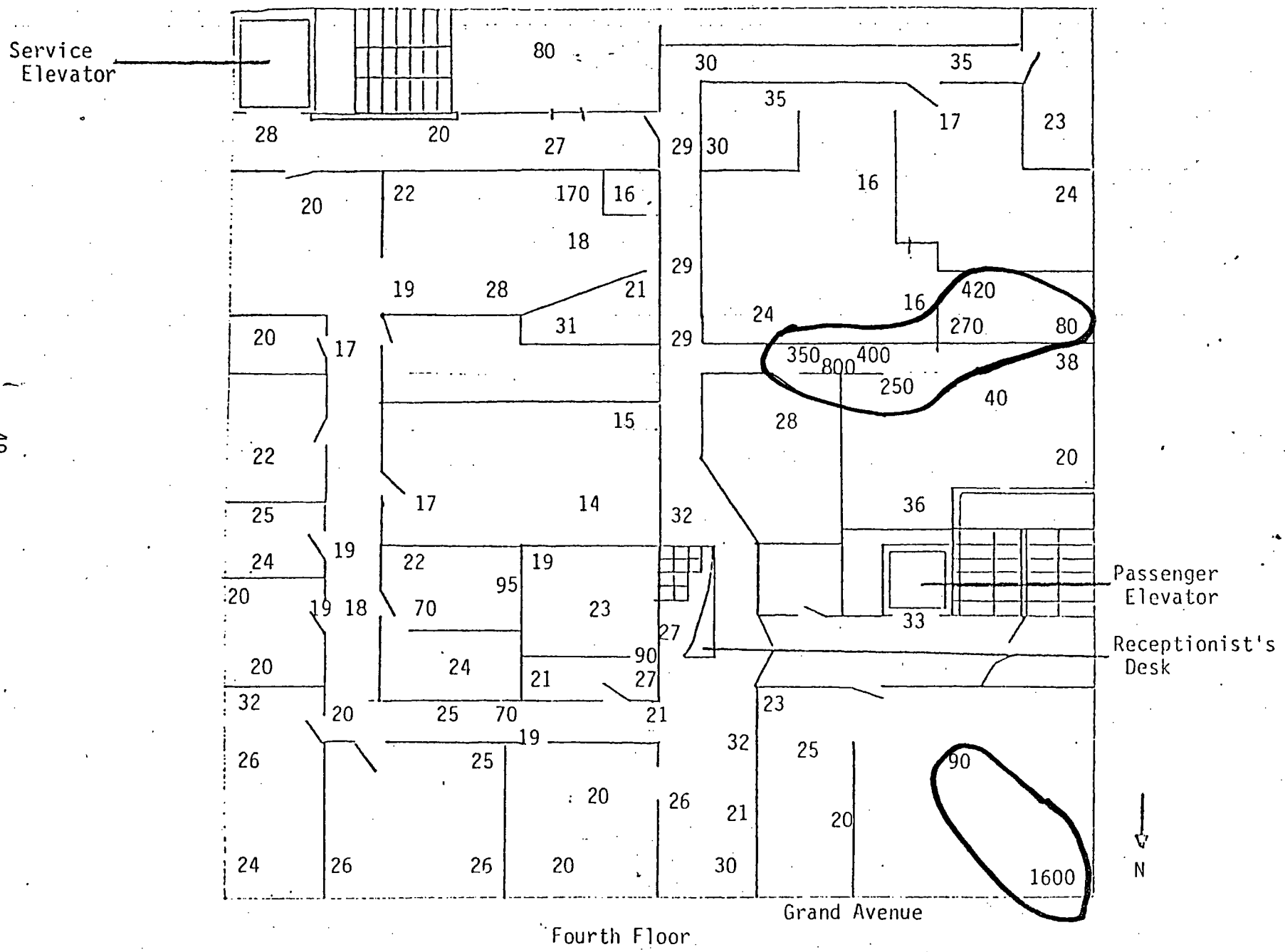
Second Floor

Figure 29 : Third Floor Regions of Contamination



3rd Floor

Figure 30 : Fourth Floor Regions of Contamination



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

TLD Chip 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. Recommendat s

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
- C. Air Sample Results

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

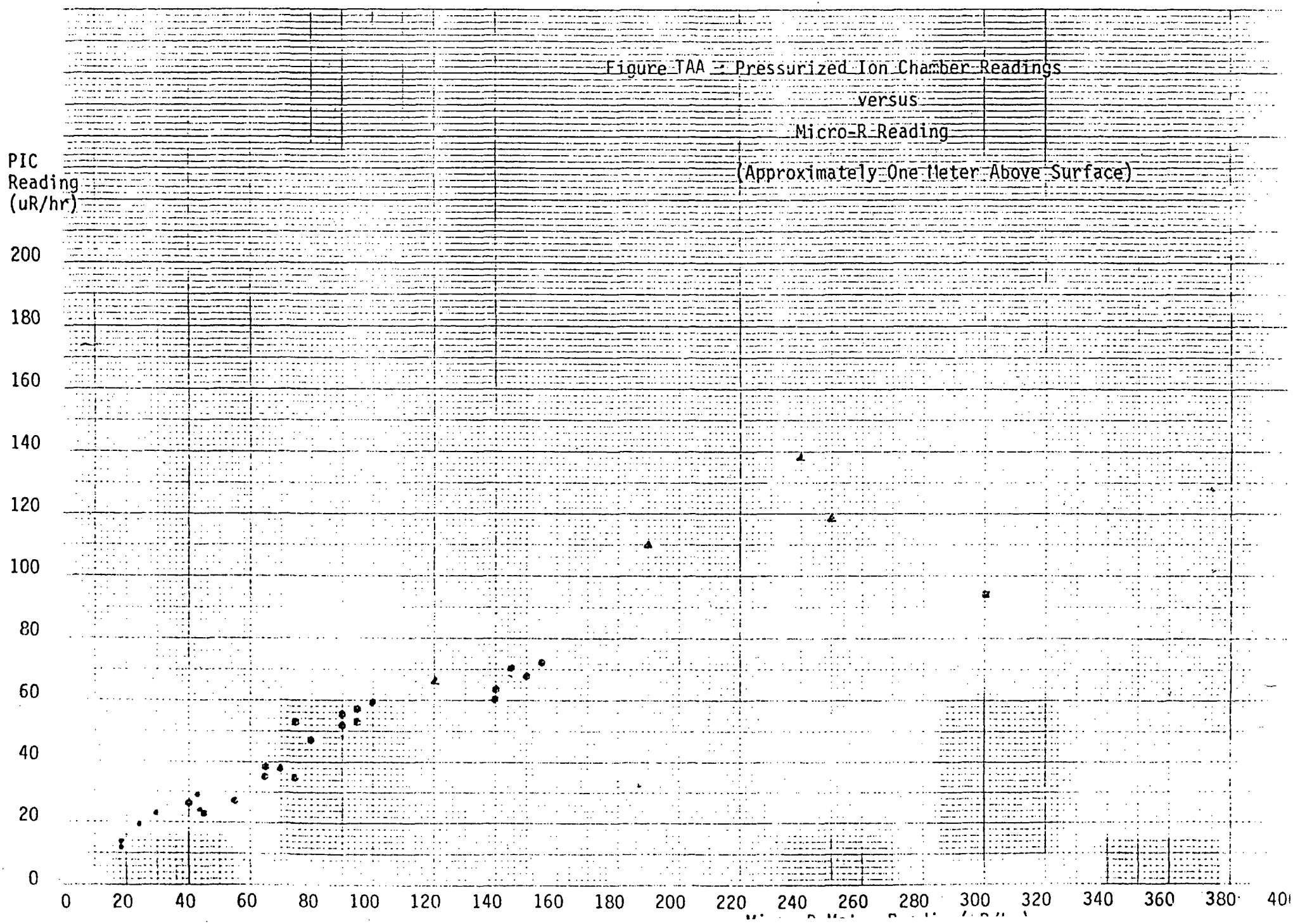

Figure TAA - Pressurized Ion Chamber Readings versus Micro-R Reading (Approximately One Meter Above Surface)

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 ----

CGGCF017 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)

DATE 1/21/81 MICROFILM ----

CCGCF017 LABORATORY INPUT SHEET FOR RADIOLOGICAL SAMPLES PAGE 5

TAB

TRAN CODE 45
SAMPLE KEY 8035845067 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)

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.

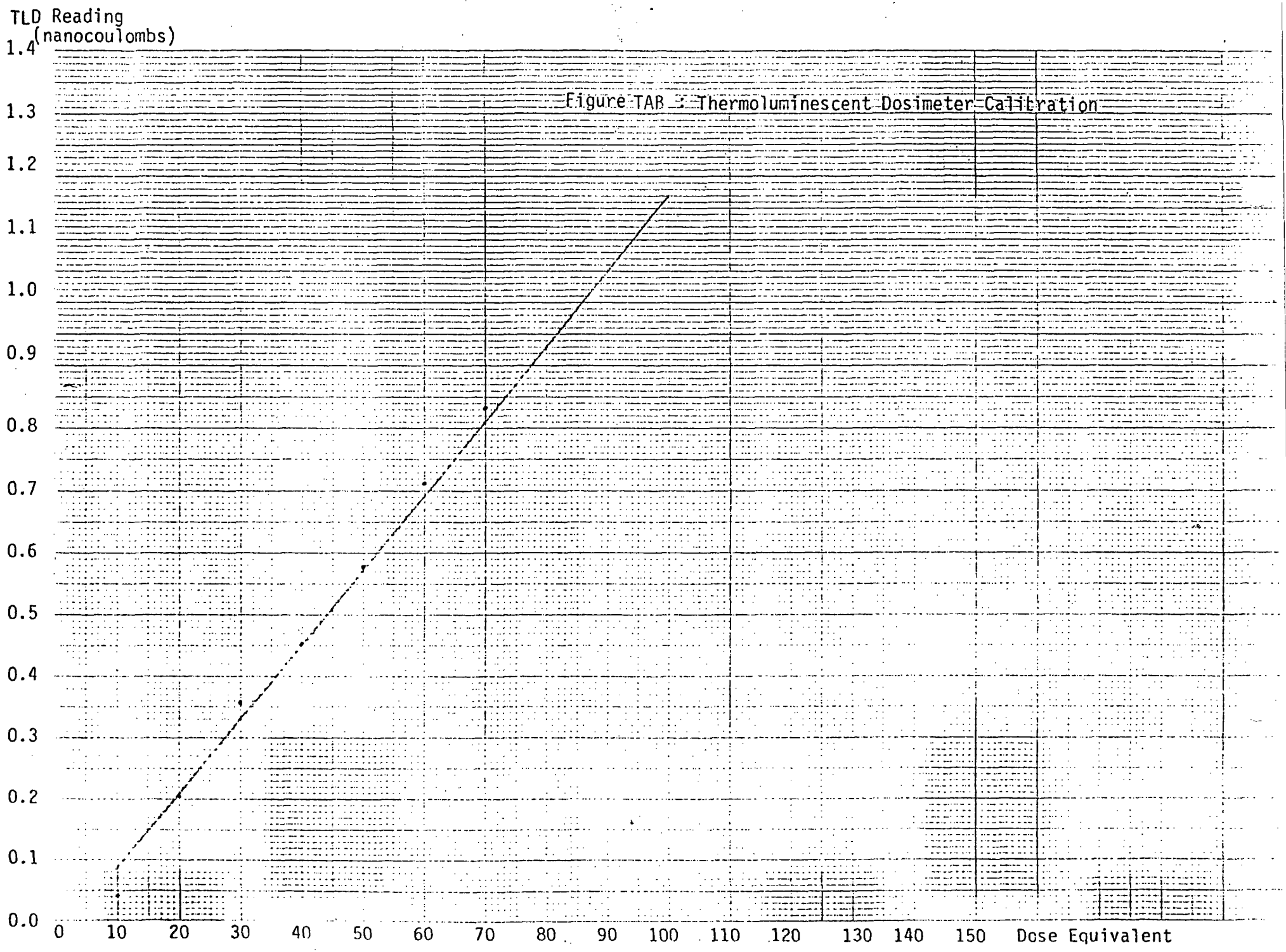

Figure TAB 3: Thermoluminescent Dosimeter Calibration

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

Table TA4

TLD Chip 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
10	On South Wall In Storage Room	40	0.043	7.24	377	1.72	86
11	On West Wall In Entrance Foyer	46	0.049	8.25	429	1.96	98
12	Under Lip Of Reception Desk	56	0.060	10.11	526	2.40	120
13	On Pipe Proximal to Grand Avenue	94	0.100	16.80	880	4.00	200
14	On Side of Desk Near Grand Avenue	65	0.069	11.62	604	2.76	138
15	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

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

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

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

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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Route

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 ($\gtrsim 2\frac{1}{2}$ 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 $2\frac{1}{2}$ 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

2½ hr so

Following (after the other in sequence), i.e. 20–85 and 105 to 210.

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

lps

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

TA20

TABLE 1. VALUES OF a, b, c, AND d FOR SUBSTITUTIONS IN EQUATION (1)

Sampling time τ (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	10.36	11.65	13.12	14.79	16.67	18.81	21.23	23.97	27.08	30.61
	b	1.39	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	21.49	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	5.88	6.58	7.37	8.27	9.28	10.43	11.74	13.21	14.88	16.77	18.91	21.34	24.09	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	1.23	1.22
	c	21.37	20.93	20.54	20.20	19.89	19.62	19.38	19.16	18.96	18.78	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	16.45	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	9.40	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	15.56	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	1.21	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	28.28	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	15.83	17.78	19.98	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	1.18	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	6.78	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	7.56	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
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.

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JAMES, A. C. and STRONG, J. C. (1974) A radon-daughter monitor for use in mines. *Proceedings of the 3rd International Congress of IRPA, Washington, D.C., Sept.* 1973. US AEC CONF-730907. U.S. Atomic Energy Commission, Washington, D.C.

OGDEN, T. L. (1974) *Ann. occup. Hyg.* 17, 23–34.

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

$$a = 10^5 K/(JM - LK)$$
$$b = M/K$$
$$c = 10^5 L\,(1 + 0.0949\gamma)/(JM - LK)$$

$$d = J/L$$
$$J = 3.859\times10^{4}\exp(-4.310\times10^{-4}\,t_Q) - 1.821\times10^{4}\exp(-5.862\times10^{-4}\,t_Q)$$
$$K = 1.972\times10^{3}\,k_{Ta}\exp(-1.809\times10^{-5}\,t_Q) - 309.6\,(1.105-\gamma)k_{Tc}\exp(-1.906\times10^{-4}\,t_Q)$$
$$L = 4.499\times10^{3}\exp(-4.310\times10^{-4}\,t_Q) - 940.6\exp(-5.862\times10^{-4}\,t_Q)$$
$$M = 2.197\times10^{3}\,k_{Ta}\exp(-1.809\times10^{-5}\,t_Q) - 131.7\,(1.105-\gamma)k_{Tc}\exp(-1.906\times10^{-4}\,t_Q)$$
(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.

NO. 342 DIETZGEN GRAPH PAPER
10 PER HALF INCH
DIETZGEN CORPORATION

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

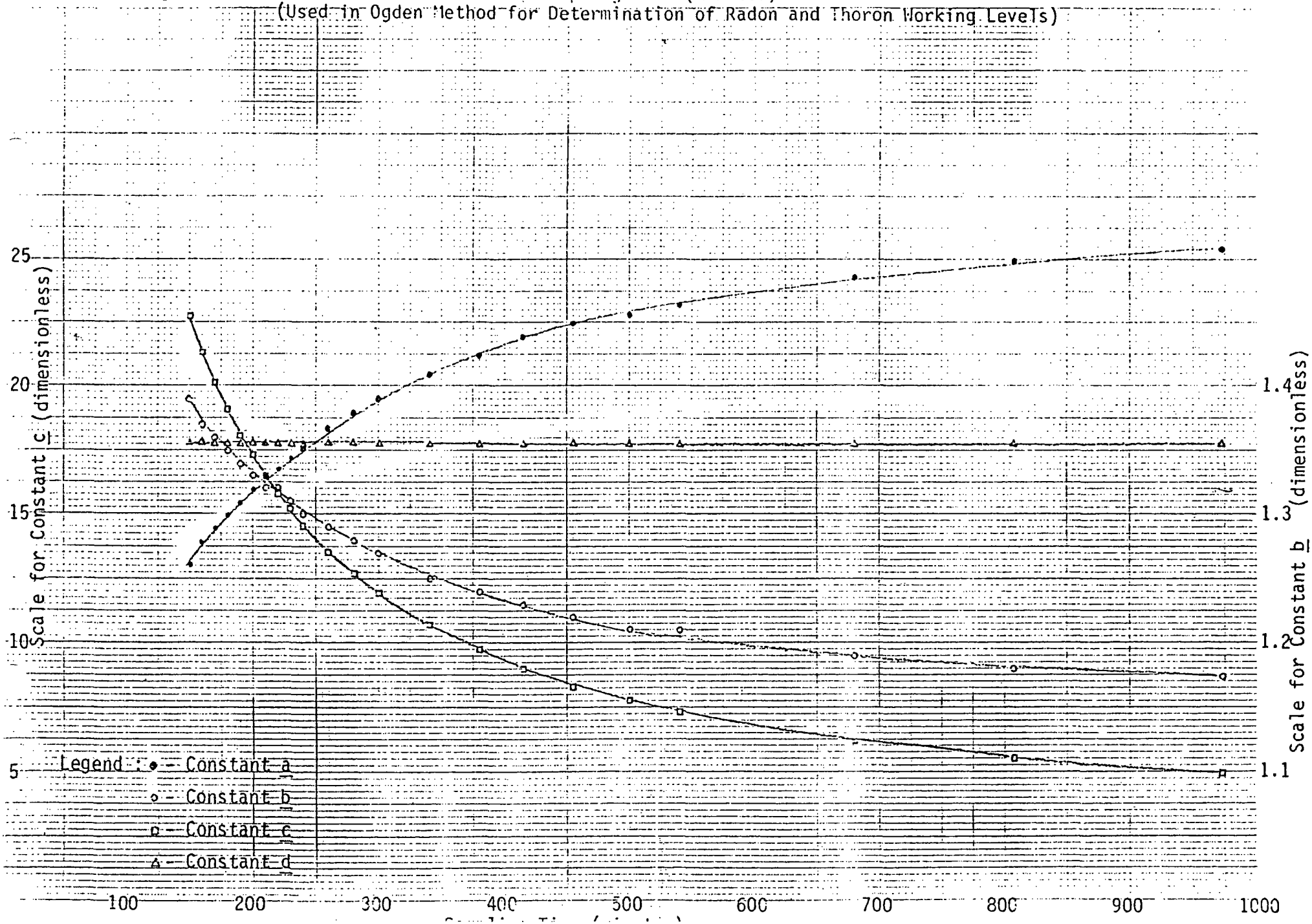

Table TA6: Air Sample (Filter) Collection and Background Counting Periods

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

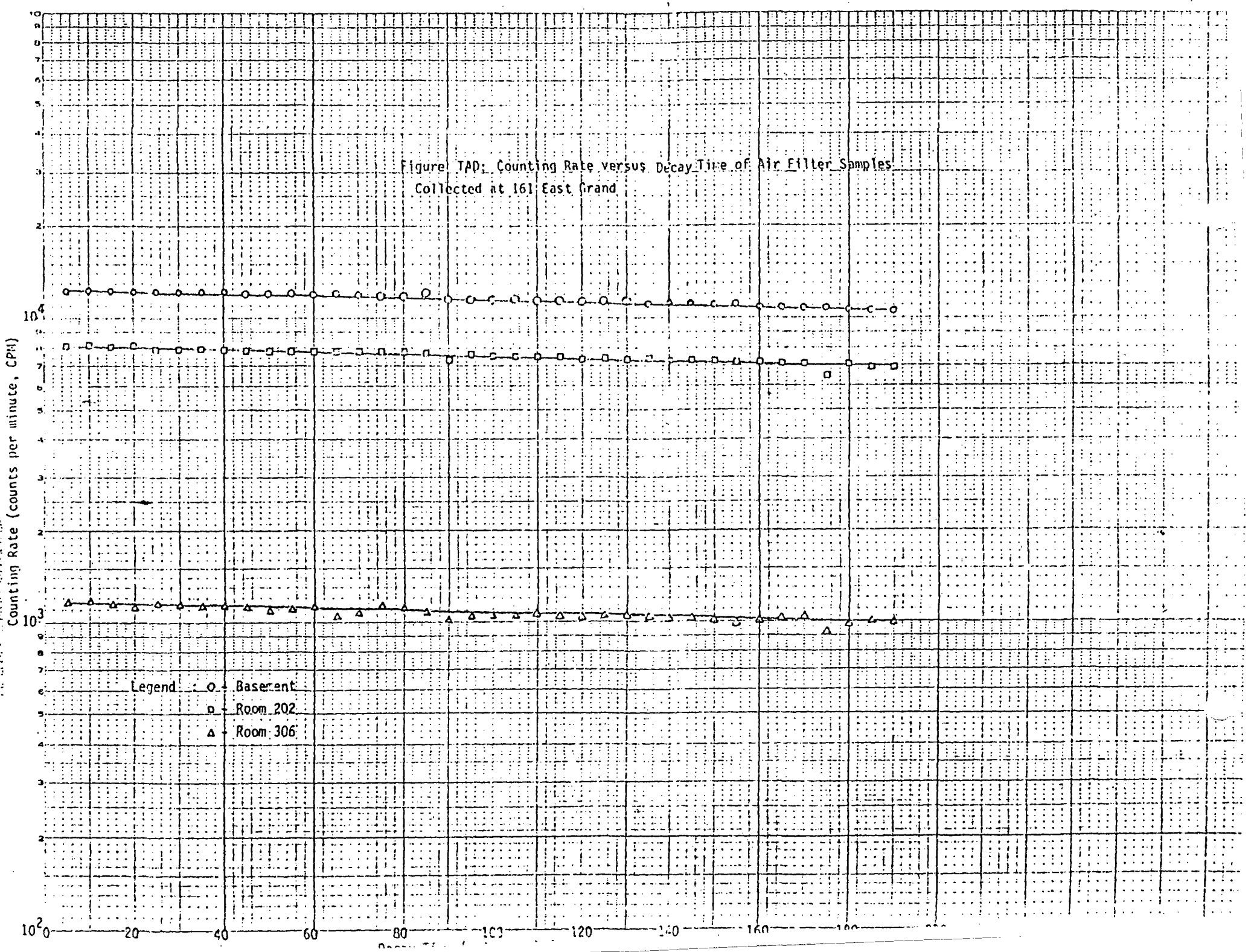

Figure TAD: Counting Rate versus Decay Time of Air Filter Samples
Collected at 161 East Grand

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

Prepared by

RADIATION SAFETY SERVICES, INC.

April 9, 1984

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

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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

Attendance List 161 E. Grand Ave.

Marge Thériault
Johnston Bell
Chester Brown
Ron Klyber
Ellen Manowicz
Joseph Stancle

APPENDIX B

RADIATION SURVEY RESULTS

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 ☐

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	→ 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		

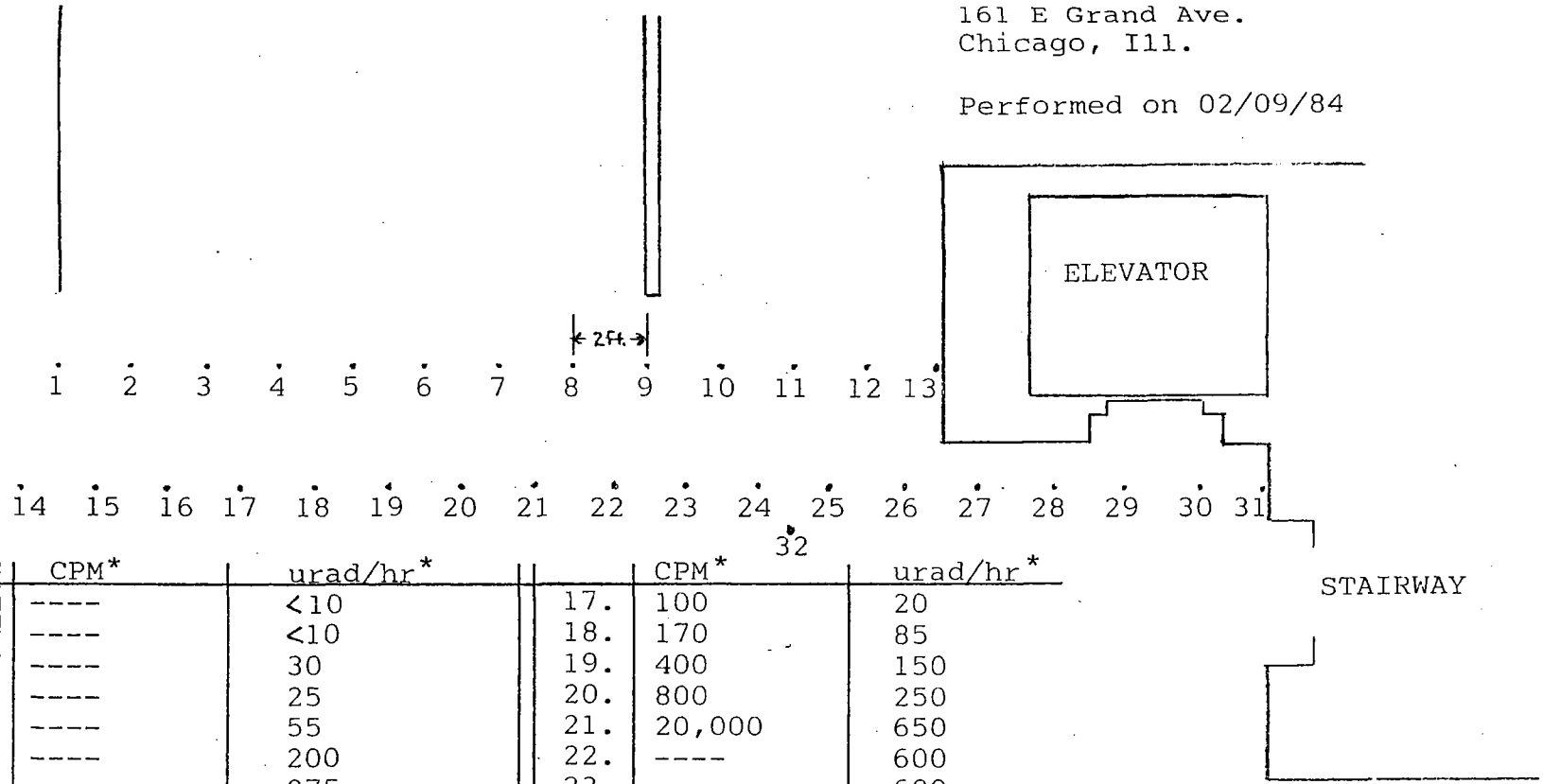
RECOMMENDATIONS:

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

Radiation Safety Services, Inc.

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.

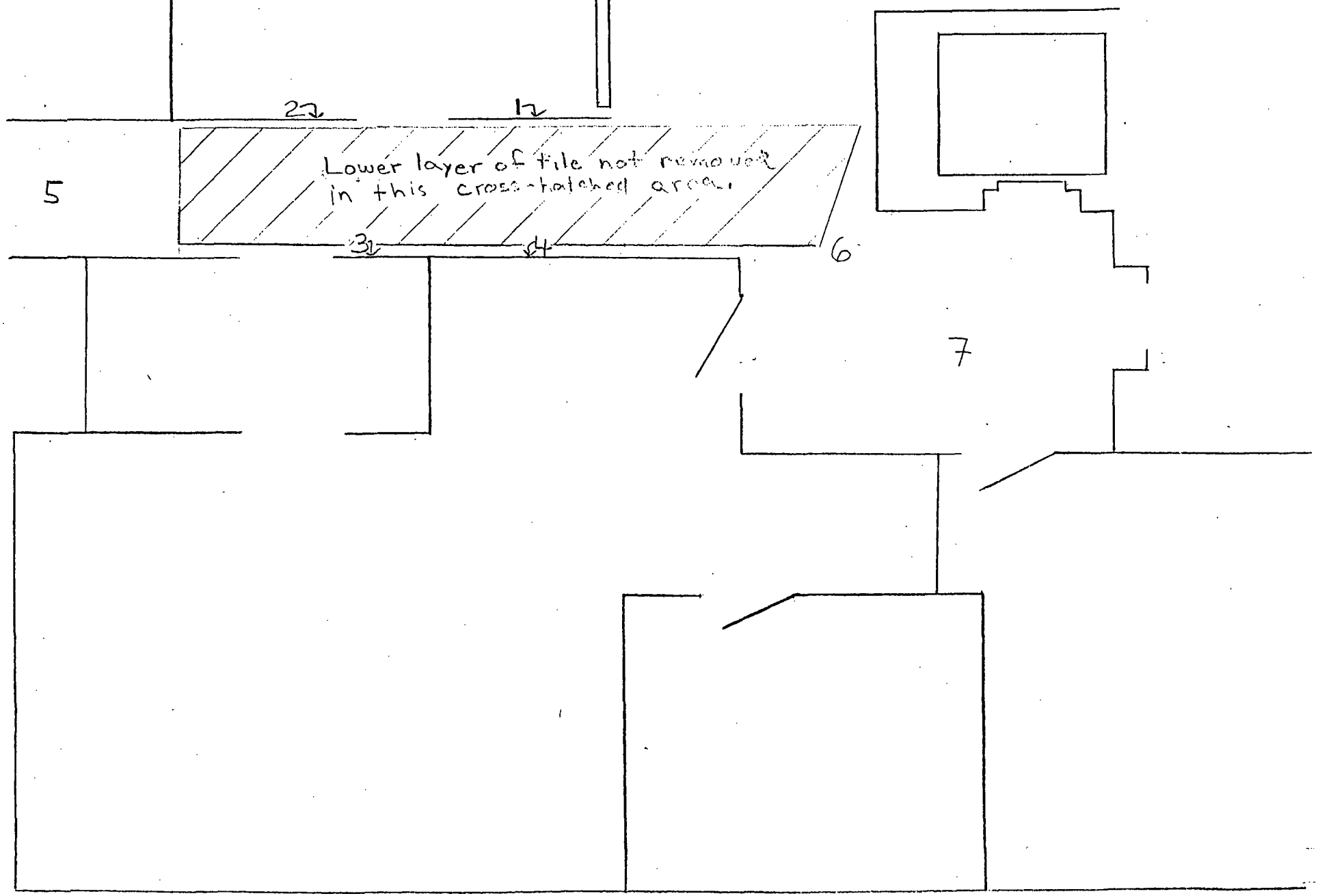
SCALE
1"=5'

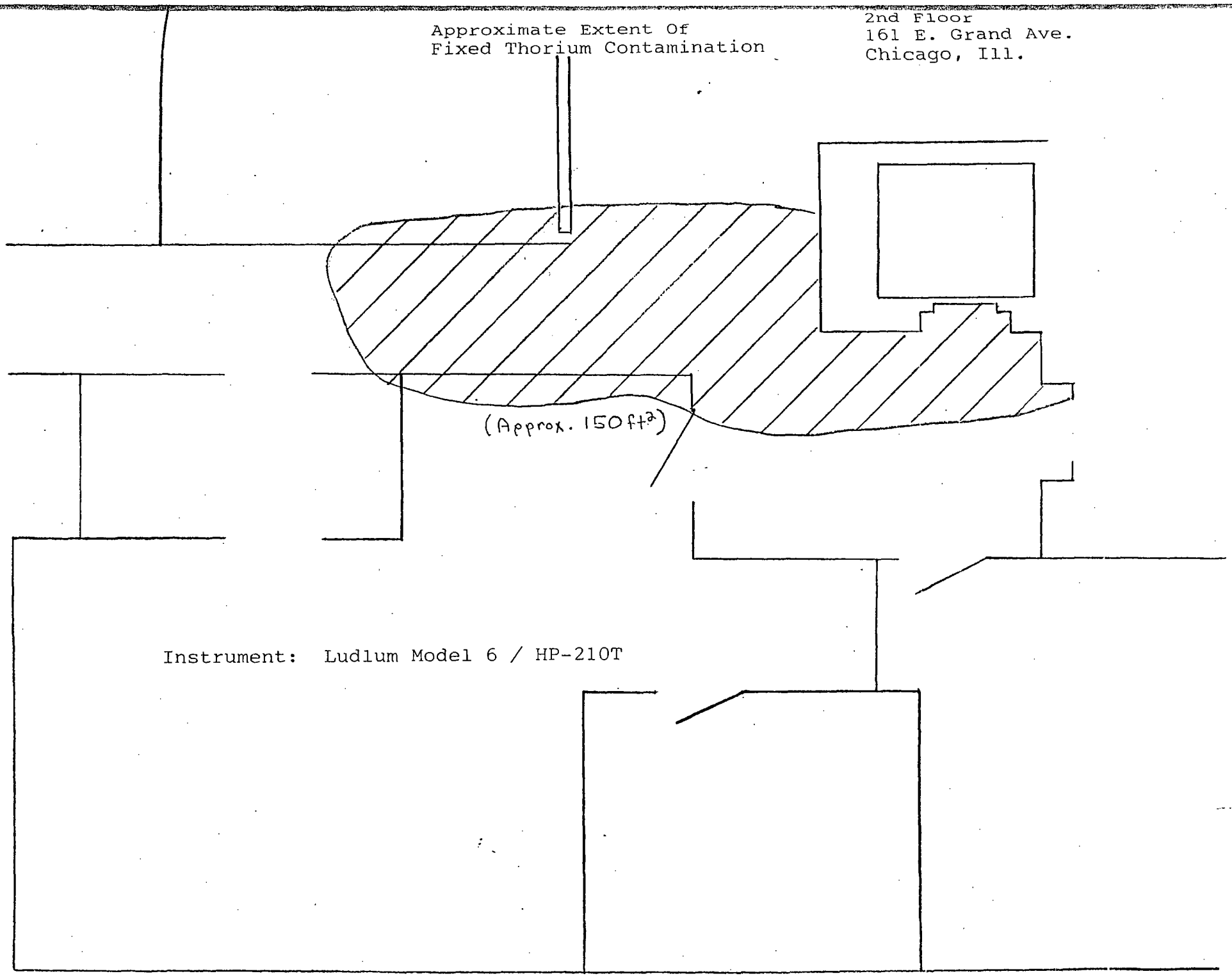
*Readings taken at the surface of the existing floor. The HPI 1010 chamber center is 2 5/16" from the floor with instrument on floor.

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

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.

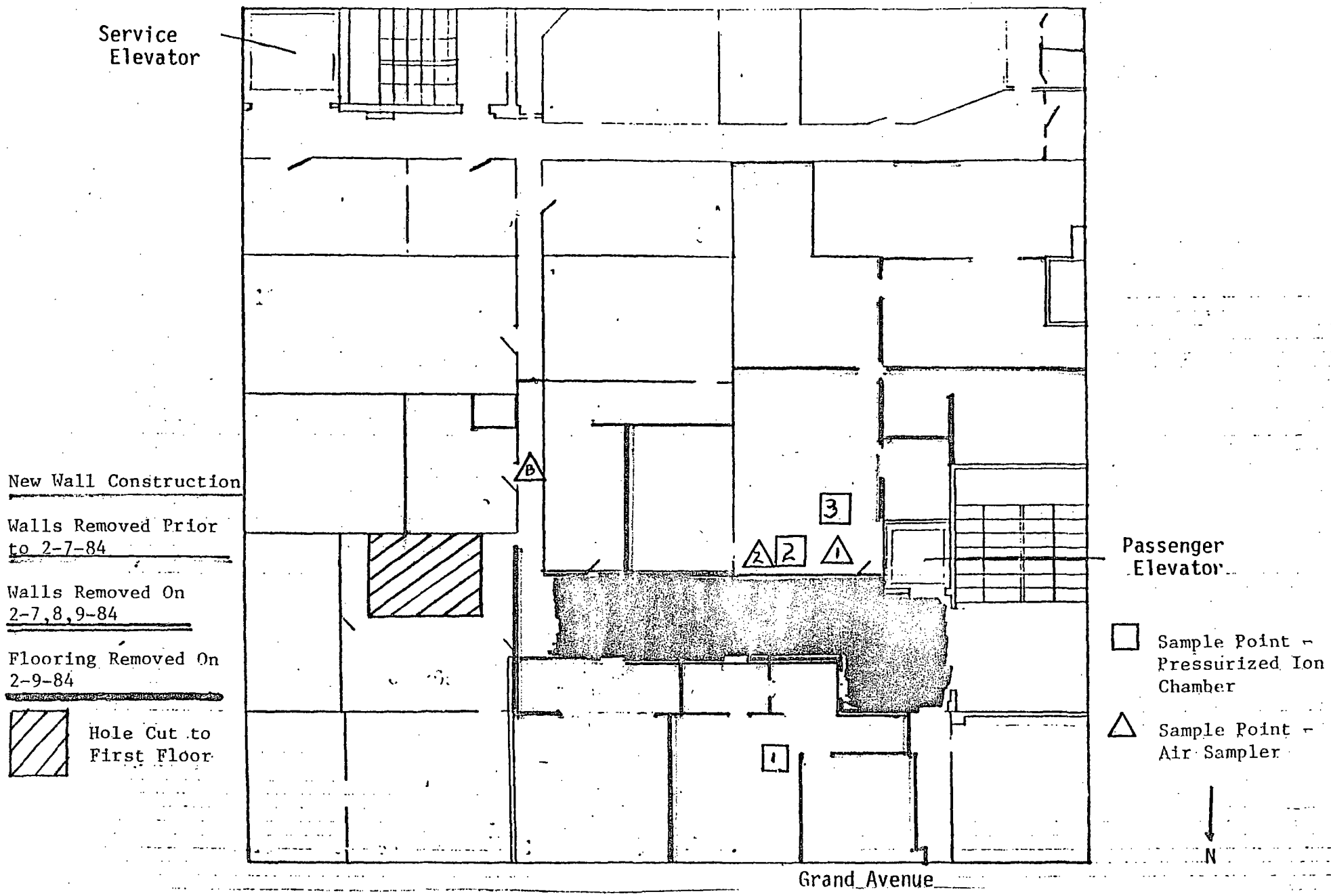
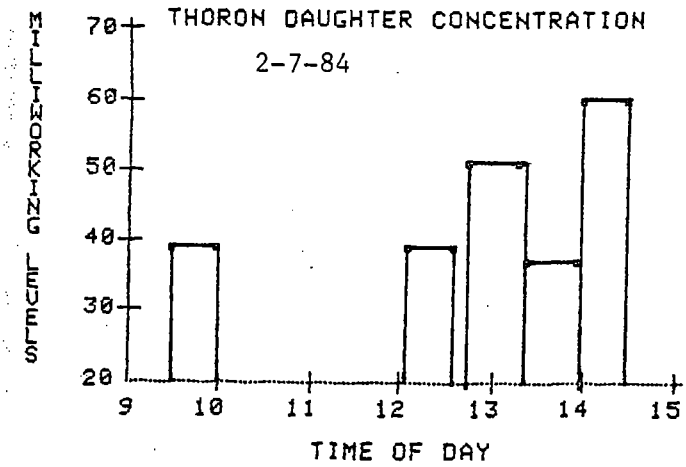


Figure 1: Floor Plan of Second Floor Showing Work Areas and Sample Collection Results

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

	DATE	TIME PERIOD	DAUGHTER CONCENTRATION RADON (MILLIWORKING LEVELS)	DAUGHTER CONCENTRATION THORON (MILLIWORKING LEVELS)	
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



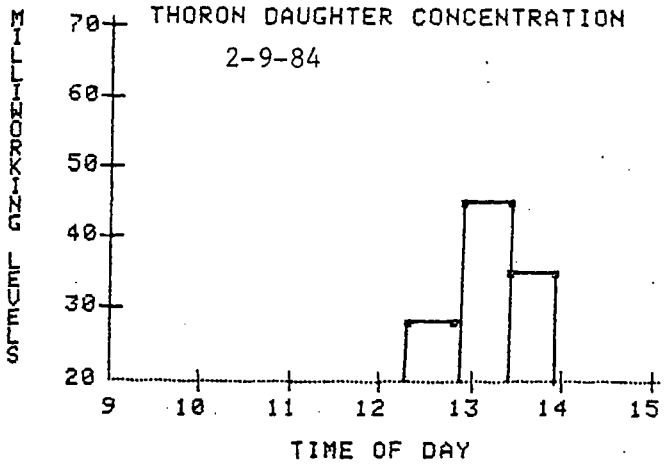


Figure 3: Radon/Thoron Daughter Concentrations - Air Sample Results

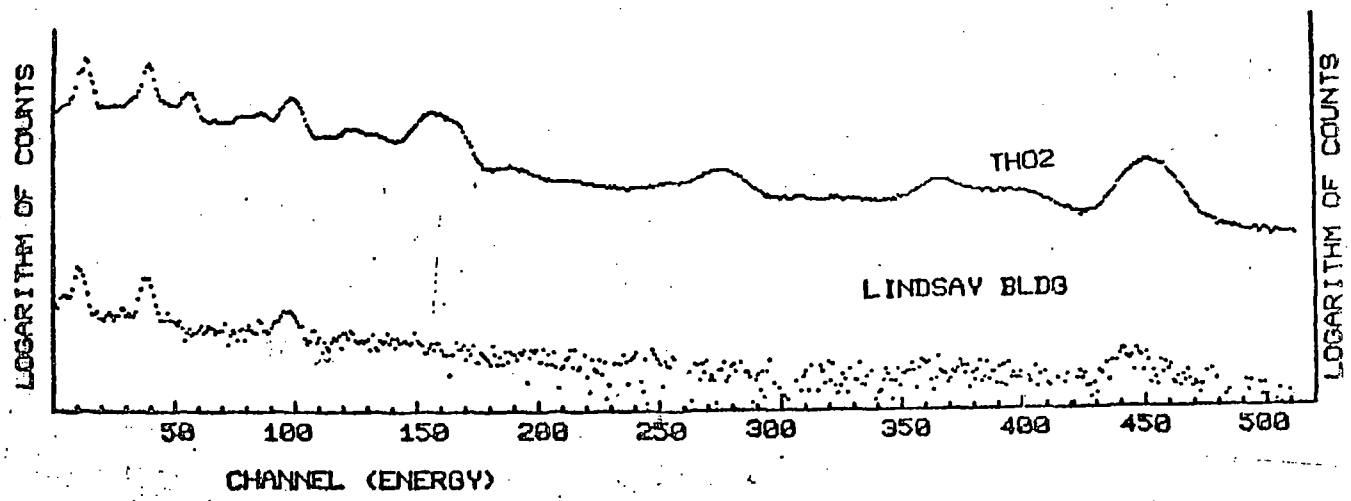


Figure 4: Gamma-ray Spectra - 2/8/84 Air Filters versus Thorium Oxide

APPENDIX D

USNRC GUIDELINES
FOR THE RELEASE OF FACILITIES
FOR UNRESTRICTED USE

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]
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 βγ/100 cm^2	15,000 dpm βγ/100 cm^2	1000 dpm βγ/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.

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.

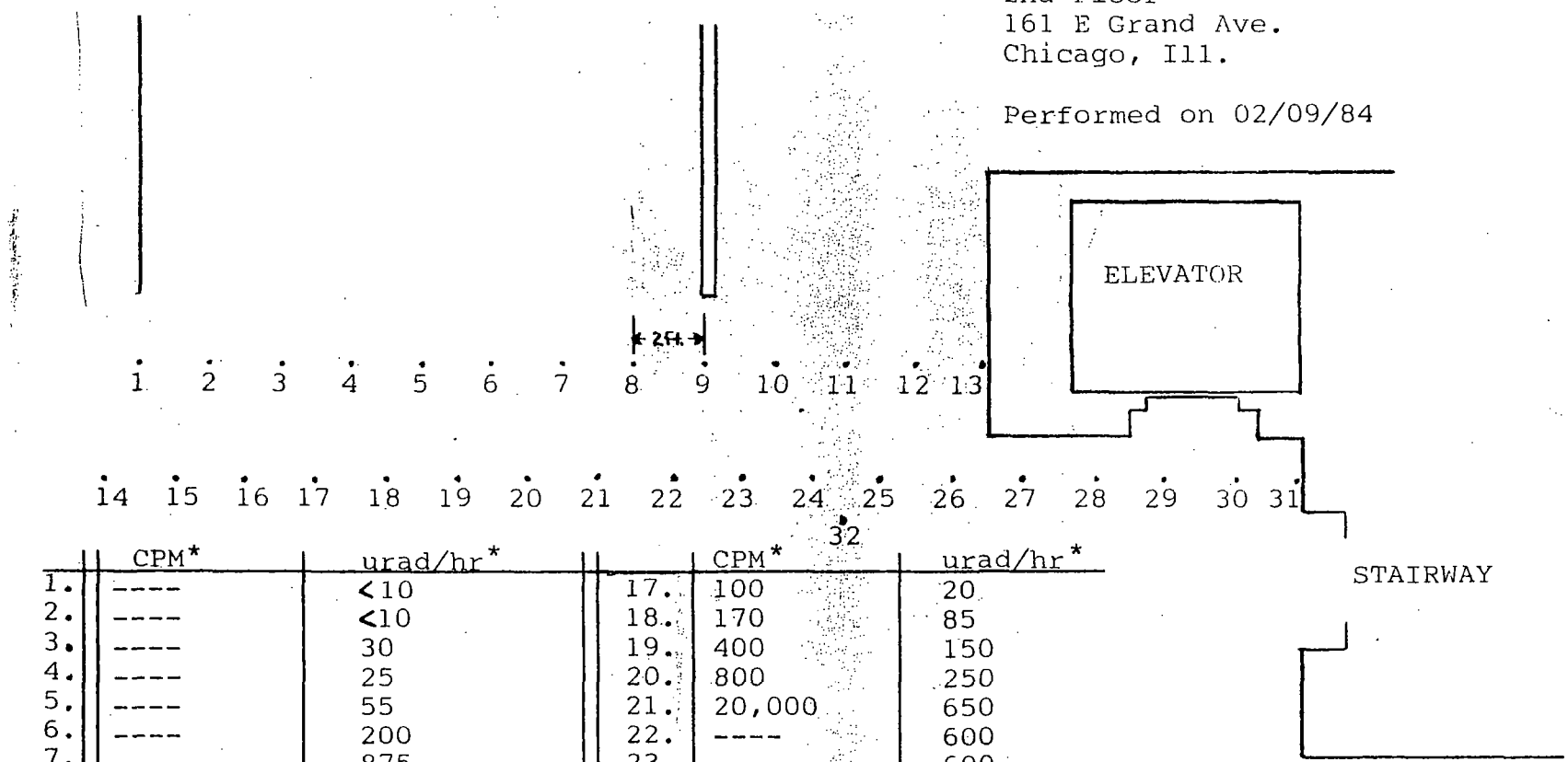
On the fourth floor Streeterville post-production room the thin concrete floor was broken up, the oak flooring removed, and the planking chiseled and sanded. This reduced the dose rate from the 300 microrads per hour reported by the EPA to 150 microrads per hour at 1 meter from the floor.

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.
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.

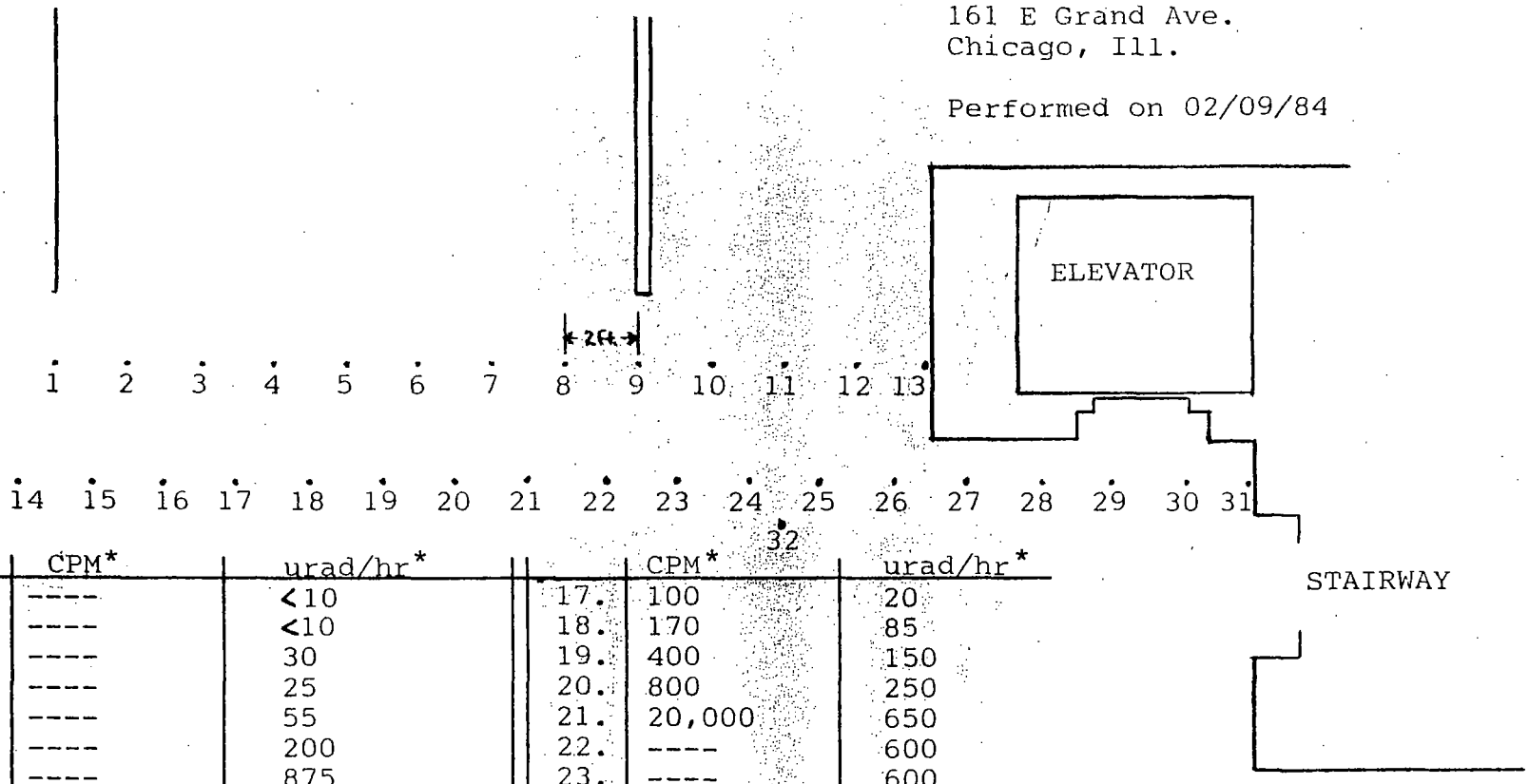
BACKGROUND: The background in relatively uncontaminated portions of the building are 10 to 15 urad/hr. In these areas the Model 16/HP-210T background was 50-70 CPM.

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.

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

Performed on 02/09/84



	CPM*	urad/hr*		CPM*	urad/hr*
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*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'

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

March 15, 1984

Ron Klyber
Optimus, Inc.
161 East Grand Avenue
Chicago, IL 60611

Dear Ron:

This letter summarizes our recent telephone conversations regarding the amount of activity and weight of thorium in the building rubble scheduled for disposal as radioactive waste. The rubble contains an estimated 0.000001 Curies of thorium weighing approximately 0.02 pounds. This information is supplied to satisfy in part the requirements of Ted Kason's letter of January 31, 1984, and the request for information from ADCO.

Our report regarding the monitoring of decontamination activities will be submitted to you within the next ten days. Should you have any questions or require further information regarding the building rubble, please contact me at 866-7744.

Sincerely,

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

EAP:ts

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

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

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

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

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

Attendance List 161 E. Grand Ave.

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

APPENDIX B

RADIATION SURVEY RESULTS

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 ☐

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		

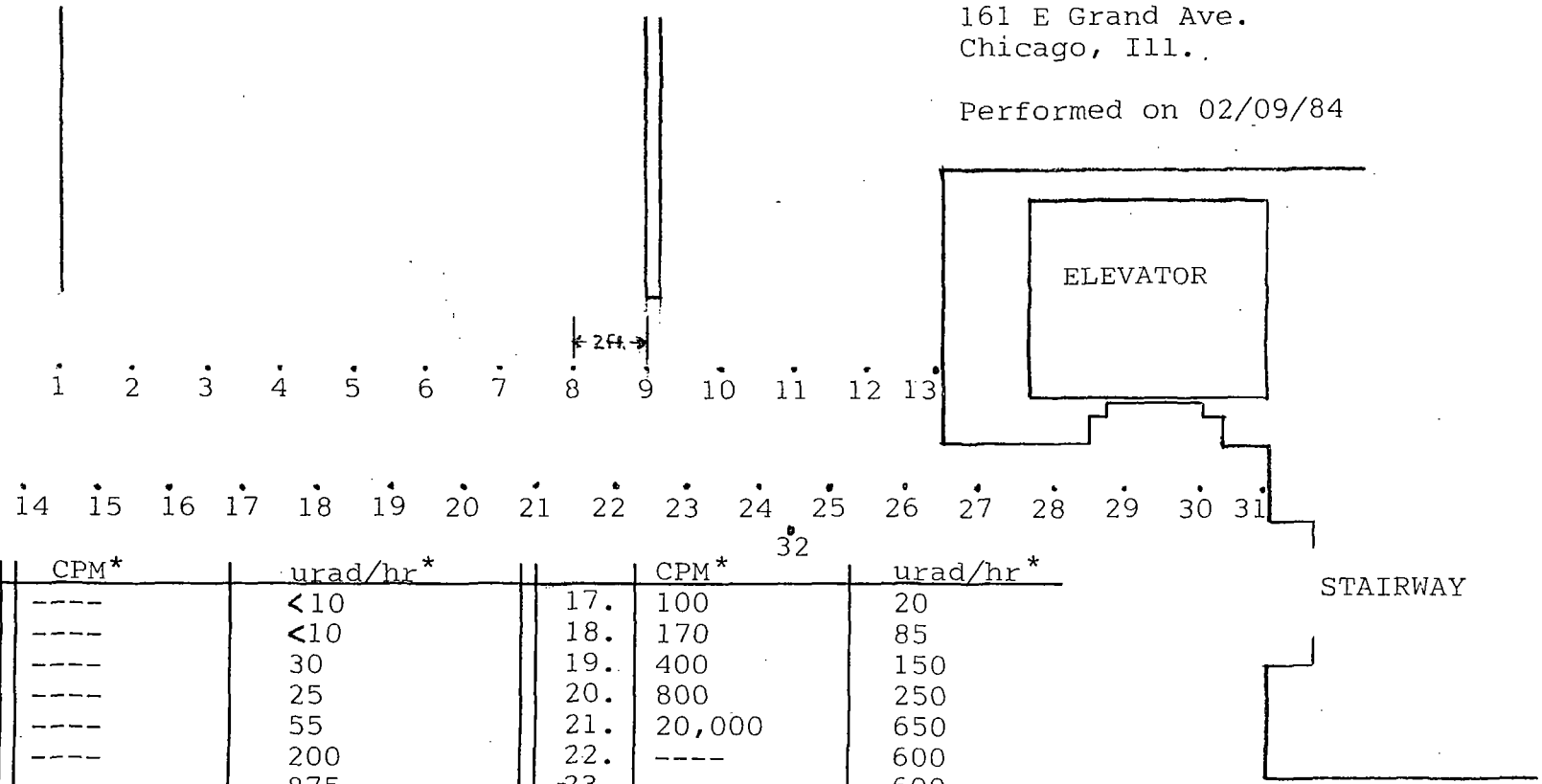
RECOMMENDATIONS:

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
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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.

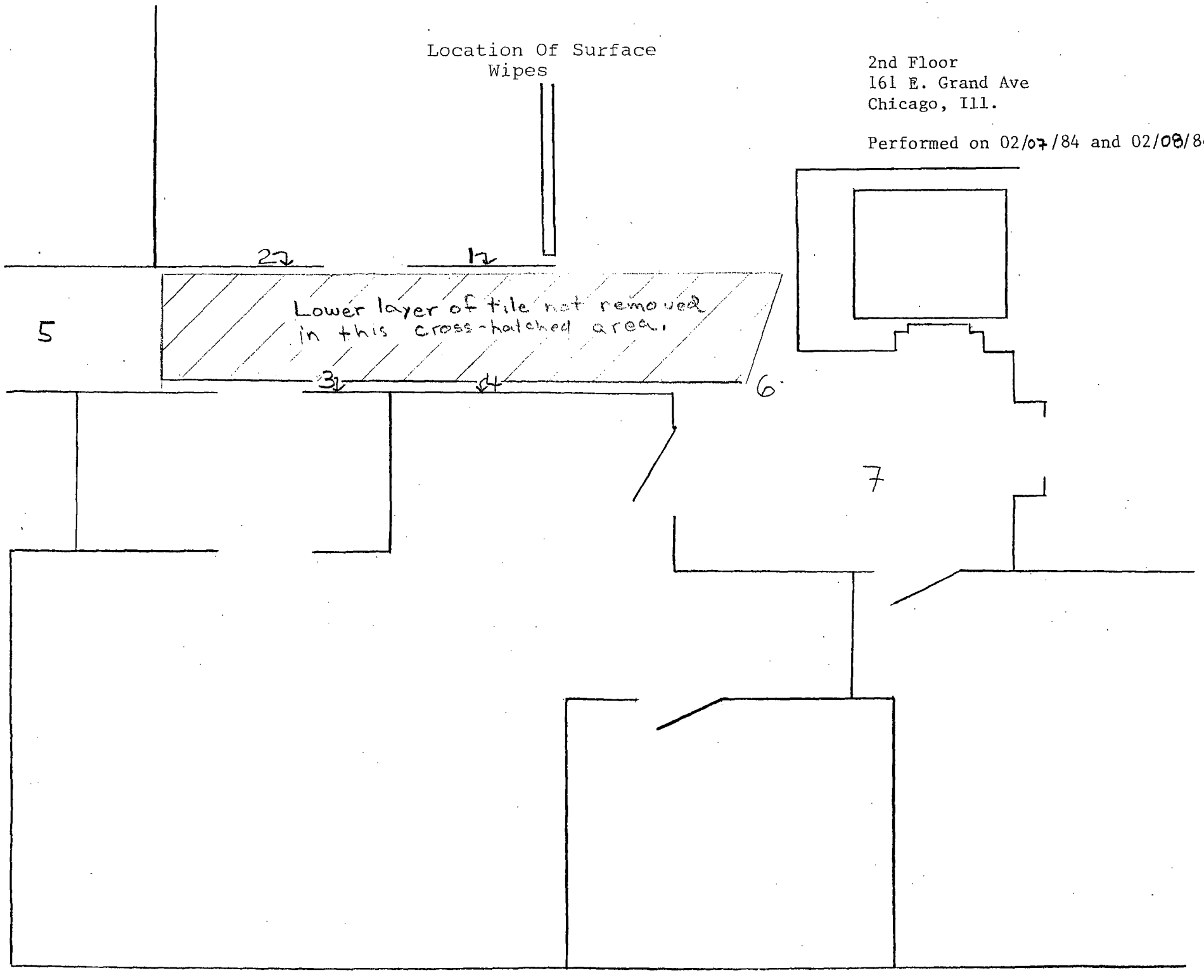
SCALE
1"=5'

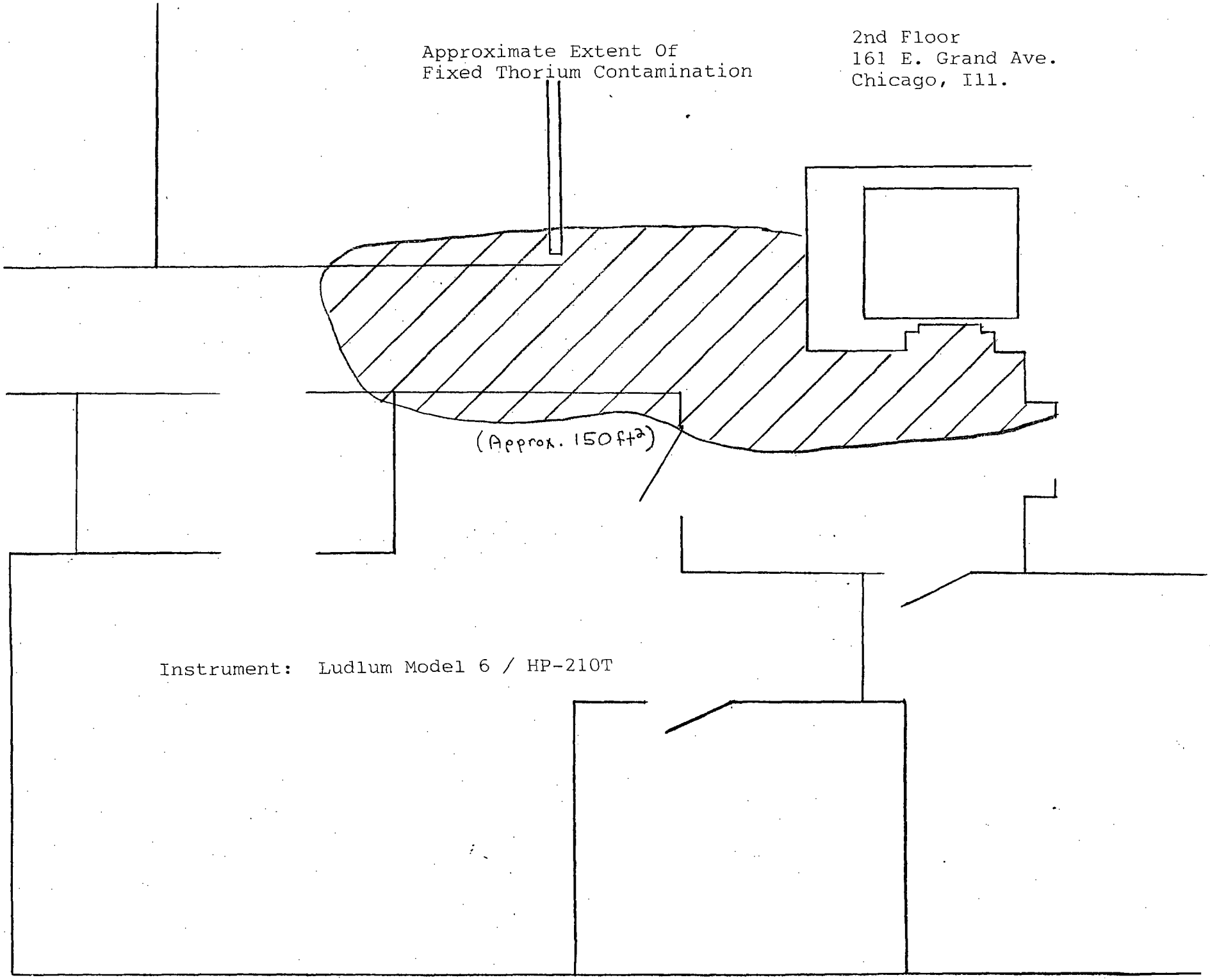
*Readings taken at the surface of the existing floor. The HPI 1010 chamber center is 2 5/16" from the floor with instrument on floor.

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

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.

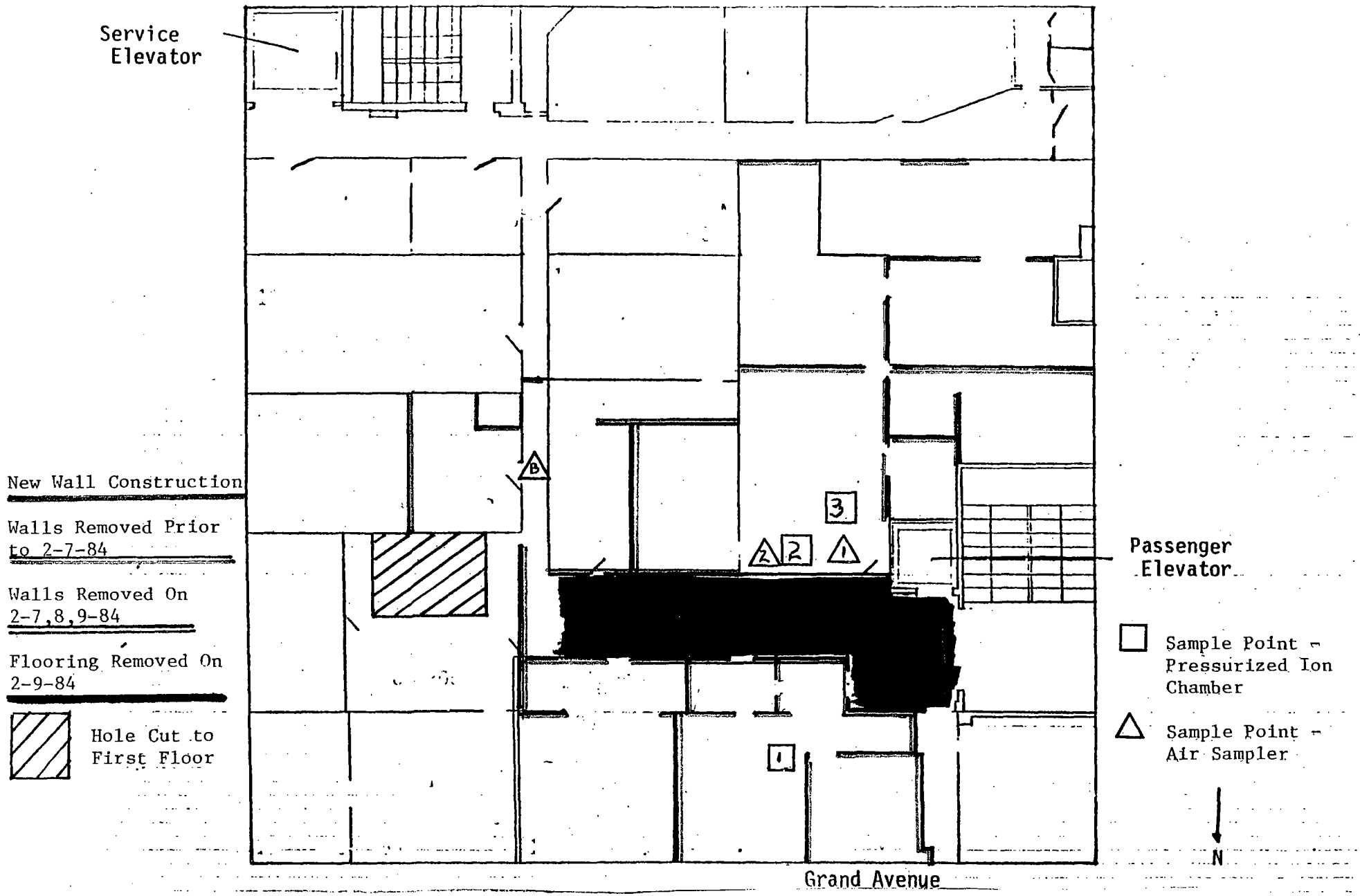
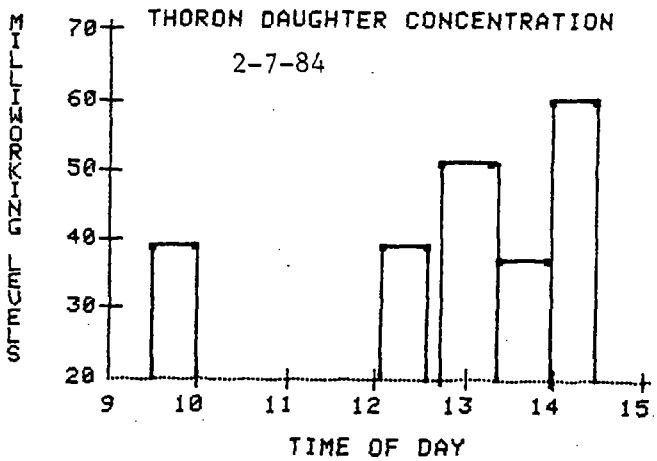


Figure 1: Floor Plan of Second Floor Showing Work Areas and Sample Collection Results

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

	DATE	TIME PERIOD	DAUGHTER CONCENTRATION RADON (MILLIWORKING LEVELS)	DAUGHTER CONCENTRATION THORON (MILLIWORKING LEVELS)	
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



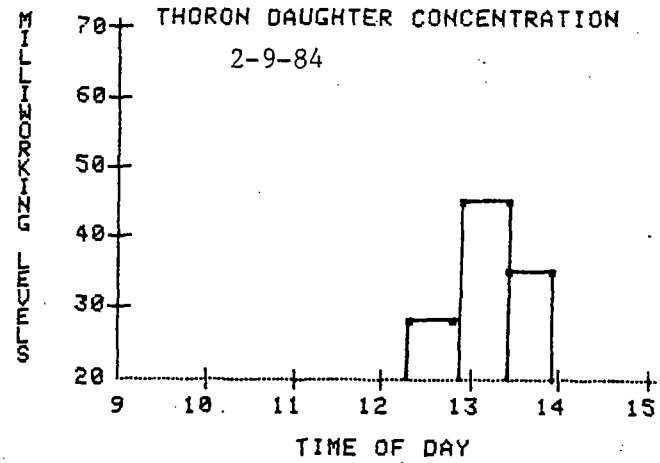


Figure 3: Radon/Thoron Daughter Concentrations - Air Sample Results

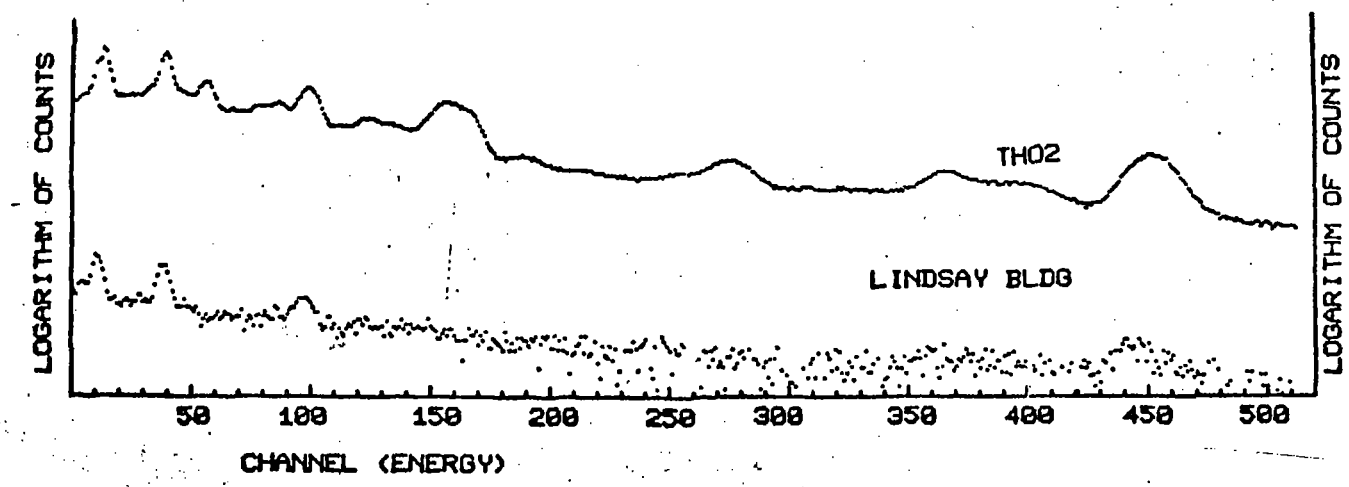


Figure 4: Gamma-ray Spectra - 2/8/84 Air Filters versus Thorium Oxide

APPENDIX D

USNRC GUIDELINES
FOR THE RELEASE OF FACILITIES
FOR UNRESTRICTED USE

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]
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 βγ/100 cm^2	15,000 dpm βγ/100 cm^2	1000 dpm βγ/100 cm^2

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.

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.

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.

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

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.

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.

U.S. ENVIRONMENTAL PROTECTION AGENCY

REGION V

AIR MANAGEMENT DIVISION

RECORD OF TELEPHONE CONVERSATION

DATE: February 24, 1984 TIME: 10:00 A.M.

RECORDED BY: Larry Jensen TALKED WITH: Eli Port
Radiation Safety Services

NATURE 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:

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION V

DATE: FEB 2 1 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

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.

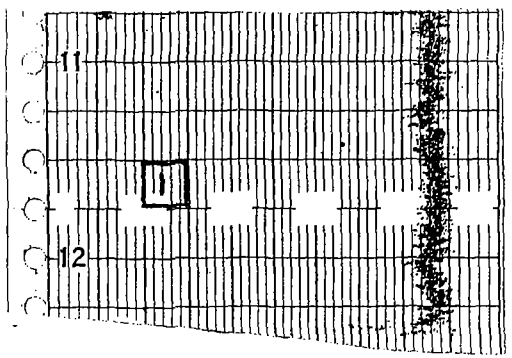
Item 7. Smears were taken from contaminated flooring on the second floor. It was not observed that smears were taken elsewhere on the second floor or on the first floor.

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.

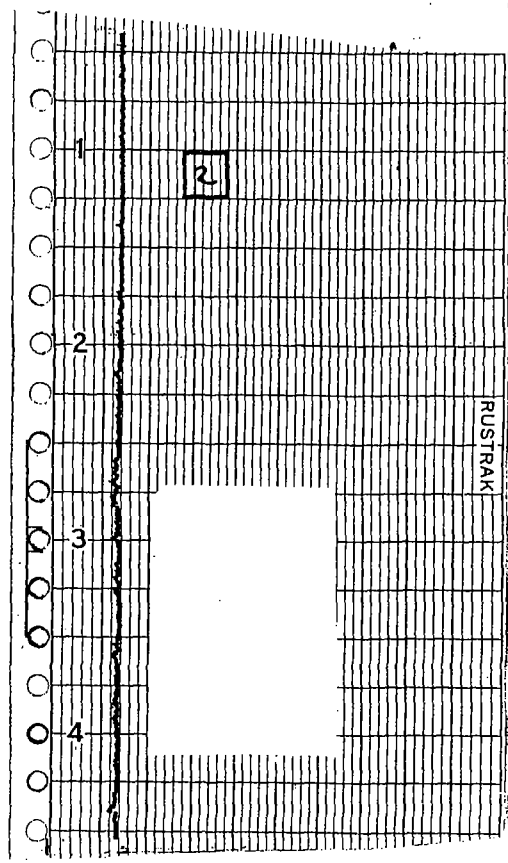
Attachment

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

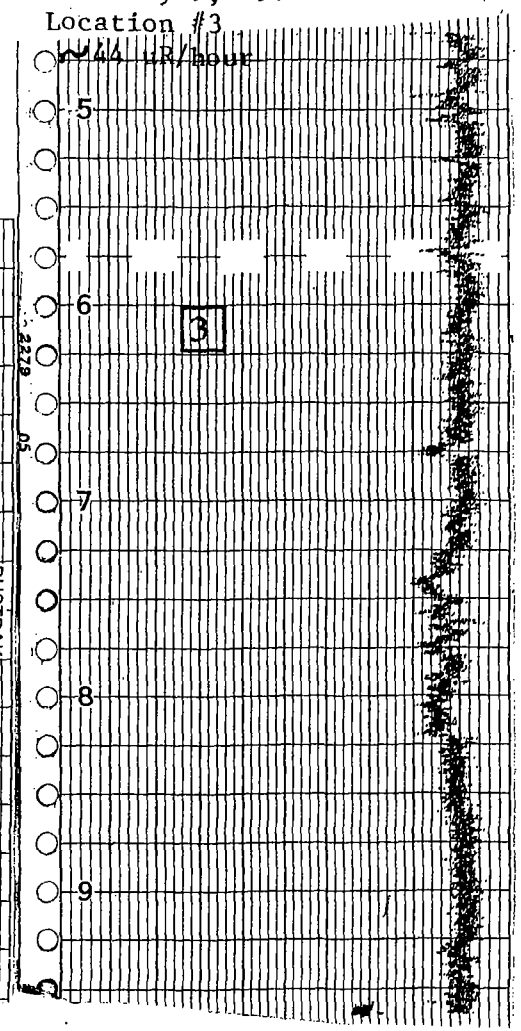
February 7, 1984
Location #1
~ 44 uR/hour



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

APPENDIX A

City of Chicago Letter

to

161 East Grand Associates

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

cc: Eli Port
Steve Rothblatt
Paul D. Eastvold
Bernadine Wright
James Barrett
George Wienold
John Evanoff

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

Janu. 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.

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

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

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.

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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

D R A F T

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

December 16, 1983

To the Owner of Record
161 East Grand Avenue
Chicago, IL 60611

Re: Radioactive Thorium Radiation

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.K

T. T. Kason
Deputy Commissioner

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

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, CIH, CHP, P.E.
steele03.let

THORON DAUGHTER MEASUREMENT

SITE 161 Date: 5/10/96

Fmd Blk Location: _____

1 Sample Stop__:__ Sample Start__:__ Elapsed time = ___m (<60 m)

2 Sample Rate__._ lpm x Sample time___m = sample___._ l(>10)

3 Bkg. rate___c/___min = ___._cpm

4 Eff. = 0.___cpm/dpm

5 Count Start__:__(5-17 hours after sample stop)

6 5 minute count = 2 c

7 Net count rate = (___c/5 min.) - Bkg. rate = ___._cpm

8 Net alpha rate = Net count rate___/Eff.0.___ = ___._dpm

9 Alpha conc. = Net alpha rate ___./sample___._l = ___._dpm/l

10 Time factor @ __._hrs = ___

11. WL = alpha conc.___._dpm/l/time factor = ___.__WL

th220wl.mas

THORON DAUGHTER MEASUREMENT

SITE 161 Date: 5/10/94

Kat's office Location: Planchette 4

1 Sample Stop 13:07 Sample Start 12:20 Elapsed time = 47 m (<60 m)

2 Sample Rate 2.0 lpm x Sample time 47 m = sample 94._ l(>10)

3 Bkg. rate 0 c/ 0 min = 0.0 cpm

4 Eff. = 0.43 cpm/dpm

5 Count Start 18:05 (5-17 hours after sample stop)

6 5 minute count = 17 c

7 Net count rate = (17 c/5 min.) - Bkg. rate = 3.4 cpm

8 Net alpha rate = Net count rate 3.4/Eff. 0.43 = 7.9 dpm

9 Alpha conc. = Net alpha rate 7.9/sample 92._l = 0.086 dpm/l

10 Time factor @ 5._hrs = 13

11. WL = alpha conc. 0.086 dpm/l/time factor = 0.007 WL

th220wl.mas

THORON DAUGHTER MEASUREMENT

SITE 161 Date: 5/10/94

Outside Mus Room Location: Planchette 5

1 Sample Stop 3 : 12 Sample Start 2 : 26 Elapsed time = 46 m (<60 m)

2 Sample Rate 2.0 lpm x Sample time 46 m = sample 92. l (>10)

3 Bkg. rate 0 c/ 0 min = 0.0 cpm

4 Eff. = 0.43 cpm/dpm

5 Count Start 18 : 12 (5-17 hours after sample stop)

6 5 minute count = 17 c

7 Net count rate = (17 c/5 min.) - Bkg. rate = 3.4 cpm

8 Net alpha rate = Net count rate 3.4/Eff. 0.43 = 7.9 dpm

9 Alpha conc. = Net alpha rate 7.9/sample 92. l = 0.086 dpm/l

10 Time factor @ 5. hrs = 13

11. WL = alpha conc. 0.086 dpm/l/time factor = 0.007 WL

th220wl.mas

THORON DAUGHTER MEASUREMENT

SITE 161 Date: 5/10/94

01 POST PROJ (PYR) Location: [illegible]

1 Sample Stop 12:40 Sample Start 11:54 Elapsed time = 46 m (<60 m)

2 Sample Rate 2.0 lpm x Sample time 46 m = sample 92.1 l(>10)

3 Bkg. rate 0 c/ 10 min = 0.0 cpm

4 Eff. = 0.43 cpm/dpm

5 Count Start 17:44 (5-17 hours after sample stop)

6 5 minute count = 78 c

7 Net count rate = (78 c/5 min.) - Bkg. rate = 15.6 cpm

8 Net alpha rate = Net count rate 15.6/Eff. 0.43 = 36.3 dpm

9 Alpha conc. = Net alpha rate 36.3/sample 92.1 = ~~36.3~~ 0.39 dpm/l

10 Time factor @ 5.1 hrs = 13

11. WL = alpha conc. 0.39 dpm/l/time factor = 0.03 WL

L.D 3.2×10^{-3} WL

th220wl.mas

THORON DAUGHTER MEASUREMENT

SITE 161 Date: 5/14/94

Mike O'Neill PRES Off Location: Phoenix 2

1 Sample Stop 12:52 Sample Start 12:06 Elapsed time = 46 m (<60 m)

2 Sample Rate 2.0 lpm x Sample time 46 m = sample 92. l (>10)

3 Bkg. rate 0 c/ 0 min = 0.0 cpm

4 Eff. = 0.43 cpm/dpm

5 Count Start 17:5 (5-17 hours after sample stop)

6 5 minute count = 30 c

7 Net count rate = (30 c/5 min.) - Bkg. rate = 6.0 cpm

8 Net alpha rate = Net count rate 6.0/Eff. 0.43 = 14.0 dpm

9 Alpha conc. = Net alpha rate 14.0/sample 92. l = 0.15 dpm/l

10 Time factor @ 5. hrs = 13

11. WL = alpha conc. 0.15 dpm/l/time factor = 0.01 WL

th220wl.mas

THORON DAUGHTER MEASUREMENT

SITE 161 Date: 5/10/09

TRISH Lindquist Seg Off Location: [illegible]

1 Sample Stop 13: 01 Sample Start 12: 15 Elapsed time = 46 m (<60 m)

2 Sample Rate 2.0 lpm x Sample time 46 m = sample 92.0 l (>10)

3 Bkg. rate 0 c/ 0 min = 0.0 cpm

4 Eff. = 0.43 cpm/dpm

5 Count Start 17: 58 (5-17 hours after sample stop)

6 5 minute count = 15 c

7 Net count rate = (15 c/5 min.) - Bkg. rate = 3.0 cpm

8 Net alpha rate = Net count rate 3.0/Eff. 0.43 = 7.0 dpm

9 Alpha conc. = Net alpha rate 7.0/sample 92.0 l = 0.076 dpm/l

10 Time factor @ 5.0 hrs = 13

11. WL = alpha conc. 0.076 dpm/l/time factor = 0.006 WL

th220wl.mas

1/10/94 Conversation with Ron Steele

Barbara Smith, OSHA
Calumet City

891-3800

Vernita - EPA

radon detection

Hallway next to men room 2nd Floor
2 on 4th Fl corner office
control room
3rd Floor corner office
2 Basement storage area

312 467 5440
708-366 1222 after 4:00

	Col 3 DAC	Table 2 col 1
Rn 222	4×10^{-6} (4000 pCi/l)	1×10^{-8} (10 pCi/l)
daughter	3×10^{-8} (30 pCi/l)	1×10^{-10} (0.1 pCi/l)
	0.33 WL	
		$\boxed{0.02\ WL = 1.8 \times 10^{-9}}$
Rn 220	7×10^{-6} (7000 pCi/l)	2×10^{-8} 20 pCi/l
	9×10^{-9} (9 pCi/l)	3×10^{-11} 0.03 pCi/l
	10 WL	

Rn 220

OLD 3×10^{-7} 9×10^{-9}

NW 9×10^{-6} 1 wk

Rn 222 Prop

OLD 3×10^{-8} 0.33 wk

NW 4×10^{-6} 3×10^{-8}

4000 pCi/L

Rn 222 400 pCi/L

0.33 WL

3×10^{-4} µCi/li

$3 \times 10^{-}$

Rm 220

4th 13 pc

32d 5.7

2 (Pat) 18

2 Pen 0

1 3.7

Contacts employer

Kevin
Cummings
801 - 487 - 0521
x 243
Bob Curtis

E-Perm

Lee Markland
301 - 694 - 0011

Luna 5.5

$\frac{10.64 \times 60^2}{55}$

$\times 6.0015$

Bob Alexander
Chief Rad Prot

4 Health Effects
Branch.

Walk

Com on Intern Agy

Rad Research poly conduction

White hood [illegible] adm.

Talk c̄ with cool

Rn-222

1/12/94

4th contd Rn 1-2
postprod 0-7

3rd Cleo'n off 1-5
2nd Hadley 2-6

Basat 4.4

~~Cr~~ Cristie 1-0

Assume 4.0 pCi

SURVEY REPORT

BUILDING: 161 E. Grand ROOM: Secretary's Office DATE: 9/30/92 BY: [illegible]

Routine ☐ Spot Check ☐ Special ☐ Equipment ☐

Survey Instrument HIPT 1010 Calibrated 8/3/92 Source of Ionizing Radiation

		220	300	300	280	180	100	80	
220	140	160	80	80	40	60	60	40	
	220	260	120	60	40	60	40	40	
	500	360	400	60	60	40	40	80	
	120	80	60	60	40	60	40	60	
80		60	60	60	40	60	40	40	
						40	60	40	
							40	40	

To Scale

TYPE	FORM	ACTIVITY
r	Th-Nat	

Ventilation:

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

Each Square = 1 ft

SURVEY FINDINGS

AREA			

Background 30 mR/hr

RECOMMENDATIONS:

Radiation Safety Services, Inc.

SURVEY REPORT

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

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
0	40	60	D	D	80	340	100	140	120
0	60	60	D	D	120	100	60	80	80
0	40	60	D	D	160	120	60	40	80
							40	40	80

To Scale

TYPE	FORM	ACTIVITY
r	TH-Nat	

Ventilation:

Comments: - = Dose Rate - μR/hr at floor surface

D = Oak Desk (could not be moved)

P = Plants + Stereo (" " " ")

O = Oak Vanity (" " " ")

Each Square = 2' x 2'

SURVEY FINDINGS

AREA			

Background 20 μR/hr

RECOMMENDATIONS:

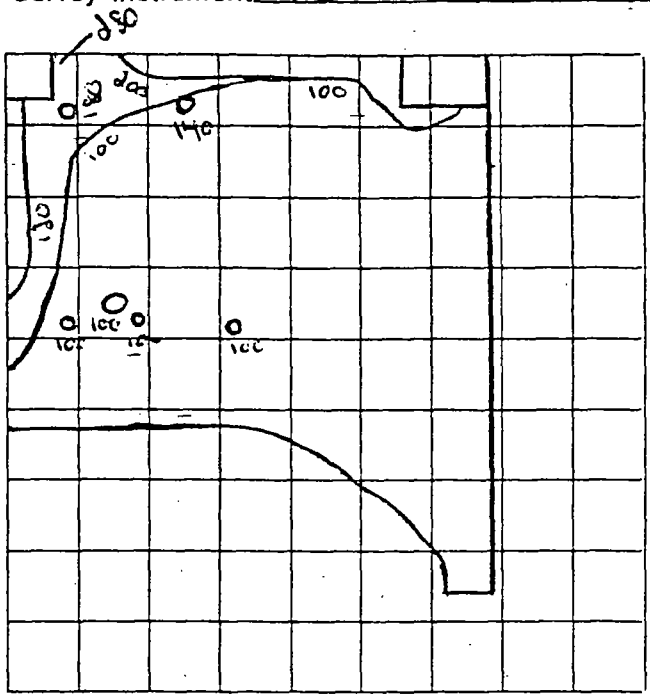
Radiation Safety Services, Inc.

SURVEY REPORT

BUILDING: 161 E. Grand ROOM: Secretary's Office DATE: 1/4/94 BY: [illegible]

Routine ☐ Spot Check ☐ Special ☐ Equipment ☐

Survey Instrument HPI 1010 Source of Ionizing Radiation



TYPE	FORM	ACTIVITY
γ	Th-Nat	

Ventilation:

Comments: Dose Rate in μR/hr at floor surface.

SURVEY FINDINGS

AREA			

Background 40 μR/hr

RECOMMENDATIONS:

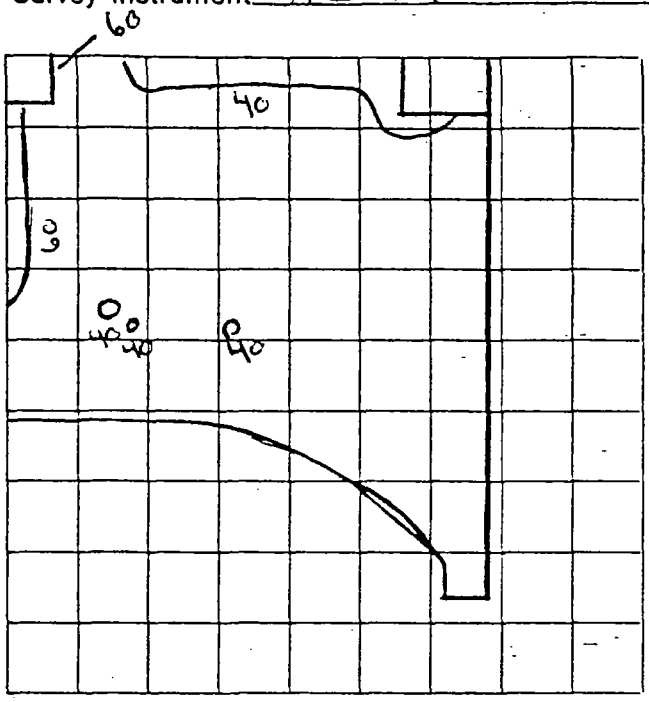
Radiation Safety Services, Inc.

SURVEY REPORT

BUILDING: 161 E. Grand ROOM: Secretary's Office DATE: 1/4/94 BY: [illegible]

Routine ☐ Spot Check ☐ Special ☐ Equipment ☐

Survey Instrument HPI 1010 Source of Ionizing Radiation



TYPE	FORM	ACTIVITY
γ	Th-Nat	

Ventilation:

Comments: Dose Rate in μR/hr at 75 cm above floor surface

SURVEY FINDINGS

AREA			

Background 30 μR/hr

RECOMMENDATIONS:

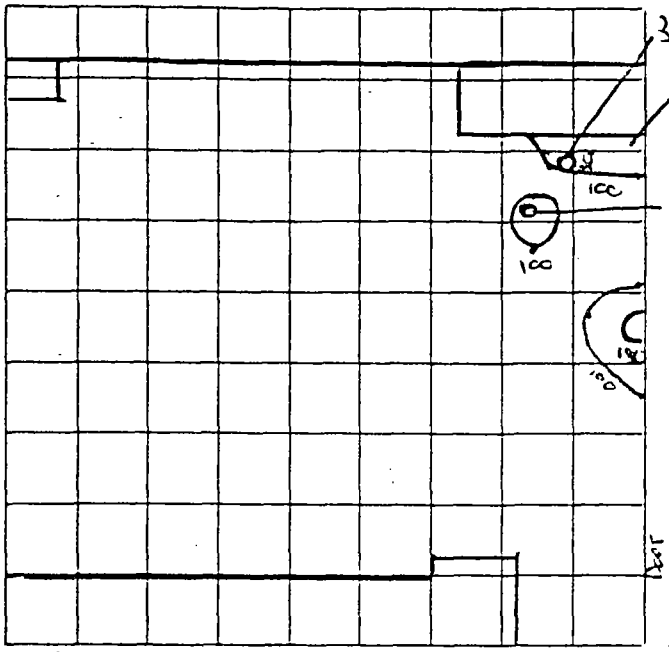
Radiation Safety Services, Inc.

SURVEY REPORT

BUILDING: 161 E. Grand ROOM: President's Office DATE: 1/4/94 BY: [illegible]

Routine ☐ Spot Check ☐ Special ☐ Equipment ☐

Survey Instrument HPI 1010 Source of Ionizing Radiation



To Scale

TYPE	FORM	ACTIVITY
r	Th-Nat	

Ventilation:

Comments: Dose rate in μR/hr at floor surface

SURVEY FINDINGS

AREA			

Background 30 μR/hr

RECOMMENDATIONS:

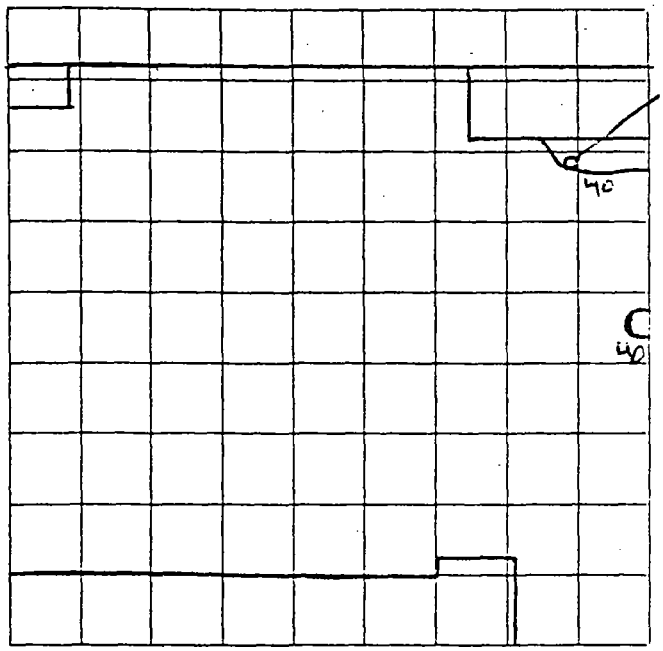
Radiation Safety Services, Inc.

SURVEY REPORT

BUILDING: 161 E. Grand ROOM: President's Office DATE: 1/4/94 BY: [illegible]

Routine ☐ Spot Check ☐ Special ☐ Equipment ☐

Survey Instrument HPI 1010 Source of Ionizing Radiation



TYPE	FORM	ACTIVITY
r	Th-Nat	

Ventilation: –

Comments: Dose rate in μR/hr at 75 cm above floor surface

SURVEY FINDINGS

AREA			

Background 30 μR/hr

RECOMMENDATIONS:

Radiation Safety Services, Inc.

DATE	SAMPLE	FLOW	TIME	VOLUM	CPM	CONC	MPC-HOURS	
11/08/93	OUTSIDE	9.0	344	3096	188	6.42E-11	184	
12/04/93	OUTSIDE	11.0	380	4180	11	2.78E-12	9	
12/11/93	OUTSIDE	10.9	400	4360	12	2.91E-12	10	
12/18/93	OUTSIDE	11.0	415	4565	118	2.73E-11	94	
12/30/93	OUTSIDE	11.0	380	4180	32	8.09E-12	26	323
11/08/93	INSIDE	9.0	344	3096	318	1.09E-10	311	
12/04/93	INSIDE	10.9	380	4142	181	4.62E-11	146	
12/11/93	INSIDE	11.0	403	4433	107	2.55E-11	86	
11/18/93	INSIDE	10.9	415	4524	72	1.68E-11	58	
12/30/93	INSIDE	10.9	380	4142	92	2.35E-11	74	676
12/11/93	KIDA	2.0	415	830	12	1.53E-11	2	
12/30/93	KIDA	2.0	380	760	13	1.81E-11	2	
12/04/93	MANIAK	2.0	380	760	75	1.04E-10	11	
12/11/93	MANIAK	2.0	415	830	44	5.60E-11	6	
12/18/93	MANIAK	2.0	425	850	46	5.72E-11	7	
11/08/93	MAREK	2.0	255	510	71	1.47E-10	10	
12/04/93	MODELSKI	2.0	380	760	38	5.29E-11	6	
12/18/93	SKOPEK	2.0	425	850	64	7.96E-11	9	
11/08/93	SZCZYGIEL	2.0	255	510	108	2.24E-10	16	

/40002/161TH

SURVEY REPORT

BUILDING: _____ ROOM: President office DATE: _____ BY: _____

Routine ☐ Spot Check ☐ Special ☐ Equipment ☐

Survey Instrument _____ Source of Ionizing Radiation

7'6"

67	66	63	46	39	32				
68	61	54	47	40	23	16	14	10	2
69	62	55	48	41	24	17	19	11	3
70	63	56	49	42	35	18	20	12	4
71	64	57	50	43	26	29	21	13	5
72	65	58	51	44	37	30	22	14	6
73	66	59	52	45	38	31	23	15	7
							24	16	8

to scale

7'2" 1'1"

TYPE	FORM	ACTIVITY

Ventilation: _____

Comments: _____

SURVEY FINDINGS

AREA

	mrem	μR/hr		mrem	μR/hr
1	160	300	17	40	80
2	60	200	18	50	140
3	175	340	19		180
4	170	360	20	47	100
5	55	120	21	60	100
6	45	80	22	37	60
7	15	80	23	32	60
8	20	80	24	20	40
9	120	240	25	30	80
10	66	160	26	40	60
11	60	180	27	56	100
12	130	360	28	145	220
13	70	140	29	180	340
14	35	80	30	44	100
15	18	40	31	43	120
16	20	40	32	25	60

Background

RECOMMENDATIONS: _____

SURVEY REPORT

BUILDING: _____ ROOM: President's Office DATE: _____ BY: _____

Routine ☐ Spot Check ☐ Special ☐ Equipment ☐

Survey Instrument _____ Source of Ionizing Radiation

TYPE	FORM	ACTIVITY

Ventilation: _____

Comments: _____

O = oak vanity

D = oak Desk - prevented Floor Meas.

P = Plants + Stereo Equipment

SURVEY FINDINGS

AREA		kcpm	wpl/hr						
	33	30	80	49	40	60	65	15	60
	34	33	80	50	D	P	66	20	40
	35	50	80	51	D	D	67	P	P
	36	40	80	52	D	D	68	P	P
	37	70	120	53	15	60	69	10	20
	38	80	160	54	35	80	70	10	20
	39	15	40	55	25	60	71	0	0
	40	50	100	56	20	60	72	0	0
	41	25	40	57	20	60	73	0	0
	42	28	80	58	30	60			
	43	D	D	59	24	60			
	44	D	D	60	P	P			
	45	D	D	61	P	P			
	46	20	60	62	20	40			
	47	60	100	63	13	60			
	48	25	80	64	15	40			

Background

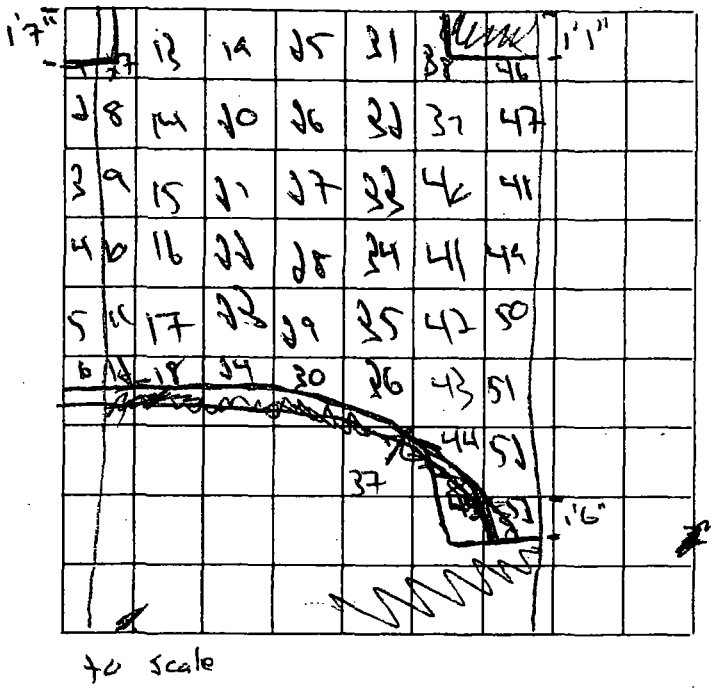
RECOMMENDATIONS: _____

SURVEY REPORT

BUILDING: _____ ROOM: Secretary's office DATE: _____ BY: _____

Routine ☐ Spot Check ☐ Special ☐ Equipment ☐

Survey Instrument _____ Source of Ionizing Radiation



to scale

TYPE	FORM	ACTIVITY

Ventilation: _____

Comments: _____

SURVEY FINDINGS

AREA											
		hgm	wR/hr		hgm	wR/hr		hgm	wR/hr		h	wR
	1	130	220	17	20	60	33	15	60	49	23	80
	2	60	140	18	20	60	34	16	40	50	20	60
	3	140	280	19	160	300	35	15	60	51	25	40
	4	210	500	20	20	80	36	20	60	52	20	40
	5	40	120	21	20	60	37	15	40	53	15	40
	6	25	80	22	20	60	38	70	100			
	7	100	220	23	17	60	39	18	60			
	8	58	160	24	14	60	40	27	40			
	9	120	260	25	[illegible]	280	41	20	40			
	10	290	360	26	10	40	42	20	40			
	11	35	80	27	15	40	43	20	40			
	12	20	60	28	20	60	44	20	60			
	13	140	300	29	15	40	45	15	40			
	14	32	80	30	15	40	46	25	80			
	15	47	120	31	90	180	47	15	40			
	16	290	400	32	15	60	48	24	40			

Background

RECOMMENDATIONS: _____

Radiation Safety Services, Inc.

AIR SAMPLING RECORD

COMPANY	LOCATION	DATE

COMPANY REPRESENTATIVE	

SAMPLE NO.	DESCRIPTION OF SAMPLE (TYPE, ACTIVITY, EMPLOYEE NAME)			CALIB. FLOW RATE	TIME ON	TIME OFF	TIME TOTAL MIN	AIR SAMPLE VOLUME	CONCEN-TRATION ~~f/cc~~
1	Environmental - outside containment	8 Nov 93		9L/m	9:40	3:44	344	3096	6.14×10^{-8}
2	Environmental - inside containment			9L/m	9:40	3:44	344	3096	1.03×10^{-7}
3	Marek			4L/m	9:50	10:05	315	630	
4	Robert			2L/m	9:50	10:05	315	630	
									1.40×10^{-7}
3(c)	Marek			+	10:40	3:40	255	255	2.79×10^{-7}
2(c)	Robert				10:40	3:40	255	510	2.03×10^{-7}

RSSI 7/86

AIR SAMPLING RECORD

COMPANY	LOCATION	DATE

COMPANY REPRESENTATIVE	

SAMPLE NO.	DESCRIPTION OF SAMPLE (TYPE, ACTIVITY, EMPLOYEE NAME)			CALIB. FLOW RATE	TIME ON	TIME OFF	TIME TOTAL MIN	AIR SAMPLE VOLUME	CONCENTRATION
1	Environmental - outside containment	8 Nov 93		9L/m	9:40	3:44	344	3096	6.4×10^{-8}
2	Environmental - inside containment			9L/m	9:40	~~3:44~~	344	3096	1.0×10^{-7}
3	Marek			4L/m	9:50	10:05 ~~3:05~~	~~315~~	~~630~~	
4	Robert			2L/m	9:50	~~3:05~~ 10:05	~~315~~	~~630~~	
									1.40×10^{-7}
	B(c) Marek				10:40	3:40	255	~~255~~ 510	~~2.79×10^{-7}~~
	1(c) Robert				10:40	3:40	255	510	2.05×10^{-7}
75	1 Christopher Maniatt	4 Dec		2.0	9:30	3:50	380	760	9.9×10^{-8}
$.51\times10^{-5}$	318-88-0022								
38	2 Marek Modelski			2.0	9:30	3:50	380	760	5.0×10^{-8}
$.78\times10^{-5}$	310-86-3606								
.1	3 Env out			11.0	9:30	3:50	380	4180	2.9×10^{-9}
1×10^{-5} 81	4 Env in			10.9	9:30	3:50	380	4142	4.46×10^{-8}
$.81\times10^{-4}$									

RSSI 7/86

AIR SAMPLING RECORD

COMPANY	LOCATION	DATE
	161 E. Grand	11 Dec 93

COMPANY REPRESENTATIVE	

	SAMPLE NO.	DESCRIPTION OF SAMPLE (TYPE, ACTIVITY, EMPLOYEE NAME)			CALIB FLOW RATE	TIME ON	TIME OFF	TIME TOTAL MIN	AIR SAMPLE VOLUME	CONCEN-TRATION f/cc	
12 20	1	LESZEK RIDA			2.0	9:25	4:20				9416
		SS - 346-82-1842									9416a
447	2.	KRZYSZTOF MANIAK			2.0	9:25	4:20				9416
		SS - 318-88-0022									9416a
7 144	3	IN			11.0	9:27	4:10				9419
											9419a
8 16	4	OUT			10.9	9:[illegible]	4:10				9416
											9416a

RSSI 7/86

AIR SAMPLING RECORD

COMPANY	LOCATION	DATE
	161	18 Dec 92

COMPANY REPRESENTATIVE	

B/R	SAMPLE NO.	DESCRIPTION OF SAMPLE (TYPE, ACTIVITY, EMPLOYEE NAME)			CALIB. FLOW RATE	TIME ON	TIME OFF	TIME TOTAL MIN	AIR SAMPLE VOLUME	CONCENTRATION f/cc	
105	1	Janusz Skopek			2.0	9:25	4:30				9410
		SS 629-26-1110									941000
115	2	Krzysztof Maniak									9410
		SS 318-88-0022			2.0	9:25					941001
											9410
165	3	IN			10.9	9:35					941002
97	4	Out			11.0	9:35					9410
											941003

AIR SAMPLING RECORD

COMPANY	LOCATION	DATE
RSSI	161 E. Grand	11/30/93

COMPANY REPRESENTATIVE	
B. Bugg / E. Port	

	SAMPLE NO.	DESCRIPTION OF SAMPLE (TYPE, ACTIVITY, EMPLOYEE NAME)			CALIB. FLOW RATE L/min	TIME ON	TIME OFF	TOTAL MIN	AIR SAMPLE VOLUME	CONCENTRATION f/cc	
2 48	1	Outside Containment			11.0		4:50				9419
											941008
2 203	2.	Inside Containment			10.9						946
											941000
3 38	3.	Lestek Kida 346-82-1842			2.0	10:30					9411
											941010

1617

161 E Grand Association

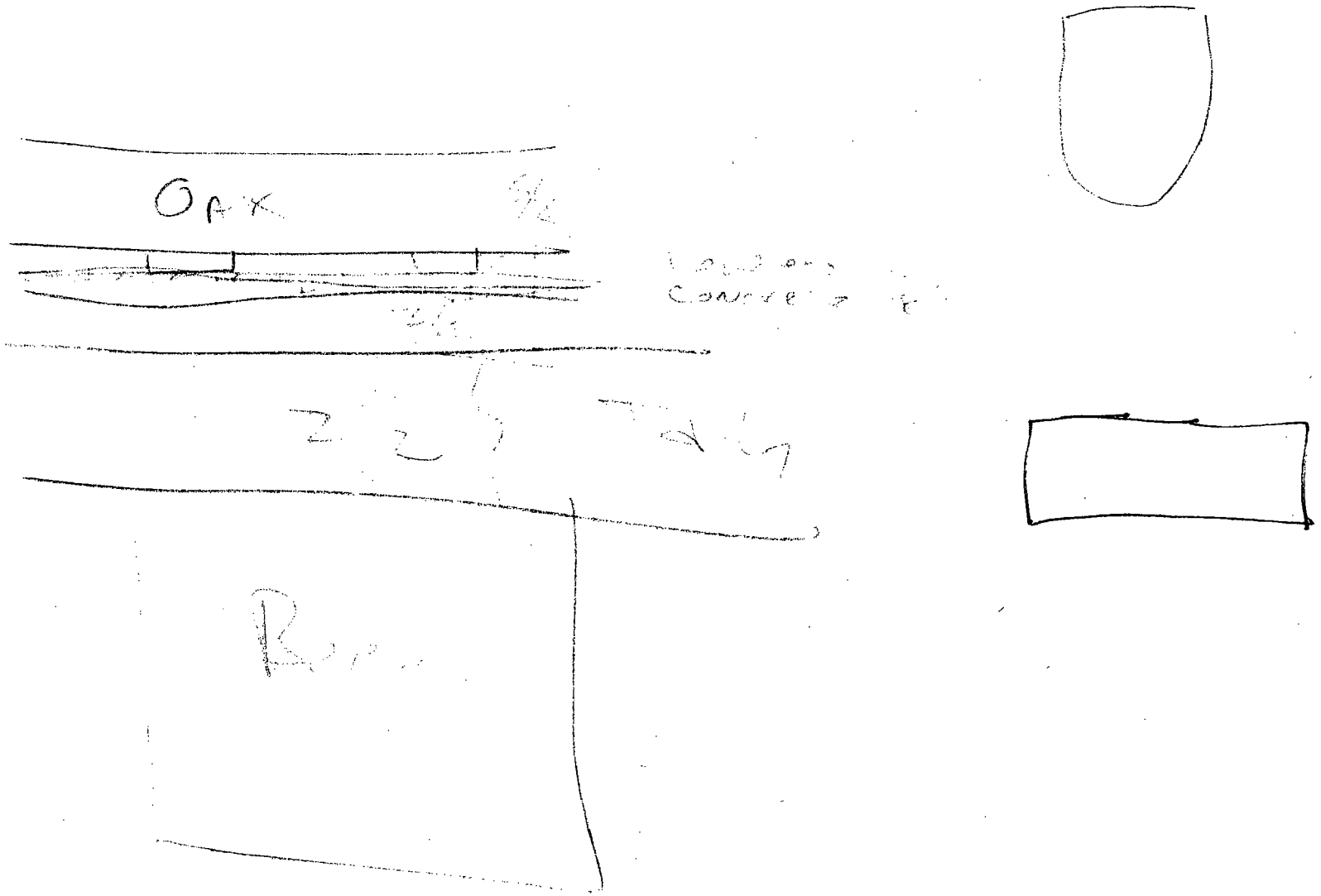
Personnel Supply + Training 8 Nov 93

Name	S/S
MARIK MODLISKI	340-86-3606
Robert Szczygiel	325-86-1617
	325-86-1617
JOE MANIANSKI	339-68-2105

ml/min

High Vol

A	~~9159~~ 8771	9646	9493	9.0L/min
B	8901	9063	8595	= 9.0L/min



Rotameter Cal

Flow Rate (L/m)	Red	Silver
1	39	17
2	82	34
3	143	53

1.1

N.E. Corner Directors Office

1'-2' east wall Directors

Secretaries office ~~wall~~ = ~~East~~ west wall &
any unsanded areas.

.1 Mfelhr at surface

Pump Cal's

ml/min

Pump #	Cal 1	Cal 2	Cal 3
15176	1935	1973	1948
15177	1954	2007	1942
15185	1948	1967	1948
11180	~~1960~~ ~~1967~~ ~~2017~~ 2020	1960	2041
15178	1987	2077	2041

Critical Flow

A	600	636	620
B	629	626	620
C	636	631	628
D	617	616	635

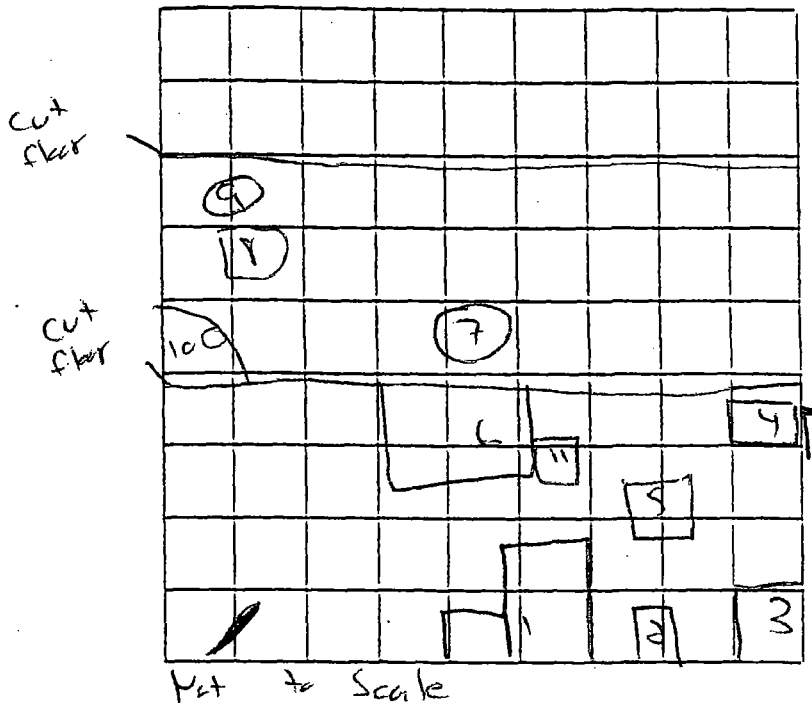
$$\frac{100\,ml}{3.92} = \frac{x}{60}$$

SURVEY REPORT

BUILDING: 161E. Gr. ROOM: Directors Office DATE: 1/20/93 BY: [signature]

Routine ☐ Spot Check ☐ Special ☐ Equipment ☐

Survey Instrument Ludlum 16 w/ HP-270 Source of Ionizing Radiation



TYPE	FORM	ACTIVITY

Ventilation:

Comments:

SURVEY FINDINGS

AREA	mR/hr		
1	.8		
2	.5		
3	.8		
4	.3		
5	.6		
6	.3		
7	.2		
8	<.1 mR/hr		
9	<.1 mR/hr		
10	.3 .3		
11 Background	.05		

RECOMMENDATIONS:

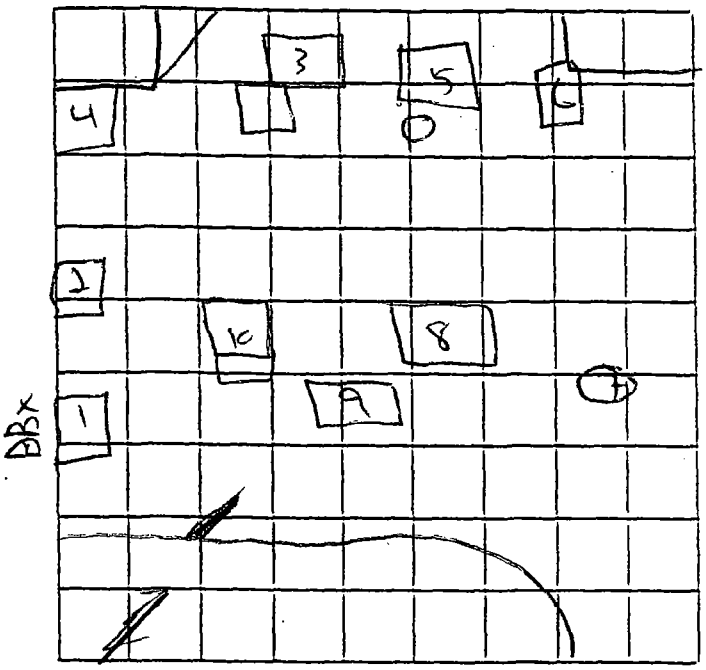
RSSI/Radiation Safety Services, Inc.
6312 W. Oakton Street
Morton Grove, IL 60053-2723
(708) 965-1999

SURVEY REPORT

BUILDING: 161 E.C. 2d ROOM: Secretaries office DATE: 12/93 BY: [signature]

Routine ☐ Spot Check ☐ Special ☐ Equipment ☐

Survey Instrument Ludlum 16 w/ HP-270 Source of Ionizing Radiation



TYPE	FORM	ACTIVITY

Ventilation:

Comments:

SURVEY FINDINGS

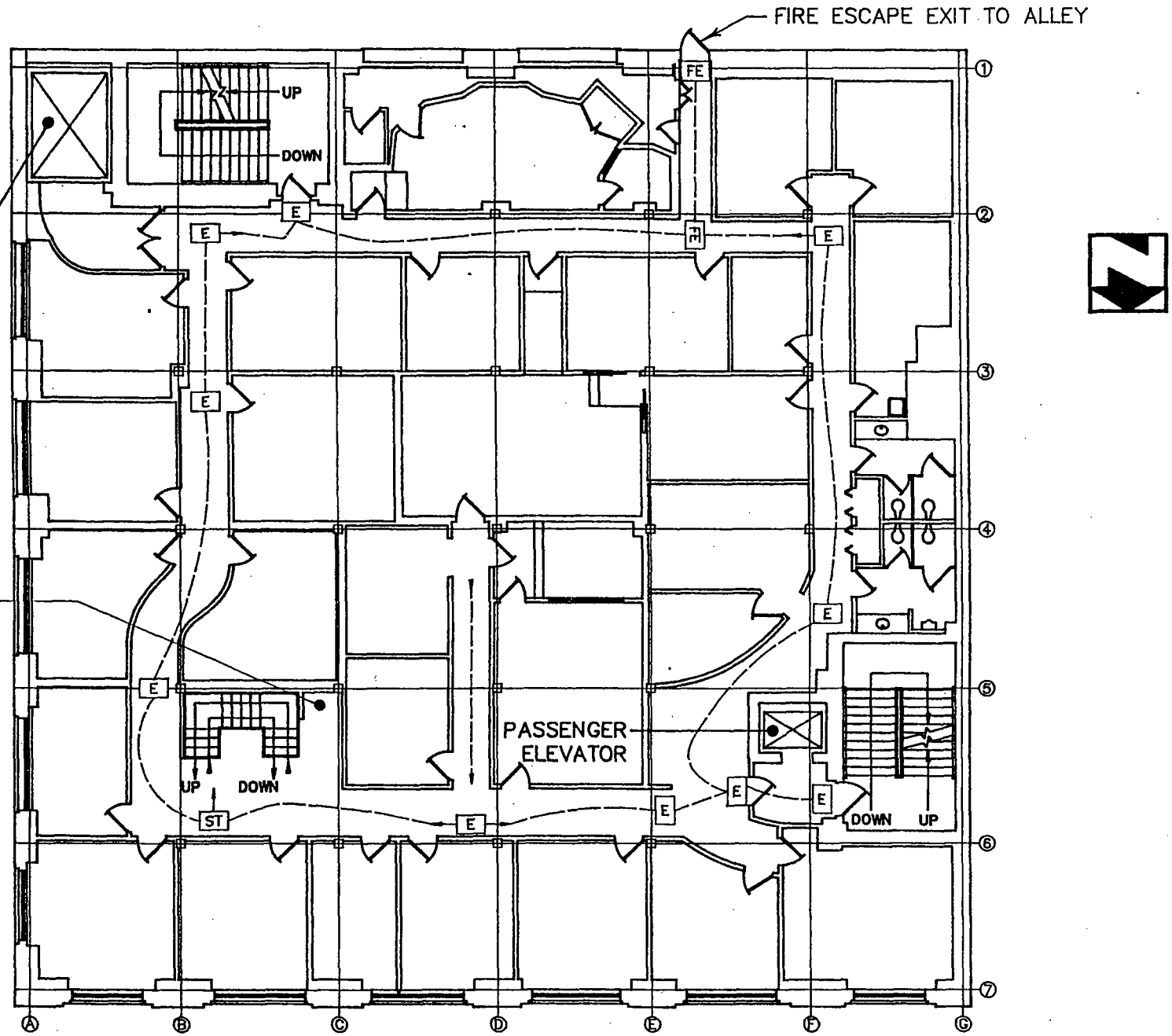
AREA	mR/hr	= 1/4" floor Removed	
1	.16	<.1	
2	.5	.3*	
3	.3	.2	
4	.3	.3*	
5	.3	.3	
6	.4	.4	
7	.2	<.1	
8	.3	<.1	
9	.3	<.1	
10	.3	<.1	

Background .1 mR/hr

RECOMMENDATIONS:

RSSI/Radiation Safety Services, Inc.
6312 W. Oakton Street
Morton Grove, IL 60053-2723
(708) 965-1999

FIRE SCAPE PLAN



2nd FLOOR AREA
OPTIMUS
161 EAST GRAND AVE.
CHICAGO, IL. 60611

EXIT SIGNS
STAIR SIGN
FIRE ESCAPE SIGNS
HAZARDOUS MATERIALS

SCALE: 1/16"=1'

RSSI

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

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

rule. A copy of 10 CFR 32 is available for public inspection at the Department of Nuclear Safety.

(Source: Amended at 10 Ill. Reg. 17315, effective September 25, 1986)

SUBPART B: TYPES OF LICENSES

Section 330.200 Types of Licenses

Licenses for radioactive materials are of two types: general and specific.

a) "General license" means a license, set forth in this Part and 32 Ill. Adm. Code 341, which is *effective without the filing of an application to transfer, acquire, own, possess, or use quantities of, or devices or equipment utilizing radioactive material* (Ill. Rev. Stat. 1990 Supp., ch. 111½, par. 210-4(d)), although the filing of a certificate with the Department may be required by the particular general license. The general licensee is subject to all other applicable portions of 32 Ill. Adm. Code: Chapter II and any limitations of the general license.

b) "Specific license" means a license, as set forth in this Part, *issued after application to use, manufacture, produce, transfer, receive, acquire, own, or possess quantities of, or devices or equipment utilizing radioactive material* (Ill. Rev. Stat. 1990 Supp., ch. 111½, par. 210-4(m)). The licensee is subject to all applicable portions of 32 Ill. Adm. Code: Chapter II as well as any limitations specified in the licensing document.

(Source: Amended at 15 Ill. Reg. 10632, effective July 15, 1991)

Section 330.210 General Licenses - Source Material

a) A general license is hereby issued authorizing commercial and industrial firms, research, educational, and medical institutions, and State and local government agencies to use and transfer not more than 15 pounds (6.82 kg) of source material at any one time for research, development, educational, commercial, or operational purposes. A person authorized to use or transfer source material, pursuant to this general license, may not receive more than a total of 150 pounds (68.2 kg) of source material in any one calendar year.

b) Persons who receive, possess, use, or transfer source material pursuant to the general license issued in Section 330.210(a) are exempt from the provisions of 32 Ill. Adm. Code 340 and 400 to the extent that such receipt, possession, use, or transfer is within the terms of such general license; provided, however, that this exemption shall not be deemed to apply to any such person who is also in possession of source material under a specific license issued pursuant to this Part.

(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

Atomic No.	Radionuclide	Class	Table 1 Occupational Values: Col. 1 Oral Ingestion ALI (μCi)	Col. 2 Inhalation ALI (μCi)	Col. 3 Inhalation DAC (μCi/ml)	Table 2 Effluent Concentrations: Col. 1 Air (μCi/ml)	Col. 2 Water (μCi/ml)	Table 3 Releases to Sewers: Monthly Average Concentration (μCi/ml)
83	Bismuth-203	D, see ^{200}Bi	2E+3	7E+3	3E-6	9E-9	3E-5	3E-4
		W, see ^{200}Bi	-	6E+3	3E-6	9E-9	-	-
83	Bismuth-205	D, see ^{200}Bi	1E+3	3E+3	1E-6	3E-9	2E-5	2E-4
		W, see ^{200}Bi	-	1E+3	5E-7	2E-9	-	-
83	Bismuth-206	D, see ^{200}Bi	6E+2	1E+3	6E-7	2E-9	9E-6	9E-5
		W, see ^{200}Bi	-	9E+2	4E-7	1E-9	-	-
83	Bismuth-207	D, see ^{200}Bi	1E+3	2E+3	7E-7	2E-9	1E-5	1E-4
		W, see ^{200}Bi	-	4E+2	1E-7	5E-10	-	-
83	Bismuth-210m	D, see ^{200}Bi	4E+1	5E+0	2E-9	-	-	-
			Kidneys (6E+1)	Kidneys (6E+0)	-	9E-12	8E-7	8E-6
		W, see ^{200}Bi	-	7E-1	3E-10	9E-13	-	-
83	Bismuth-210	D, see ^{200}Bi	8E+2	2E+2	1E-7	-	1E-5	1E-4
			-	Kidneys (4E+2)	-	5E-10	-	-
		W, see ^{200}Bi	-	3E+1	1E-8	4E-11	-	-
83	Bismuth-212[2]	D, see ^{200}Bi	5E+3	2E+2	1E-7	3E-10	7E-5	7E-4
		W, see ^{200}Bi	-	3E+2	1E-7	4E-10	-	-
83	Bismuth-213[2]	D, see ^{200}Bi	7E+3	3E+2	1E-7	4E-10	1E-4	1E-3
		W, see ^{200}Bi	-	4E+2	1E-7	5E-10	-	-
83	Bismuth-214[2]	D, see ^{200}Bi	2E+4	8E+2	3E-7	1E-9	-	-
			St. wall (2E+4)	-	-	-	3E-4	3E-3
		W, see ^{200}Bi	-	9E-2	4E-7	1E-9	-	-
84	Polonium-203[2]	D, all compounds except those given for W	3E+4	6E+4	3E-5	9E-8	3E-4	3E-3
		W, oxides, hydroxides, and nitrates	-	9E+4	4E-5	1E-7	-	-
84	Polonium-205[2]	D, see ^{203}Po	2E+4	4E+4	2E-5	5E-8	3E-4	3E-3
		W, see ^{203}Po	-	7E+4	3E-5	1E-7	-	-
84	Polonium-207	D, see ^{203}Po	8E+3	3E+4	1E-5	3E-8	1E-4	1E-3
		W, see ^{203}Po	-	3E+4	1E-5	4E-8	-	-
84	Polonium-210	D, see ^{203}Po	3E+0	6E-1	3E-10	9E-13	4E-8	4E-7
		W, see ^{203}Po	-	6E-1	3E-10	9E-13	-	-
85	Astatine-207[2]	D, halides	6E+3	3E+3	1E-6	4E-9	8E-5	8E-4
		W	-	2E+3	9E-7	3E-9	-	-
85	Astatine-211	D, halides	1E+2	8E+1	3E-8	1E-10	2E-6	2E-5
		W	-	5E+1	2E-8	8E-11	-	-
86	Radon-220	With daughters removed	-	2E+4	7E-6	2E-8	-	-
		With daughters present	-	2E+1 (or 12 working level months)	9E-9 (or 1.0 working level)	3E-11	-	-

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Atomic No.	Radionuclide	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (µCi)	Col. 2 Inhalation ALI (µCi)	Col. 3 Inhalation DAC (µCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (µCi/ml)	Col. 2 Water (µCi/ml)	Table 3 Releases to Sewers Monthly Average Concentration (µCi/ml)
86	Radon-222	With daughters removed	-	1E+4	4E-6	1E-8	-	-
		With daughters present	-	1E+2 (or 4 working level months)	3E-8 (or 0.33 working level)	1E-10	-	-
87	Francium-222[2]	D, all compounds	2E+3	5E+2	2E-7	6E-10	3E-5	3E-4
87	Francium-223[2]	D, all compounds	6E+2	8E+2	3E-7	1E-9	8E-6	8E-5
88	Radium-223	W, all compounds	5E+0	7E-1	3E-10	9E-13	-	-
			Bone surf (9E+0)	-	-	-	1E-7	1E-6
88	Radium-224	W, all compounds	8E+0	2E+0	7E-10	2E-12	-	-
			Bone surf (2E+1)	-	-	-	2E-7	2E-6
88	Radium-225	W, all compounds	8E+0	7E-1	3E-10	9E-13	-	-
			Bone surf (2E+1)	-	-	-	2E-7	2E-6
88	Radium-226	W, all compounds	2E+0	6E-1	3E-10	9E-13	-	-
			Bone surf (5E+0)	-	-	-	6E-8	6E-7
88	Radium-227[2]	W, all compounds	2E+4	1E+4	6E-6	-	-	-
			Bone surf (2E+4)	Bone surf (2E+4)	-	3E-8	3E-4	3E-3
88	Radium-228	W, all compounds	2E+0	1E+0	5E-10	2E-12	-	-
			Bone surf (4E+0)	-	-	-	6E-8	6E-7
89	Actinium-224	D, all compounds except those given for W and Y	2E+3	3E+1	1E-8	-	-	-
			LLI wall (2E+3)	Bone surf (4E+1)	-	5E-11	3E-5	3E-4
		W, halides and nitrates	-	5E+1	2E-8	7E-11	-	-
		Y, oxides and hydroxides	-	5E+1	2E-8	6E-11	-	-
89	Actinium-225	D, see ^{224}Ac	5E+1	3E-1	1E-10	-	-	-
			LLI wall (5E+1)	Bone surf (5E-1)	-	7E-13	7E-7	7E-6
		W, see ^{224}Ac	-	6E-1	3E-10	9E-13	-	-
		Y, see ^{224}Ac	-	6E-1	3E-10	9E-13	-	-
89	Actinium-226	D, see ^{224}Ac	1E+2	3E+0	1E-9	-	-	-
			LLI wall (1E+2)	Bone surf (4E+0)	-	5E-12	2E-6	2E-5
		W, see ^{224}Ac	-	5E+0	2E-9	7E-12	-	-
		Y, see ^{224}Ac	-	5E+0	2E-9	6E-12	-	-
89	Actinium-227	D, see ^{224}Ac	2E-1	4E-4	2E-13	-	-	-
			Bone surf (4E-1)	Bone surf (8E-4)	-	1E-15	5E-9	5E-8
		W, see ^{224}Ac	-	2E-3	7E-13	-	-	-
			-	Bone surf (3E-3)	-	4E-15	-	-
		Y, see ^{224}Ac	-	4E-3	2E-12	6E-15	-	-

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Consequently, there are two MPC values currently being applied in the control of occupational exposures to radon daughters, the ICRP value of 3×10^{-8} μCi/cm^3 (30 pCi/l) and 4 WLM per year which, expressed as an average concentration, is 0.3 WL. For an atmosphere containing an equilibrium mixture of radon and its daughters, the two MPCs are identical because 1 WL is equivalent to 100 pCi/l each of RaA, RaB and RaC, as indicated previously. But equilibrium concentrations rarely occur in practical circumstances, and 0.3 WL is more likely to be associated with radon concentrations of the order of 100 pCi/l than 30 pCi/l. Therefore, the MPC recommended by ICRP tends to be more restrictive by an approximate factor of three.

4.3.3. Thoron and thoron daughters

Thoron and its daughters have received much less attention than the radon species because there are few underground mines where airborne activity can accumulate to hazardous concentrations [22]. There are no epidemiological studies to provide evidence for an exposure/risk relationship and, in consequence, standards of exposure are based on analogies with radon and on dose calculations.

The ICRP [2] presents an equation for calculating MPC_{air} for thoron which is similar in concept and form to the equation for radon MPC_{air} (Section 4.3.2). The equation for a 40-hour-week occupational exposure to thoron is $6 \times 10^{-6}/(1 + 40\,000\ f)$, in which the uncombined atoms of ThB constitute a fraction, f, of the equilibrium number of such atoms. ICRP adopted a value of 1/2000 for f as typical for ordinary unfiltered air. Substituting that value for f in the equation results in MPC_{air} for thoron = 3×10^{-7} μCi/cm^3. The equation implies that the dominant dose of consequence is due to ThB.

ICRP [2] also presents an MPC_{air} value for ThB which is 2×10^{-8} μCi/cm^3. Presumably, the same considerations that led to MPC_{air} for thoron were applied in calculating MPC_{air} for ThB, although this is not explicitly mentioned in the ICRP report.

Since the hazard from thoron is predominantly attributable to ThB, which occurs with thoron in all practical situations, it is permissible to apply the MPC_{air} value for ThB as the standard of control for both radionuclides. This eliminates the need of thoron monitoring for which a simple, reliable technology has not yet been developed.

Because of the very short half-lives of thoron (55.3 s) and ThA (0.15 s) compared to ThB (10.6 h), dilution ventilation is relatively ineffective for these radionuclides but it can reduce the concentration of ThB by a large factor. Thus, in some atmospheres, the concentration of thoron may exceed that of ThB by orders of magnitude. This situation is restricted to places where clean ventilating air is continuously available at the source and therefore it could be manifested in mills but not in mines. Duggan [23] has cautioned that the dose from thoron itself may be comparable to that of ThB in cases of extreme disequilibrium. Consequently, in mills it would be prudent to verify the exclusive use of the value for ThB-MPC_{air}. Duggan describes a procedure for monitoring thoron and thoron daughters separately.

They are in various stages of development and have not been tested sufficiently to be considered satisfactory for routine use. The basic principle in each case is to collect an air sample on a filter paper positioned next to two detectors which analyse alpha and beta activity separately and actuate a meter calibrated in units of WL or pCi/l. The instruments execute these functions automatically in periods of about 10 min or less.

(c) Measurement of uncombined fraction of radon daughters. Several methods have been used experimentally to measure the uncombined radon daughters, usually as the fraction of uncombined RaA to total RaA activity in the air or uncombined RaA to the equilibrium amount of RaA (with radon). These measurements have been performed mainly to provide an information for dose calculations because uncombined radon daughters are considered by some investigators to contribute a disproportionately large share of bronchial dose.

Methods involving the selective collection of uncombined radon daughters by electrostatic precipitation [39] and by diffusion [40, 41] have been used for this purpose. The methods are relatively simple but are not yet included in routine monitoring programmes.

6.2.5. Measurement of thoron daughters

Principle. Unlike with radon daughters, the inhalation hazard of thoron daughters is almost entirely dependent on the air concentration of only one radionuclide, ^{212}Pb (ThB). Consequently, monitoring may be directed to the determination of ThB concentration alone. A measurement may be made by sampling thoron daughters on a high-efficiency filter paper at any convenient combination of volumetric flow rate and time (up to about 60 min) and then alpha-counting the filter after a delay of five hours or more from the end of sampling. By that time, ThB, a beta-emitter, is in transient equilibrium with its alpha-emitting daughters, ThC and ThC′, enabling its air concentration at the time of sampling to be calculated readily from the alpha count.

The sensitivity depends on sample volume and on whether a rate meter or a scaler is used for alpha counting. For a sample volume of 100 litres, concentrations down to about 5 pCi/l can be measured with a rate meter. The corresponding sensitivity obtained with a scaler is about 0.5 pCi/l or less.

Equipment. The equipment is identical to that required for the Kusnetz method (Section 6.2.1) except that the alpha counter need not be used underground (in mine applications) because of the long delay between sampling and counting.

Procedure. Air is sampled on a high-efficiency membrane or glass fibre filter paper at a rate of 2 to 10 l/min for any convenient period up to 60 min. This time limit is specified to avoid a decay correction for the sampling period. Following sampling, the filter paper is removed from the filter holder and stored in an envelope for five hours or more, after which the filter is alpha-counted and the time interval between sampling and counting is noted. Either count rate or cumulative count may be measured.

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...pt (d) of this section is required ...whom ...ise 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, 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 section with respect to such possession and use.

(2) AEC contractors operating AEC plants and facilities: Any employer who possesses or uses source material, special nuclear material, or other radiation sources in contract with the Atomic Energy Commission for the operation of plants and facilities and in accordance with 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, Washington, Maryland, Nebraska, 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 amend-

ed, 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.

Paragraph designation	Referenced publication	Available from—
Appendix 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
Appendix D	"Specification for Sound Level Meters," S1.4-1971 (R1976).	American National Standards Institute, Inc., 1430 Broadway, New York, NY 10018.
§ 1910.95(k)(2), appendix E	"Specifications for Audiometers," S3.6-1969.	American National Standards Institute, Inc., 1430 Broadway, New York, NY 10018.
Appendix 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.

The referenced publications (or a microfiche of the publications) are available for review at many universities and public libraries throughout the country. These publications may also be examined at the OSHA Technical Data Center, Room N2439, United States Department of Labor, 200 Constitution Avenue, NW., Washington, DC 20210, (202) 523-9700 or at any OSHA Regional Office (see telephone directories under United States Government—Labor Department).

APPENDIX I TO § 1910.95—DEFINITIONS

These definitions apply to the following terms as used in paragraphs (c) through (n) of 29 CFR 1910.95.

Action level—An 8-hour time-weighted average of 85 decibels measured on the A-scale, slow response, or equivalently, a dose of fifty percent.

Audiogram—A chart, graph, or table resulting from an audiometric test showing an individual's hearing threshold levels as a function of frequency.

Audiologist—A professional, specializing in the study and rehabilitation of hearing, who is certified by the American Speech-Language-Hearing Association or licensed by state board of examiners.

Baseline audiogram—The audiogram against which future audiograms are compared.

Criterion sound level—A sound level of 90 decibels.

Decibel (dB)—Unit of measurement of sound level.

Hertz (Hz)—Unit of measurement of frequency, numerically equal to cycles per second.

Medical pathology—A disorder or disease. For purposes of this regulation, a condition or disease affecting the ear, which should be treated by a physician specialist.

Noise dose—The ratio, expressed as a percentage, 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	970×10^6	670
0.0001	720×10^6	500
0.005	820×10^6	570
0.02	400×10^6	280
0.1	120×10^6	80
0.5	43×10^6	30
1.0	26×10^6	18
2.5	29×10^6	20
5.0	26×10^6	18
7.5	24×10^6	17
10	24×10^6	17
10 to 30	14×10^6	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:

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.);

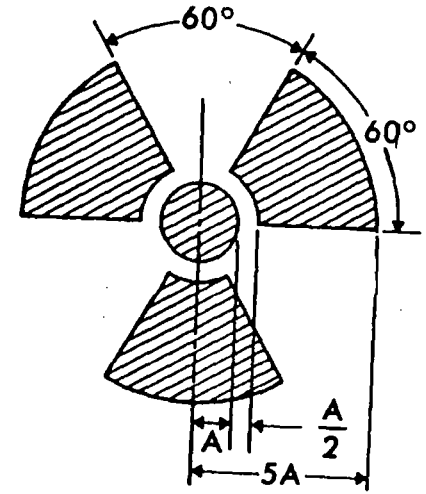
(ii) "Radiation area" means any area, accessible to personnel, in which there exists radiation at such levels that a major portion of the body could receive in any 1 hour a dose in excess of 5 millirem, or in any 5 consecutive days a dose in excess of 100 millirem; and

(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 [illegible] of 100 millirems in 1 hour upon [illegible]y 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 [illegible]h, averaged over the number of [illegible]urs 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 1, 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 non-radiation 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 mployer 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.

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

Referral Report

U.S. Departme f Labor
Occupational Safety and Health Administration

MOD Date	1. Reporting ID	2. Previous Activity? ☐ Yes ☐ No If Yes, Enter Type: Number:	3. Referral Number (Identifies this Referral) ▶ 901315242

4. a. ☐ Change? b. Establishment Name Brown & Storch/Lindsay Light Company [redacted]

6. a. ☐ Change? b. Site Address (Street, City, State, ZIP) 161 E. Grand Avenue, Chicago, IL 60605 | 7. City Code 1670 | 8. County Code 031

9. Mailing Address (Street, City, State, ZIP)

10. Type of Business Real Estate /Rental property. | 11. Primary SIC 6798 | 12. No. of Employees

13. Ownership (Mark "X" in one box)
a. ☒ Private Sector b. ☐ Local Government c. ☐ State Government d. ☐ Federal Agency/Code

14. Referred by:
a. ☐ CSHO (Within office)/CSHO ID
b. ☐ Federal OSHA
c. ☐ State OSH
d. ☐ Discrimination
e. ☐ Other Federal Agency/Code Q090 USEPA
f. ☐ Consultation
g. ☐ State/Local Government
h. ☐ Media
i. ☐ Other (specify)

15. Date Received: 11/15/93

16. Source or Contact (Name, Location, Affiliation, Telephone Number)

17. a. Safety (1) ☐ Imminent Danger (2) ☐ Serious (3) ☐ Other
b. Health (1) ☐ Imminent Danger (2) ☒ Serious (3) ☐ Other

18. ☐ Migrant Farmworker Camp

19. Hazard Description

Employees (tenants) are exposed to ionizing radiation from decaying radio-isotopes remained in the building.
Radiation levels as measured by EPA Survey are:
First floor Secretary area 100 μR/hr., Lobby area = 30-75 μR/hr.
Basement Concrete plug in chimney 2,250 μR/hr.; Central area (Records) = 20-100 μR/hr
Second floor. Freight Elevator - 18-20 μR/hour.

Hazards: Increased risk of cancer of lungs & liver from Gamma radiation & Radon 220.

Cont'd

20. a. ☐ Send Letter b. Date Letter Sent: c. Date Response Due:

21. Supervisor(s) Assigned a. Q1488 b.

22. Inspection Planned? ☒ Yes ☐ No If Yes, Priority: 18 If No, Reason:

23. Transfer to (Name): 24. Transfer Date:

25. Transfer to (Category):
a. ☐ Federal OSHA/Reporting ID
b. ☐ State OSH/Reporting ID
c. ☐ Other Federal Agency/Code
d. ☐ State/Local Government
e. ☐ Other

26. Optional Information

Type	ID		Value

27. Total Entries

28. Comments

OPTIONAL FORM 99 (7-90)

FAX TRANSMITTAL # of pages ▶

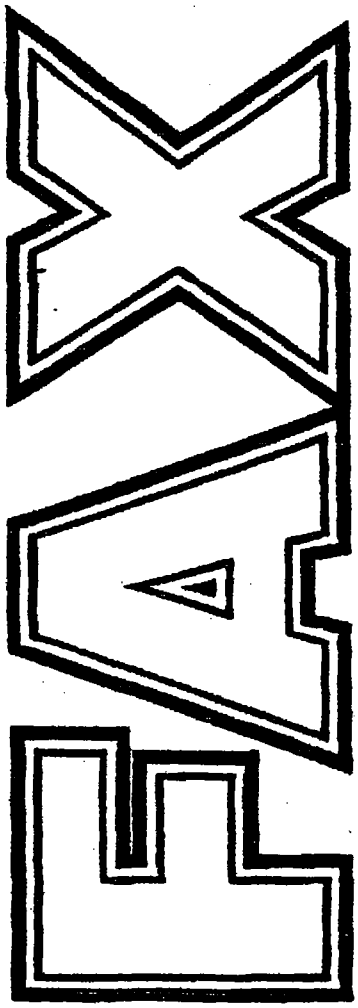
To Eli Port
Dept./Agency
Phone 708-9105-1991
Fax # 708-1891-3800

From Gary Anderson
Phone 708-1891-3800
Fax #

NSN 7540-01-317-7368 5099-101 GENERAL SERVICES ADMINISTRATION

OSHA-90 (Rev. 1/84)

CASE FILE OR TRANSFER COPY



TRANSMITTAL

TO: Eli Porte

Fax #:

From: BARBARA Smith - OSHA

Date: 5/23/94

Pages (including cover sheet): 2

Re: Referral form

U.S. Department of Labor
Occupational Safety and Health
Administration
1600 167th Street, Suite 12
Calumet City, Illinois 60409
Commercial (708) 891-3800
FAX (708) 862-9659

Referral Report

U.S. Departme[illegible]f Labor
Occupational Safety and Health Administration

MOD Date	1. Reporting ID	2. Previous Activity? ☐ Yes ☐ No If Yes, Enter Type: Number:	3. Referral Number (Identifies this Referral) ▶ 901315242

4. a. ☐ b. Establishment Name Change? Brown & Storch/Lindsay Light Company

6. a. ☐ b. Site Address (Street, City, State, ZIP) Change? 161 E. Grand Avenue, Chicago, IL 60605 | 7. City Code 1670 | 8. County Code 031

9. Mailing Address (Street, City, State, ZIP)

10. Type of Business: Real Estate /Rental property | 11. Primary SIC: 6798 | 12. No. of Employees

13. Ownership (Mark "X" in one box)
a. ☒ Private Sector b. ☐ Local Government c. ☐ State Government d. ☐ Federal Agency/Code

14. Referred by:
a. ☐ CSHO (Within office)/CSHO ID
b. ☐ Federal OSHA
c. ☐ State OSH
d. ☐ Discrimination
e. ☐ Other Federal Agency/Code 0090 US EPA

15. Date Received: 11/15/93
f. ☐ Consultation
g. ☐ State/Local Government
h. ☐ Media
i. ☐ Other (specify)

16. Source or Contact (Name, Location, Affiliation, Telephone Number)

17. a. Safety (1) ☐ Imminent Danger (2) ☐ Serious (3) ☐ Other
b. Health (1) ☐ Imminent Danger (2) ☒ Serious (3) ☐ Other

18. ☐ Migrant Farmworker Camp

19. Hazard Description

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Second floor. Freight Elevator = 18-20 μR/hour.

Hazards: Increased risk of cancer of lungs & liver from Gamma radiation & Radon 220.

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20. a. ☐ Send Letter b. Date Letter Sent: c. Date Response Due: | 21. Supervisor(s) Assigned a. Q1488 b.

22. Inspection Planned? ☒ Yes ☐ No If Yes, Priority: 18 If No, Reason:

23. Transfer to (Name): | 24. Transfer Date:

25. Transfer to (Category):
a. ☐ Federal OSHA/Reporting ID
b. ☐ State OSH/Reporting ID
c. ☐ Other Federal Agency/Code
d. ☐ State/Local Government
e. ☐ Other

26. Optional Information

Type	ID	Value	Type	ID	Value

27. Total Entries

28. Comments

OSHA-90 (Rev. 1/84)

CASE FILE OR TRANSFER COPY

U.S. Department of Labor

Occupational Safety and Health Administration
Washington, D.C. 20210

Reply to the Attention of:

AUG 16 1989

MEMORANDUM FOR: Harvey E. Harris, Director
Office of Training and Education

THROUGH: Bruce Hillenbrand, Director
Directorate of Federal-State Operations

FROM: Patricia K. Clark, Acting Director
Directorate of Compliance Programs

SUBJECT: The Ionizing Radiation Standard, 29 CFR 1910.96

This is in response to your memorandum of October 20, 1988, requesting some interpretations and policy determinations for the standard for ionizing radiation, 29 CFR 1910.96.

Neither 29 CFR 1910.96 nor the original standard on which it is based, 10 CFR 20, define restricted areas for ionizing radiation or airborne radioactive materials in terms of the potential level of exposure. "Unrestricted area" is defined at 10 CFR 20.105(b)(1) and (2) and at 10 CFR 20.106(a), however. It follows, therefore, that areas that cannot qualify as "unrestricted areas" are "restricted areas."

"Unrestricted areas" for ionizing radiation are areas where even if an employee were continuously present in the area (1) the dose received in any one hour could not exceed two millirems, or (2) the dose received in any seven consecutive days could not exceed 100 millirems. "Unrestricted areas" for airborne radioactive materials are areas where concentrations do not exceed the limits specified in Table 2 of Appendix B to 10 CFR 20. The concentrations may be averaged over a period not greater than one year.

Standard 29 CFR 1910.96 defines three types of restricted areas that must be identified and have their boundaries demarcated with special warning signs. They are "radiation area," "high radiation area," and "airborne radioactive area."

An employer possesses radioactive material and comes under the scope of 29 CFR 1910.96 if there are artificially enhanced concentrations of environmental radon-222 in the workplace. If environmental radon-222 concentrations have not been artificially enhanced, they are very much lower than the permissible exposure limit (PEL). Accordingly, only artificially enhanced concentrations of environmental radon-222 would be sufficiently high that provisions of 29 CFR 1910.96 would go into effect. The most common places for significant artificial enhancement of radon-222 concentrations to occur are the inside of buildings or other types of enclosures constructed on or in the ground.

As you noted, footnote 3 to Table 1 of Appendix B to 10 CFR 20 states that "the limit on [exposure to] radon-222 concentrations in restricted areas may be based on an annual average." OSHA must permit employers to follow this option.

OSHA obviously cannot spare enough resources to measure the annual average concentration of airborne radon-222 exposure received by an employee. It is not necessary for OSHA to do this measurement in order to determine and enforce compliance with the exposure limit, however. Rather, OSHA can reach these objectives by enforcing compliance with the survey requirement described at 29 CFR 1910.96(d) and assuring that employers take appropriate corrective action when their measurements show any employees overexposed to radon-222.

A survey is defined as "... 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 ... measurements of ... concentrations of radioactive material present." An employer's evaluation of a radon-222 hazard will frequently have to be done in two stages. The first stage would consist of several short duration samples intended to find any areas where radon-222 concentrations may be excessive. The second stage would involve long duration sampling to accurately determine the long-term, time-weighted average radon-222 concentrations in the areas where short duration samples indicated that the concentrations might be excessive.

Before citing an employer for not doing a survey to evaluate the radiation hazard incident to the presence of radon-222 gas, OSHA will have to obtain information supporting the need for the survey. Usually OSHA will have to produce this information through its own exploratory measurements of radon-222 concentration levels.

Decisions on when to sample for radon-222 may be done in the area offices at the level of the supervisory industrial hygienist. You will note that the exposure limits for airborne radioactive materials listed in Appendix B to 10 CFR 20 are expressed as concentrations above natural background radioactivity. However, true background radioactivity is so small relative to the limit for radon-222 in Table 1, that it may be disregarded. We have referred your inquiry about sampling instruments and procedures to the Directorate of Technical Support.

Twenty-nine states have entered into agreements with the Nuclear Regulatory Commission (NRC). All twenty-nine states operate regulatory programs covering all ionizing radiation hazards, but their agreements with NRC pertain only to specific materials called "agreement materials." Agreement materials are (1) source

material, special nuclear material, and byproduct material, as these terms are defined in 10 CFR Part 20, and (2) uranium and thorium tailings resulting from recovery operations. A circular issued by NRC in June, 1987, entitled, "Summary Of the Nuclear Regulatory Commission's Agreement State Program," (copy enclosed) identifies the current NRC agreement States.

NRC periodically reviews agreement State programs for adequacy and compatibility. NRC's authority over agreement States pertain only to agreement materials, however. Thus NRC considers only activities involving agreement materials when determining the acceptability of an agreement State's regulatory program. Consequently, an agreement State that maintains a satisfactory regulatory program for agreement materials will retain the regulatory authority granted by NRC even if it operates a poor program for regulating nonagreement sources and materials, such as x-ray machines. Accordingly, OSHA Instruction STD 1-4.1 and OSHA Instruction STP 2.8 with its attached memorandum from NRC contain correct information and the policy and guidelines contained in them must still be observed.

Some individuals, perhaps even some State officials, may construe 29 CFR 1910.96(p)(3)(ii) to transfer OSHA's authority for regulating ionizing radiation to NRC agreement States, provided their program for controlling nonagreement materials is compatible with 29 standard CFR 1910.96. This is a misinterpretation of 29 CFR 1910.96(p)(3)(ii), however. It does not transfer authority, but describes the conditions when compliance with State requirements will also comply with Federal OSHA requirements.

No NRC agreement State that is not an OSHA State Plan State has had a recent formal determination by the Assistant Secretary of Labor as to whether the State's program for controlling nonagreement materials is compatible with 29 CFR 1910.96. The lack of a recent determination has no practical effect on OSHA enforcement responsibility, however. That is, OSHA will issue citations to employers not in compliance with 29 CFR 1910.96 regardless of whether the State's regulatory program is compatible with 29 CFR 1910.96.

OSHA does not have jurisdiction over Department of Defense ionizing radiation sources that are part of uniquely military equipment, systems, or operations. The use of an ionizing radiation source for medical purposes is not a uniquely military operation so OSHA has jurisdiction over those sources that are not licensed by NRC. In the case where radioactive isotopes are used as a radiation source for medical purposes, any isotopes not produced by nuclear reactors come under the jurisdiction of OSHA as they are not licensed by NRC.

Attachment

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

June, 1987

SUMMARY OF THE NUCLEAR REGULATORY COMMISSION'S AGREEMENT STATE PROGRAM

Prior to enactment of the Atomic Energy Act of 1954, nuclear energy activities in the United States were largely confined to the Federal Government. The Act made it possible for private commercial firms to enter the field for the first time. Because of the hazards associated with nuclear materials, Congress determined that these activities should be regulated under a Federal licensing system to protect the health and safety of workers in the nuclear industry and the public. The Nuclear Regulatory Commission is the Federal agency charged with this responsibility.

Although protection of the public's health and safety has traditionally been a State responsibility, the Atomic Energy Act of 1954 did not specify such a role for the States in nuclear matters. This policy was changed in 1959 when Congress enacted Section 274 of the Atomic Energy Act. Section 274 spells out a State role and provides a statutory basis under which the Federal Government can relinquish to the States portions of its regulatory authority. The 1959 amendment made it possible for the States to license and regulate byproduct material (radioisotopes),[1] source material (the raw materials of atomic energy), and small quantities of special nuclear material. The Commission is required, however, to retain regulatory authority over the regulation of nuclear facilities such as reactors, exports and imports of nuclear materials and facilities, larger quantities of fissionable material, consumer products, facilities vital to the national common defense and security and certain types of radioactive wastes. The Atomic Energy Act was amended in 1978 by the passage of the Uranium Mill Tailings Radiation Control Act of 1978 which requires Agreement States regulating uranium and thorium tailings resulting from recovery operations to adopt certain technical and procedural requirements. The 1978 amendment also requires NRC to periodically review Agreement State programs for adequacy and compatibility.

Section 274j of the Atomic Energy Act provides that the NRC may terminate its agreement with a State if the Commission finds that such termination is necessary to protect the public health and safety. In 1980, Section 274j was amended to authorize the Commission to

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1 In 1978, Congress enacted the Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA) which, among other things, added to the category of byproduct material "tailings or wastes produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content."

temporarily suspend all or part of an agreement with a State in the case of an emergency situation where the State failed to take necessary action. Such suspensions may remain in effect only for the duration of the emergency. A copy of Section 274 of the Act, as amended, is enclosed (Enclosure 1).

The mechanism for the transfer of NRC authority to a State to regulate the radiological health and safety aspects of nuclear materials is an agreement between the Governor of the State and the Commission. Criteria for such agreements have been published by NRC as a Policy Statement in the Federal Register (Enclosure 2). A copy of the most recent agreement, with Illinois, is enclosed for illustration (Enclosure 3). Before actually signing the document, the Commission, by statute, must determine that the State's radiation control program is compatible with the Commission's, meets the applicable parts of Section 274 and that it is adequate to protect the public health and safety. For its part, the State establishes its authority to enter such an agreement by passing enabling legislation.

At present, twenty-nine States have entered into such Agreements with NRC.[2] These States now regulate over 65% of the 20,000 licensees for byproduct, source material, and special nuclear material in the United States. In 1981 the Commission determined that qualified States may also enter into limited agreements for regulation of low-level waste in permanent disposal facilities.

Each agreement provides that the State will use its best efforts to maintain continuing compatibility with the NRC's program. The NRC maintains a continuing relationship with each Agreement State to assure continued compatibility of the State's regulatory program and its adequacy to protect health and safety. This relationship includes: exchange of information on a current basis covering regulations, licensing, inspection and enforcement data; consultation on special licensing, inspection, enforcement and other regulatory problems; and an annual meeting of all Agreement States to consider regulatory matters of common interest. Special technical assistance is routinely provided to the States upon request.

As mandated by the Atomic Energy Act, NRC conducts on-site, in-depth program reviews periodically of each Agreement State in which organizational, administrative, personnel, regulatory, licensing, compliance and enforcement program areas are reviewed. Selected licensing and compliance casework is reviewed in detail. State inspectors are accompanied by NRC staff on selected inspections of State licensees. A copy of the guidelines which the NRC uses in conducting such reviews have been published in the Federal Register as a Commission policy statement (Enclosure 4).

When program deficiencies are identified specific recommendations for improvements are developed and formally transmitted to the State for action. Follow-up reviews are made as necessary.

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2 Alabama, Arizona, Arkansas, California, Colorado, Florida, Georgia, Idaho, Illinois, Iowa, Kansas, Kentucky, Louisiana, Maryland, Mississippi, Nebraska, Nevada, New Hampshire, New Mexico, New York, North Carolina, North Dakota, Oregon, Rhode Island, South Carolina, Tennessee, Texas, Utah and Washington.

NRC provides a wide spectrum of training for State personnel. Examples are short-term courses in health physics, radiography radiation safety, nuclear medicine, licensing, inspection procedures, radiological engineering, well logging, transportation of nuclear materials and project management for licensing low-level waste disposal facilities. Travel costs and per diem for these training sessions are paid by NRC.

Although other Federal agencies, such as the Environmental Protection Agency, the Food and Drug Administration, and the Department of Transportation are also involved in the control of radiation hazards, NRC's Agreement State Program serves as a focal point for Federal-State cooperation in radiation control.

The NRC State Agreements Program is administered by the State, Local and Indian Tribes Program in the Office of Governmental and Public Affairs. This is a new Commission level office which was established as part of an overall NRC reorganization which became effective April 12, 1987. The NRC regional offices participate in implementation of the State Agreement Program.

The staffs of the Office of Governmental and Public Affairs and the Regional Offices are ready to meet with Governors, State agencies, State legislative committees, State advisory groups and others to explain fully the NRC Agreement program. They can provide descriptive materials about these programs and model State acts for regulatory legislation and will also arrange meetings with other NRC staff members on specialized subjects as appropriate.

What are the advantages for a State that takes over the Commission's regulatory authority as described above? The principal advantages are the following:

(a) NRC's authority does not include regulation of x-ray machines and other radiation producing equipment, accelerator-produced radioactive materials, and radium.[3] Regulation of these sources for radiation protection is, and always has been, primarily the responsibility of the States. Many States now exercise surveillance over these sources of radiation which, in the aggregate, are responsible for over 75% of the public's exposure to radiation, other than from background. Thus, by assuming the authority which the NRC is authorized to relinquish, a State is able to have, as part of its public health system, a complete and comprehensive program for radiation safety.

(b) Many facilities, including medical institutions and physicians, use radioisotopes as well as x-ray machines and radium. A State regulatory system which covers all such radiation sources enables most users to deal with a single agency rather than with a Federal agency for a part and the State for the remainder.

(c) An agreement with NRC enables a State to make its own licensing decisions and in doing so, to take into account local conditions.

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3 NRC does regulate radium to the extent it occurs in uranium or thorium mill tailings, see footnote 1, p. 1.

(d) The proximity of licensed users of radioactive materials to the regulating agency has been cited as having significant advantages for both the users and the agency.

(e) Entering into such an agreement with NRC would be consistent with a serious interest of a State in being knowledgeable about all sources of radiation located within its boundaries.

(f) An agreement with NRC enhances the core of knowledgeable people at the State level who can respond to inquiries and incidents.

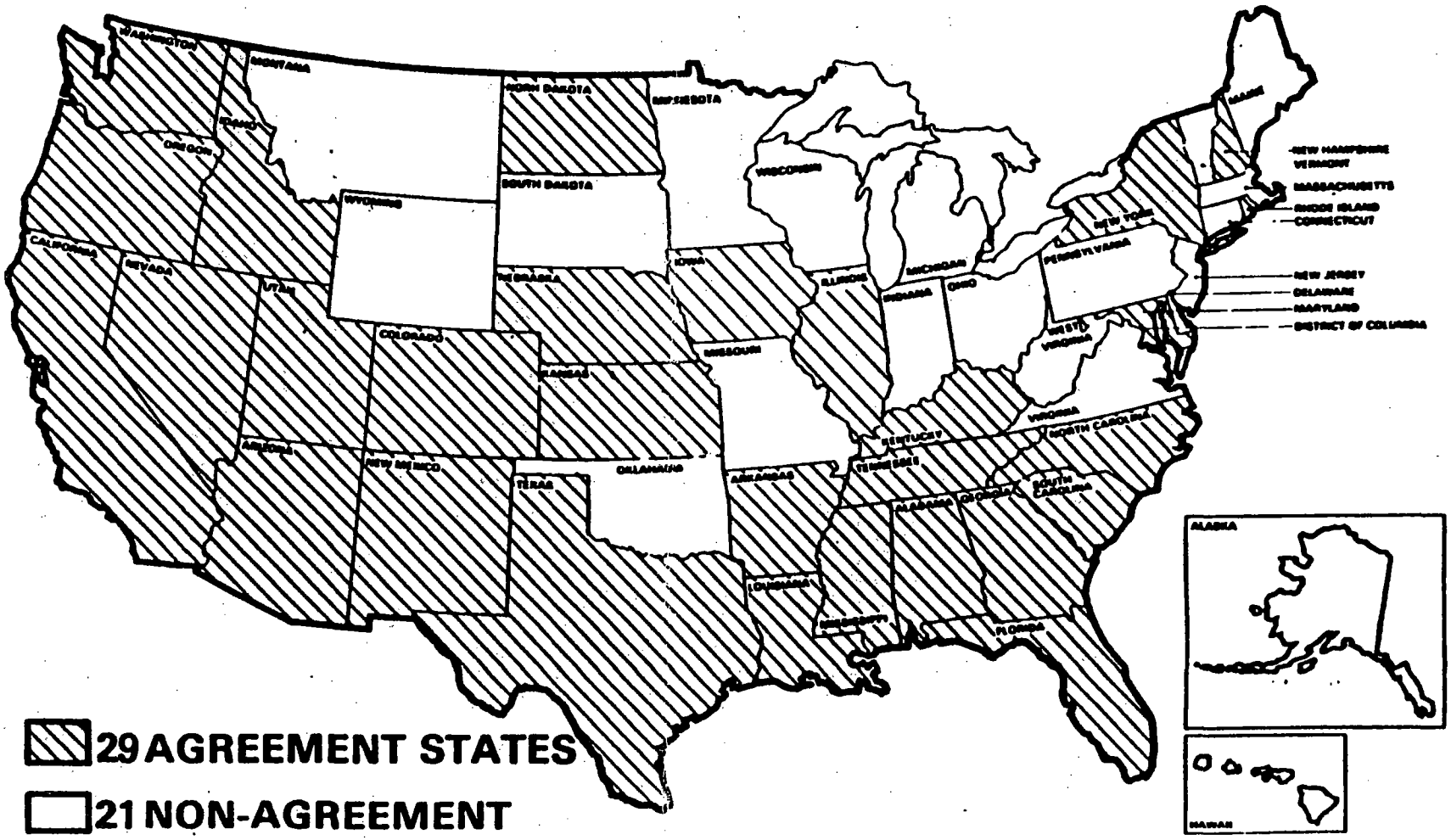
Administrative costs that are incurred by a State becoming an Agreement State vary from State to State, depending, among other factors, upon whether or not the State already has a radiation control program covering sources of radiation not regulated by the NRC, i.e., x-ray machines, accelerator-produced radioactive materials and radium. Where this is the case, the incremental costs would be less than if the State previously had only a limited or voluntary radiation control program. As a rule of thumb, 1.0-1.5 staff-years per 100 licenses is needed to effectively administer the program assumed from the NRC. This is a rather general index and actual staffing needs will vary according to the particular circumstances in any given State. Further, those States which have major licensed facilities in their State, such as low level radioactive waste disposal facilities and uranium mills, will need additional resources. NRC staff can provide further guidance on staffing requirements for regulating in these areas.

NRC charges most of its licensees license application and inspection fees. Whether or not an Agreement State charges fees is a matter of choice for the State. NRC does not provide funding to States for routine program costs. Some Agreement States fund their programs out of general revenues and plan to continue doing so. The majority of the Agreement States, however, have authorized collection of user fees as a means of assuring an adequate funding base. As a result of these States' fees and those of NRC, over two-thirds of the licensees in the United States are licensed by agencies authorized to charge user fees. NRC has prepared model State legislation which includes authorization for a fee system. NRC staff can assist States in developing fee systems.

The Agreement State experience since 1962, the year of the first Agreement, has been that the States generally conduct effective radiation control programs. When major program deficiencies are noted by NRC, technical advice, assistance and training is offered by NRC (within its resources). The main area of concern is maintaining adequate staffing levels, a reflection of State salary structures and funding. On the other hand, Agreement States typically excel in having highly trained staff and by conducting more frequent inspections than NRC.

Enclosures:
1. Section 274 of the Act, as amended
2. NRC Policy Statement for criteria for applicant Agreement States
3. Agreement with the State of Illinois
4. NRC Policy Statement for review of Agreement State Programs

AGREEMENT STATE PROGRAM



SAFETY SERIES No. 75

Manual on Radiological Safety in Uranium and Thorium Mines and Mills

Sponsored by the
IAEA and ILO

...is ...of whom ...graph (d) of this section is required ...this individual exposure each of his employees of 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, 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 regulation with respect to such possession and use.

(2) AEC contractors operating AEC plants and facilities: Any employer who possesses or uses source material, special nuclear material, or other radiation sources under contract with the Atomic Energy Commission for the operation of such plants and facilities and in ac-

...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 agreement States 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 amend-

ed, 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.

Paragraph designation	Referenced publication	Available from—
Appendix 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.
Appendix D	"Specification for Sound Level Meters," S1.4-1971 (R1976).	American National Standards Institute, Inc., 1430 Broadway, New York, NY 10018.
§ 1910.95(k)(2), appendix E	"Specifications for Audiometers," S3.6-1969.	American National Standards Institute, Inc., 1430 Broadway, New York, NY 10018.
Appendix 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.

The referenced publications (or a microfiche of the publications) are available for review at many universities and public libraries throughout the country. These publications may also be examined at the OSHA Technical Data Center, Room N2439, United States Department of Labor, 200 Constitution Avenue, NW., Washington, DC 20210, (202) 523-9700 or at any OSHA Regional Office (see telephone directories under United States Government—Labor Department).

Appendix I to § 1910.95—Definitions

These definitions apply to the following terms as used in paragraphs (c) through (n) of 29 CFR 1910.95.

Action level—An 8-hour time-weighted average of 85 decibels measured on the A-scale, slow response, or equivalently, a dose of fifty percent.

Audiogram—A chart, graph, or table resulting from an audiometric test showing an individual's hearing threshold levels as a function of frequency.

Audiologist—A professional, specializing in the study and rehabilitation of hearing, who is certified by the American Speech-Language-Hearing Association or licensed by a state board of examiners.

Baseline audiogram—The audiogram against which future audiograms are compared.

Criterion sound level—A sound level of 90 decibels.

Decibel (dB)—Unit of measurement of sound level.

Hertz (Hz)—Unit of measurement of frequency, numerically equal to cycles per second.

Medical pathology—A disorder or disease. For purposes of this regulation, a condition or disease affecting the ear, which should be treated by a physician specialist.

Noise dose—The ratio, expressed as a percentage, 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	970×10^6	670
0.0001	720×10^6	500
0.005	820×10^6	570
0.02	400×10^6	280
0.1	120×10^6	80
0.5	43×10^6	30
1.0	26×10^6	18
2.5	29×10^6	20
5.0	26×10^6	18
7.5	24×10^6	17
10	24×10^6	17
10 to 30	14×10^6	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:

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.);

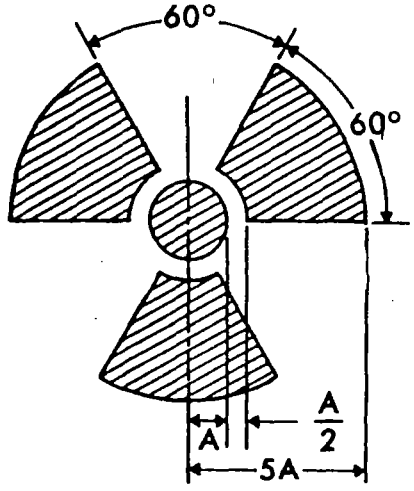
(ii) "Radiation area" means any area, accessible to personnel, in which there exists radiation at such levels that a major portion of the body could receive in any 1 hour a dose in excess of 5 millirem, or in any 5 consecutive days a dose in excess of 100 millirem; and

(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 [illegible] of 100 millirems in 1 hour upon [illegible]y 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 [illegible]h, averaged over the number of [illegible]urs 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 (1) 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 mployer 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.

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

Referral Report

U.S. Departme / Labor
Occupational Safety and Health Administration

MOD Date	1. Reporting ID	2. Previous Activity? ☐ Yes ☐ No If Yes, Enter Type: Number:	3. Referral Number (Identifies this Referral) ▶ 901315242

4. a. ☐ b. Establishment Name Change? Brown & Storch/Lindsay Light Company [redacted]

6. a. ☐ b. Site Address (Street, City, State, ZIP) Change? 161 E. Grand Avenue, Chicago, IL 60605 | 7. City Code 1670 | 8. County Code 031

9. Mailing Address (Street, City, State, ZIP)

[redacted]

10. Type of Business: Real Estate /Rental property. | 11. Primary SIC 6798 | 12. No. of Employees

13. Ownership (Mark "X" in one box)
a. ☒ Private Sector b. ☐ Local Government c. ☐ State Government d. ☐ Federal Agency/Code

14. Referred by:
a. ☐ CSHO (Within office)/CSHO ID
b. ☐ Federal OSHA
c. ☐ State OSH
d. ☐ Discrimination
e. ☐ Other Federal Agency/Code Q090 USEPA
f. ☐ Consultation
g. ☐ State/Local Government
h. ☐ Media
i. ☐ Other (specify)

15. Date Received: 11/15/93

16. Source or Contact (Name, Location, Affiliation, Telephone Number)

17. a. Safety (1) ☐ Imminent Danger (2) ☐ Serious (3) ☐ Other
b. Health (1) ☐ Imminent Danger (2) ☒ Serious (3) ☐ Other

18. ☐ Migrant Farmworker Camp

19. Hazard Description

Employees (tenants) are exposed to ionizing radiation from decaying radio isotopes remained in the building.
Radiation levels as measured by EPA Survey are:
First floor Secretary area 100 μR/hr., Lobby area = 30-75 μR/hr.
Basement Concrete plug in chimney 2,250 μR/hr.; Central area (Records) = 20-100 μR/hr
Second floor Freight Elevator = 18-20 μR/hour.

Hazards: Increased risk of Cancer of lungs & liver from Gamma radiation & Radon 220.

Cont'd

20. a. ☐ Send Letter b. Date Letter Sent: c. Date Response Due: | 21. Supervisor(s) Assigned a. Q1488 b.

22. Inspection Planned? ☒ Yes ☐ No If Yes, Priority: 18 If No, Reason:

23. Transfer to (Name): 24. Transfer Date:

25. Transfer to (Category):
a. ☐ Federal OSHA/Reporting ID
b. ☐ State OSH/Reporting ID
c. ☐ Other Federal Agency/Code
d. ☐ State/Local Government
e. ☐ Other

26. Optional Information

Type	ID		Value

27. Total Entries

28. Comments

OPTIONAL FORM 99 (7-90)

FAX TRANSMITTAL # of pages ▶

To Eli Port
Dept./Agency
Phone 708-905-1991
Fax #

From Gary Anderson
Phone 708-891-3800
Fax #

NSN 7540-01-317-7368 5099-101 GENERAL SERVICES ADMINISTRATION

OSHA-90 (Rev. 1/84)

CASE FILE OR TRANSFER COPY

FAX

TRANSMITTAL

TO: Eli Porte

Fax #:

From: BARBARA Smith - OSHA

Date: 5/23/94

Pages (including cover sheet): 2

Re: Referral form

U.S. Department of Labor
Occupational Safety and Health
Administration
1600 167th Street, Suite 12
Calumet City, Illinois 60409
Commercial (708) 891-3800
FAX (708) 862-9659

Referral Report

U.S. Departme .f Labor
Occupational Safety and Health Administration

MOD Date	1. Reporting ID	2. Previous Activity? ☐ Yes ☐ No If Yes, Enter Type: Number:	3. Referral Number (Identifies this Referral) ▶ 901315242

4. a. ☐ Change? b. Establishment Name: Brown & Storch/Lindsay Light Company [redacted]

5. a. ☐ Change? b. Site Address (Street, City, State, ZIP): 161 E. Grand Avenue, Chicago, IL 60605 | 7. City Code: 1670 | 8. County Code: 031

9. Mailing Address (Street, City, State, ZIP)

[redacted]

10. Type of Business: Real Estate /Rental property. | 11. Primary SIC: 6798 | 12. No. of Employees

13. Ownership (Mark "X" in one box)
a. ☒ Private Sector b. ☐ Local Government c. ☐ State Government d. ☐ Federal Agency/Code

14. Referred by:
a. ☐ CSHO (Within office)/CSHO ID
b. ☐ Federal OSHA
c. ☐ State OSH
d. ☐ Discrimination
e. ☐ Other Federal Agency/Code: Q090 USEPA

15. Date Received: 11/15/93
f. ☐ Consultation
g. ☐ State/Local Government
h. ☐ Media
i. ☐ Other (specify)

16. Source or Contact (Name, Location, Affiliation, Telephone Number)

17. a. Safety (1) ☐ Imminent Danger (2) ☐ Serious (3) ☐ Other
b. Health (1) ☐ Imminent Danger (2) ☒ Serious (3) ☐ Other

18. ☐ Migrant Farmworker Camp

19. Hazard Description

Employees (tenants) are exposed to ionizing radiation from decaying radio-isotopes remained in the building.
Radiation levels as measured by EPA Survey are:
First floor - Secretary area 100 uR/hr., Lobby area = 30-75 uR/hr.
Basement concrete plug in chimney 2,250 uR/hr., Central area (Bomb) = 20-100 uR/hr
Second floor. Freight Elevator = 18-20 uR/hour.

Hazards: Increased risk of cancer of lungs & liver from Gamma radiation & Radon-220.

Cont'd

20. a. ☐ Send Letter b. Date Letter Sent: c. Date Response Due: | 21. Supervisor(s) Assigned a. Q1488 b.

22. Inspection Planned? ☒ Yes ☐ No If Yes, Priority: 18 If No, Reason:

23. Transfer to (Name): 24. Transfer Date:

25. Transfer to (Category):
a. ☐ Federal OSHA/Reporting ID
b. ☐ State OSH/Reporting ID
c. ☐ Other Federal Agency/Code
d. ☐ State/Local Government
e. ☐ Other

26. Optional Information

Type	ID	Value	Type	ID	Value

27. Total Entries

28. Comments

OSHA-90 (Rev. 1/84)

CASE FILE OR TRANSFER COPY

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			
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

28042..1076P
Post-it™ brand fax transmittal memo 7671 # of pages ▸ 10
To Eli Port From Mark Kippel
Co. Co.
Dept. Phone # 708-231-0762
Fax # Fax #

12.5.6.4.. Samples with Short Half-Life. (Cont'd)

When the identity of the nuclides in the mixture is not known, the above equation can be used to establish that the longer-lived beta emitters are not present, allowing the use of 3×10^{-9} as the applicable MPC without further identification. To do this count the sample twice allowing about 30 minutes for decay, then estimate λ_i from the apparent half life and correct the count rate accordingly.

$$\lambda_i(\text{est}) = \frac{0.693}{t_{1/2}\,(\text{est})} = \frac{\ln \dfrac{A_{t1}}{A_{t2}}}{(t_2 - t_1)}$$

where A_{t1} and A_{t2} are the activities in cpm at the counting times t_1 and t_2.

12.5.7. Working Levels for Radon Daughter Exposure

A Working Level (WL) is defined as any combination of short-lived radon-222 daughters (polonium-218, lead-214, bismuth-214 and polonium-214) per liter of air without regard to equilibrium which will result in the emission of 1.3×10^5 MeV of alpha energy. One WL is also defined as the potential alpha energy present in a liter of air containing 100 pCi each of the short lived radon-222 daughters. Only 8 pci of radon-220 (thoron) in equilibrium with its short lived daughters is equivalent to one WL (see figure 12-3).

The WL concentration is an exposure level. Cumulative exposure is given in Working Level Hours or Working Level Months. An average exposure to 1 WL for 8 hours is equal to 8 WLH. An average exposure to 1 WL for 173 hours is equal to 1 WLM. The maximum permissible concentration for radon-222 in air may be given in units of activity radon (combined with its short lived daughters) per volume air or by Working Levels.

a. MPC_{40} for radon-222 in air = 3×10^{-8} µCi/ml or 1/3 WL

b. MPC_{168} for radon-222 in air = 3×10^{-9} µCi/ml or 1/30 WL

WORKING LEVEL EQUIVALENTS FOR RADON AND THORON

1. RADON (Rn-222)

a. Each atom of Po-218 contributes 13.7 MeV in decaying through Po-214 (6.0 MeV for the Po-218 decay and 7.7 MeV for the Po-214 decay).

b. Each atom of Pb-214 and Bi-214 contributes 7.7 MeV in decaying through Po-214.

100pCi Po-218 = $100 \times \frac{2.22\text{dpm}}{\text{pCi}} \times \frac{3.05\text{ min}}{0.693}$ = 977 atoms

100pCi Pb-214 = $100 \times \frac{2.22\text{dpm}}{\text{pCi}} \times \frac{26.8\text{ min}}{0.693}$ = 8585 atoms

100pCi Bi-214 = $100 \times \frac{2.22\text{dpm}}{\text{pCi}} \times \frac{19.7\text{ min}}{0.693}$ = 6311 atoms

100pCi Po-214 = $100 \times \frac{2.22\text{dpm}}{\text{pCi}} \times \frac{2.73\times10^{-6}\text{min}}{0.693}$ = 0.0009 atom

Total potential alpha energy

Po-218	977	X	13.7 MeV	=	13,400 MeV
Pb-214	8585	X	7.7 MeV	=	66,100 MeV
Bi-214	6311	X	7.7 MeV	=	48,600 MeV
Po-214	0				

Total potential alpha energy = 128,100 MeV $\cong$ 1WL

(1WL = 1.3×10^5 MeV potential alpha energy).

Figure 12-3

WORKING LEVEL EQUIVALENTS FOR RADON AND THORON(continued)

2. THORON (Rn-220)

a. Each atom of Po-216 contributes 14.7 MeV of alpha energy in decaying through Po-212 or Tl-208. (6.8 MeV for the Po-216 decay plus 7.9 MeV for the weighted average of the Bi-212 and Po-212 decays).

b. Each atom of Pb-212 and Bi-212 contributes 7.9 MeV (the weighted average of the Bi-212 and Po-212 decays).

c. Each atom of Po-212 contributes 8.9 MeV alpha energy.

d. Each atom of Tl-208 contributes no alpha energy.

$$8\text{pCi Po-216} = 8 \times \frac{2.22\text{dpm}}{\text{pCi}} \times \frac{2.7\times10^{-3}\text{min}}{0.693} = .07 \text{ atoms}$$

$$8\text{pCi Pb-212} = 8 \times \frac{2.22\text{dpm}}{\text{pCi}} \times \frac{636 \text{ min}}{0.693} = 16{,}299 \text{ atoms}$$

$$8\text{pCi Bi-212} = 8 \times \frac{2.22\text{dpm}}{\text{pCi}} \times \frac{60.5 \text{ min}}{0.693} = 1{,}550 \text{ atoms}$$

$$8\text{pCi Po-212} = 8 \times \frac{2.22\text{dpm}}{\text{pCi}} \times \frac{3\times10^{-7}\text{min}}{0.693} \times 0.663 = 5\times10^{-6} \text{ atoms}$$

$$8\text{pCi Tl-208} = 8 \times \frac{2.22\text{dpm}}{\text{pCi}} \times \frac{3.1 \text{ min}}{0.693} \times 0.337 = 26.8 \text{ atoms}$$

Total potential alpha energy

Po-216	0.07 x 14.7 MeV	=	1 MeV
Pb-212	16299 x 7.9	=	128,800 MeV
Bi-212	1550 x 7.9	=	12,200 MeV
Po-212	$5 \times 10^{-6} \times 8.9$	=	0 MeV
Tl-208	26.8 x 0	=	0 MeV

Total potential alpha energy = 128,800 x 12,200 = 141,000 ≅ 1WL
(1WL = 1.3×10^{5} MeV potential alpha energy).

Figure 12-3 (cont'd.)

12.5.7.1. Working Level Determination for Radon Daughters. Radon daughter concentrations are measured using the method described in Radiation Monitoring, U.S. Department of Labor, Mine Safety and Health Administration, 1979. The radon decay chain is shown in Figure 12-4.

a. Radon daughter particulates are filtered from 10 liters or more of air in a period of exactly 5 minutes.

b. The alpha activity on the filter paper is counted between 40 and 90 minutes after the end of sample collection using an appropriately calibrated instrument. After 40 minutes only the alpha particles from the decay of Po-214 are counted because virtually all of the Po-218 ($t_{1/2}$ = 3.05 min.) has decayed.

c. Disintegrations per minute per liter of air is derived by dividing the total counts per minute by the counter efficiency. The counter should be calibrated for gross counting of Po-214 7.7 MeV alpha particles. The total sample volume in liters is divided into the total activity in disintegrations per minute.

d. To convert to Working Levels a correction factor depending on the time elapsed from sample time to count time is used. These correction factors are determined graphically in Figure 12-5. This factor is based on the assumption that equilibrium existed between Po-218, Pb-214, and Bi-214 at the time of sampling. The factor relates dpm per liter of air from 40 to 90 minutes after sampling to the activity which would be present from an initial concentration of 1 WL.

e. A sample calculation is as follows:

Sample volume: 10 liters (2.0 lpm)
Time at end of sample: 10:15 am
Time of counting: 11:05 am
Elapsed time: 50 minutes
Count rate: 250 cpm
Gross counter efficiency: 30%
Alpha dpm: 250 ÷ .3 = 825 dpm
Dpm/liter: 825 dpm ÷ 10ℓ = 82.5
Time factor (from Figure 12-5): 130
WL = 82.5 dpm/l ÷ 130 = 0.63 WL

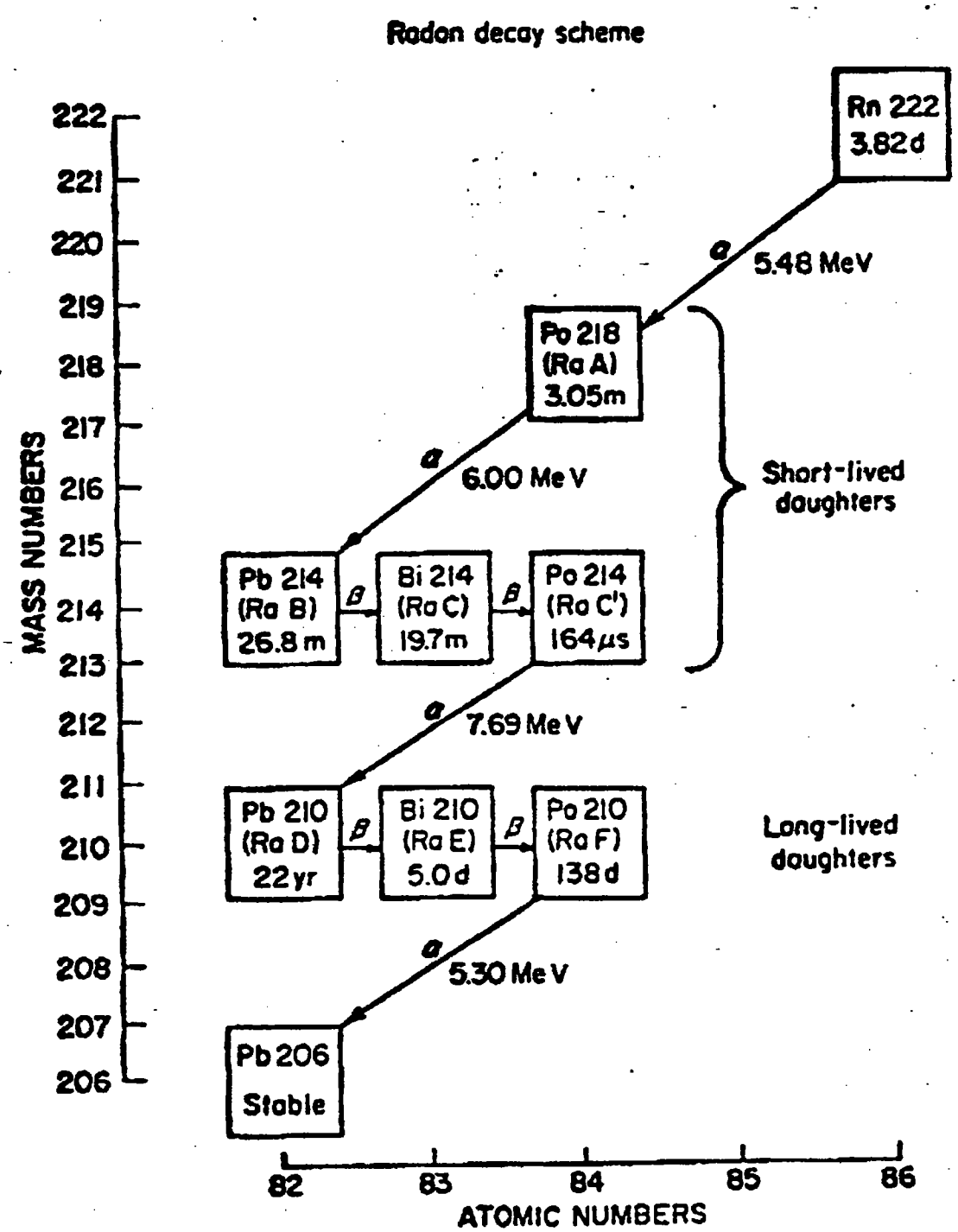
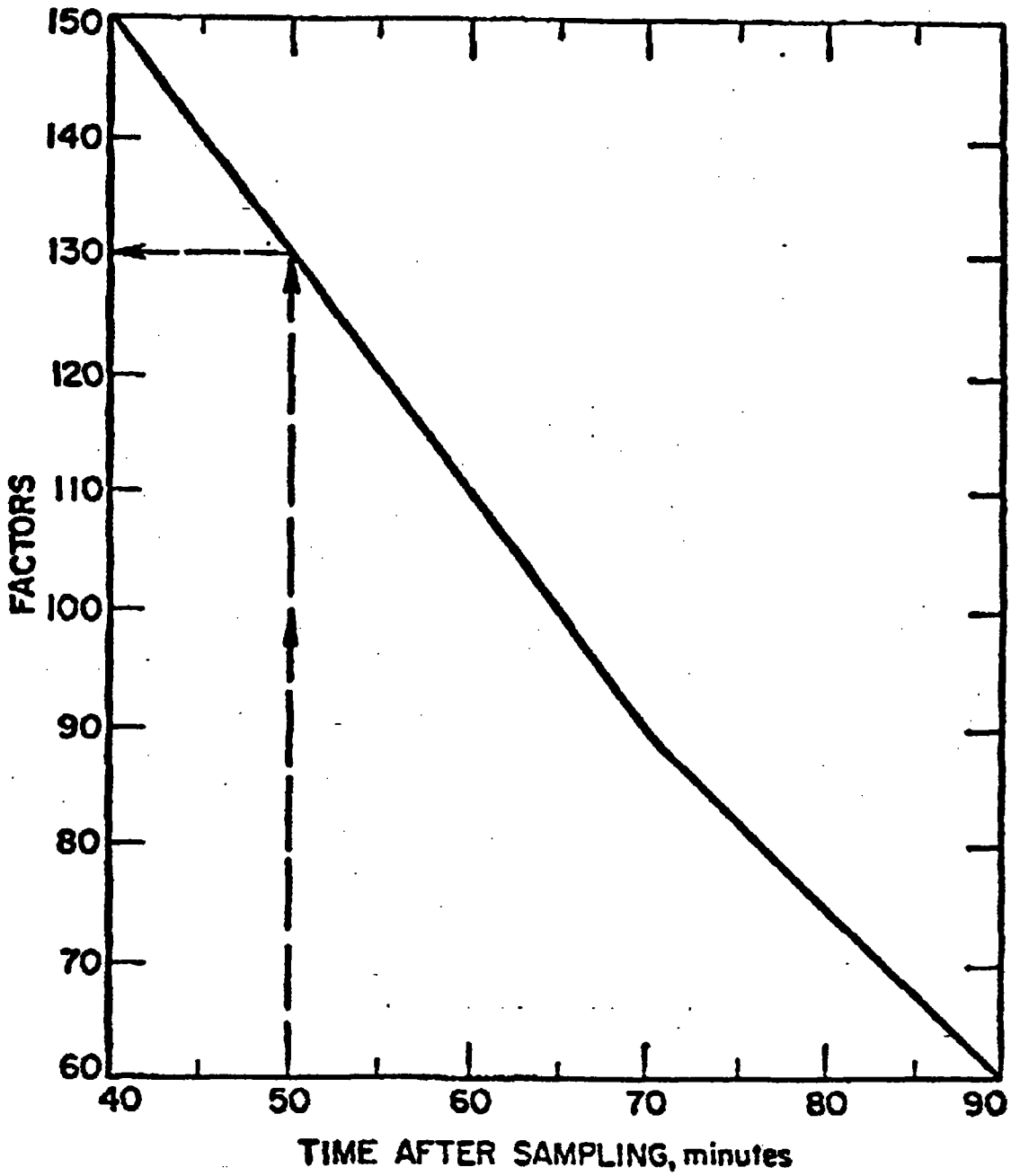


Figure 12-4. Radon decay scheme.



Time factors versus time after sampling for radon daughter samples.

Fig 12-5

12.5.7.2. Working Level Determination for Thoron Daughters. An analagous method is used to determine thoron daughter concentrations in air. The thoron decay chain is shown in Figure 12-6.

a. Thoron daughter particulates are filtered from 10 liters or more (preferably about 50 liters) of air in a period of up to 1 hour.

b. The alpha activity on the filter paper is counted between 5 to 17 hours after the end of the sample using an appropriately calibrated instrument. After 5 hours, Pb-212 and Bi-212 are in equilibrium so that the combined alpha counts of Bi-212 and Po-212 may be directly related to the number of atoms of Pb-212 present on the filter.

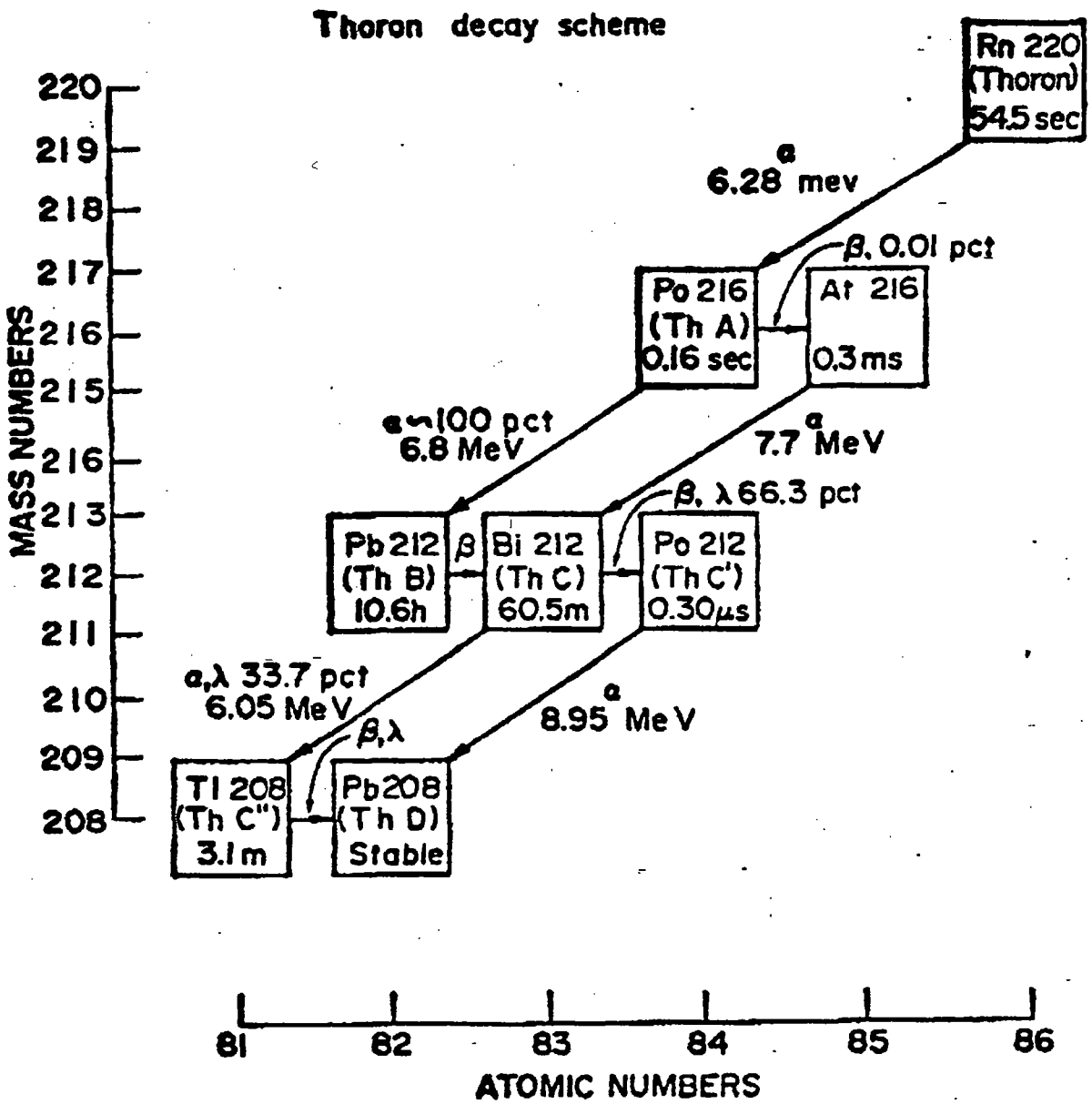
c. Total counts per minute on the filter are converted to dpm per liter of air by dividing total counts by counter efficiency and by the total volume of air filtered, in liters.

d. Activity (dpm) per liter of air is converted to Working Levels by dividing by the time factors given in Figure 12-7.

e. The following is a sample calculation:

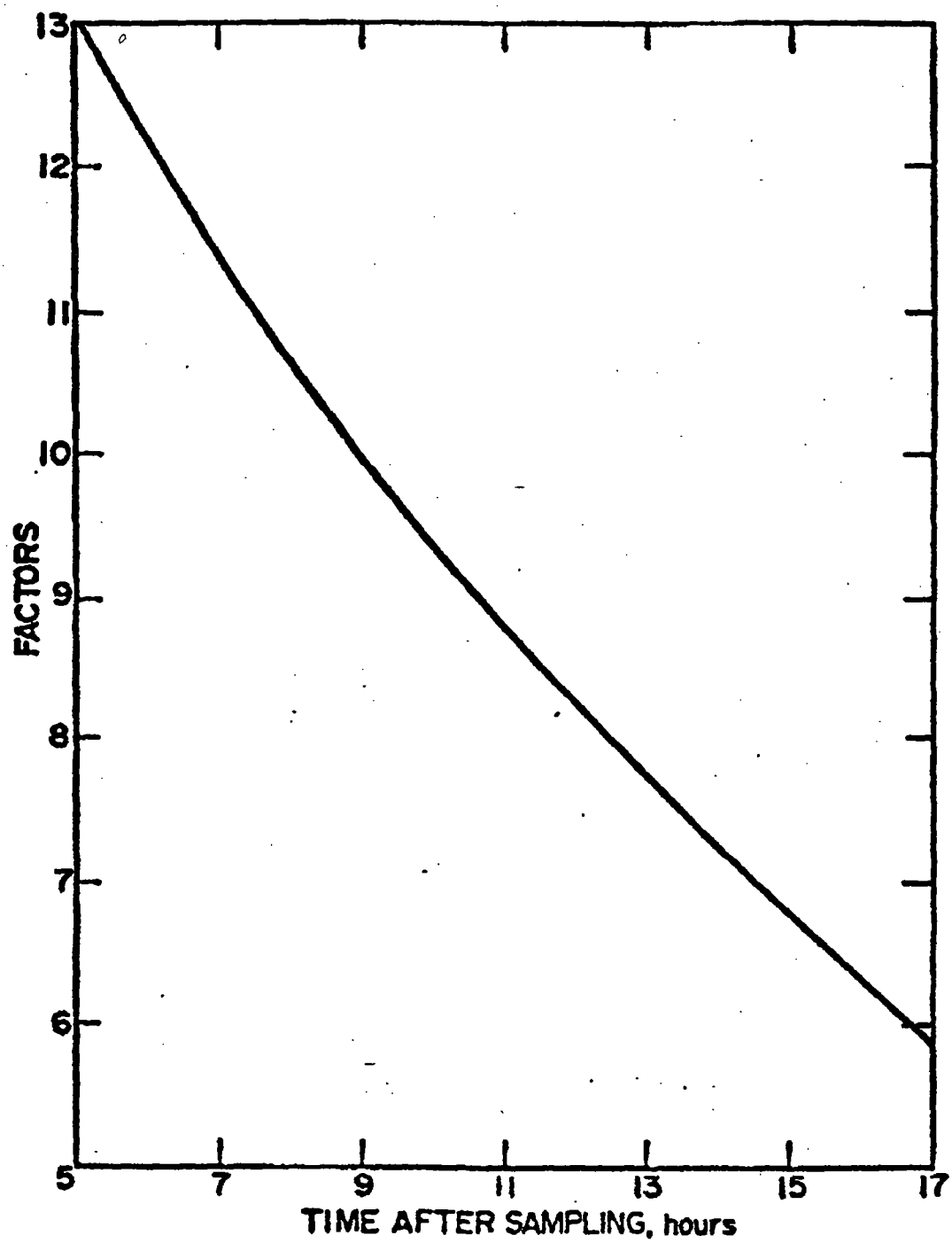
Sample volume: 50 liters (2.0 lpm, 25 min.)
Time at end of sampling: 10:00 am
Time of counting: 3:00 pm
Elapsed time: 5 hours
Counts (5 min.): 502
Count rate: 502 ÷ 5 = 100 cpm
Gross counter efficiency: 30%
Alpha dpm: 100 ÷ .3 = 330
Dpm/liter: 330 ÷ 50 = 6.6
Time factor (from Figure 12-7): 13
WL: 6.6 ÷ 13 = 0.51 WL

12.5.7.3. WL Corrections for Mixtures of Radon and Thoron. No correction is needed for thoron daughter calculations when mixtures of radon and thoron are present. However, adjustments are necessary to determine true radon daughter concentrations. Figure 12-8 lists corrections which must be subtracted from radon daughter activity per liter (dpm/liter) for thoron daughter activity adjustment.



Thoron decay scheme.

Fig. 12-6



Time factors versus time after sampling for thoron daughter samples.

Fig 12-7

Dpm per liter of air which should be subtracted when calculating radon daughter working levels mixed with thoron daughter working levels 1/

Measured Thoron Daughter Working Levels	Elapsed Minutes After Sampling When Radon Daughter Dpm Per Liter of Air Was Counted					
	40	50	60	70	80	90
0.1	2	2	2	2	2	2
0.2	3	3	3	3	3	3
0.3	5	5	5	5	5	5
0.4	7	7	7	7	6	6
0.5	8	8	8	8	8	8
0.6	10	10	10	10	10	10
0.7	12	12	12	11	11	11
0.8	13	13	13	13	13	13
0.9	15	15	15	15	15	14
1.0	17	17	17	17	17	17
1.2	20	20	20	20	19	19
1.4	23	23	23	23	23	22
1.6	27	27	26	26	26	26
1.8	30	30	30	29	29	29
2.0	34	33	33	33	32	32

1/ Based on the assumption that ThC is nearly at equilibrium with ThB. Generally, this will result in a conservative estimate of radon daughter working levels, especially at counting times of between 40 and 60 minutes. An underestimate of more than 10 percent should not result under the high equilibrium conditions where most screening samples will be taken. Compensation for low initial Bi-212 to Pb-212 equilibrium commences to be significant only above one working level of thoron daughters.

Fig. 12-8

DAILY HERALD - Arlington Heights
Wednesday, April 20, 1994

ILLINOIS
Kerr-McGee

Radiation leaves opera house owner responsible for cleanup

By Robert McCoppin
Daily Herald Staff Writer

When Robert Westrom bought the Bolles Opera House in West Chicago, he was given a piece of paper from the Atomic Energy Commission that said the property was cleared for all uses.

That was in 1977, and it was the first hint he had that the building had radioactive contamination. The paper worried Westrom, but he said he trusted the government's evaluation.

Last fall, the U.S. Occupational Safety and Health Administration inspected the historic building and found it had radiation levels that exceeded federal safety standards.

OSHA ordered Westrom to evacuate the building by April 6 or be fined up to $70,000. Westrom moved his Microfilm Service Bureau and two employees out of the building and ended up paying about $3,000 in fines.

OSHA Area Director Charles Shields said OSHA had to apply safety standards that have gotten more stringent over the years since Westrom bought the building. Now OSHA says Westrom must clean up the building, at a likely cost of at least tens of thousands of dollars.

"I've lost my business. I've lost the use of the building and we can't sell it, and I'm responsible I guess for cleaning this up," Westrom said. "If this wasn't so serious, it'd be really funny. It's just a big joke."

Nobody involved is laughing. Even officials from the U.S. Environmental Protection Agency say Westrom got a bad deal.

"It seems patently clear the building should never have been released for unrestricted use," EPA regional radiation expert Larry Jensen said.

The case has broader implications for those operating a business out of their homes, according to Westrom's son, DuPage County Board member Dean Westrom.

Federal officials confirmed that when radioactive contamination is in a workplace, it is OSHA's jurisdiction, not the EPA's. That means that any similar building could be subject to OSHA fines and orders to pay for a cleanup but would not be eligible for money under the EPA's planned Superfund cleanup of West Chicago.

> "I've lost my business. I've lost the use of the building and we can't sell it. . . . If this wasn't so serious, it'd be really funny. It's just a big joke."
>
> —Robert Westrom, owner of Bolles Opera House

That could leave "islands" of contamination in the city, the Westroms fear.

"I don't want the rest of you to be hysterical and very excited, but ... it has changed the whole outlook of the thorium issue in West Chicago," Dean Westrom . . said.

But regulators say the case is unusual. OSHA typically does not investigate a particular property unless there is a complaint, Shields said.

Additionally, it is doubtful there are many properties contaminated inside like the opera house, said Rebecca Frey, manager of the EPA's planned cleanup of the city's residential sites. The EPA is measuring indoor radiation in homes but expects any radiation to come from the soil outside or below, she said.

Any such radiation will be removed, she said.

The three-story opera house, at 185-189 W. Washington St., is a special case in several ways. First, it was built in 1894 by a businessman to play host to operas, plays and public meetings.

In 1941, after some years of disuse, it was sold to the Lindsay Light & Chemical Corp., which renovated the site and built a laboratory there to test or produce radioactive products. The company produced radioactive thorium for gas light mantles and government weapons programs at a large factory just a few blocks away. The resulting radioactive byproduct was spread throughout the city. The material increases the risk of cancer.

The Kerr-McGee Chemical Corp. bought Lindsay Light in 1967, inheriting the lab and the factory, which it closed in 1973. Westrom bought the lab from Kerr-McGee in 1977.

Shortly thereafter, when Westrom heard Kerr-McGee was buying back some contaminated factory property it had sold, he checked his building with a Geiger counter and found radiation.

Kerr-McGee had plans to clean up the property but dropped them when Westrom filed suit against Kerr-McGee. A federal judge threw out the suit, saying there was no proof of personal injury.

After finding the contamination, Westrom contacted the Nuclear Regulatory Commission, which cleaned out some of the contaminated material in the early 1980s and again declared the building safe, he said.

When Westrom still found radiation, he closed off most of the building and contacted the EPA.

Last fall, Jensen and another EPA expert recommended that the agency declare "an imminent and substantial endangerment" at the site. But EPA superiors said the agency had no jurisdiction over the site.

That was when Jensen called in OSHA, hoping it could help Westrom with a cleanup.

Jensen holds out hope that federal regulators can help.

Westrom said he will get estimates to see if he can afford a cleanup.

He was not optimistic. As he put it, "I haven't got a prayer."

CHICAGO SUN TIMES
Friday, March 4, 1994

ILLINOIS
General

161

Radioactive Debris Buried in Parking Lot

By Jim Ritter
Staff Writer

234L-130

One of the choicest pieces of real estate in Chicago is a parking lot in the elite Streeterville neighborhood.

The owner hopes to interest developers in building a high-rise there as part of Cityfront Center, a multibillion-dollar commercial and residential complex.

But first, Chicago Dock and Canal Trust must deal with a legacy of the past—radioactive debris that's buried beneath the lot from a defunct lantern factory.

Levels of radioactivity at the surface aren't high enough to endanger motorists, parking lot attendants or neighbors, the Environmental Protection Agency says. But the agency is requiring Chicago Dock and Canal to do a study of radioactive levels below the asphalt.

The lot is on East Illinois between Columbus and McClurg.

If it's ever developed, contractors might dig up "potentially contaminated soils," the EPA said. This could "cause increased releases into the environment and human exposure to contaminants."

An attorney for Chicago Dock and Canal said there's no health risk and the company is voluntarily cooperating with the EPA to conduct the study.

Records indicate the defunct Lindsay Light Co. used a building that once stood on the parking lot. The firm made mantles for gas lanterns. The mantles contained thorium, a radioactive metal.

In 1936, Lindsay Light moved to suburban West Chicago, where low-level radioactive thorium waste has been left all over town. Kerr-McGee, a successor company to Lindsay Light, has agreed to clean up the suburban waste.

At the Chicago parking lot, EPA readings taken last summer showed radioactivity levels as much as 14 times as high as background radioactivity in the area.

SUN-TIMES

A motorist who parked in the lot five times a week, 50 weeks a year in the spot with the highest radioactivity would receive about 7 millirems of radiation per year, said EPA radiation expert Larry Jensen. By comparison, a chest X-ray is about 15 millirems.

Lindsay Light also operated in a four-story loft building at 161 E. Grand. EPA measurements taken last summer show that some radioactivity remains in the building, which is leased to studios and other businesses.

The EPA says it doesn't have authority to regulate the inside of the building, and has referred the matter to the Occupational Safety and Health Administration.

Years ago, workers sanded spots on the floor where radioactive liquid had dripped, said building manager Ron Steele. Last year, the floor in one room was replaced.

"Our people in the building are fully informed," Steele said.

Paul Charp, a health physicist with the U.S. Public Health Service, said only corner spots might be hazardous.

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

REPLY TO THE ATTENTION OF:

HSE3-5J

OCT 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	[illegible]	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 Varneta 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

16 E. Grand Associa 1

161 E. Grand
Chicago, IL 60611
(312) 644-6112

DATE: Sept 22, 1993

NUMBER OF PAGES INCLUDING THIS ONE: 13

FAX TO: Ely Port (Radiation Safety Services)

FAX #: 708-965-1991

FROM: Ron Steele, Manager

FAX #: 312-467-0867

If there is a problem with this fax, contact Ron Steele at (312) 467-5440. 5440 Home 366-1222

COMMENTS:

DOSIMETER READINGS

Draft

(MREM/EXPOSURE PERIOD)

	TLD NUMBER	TLD #1	TLD #2	TLD #3	TLD #4	TLD #5	MEAN
161 E. GRAND	.....	.....	.....	.....	.....	.....	.....
EXPOSED (7/2-8/2, 1993)	9021	3280	3224	3253	3334	2921	3202.4
	9022	182	245	208	226	190	210.2
	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

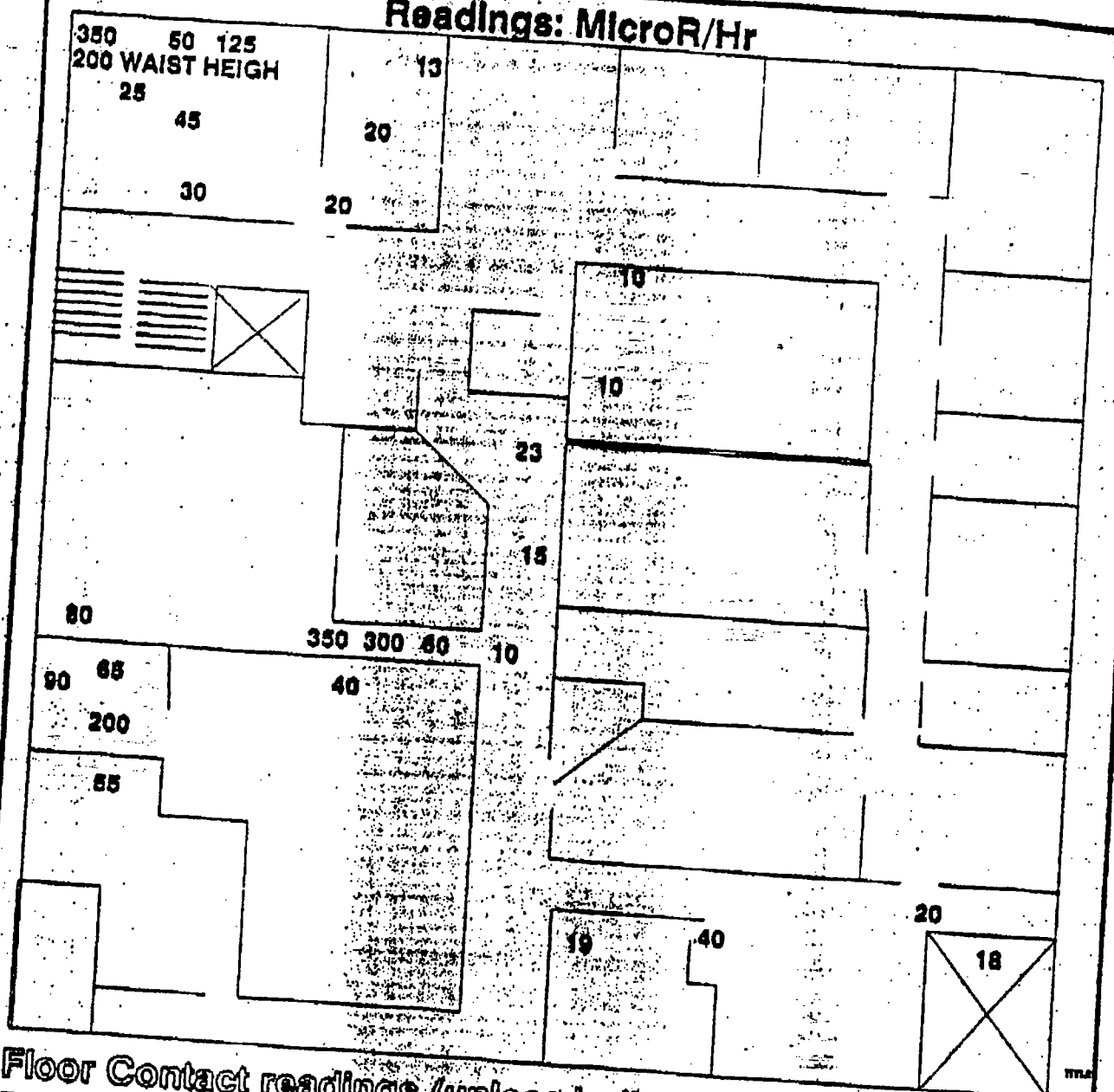
LINDSAY LIGHT COMPANY RELATED DOSE READINGS

	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	.....	.....	.....	.....	.....	.....
EXPOSED (7/2-8/2, 1993)	9021	4.28929	171.6	8578.6	5.3E-03	2.7E-01
	9022	0.26751	10.7	535.0	3.3E-04	1.7E-02
	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



Floor Contact readings (unless indicated differently)

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

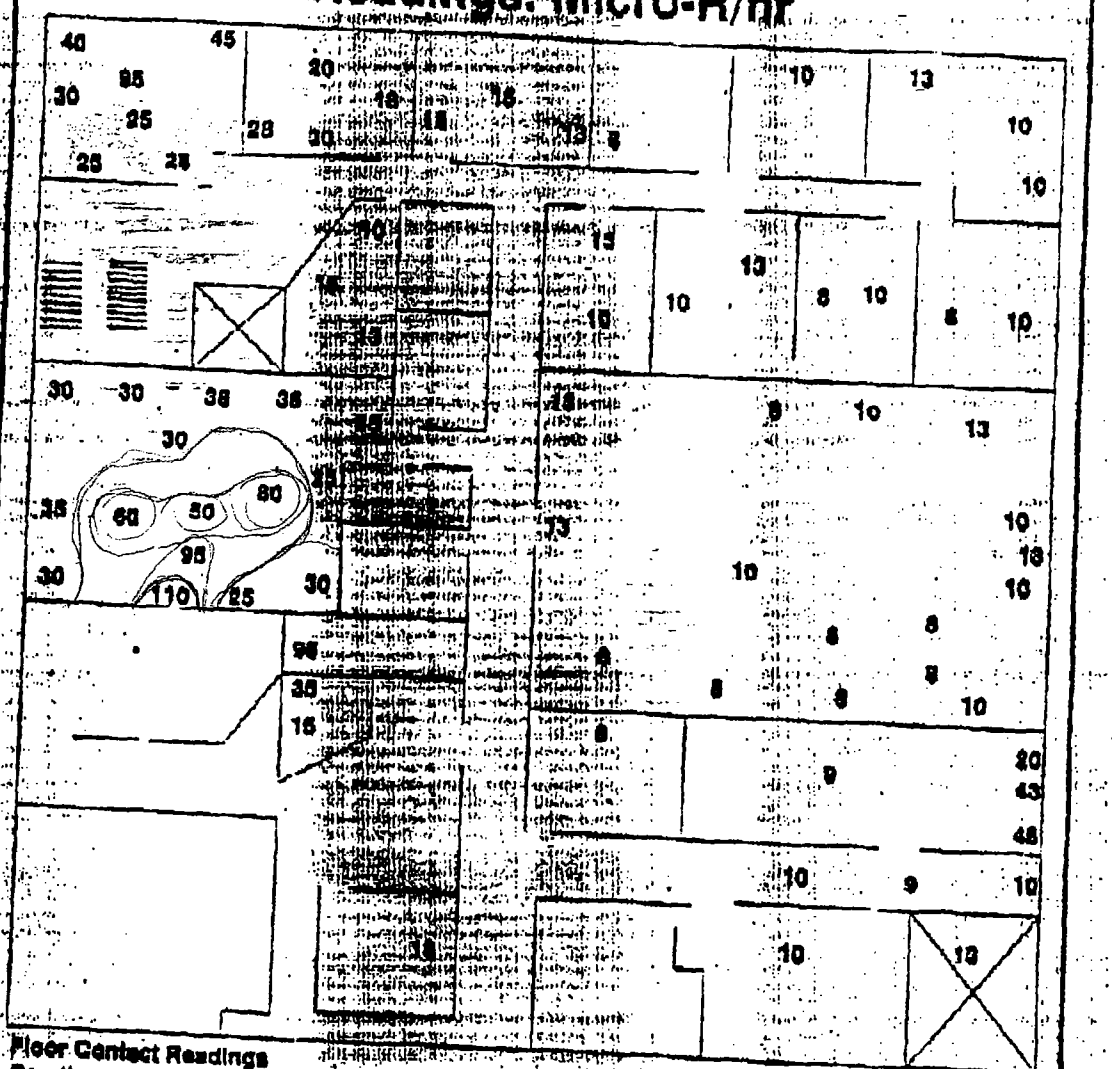
LEGEND

N

ecology and environment, inc.
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

Readings: Micro-R/hr



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

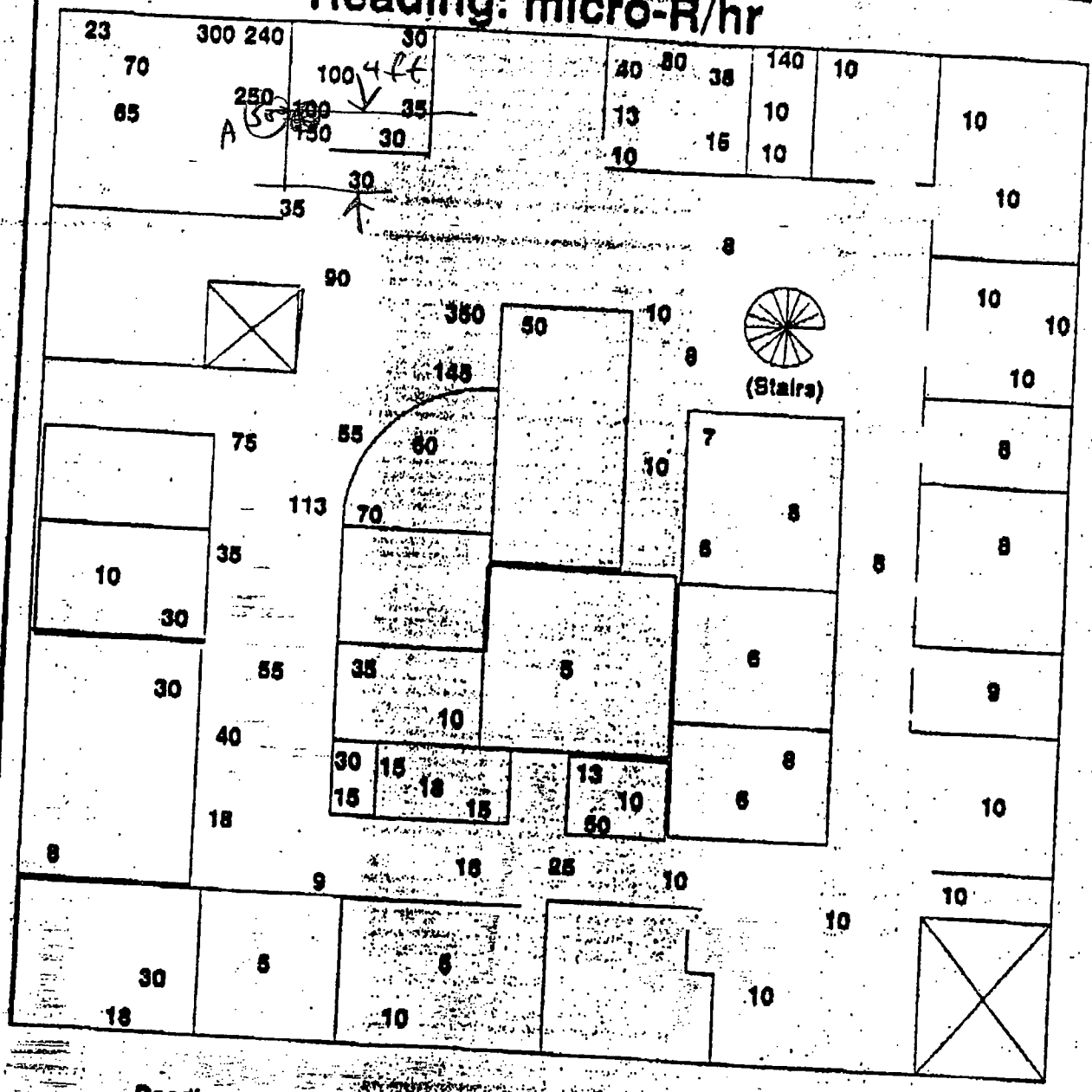
LEGEND

ecology and environment, inc.
Technical Assistance Team
Region V

[illegible] 3rd Floor (Optumus)	Figure 3
[illegible] Company	T05-9305-014
STATE IL	Not to Scale
Instrument: Ludlum Model 19	July 16, 1993

at outlet 500 floor west 120
floor 4.20 west 80

Reading: micro-R/hr

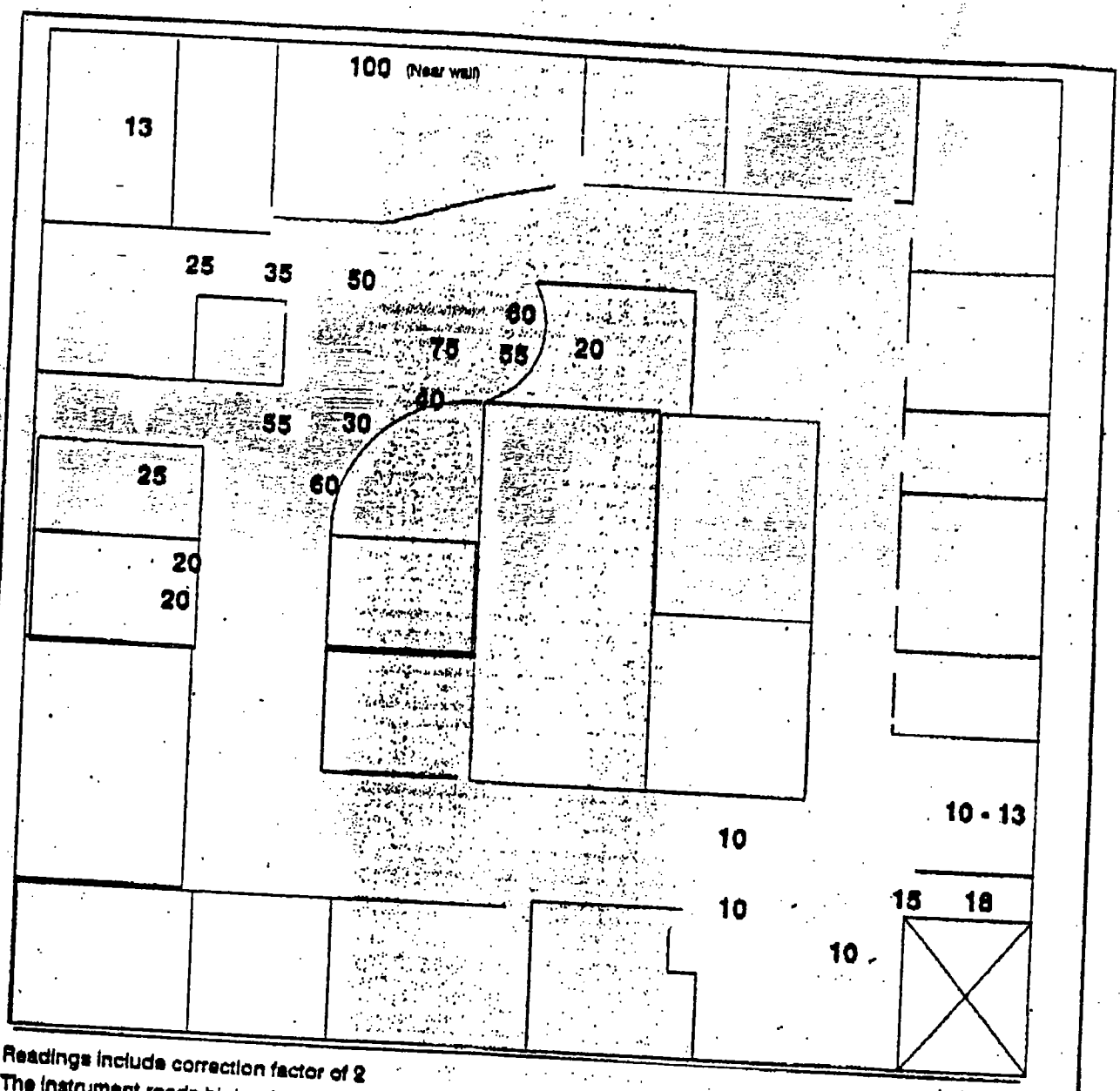


Readings include correction factor
The instrument reads higher by a factor of 2

N

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 Instrument: Ludlum Model 19	DATE July 16, 1993
	REVISED



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

LEGEND

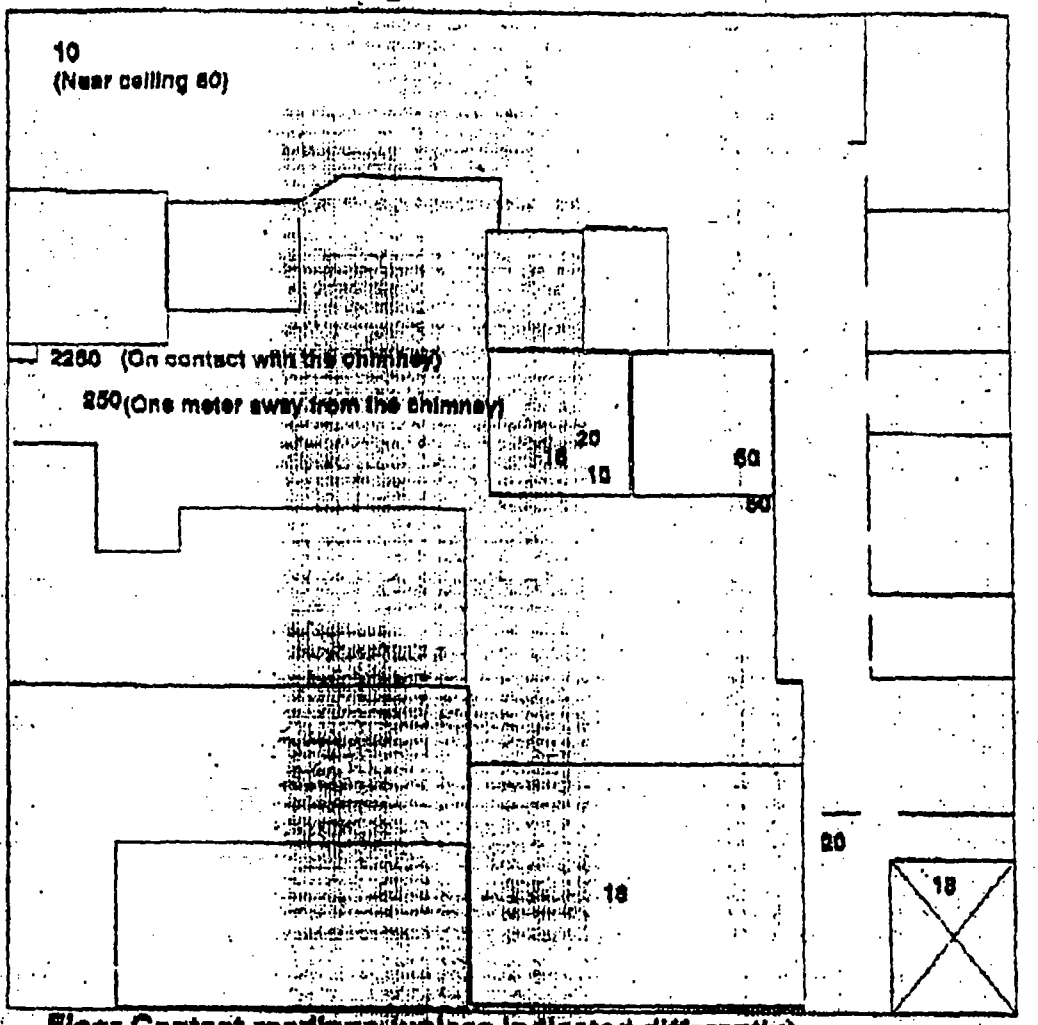
N

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	PAN: Not to Scale
SOURCE: Instrument: Ludlum Model 19	DATE:
	REVISED:

Readings: Micro-R/hr

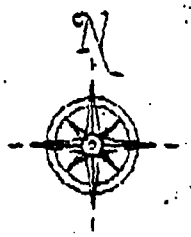


Floor Contact readings (unless indicated differently)

Readings include the correction factor

The instrument reads higher by a factor of 2

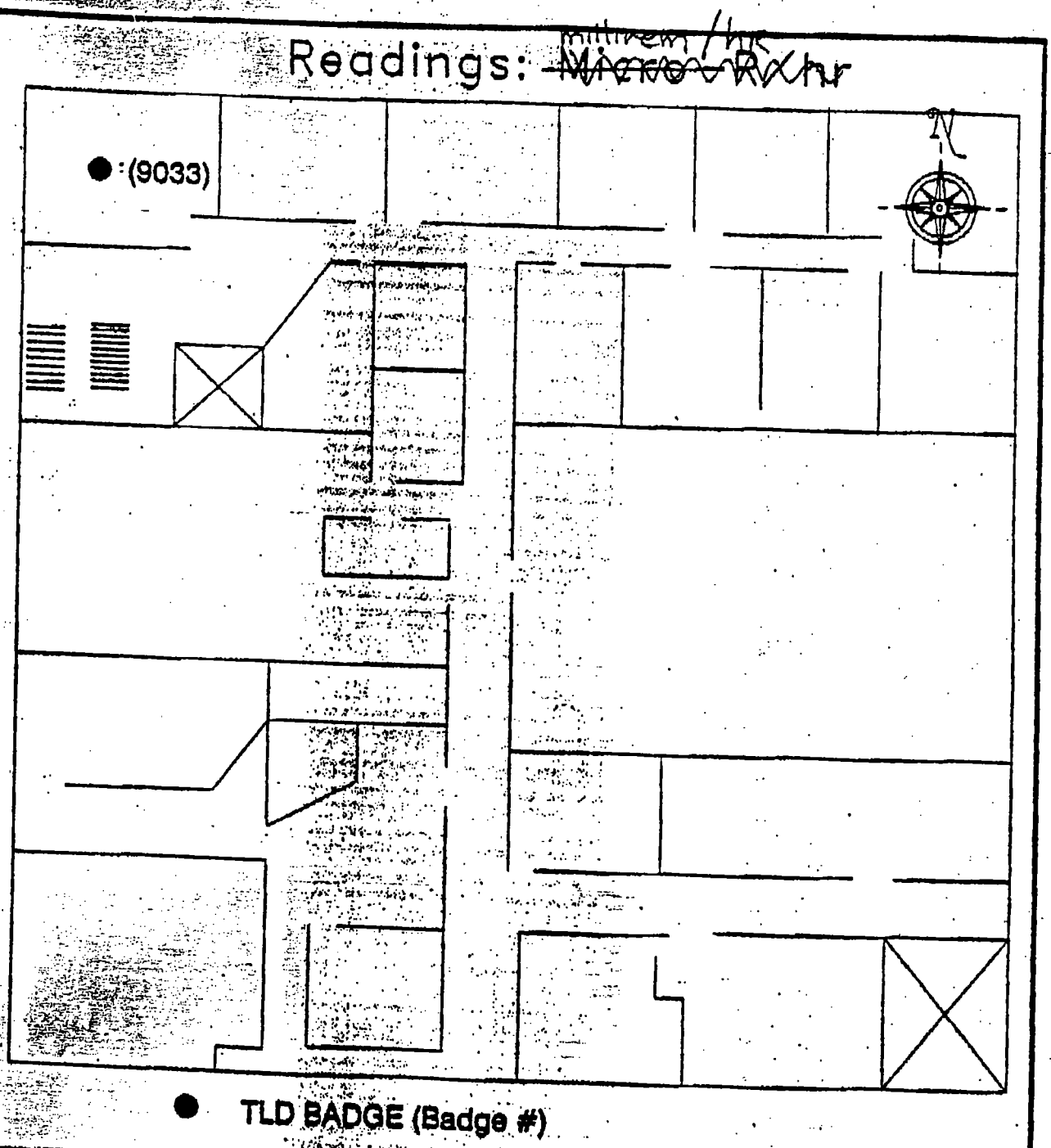
LEGEND



ecology and environment, inc.

Technical Assistance Team
Region V

[illegible] Basement (Optumus)	Figure 6
[illegible] Company	T05-8305-014
Chicago, IL	Not to Scale
Instrument: Ludlum Model 19	July 16, 1993



LEGEND

TLD RESULTS

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

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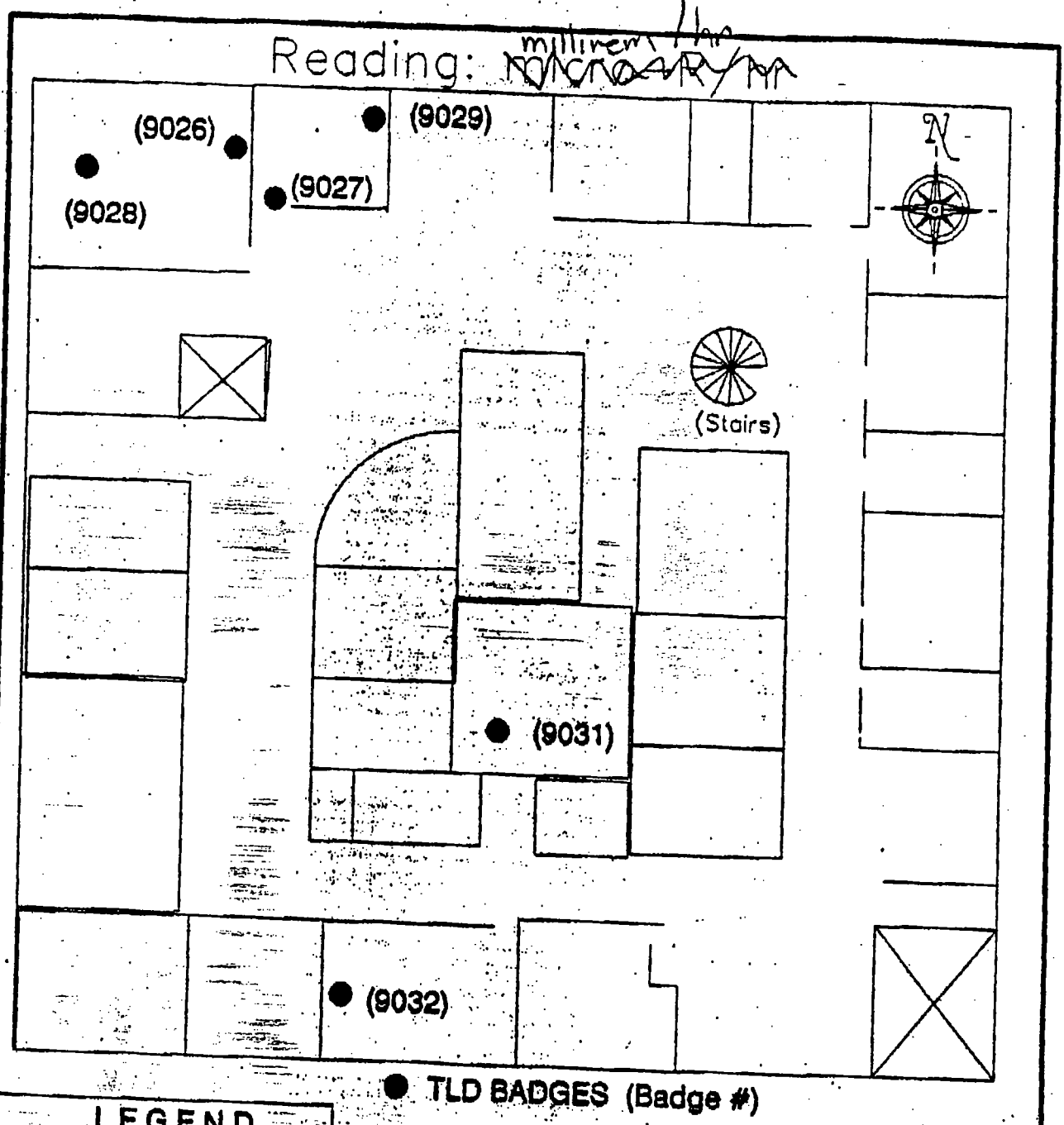
Technical Assistance Team
Region V

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



LEGEND
TLD RESULTS

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

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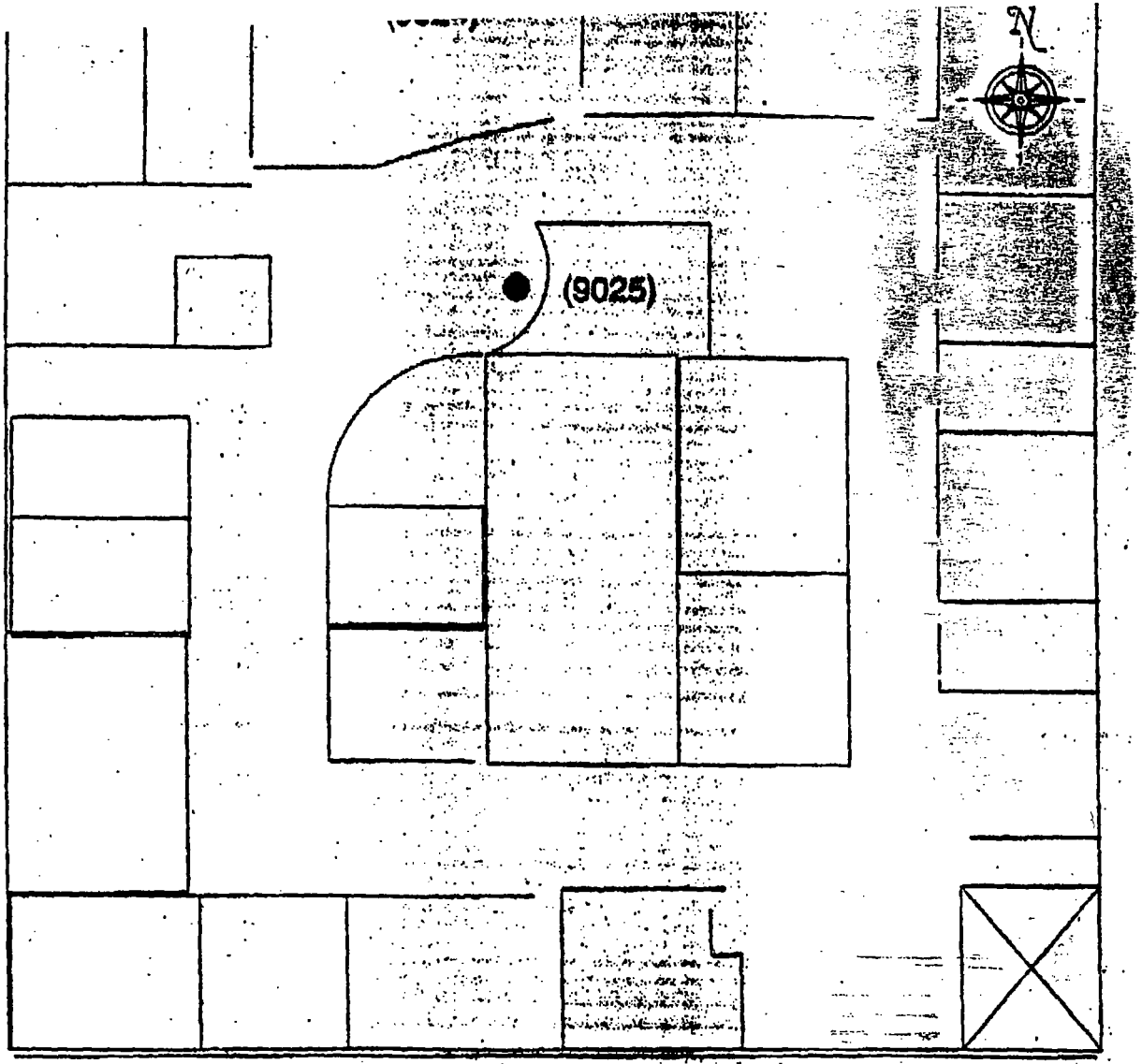
Technical Assistance Team
Region V

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



● TLD Badge (Badge #)

LEGEND

TLD Results

Readings: ~~MicroR~~ mrem/Hr

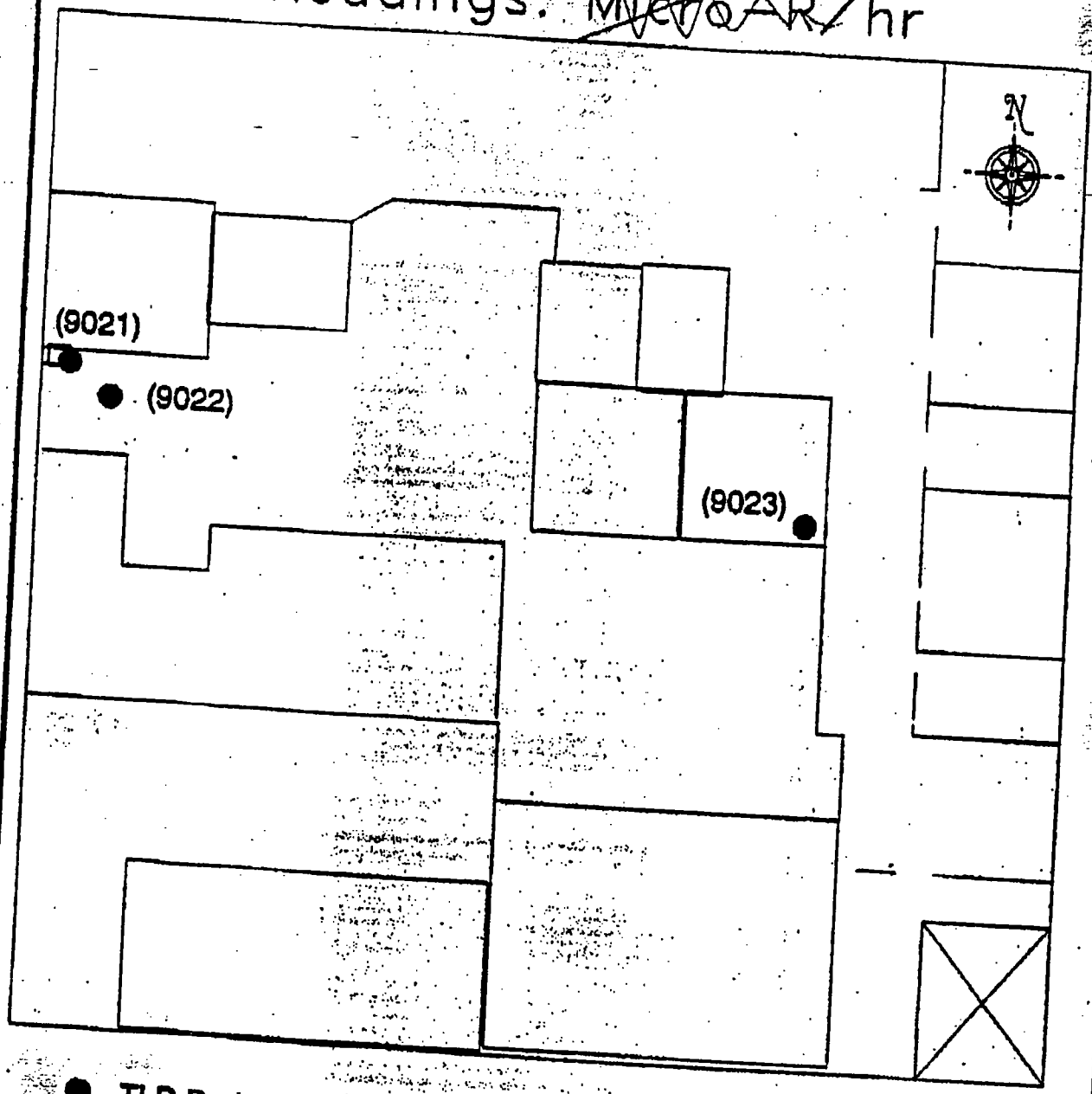
(9024) = 0.034 ~~µR~~ mrem/hr

(9025) = 0.037 ~~µR~~ mrem/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	PAN: Not to Scale
SOURCE:	DATE:
	REVISED:

Readings: ~~MicroR~~ millirem/hr



● 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
DRAWING:	DATE: July 16, 1993
	REVISED:

A")R Record of Activity

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

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

RCLIS #: ____ Cost Recovery #: 60YL Region: V

te 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

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

Contacts and Affilation

) ____ ( ) ____
) ____ ( ) ____

-EPA	2-USCG	3-OTHER FED	4-STATE ENV	5-STATE HLT
-COUNTY HLTH	7-CITY HLTH	8-HOSPITAL	9-LAW ENFORCE	10-FIRE DEPT
1-POISON CTR	12-PRIV CITZ	13-OTHER	14-UNKNOWN	15-DOD
-DOE	17-NOAA	18-OTHR STATE	19-OTHR COUNTY	20-OTHR CITY
-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
-ATSDR				

ealth Assessment _ Health Studies _ Tox Info-profile _ Worker Hlth
etition Assessment _ Health Surveilnc _ Tox Info-Nonprofil _ Admin
Emergency Response _ Disease Regstry _ Subst-Spec Resch _ Other
ealth Consultation _ Exposr Regstry _ Health Education

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

Action 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

EXPOSURE PERIOD 31 DAYS

DOSIMETER READINGS (MREM/EXPOSURE PERIOD)

Draft

	TLD NUMBER	TLD #1	TLD #2	TLD #3	TLD #4	TLD #5	MEAN
161 E. GRAND	.....	.....	.....	.....	.....	.....	.....
EXPOSED (7/2-8/2, 1993)	9021	3280	3224	3253	3334	2921	3202.4
	9022	182	245	208	226	190	210.2
	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

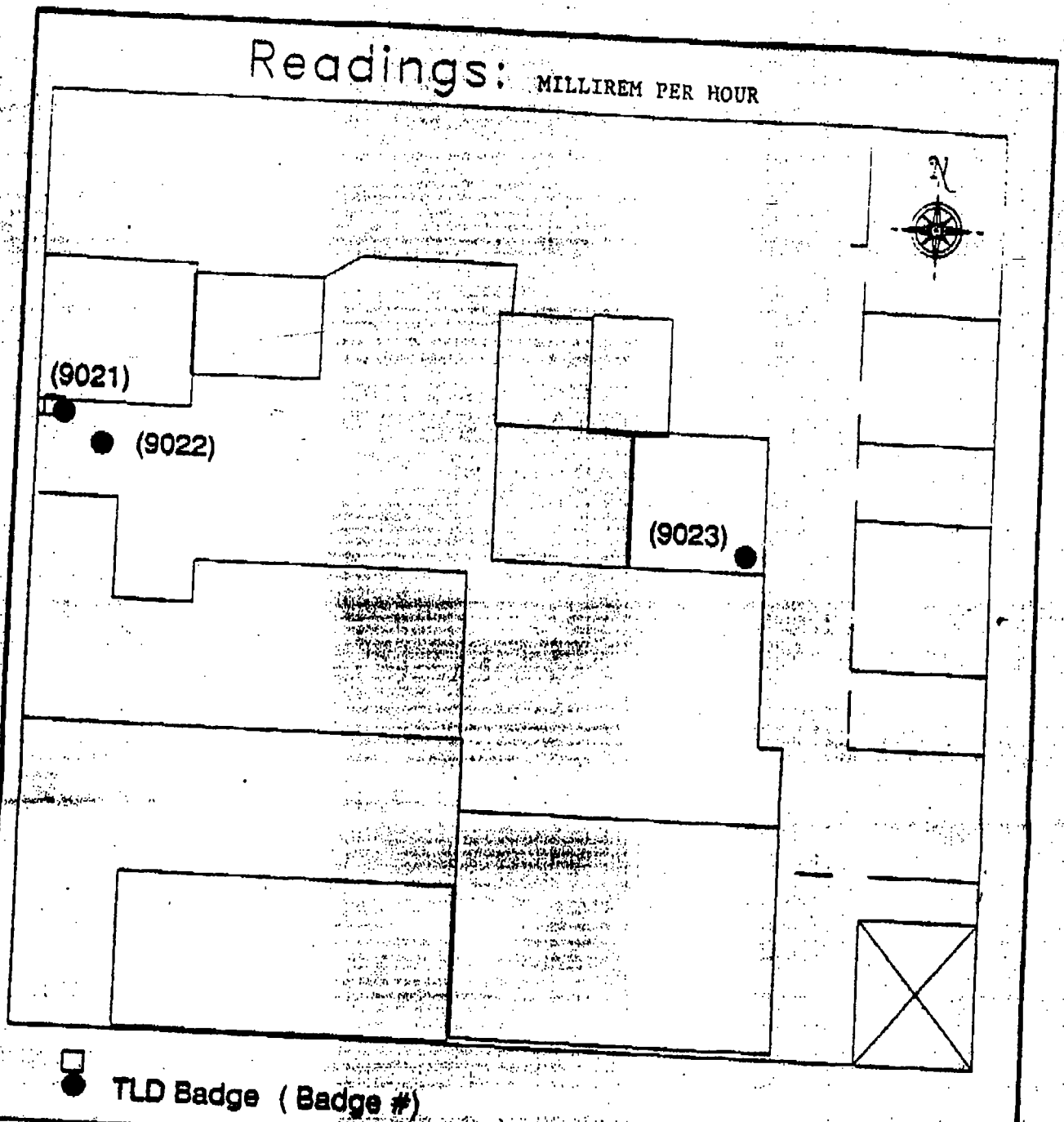
LINDSAY LIGHT COMPANY RELATED DOSE READINGS

	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	.....	.....	.....	.....	.....	.....
EXPOSED (7/2-8/2, 1993)	9021	4.28929	171.6	8578.6	5.3E-03	2.7E-01
	9022	0.26751	10.7	535.0	3.3E-04	1.7E-02
	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
SITE BACKGROUND	9029	0.03875	1.6	77.5	4.8E-05	2.4E-03
	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



LEGEND

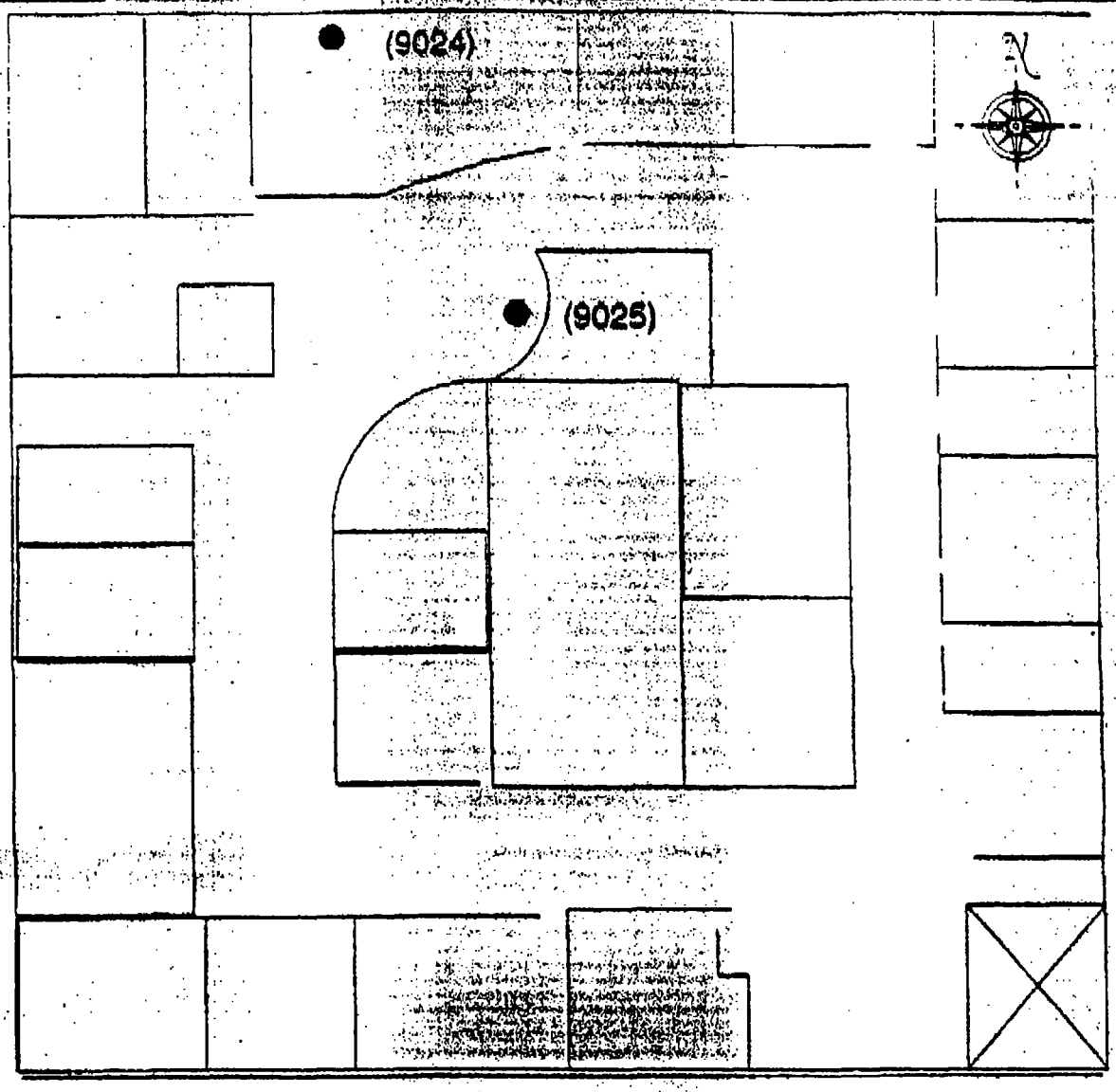
TLD EXPOSURE RESULTS

(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	TEDD T05-9305-014
CITY Chicago STATE IL	SCALE Not to Scale
	DATE July 16, 1993



● TLD Badge (Badge #)

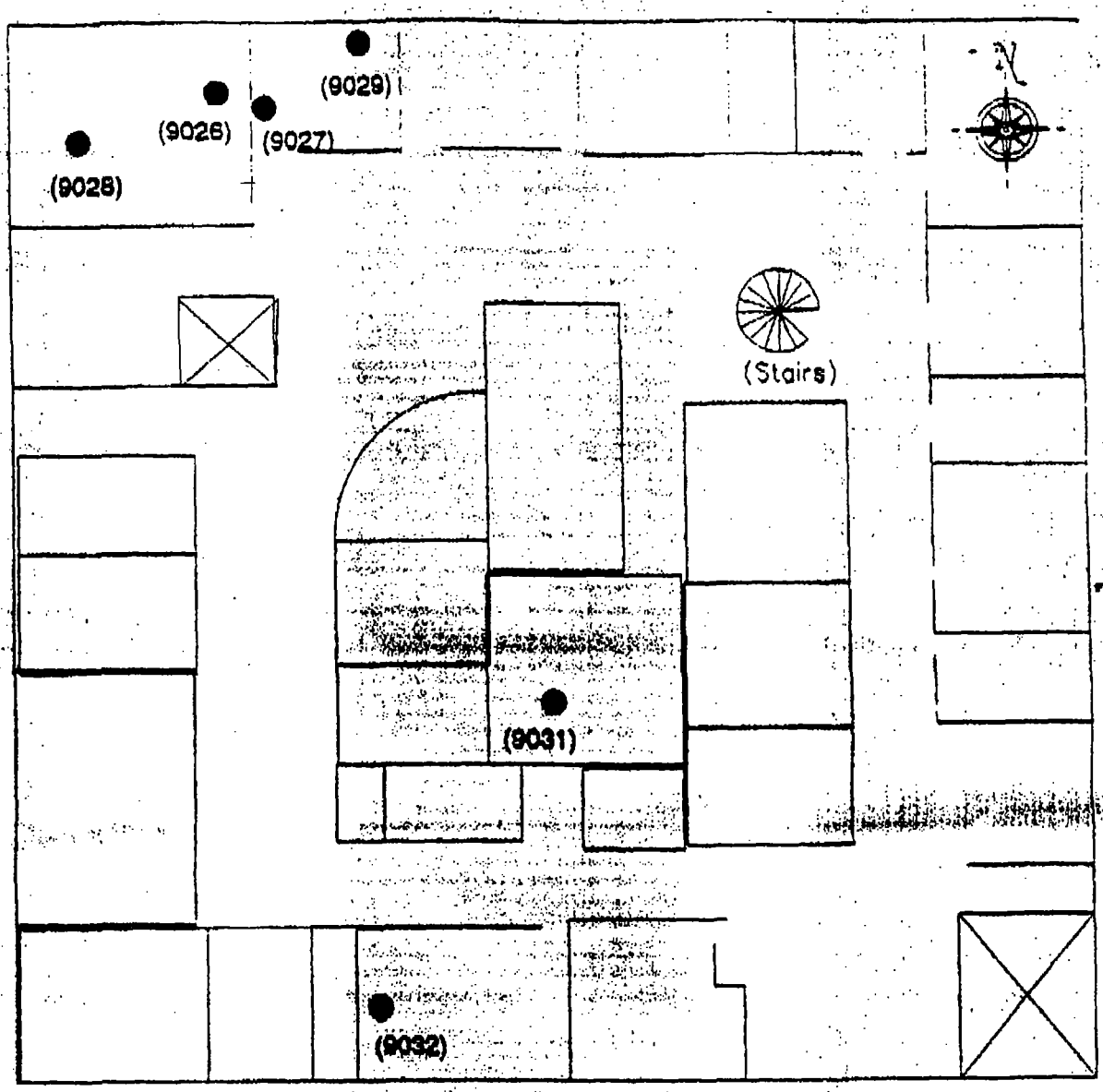
LEGEND

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: Lindsey Light Co.	SCALE: T05-0305-014
CITY: Chicago STATE: IL	PAN: Not to Scale
SOURCE:	DATE:
	REVISED:



● TLD Badge (Badge #)

LEGEND

TLD Results

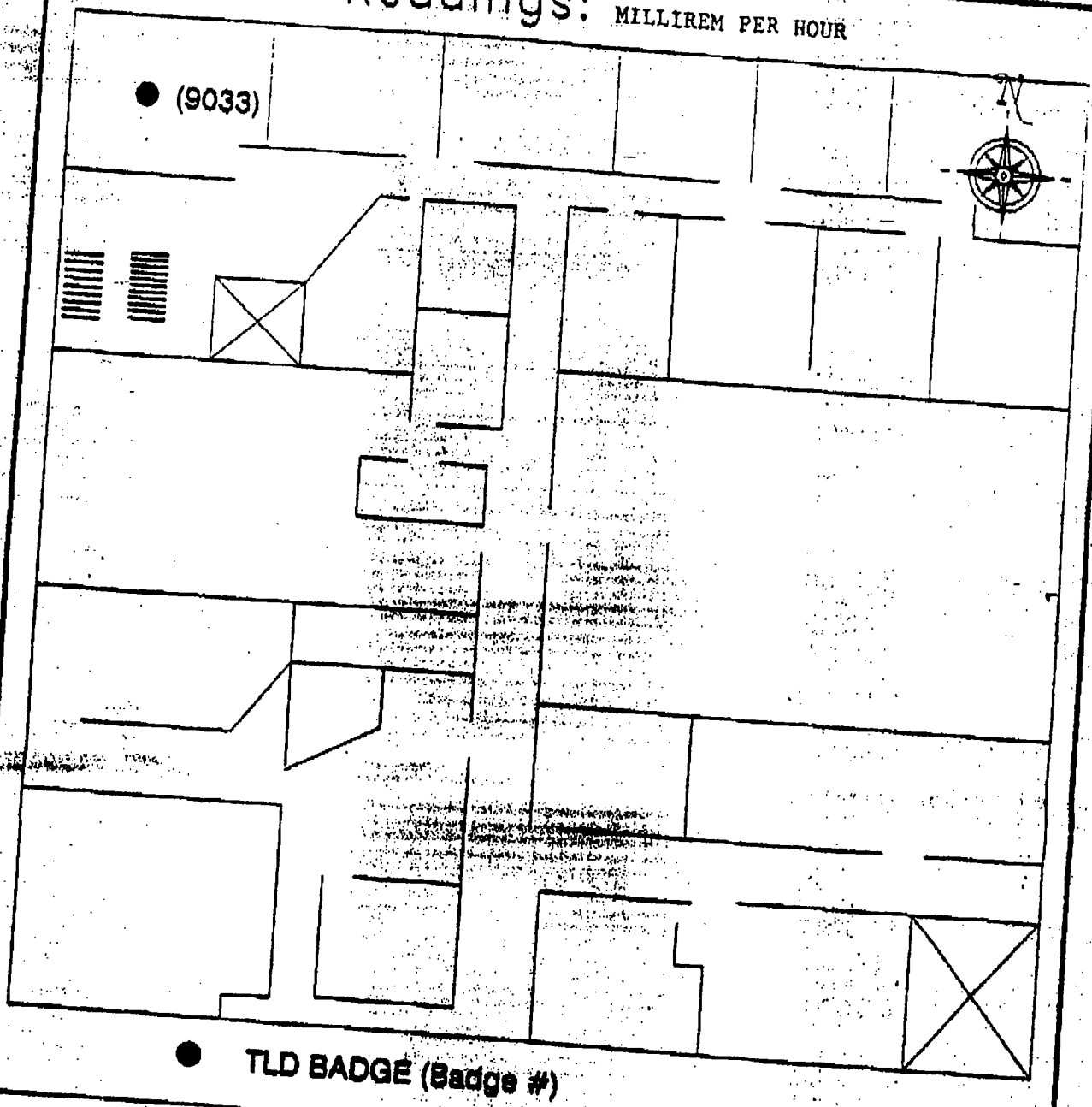
Reading: millirem per hour

(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, 199 REVISED



LEGEND

TLD RESULTS

(9033)=0.03096 mrem/hr

EPA U.S. EPA REGION V

EMERGENCY AND ENFORCEMENT RESPONSE BRANCH

161 E. Grand 3rd Floor (Optumus)	Figure 4
Lindsay Light Company	T05-9305-014
Chicago IL	Not to Scale
	July 16, 1993

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

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 Affiliation

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

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 Surveilnc _ Tox Info-Nonprofil _ Admin
_X Emergency Response _ Disease Registry _ Subst-Spec Resch _ Other
_ Health Consultation _ Exposr Registry _ Health Education

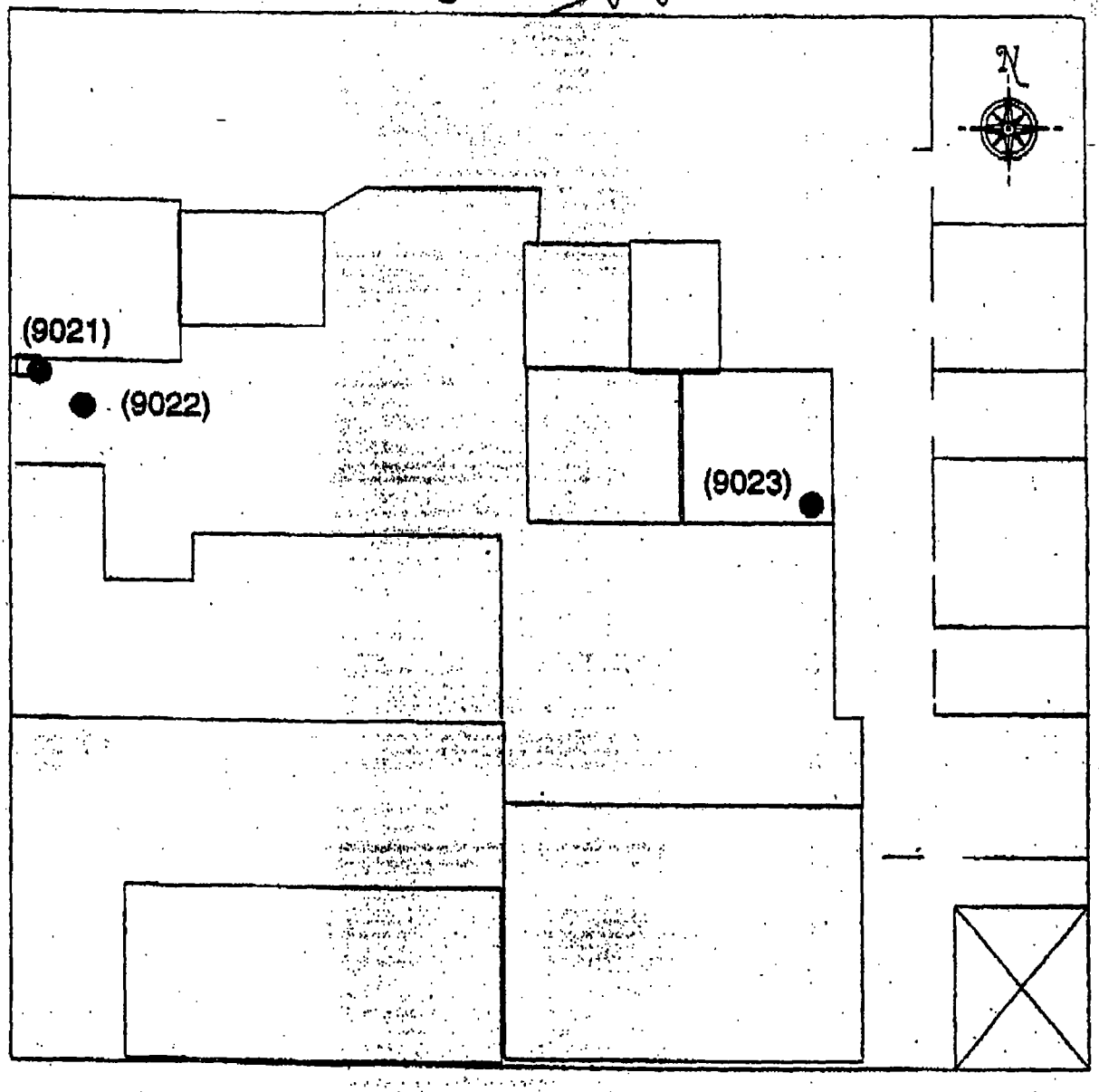
Narrative Summary: As a follow-up to the site visit to Lindsey Light, EPA has supplied the results of the TLD monitoring at several locations around the city of Chicago that may have radiological contamination. The TLD results were supplied as a function of exposure per week (24 hour exposure). To equate 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 Williams for Paul A. Charp, Ph.D. Date: September 14, 1993

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

Readings: ~~MicroR~~ millirem/hr



● 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

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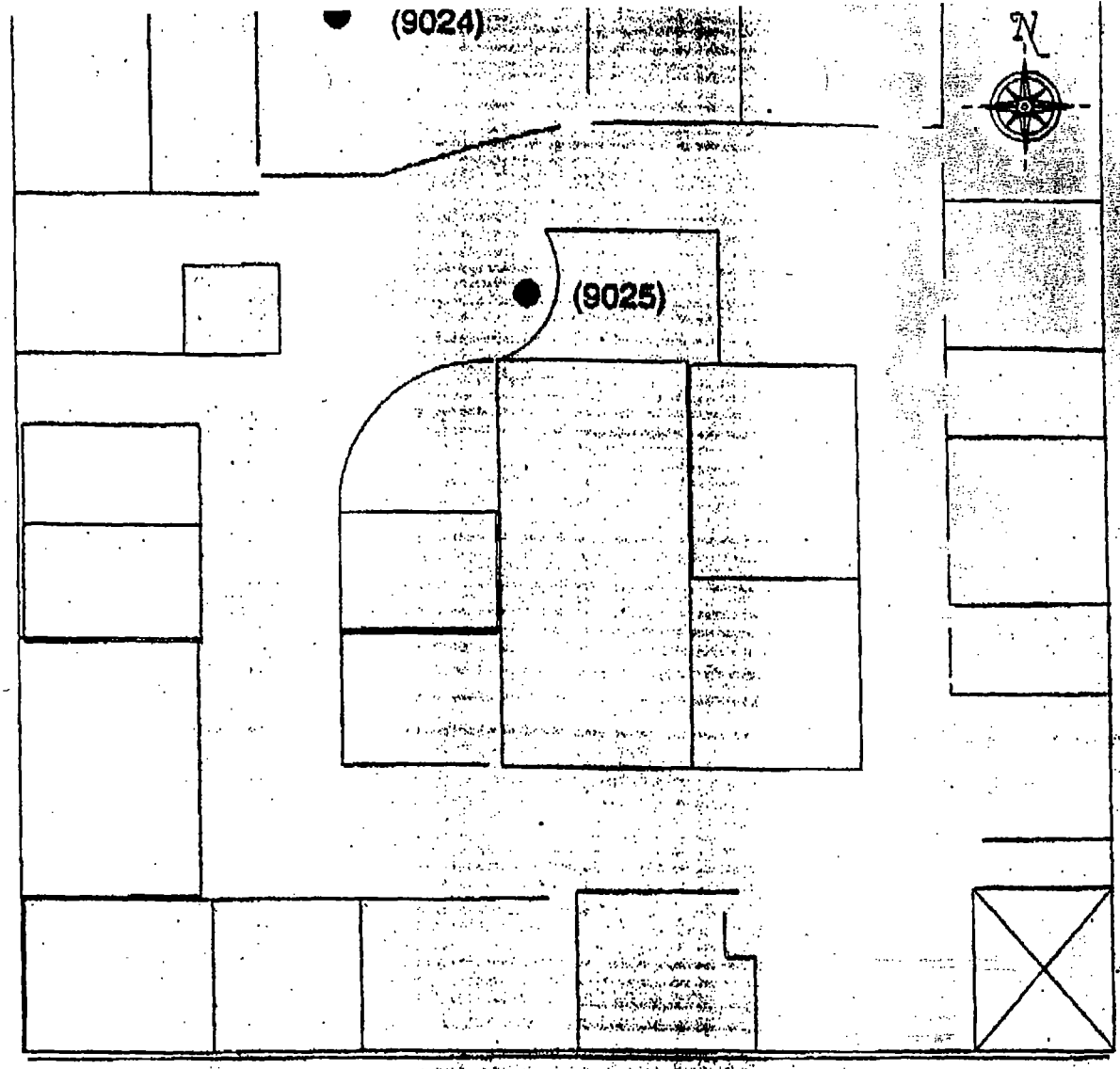
TITLE: 161 E. Grand Ave. Basement (Optumus)	FIGURE: Figure 6
SITE: Lindsay Light Company	TDD: T05-9305-014
CITY: Chicago STATE: IL	SCALE: Not to Scale
	DATE: July 16, 199



● TLD Badge (Badge #)

LEGEND

TLD Results

Readings: ~~MicroR~~ mrem/Hr

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

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

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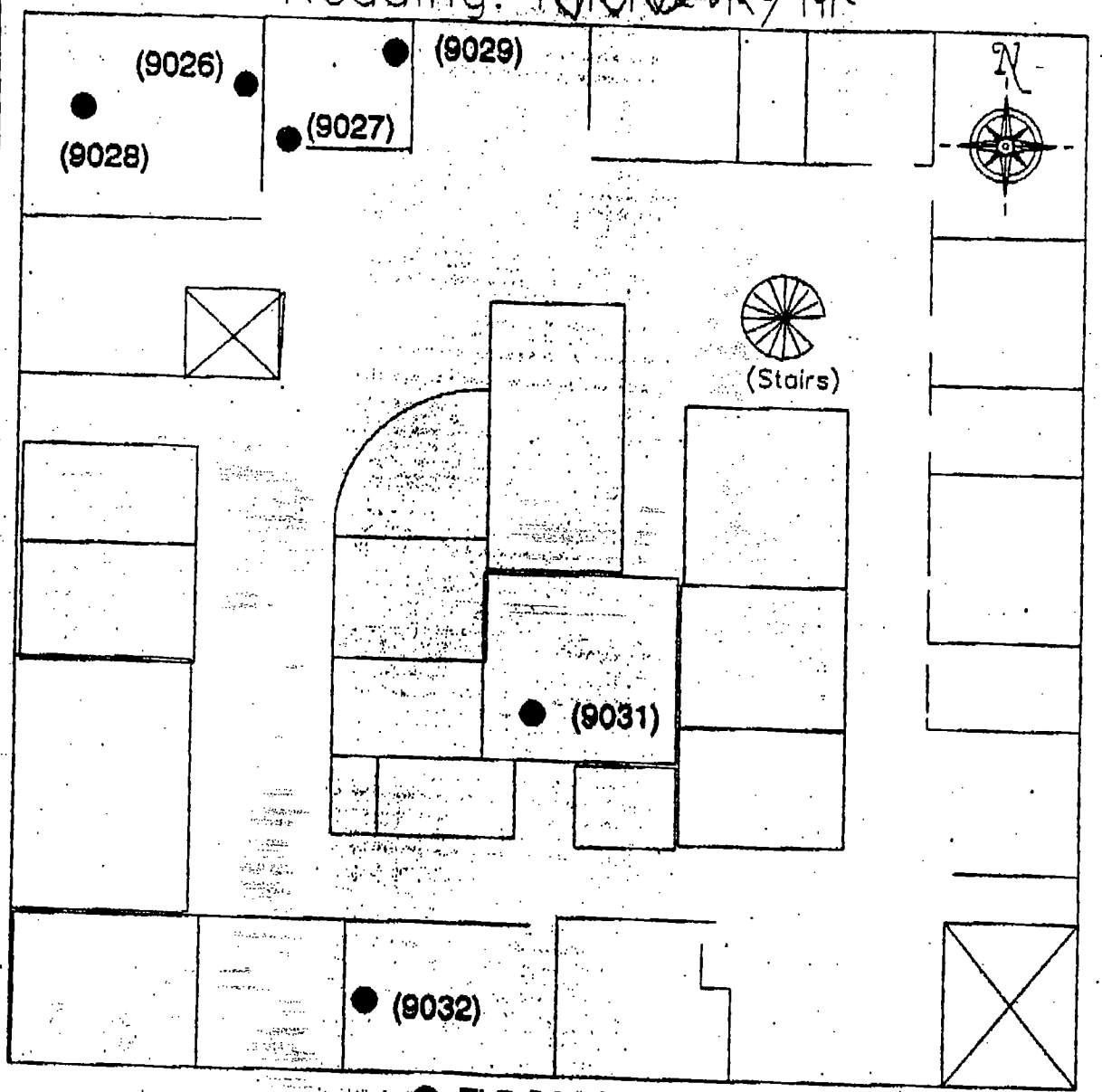
TITLE: 161 E. Grand Ave. 1st Floor Readings Optumus	FIGURE #: Figure 5
SITE: Lindsay Light Co.	SCALE: T05-9305-014
CITY: Chicago STATE: IL	PAN: Not to Scale
SOURCE:	DATE:
	REVISED:

Reading: ~~microR/hr~~ millirem/hr



● TLD BADGES (Badge #)

LEGEND
TLD RESULTS

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

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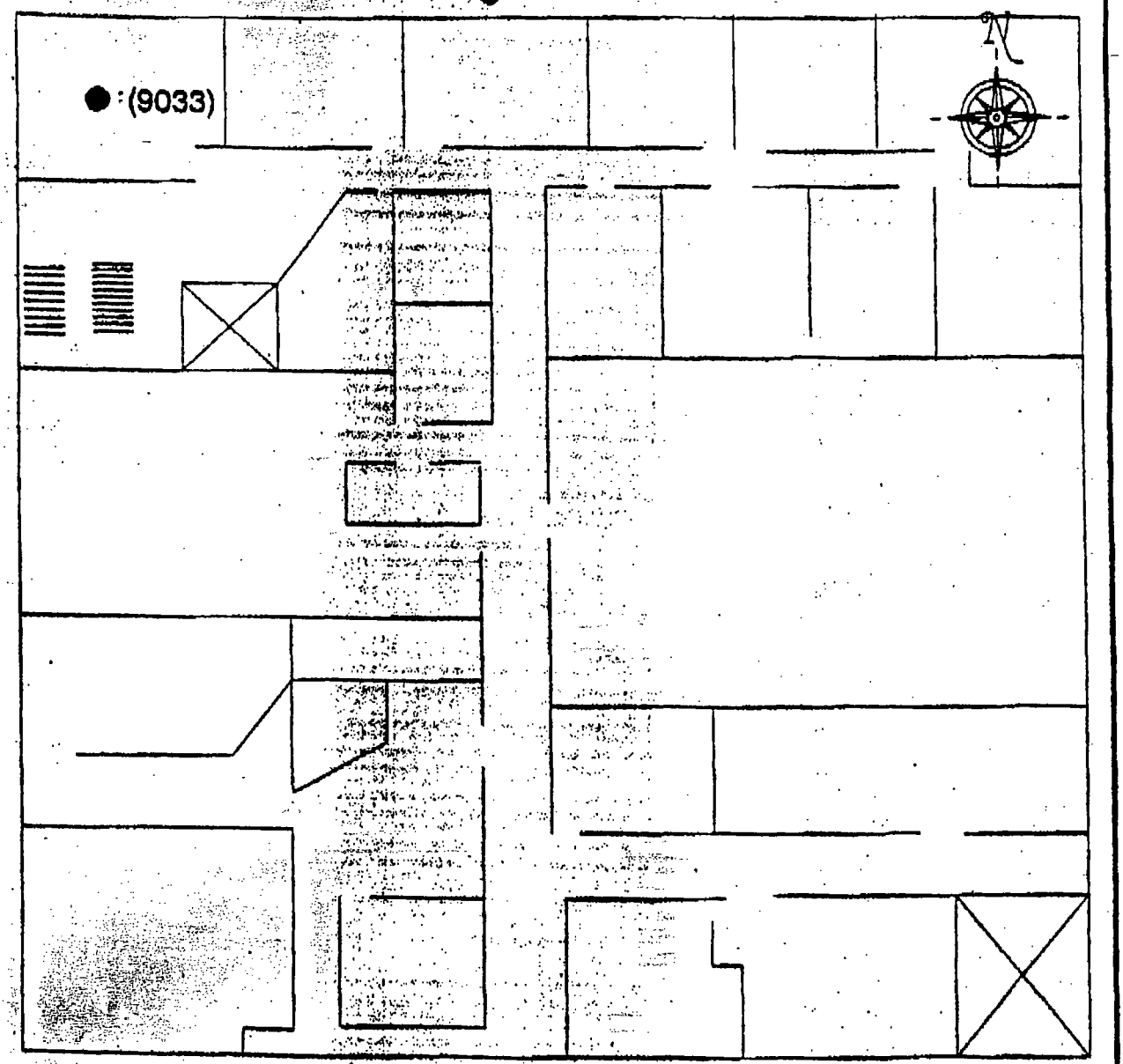
TITLE 161 E. Grand Ave. 2nd Floor (Optumus)	FIGURE # Figure 2
SITE Lindsay Light Company	TOD # T05-9305-014
CITY Chicago STATE IL	SCALE Not to Scale
SOURCE	DATE July 16, 199
	REVISED

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



● TLD BADGE (Badge #)

LEGEND

TLD RESULTS

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

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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

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 Gass 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

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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

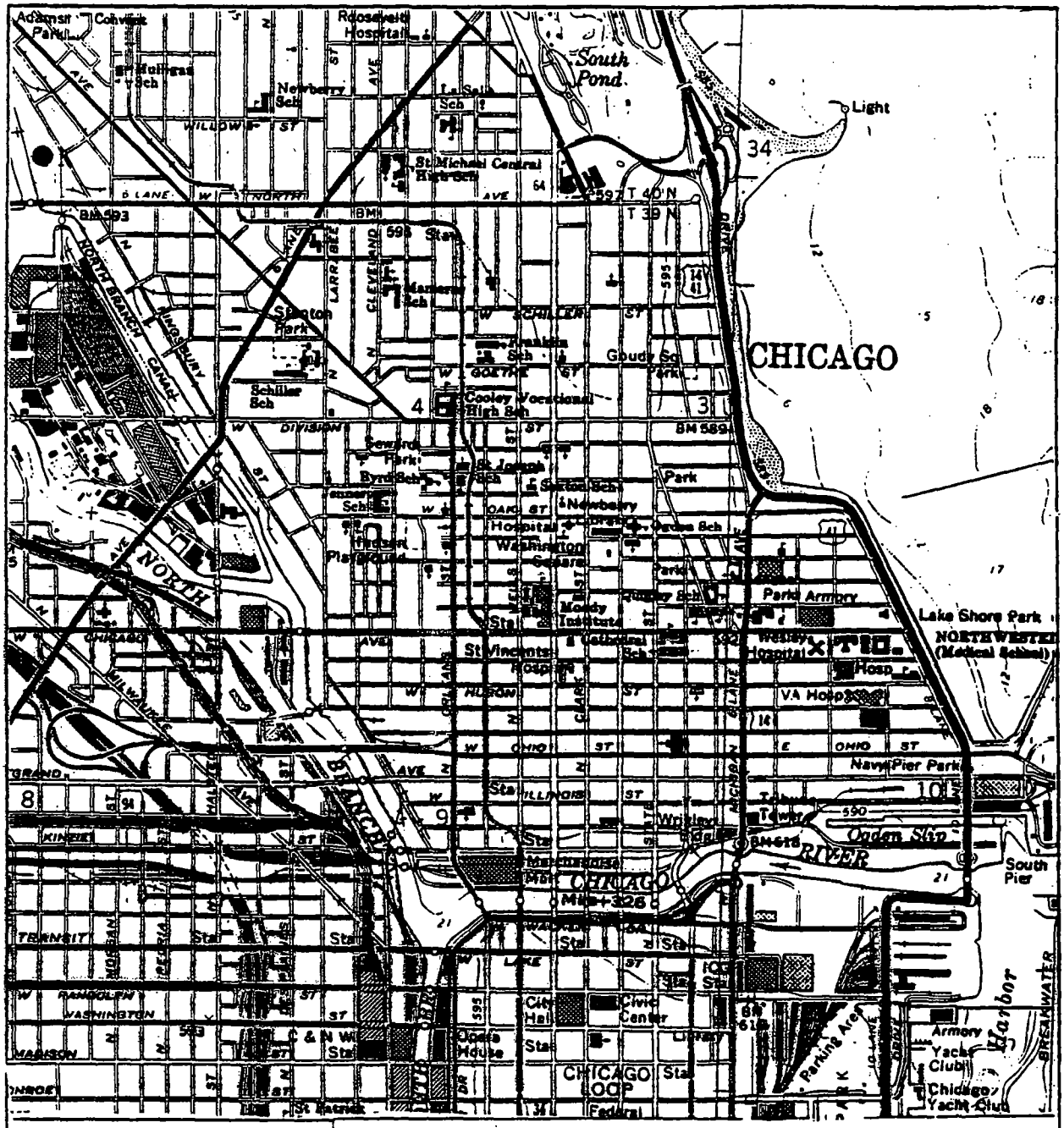
The Lindsay Light Company manufactured incandescent gas mantles for home and street lighting in this building from at least 1910 until 1936. Lindsay Light moved to West Chicago and was later purchased by American Potash, which was later purchased by Kerr McGee Chemical Company in 1967. The principal 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.

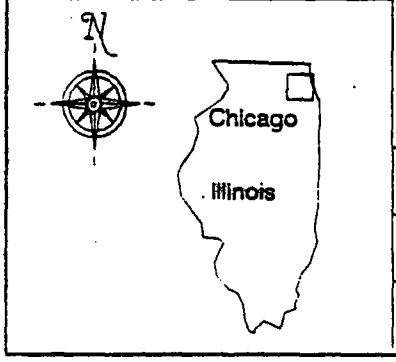
In August of 1981, The building owners attempted to decontaminate part of the second and fourth floor. The building owners hired Radiation Safety Services (RSSI) to determine the contaminated areas. RSSI identified areas of gamma dose rate at one meter above the floor in the building. Any readings above 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.





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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.

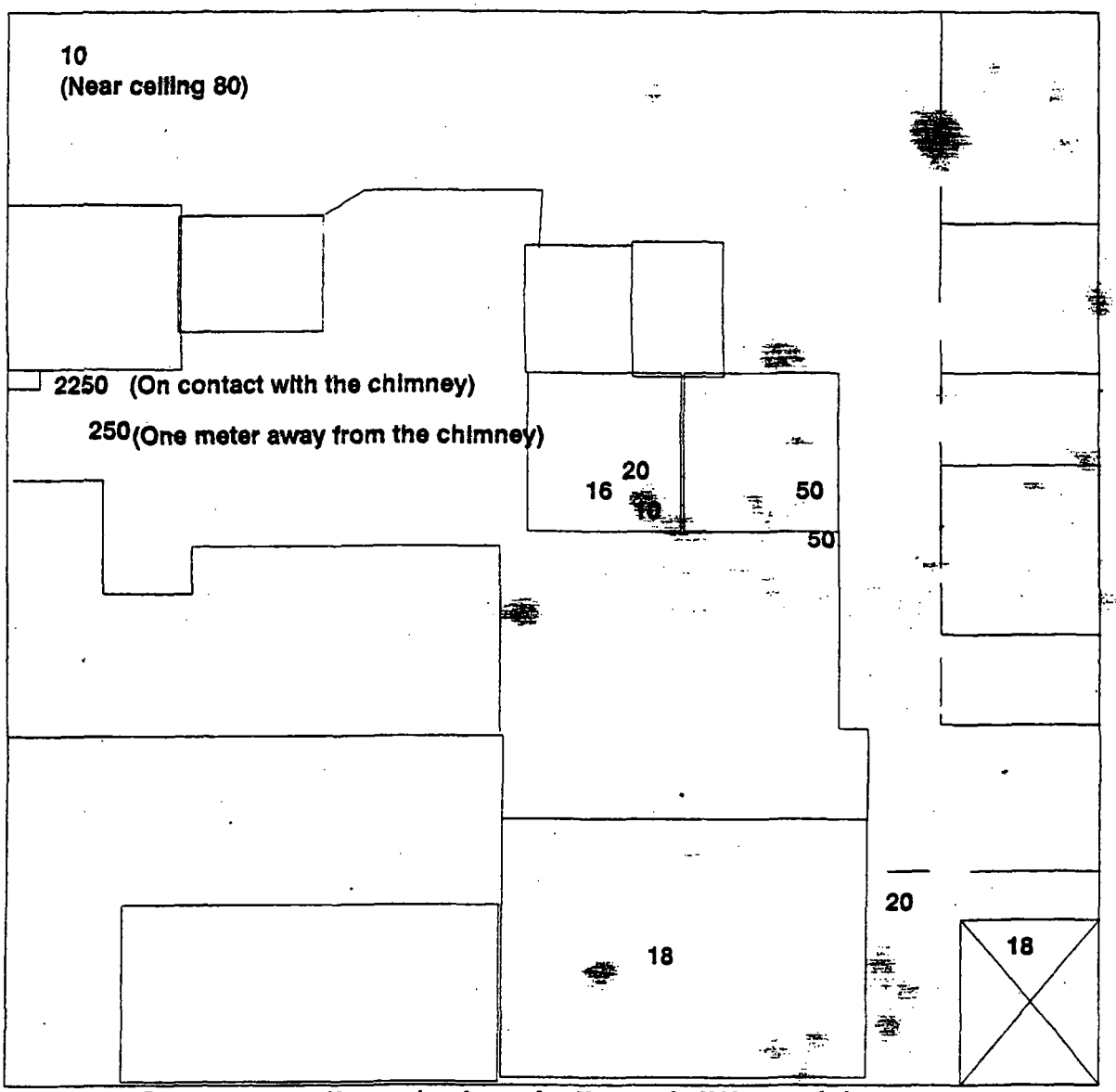
Due to the contaminant of concern, one may be exposed to radioactive isotopes and the effects may occur many years after exposure. Thorium occurs principally as the parent radionuclide thorium-232 in association with its daughter products in a decay sequence known as the Thorium Decay Series. Thorium-232 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

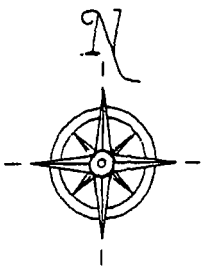


Floor Contact readings (unless indicated differently)

Readings include the correction factor

The instrument reads higher by a factor of 2

LEGEND



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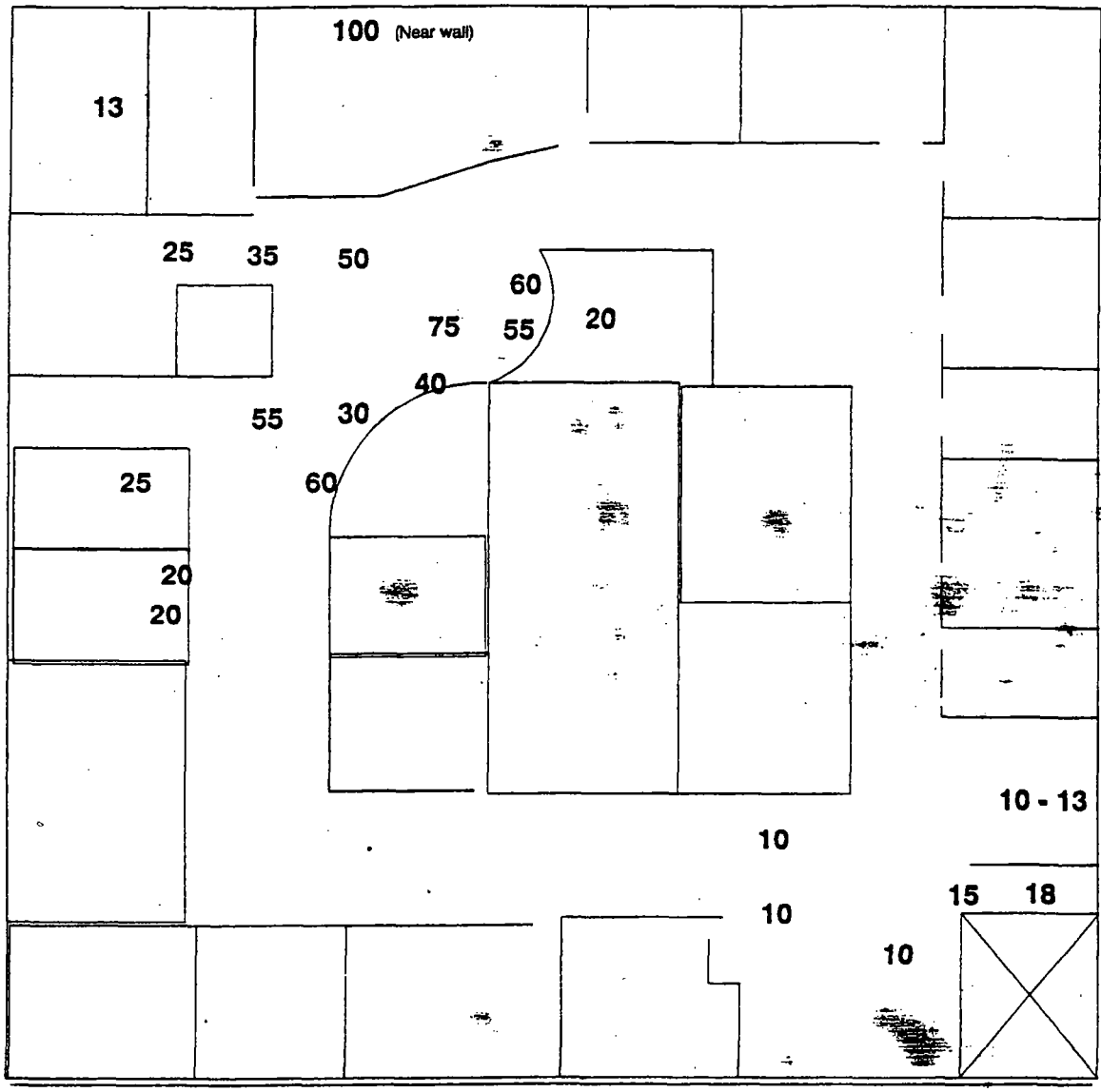
Region V

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

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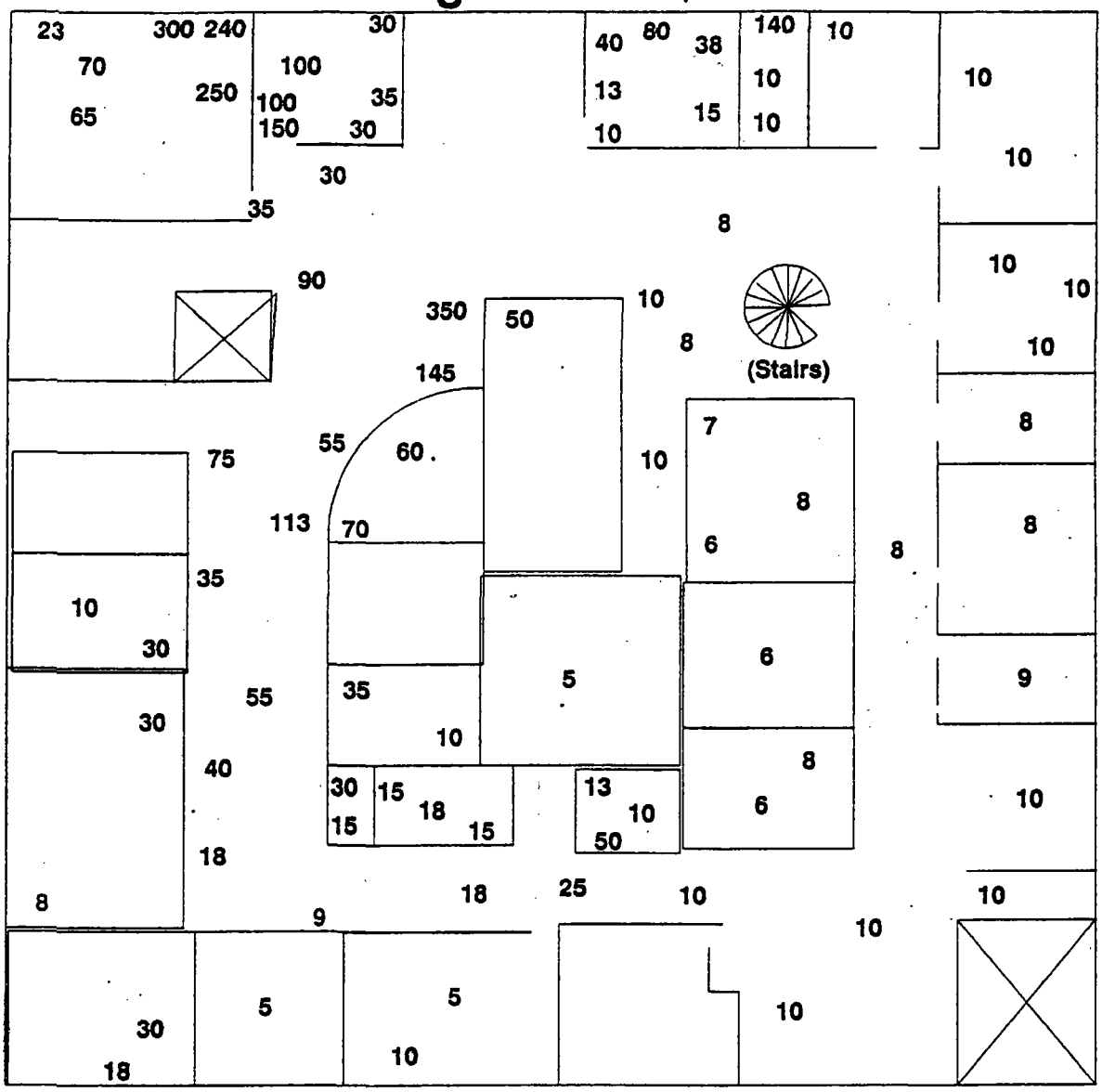
TITLE 161 E. Grand Ave. 1st Floor Readings **Optumus**	FIGURE Figure 5
SITE Lindsay Light Co.	SCALE T05-9305-014
CITY Chicago STATE IL	PAM Not to Scale
SOURCE Instrument: Ludlum Model 19	DATE
	REVISED

2

Reading: micro-R/hr



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

N

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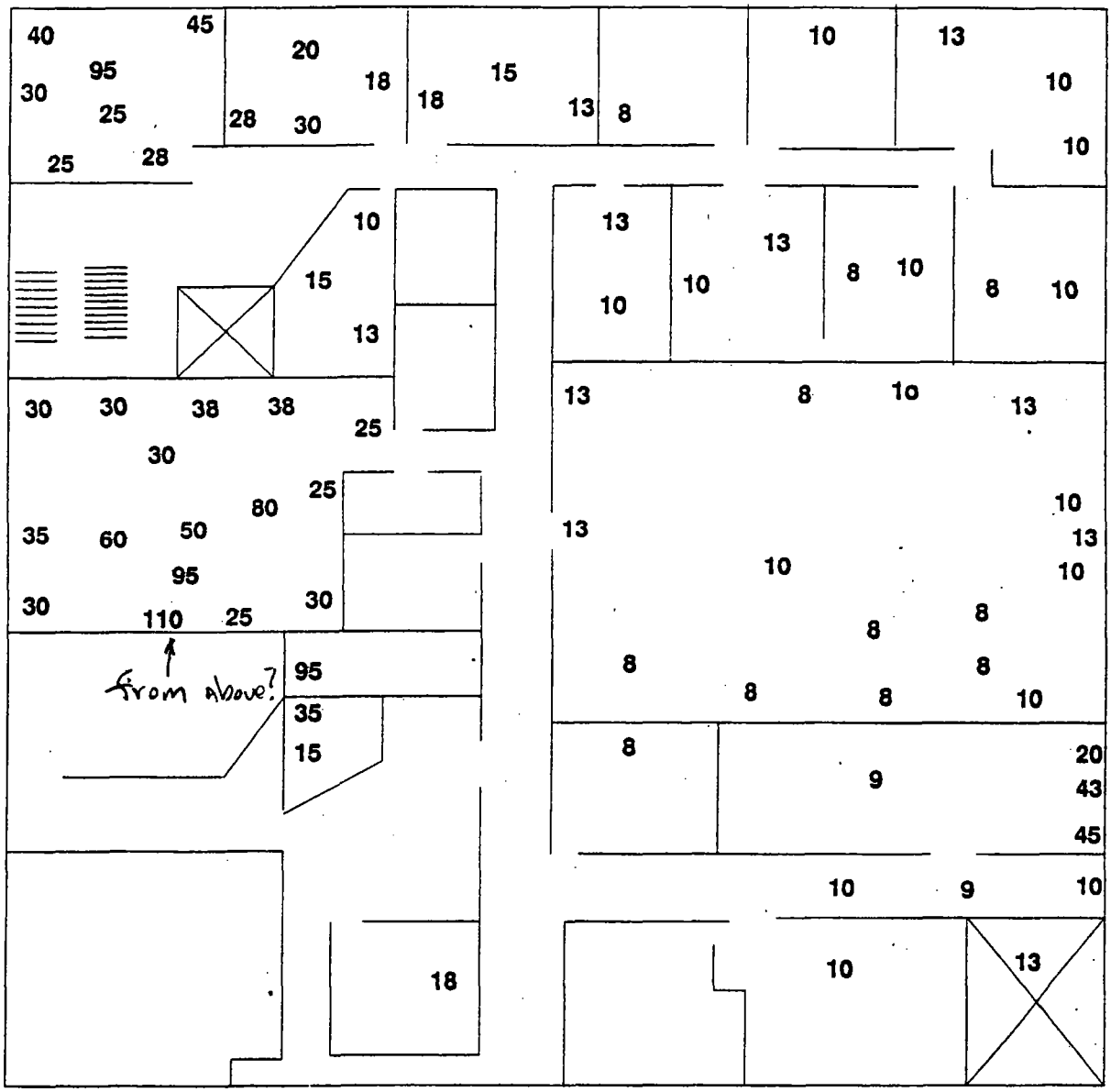
TITLE 161 E. Grand Ave. 2nd Floor (Optumus)	FIGURE # Figure 2
SITE Lindsay Light Company	TDD# T05-9305-014
CITY Chicago STATE IL	SCALE Not to Scale
SOURCE Instrument: Ludlum Model 19	DATE July 16, 1993
	REVISED

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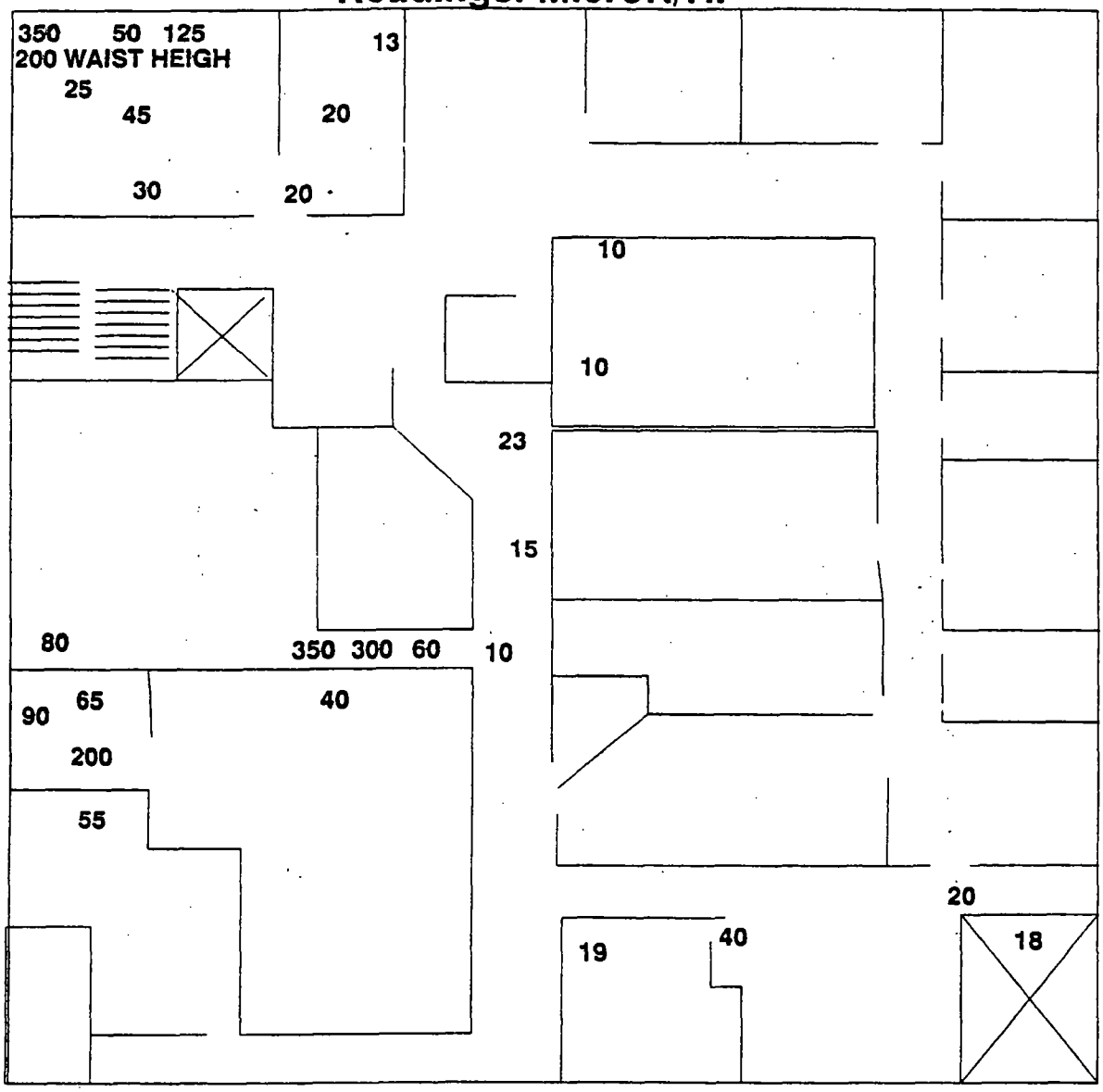
TITLE 161 E. Grand 3rd Floor (Optumus)	FIGURE # Figure 3
SITE Lindsay Light Company	TDD# T05-9305-014
CITY Chicago STATE IL	SCALE Not to Scale
SOURCE Instrument: Ludlum Model 19	DATE July 16, 1993
	REVISED

4

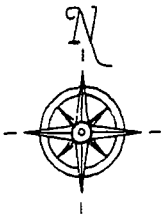
Readings: MicroR/Hr



Floor Contact readings (unless indicated differently)

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

LEGEND



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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

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

DATE: 6/2/93

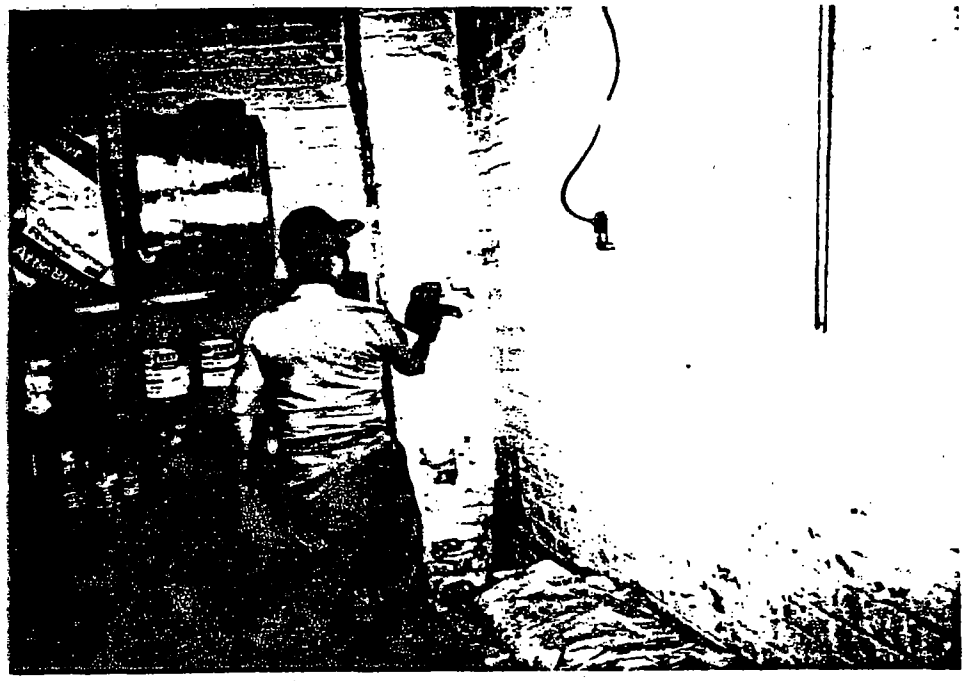
TIME: 2030

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

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

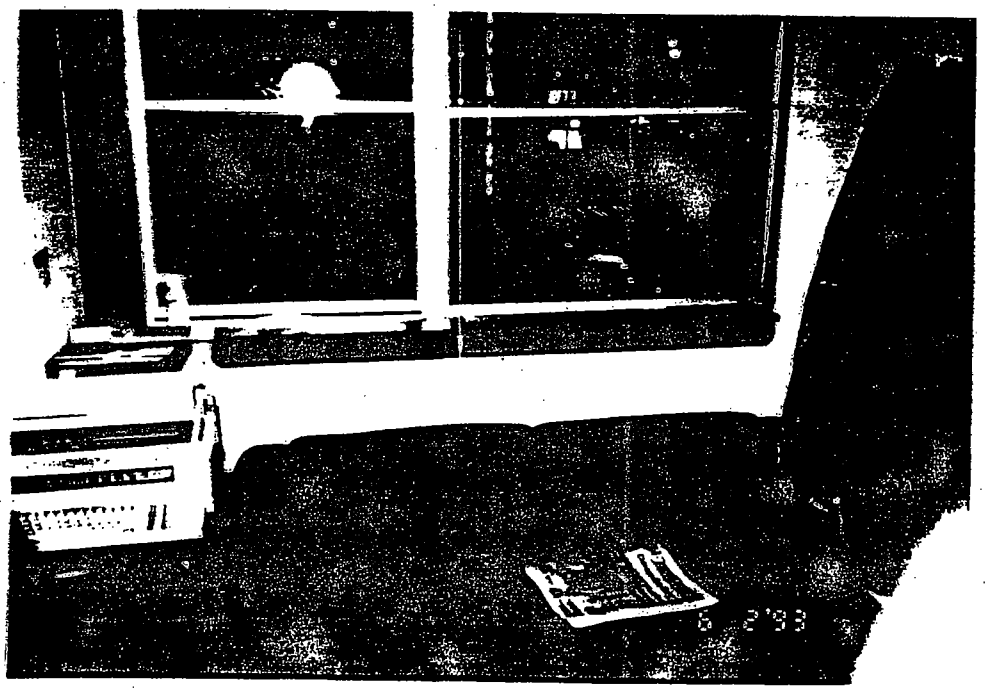
TIME: 2000

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

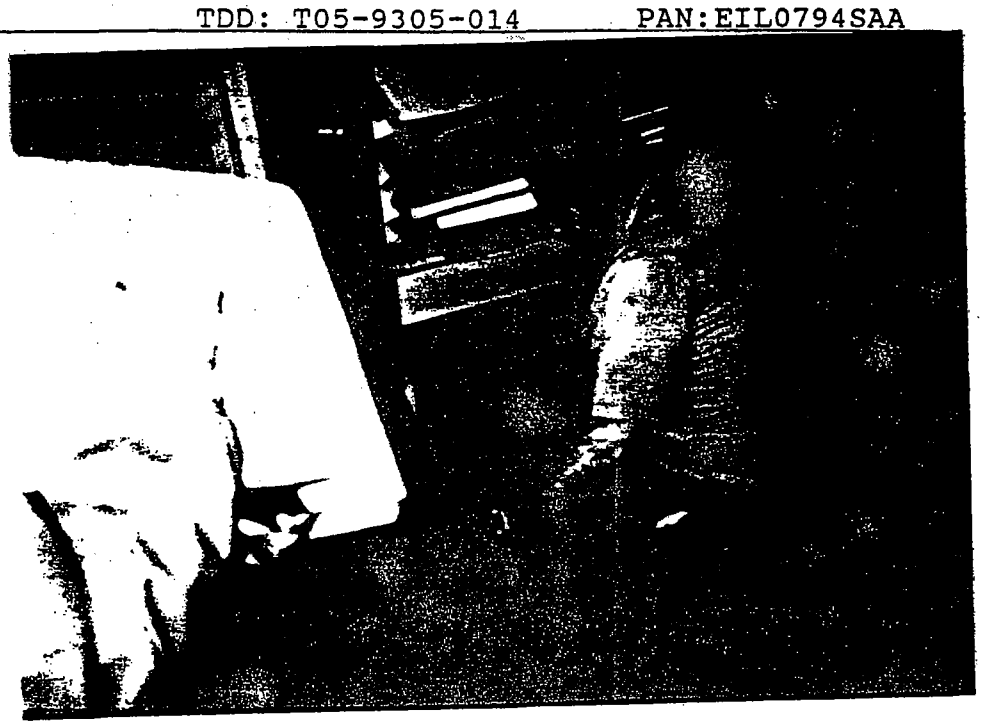
TIME: 1745

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

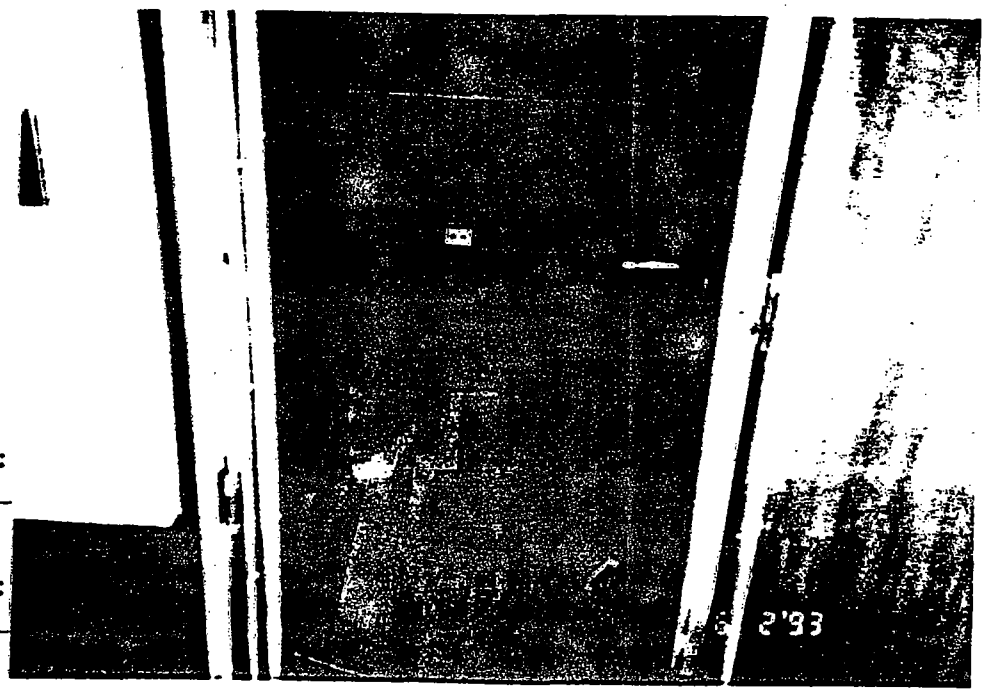
TIME: 1830

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

SITE NAME: Lindsay Light Company

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

DATE: 6/2/93

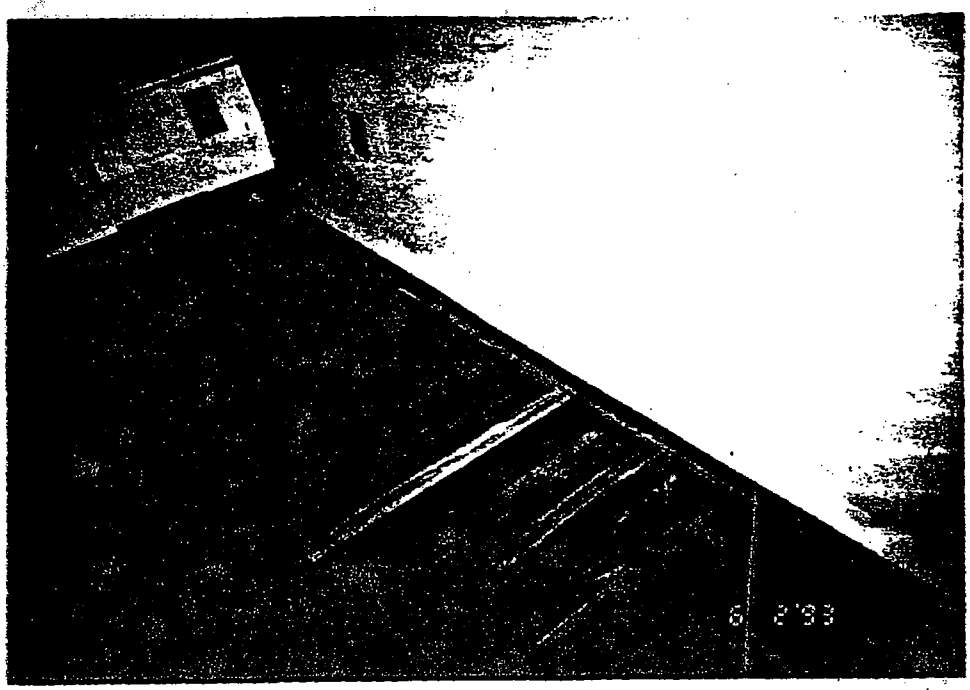
TIME: 1745

DIRECTION OF PHOTOGRAPH: North

WEATHER CONDITIONS: N/A

PHOTGORAPHED BY: Ron Bugg

SAMPLE ID (if applicable):



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

DATE: 6/2/93

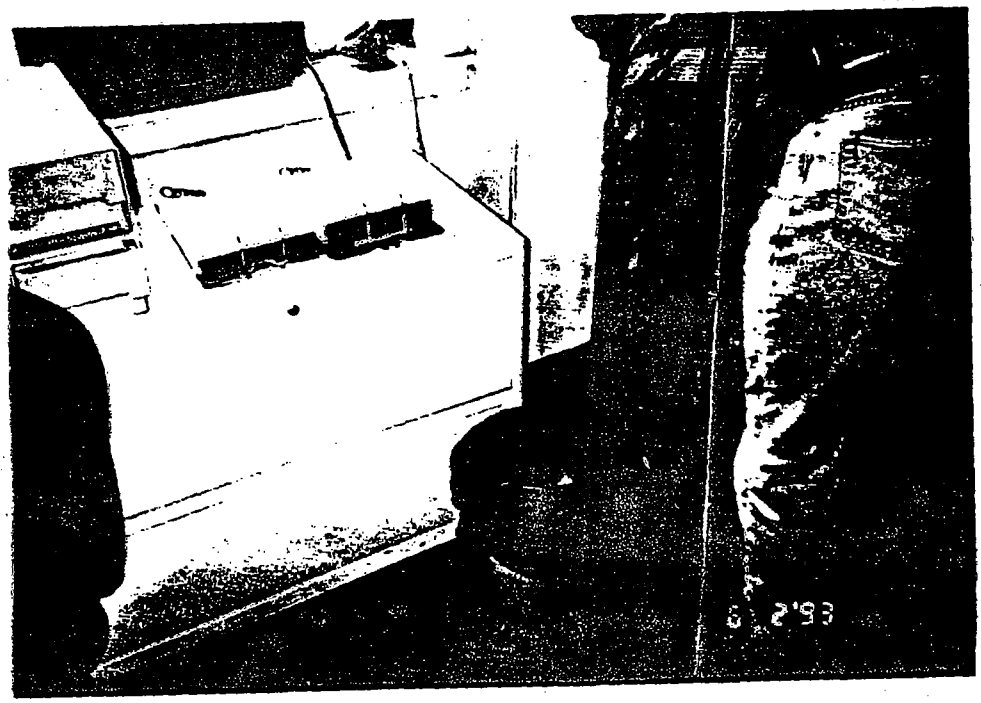
TIME: 1830

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

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

DATE: 6/2/93

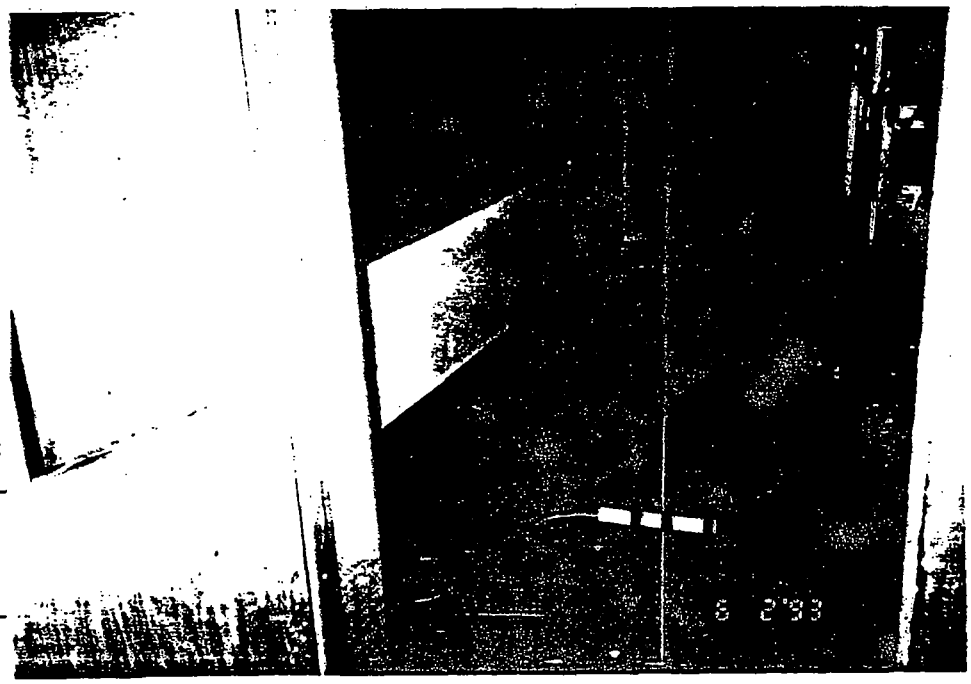
TIME: 1845

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

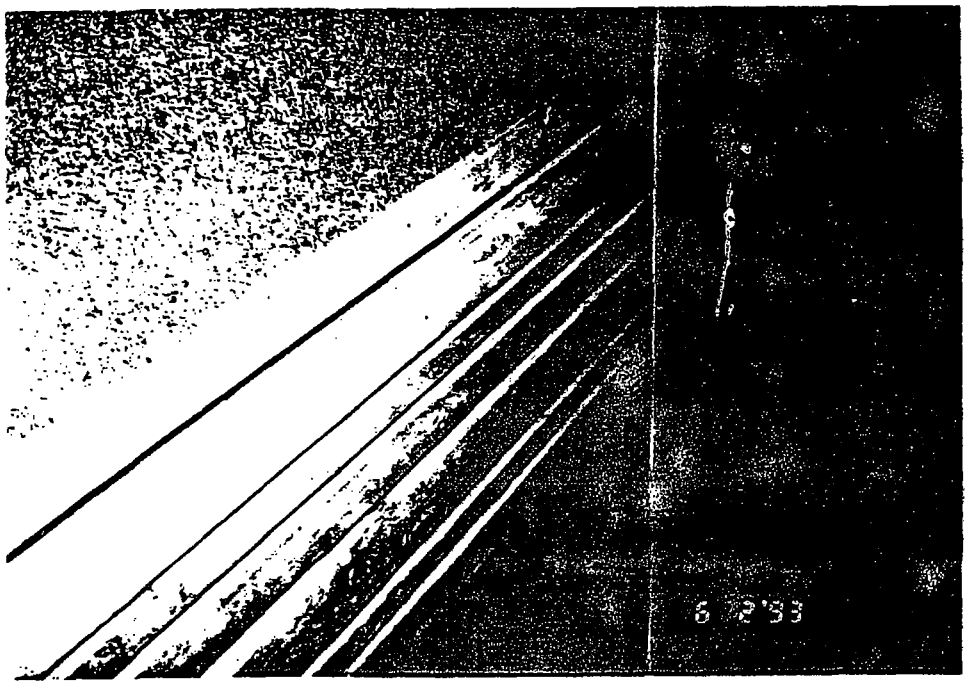
TIME: 1845

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 (4

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: $^{4n+2}_{90}Th$ (4n).....n(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]).

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

Thermo Analytical Inc.
TMAE Berline
5435 Jefferson Street NE
Albuquerque NM 87109
(505) 345-0831

There are a series of tests, on the same badge!

TLD ENVIRONMENTAL 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 08/24/93 PAGE 2 OF 3 DATE 08/26/93

10CFR20 Limits = 100 MREM/WEEK

BADGE NUMBER	IDENTIFICATION	DOSIMETER READINGS (mrem) FIRST	SECOND	THIRD	FOURTH	FIFTH	AVERAGE ± 2σ	
9016		[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
9033	3- Corner Off (NW)	33	36	29	40	35	34.2	7.9
9018		[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
901[illegible]		[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
9020		[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
9021	B- Chimney	3280	3224	3253	3334	2921	3202.4	324.9
9022	B- Shelving (By Chimney)	182	243	208	226	190	210.2	31.7
9023	B- Shipping	33	26	32	39	31	32.2	9.3
9024	1- Window (200)	28	36	35	42	40	36.2	10.8
9025	1- Reception	35	36	44	42	39	39.2	7.7
9026	2- NE Office Corner	199	183	231	194	185	202.4	95.9
9027	2- Sm Office	432	548	436	442	535	478.6	115.4
9028	2- Center "	49	51	38	46	47	49.8	7.9
9029	2- Sm Office	46	43	35	41	35	40.0	9.8
9031	2- Core	17	14	14	12	16	14.6	3.9
9032	2- S Office	15	20	16	13	15	15.8	5.2

- DOSIMETER DAMAGED

- BASED ON ELAPSED TIME FROM DATE ANNEALED TO DATE READ

FREQUENCY CODES

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

CUSTOMER ECOLOGY & ENVIRONMENT
ATTENTION SALLY INES/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

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.

827 Simpson Street
Evanston, Illinois 60201

312/866-7744

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.

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.

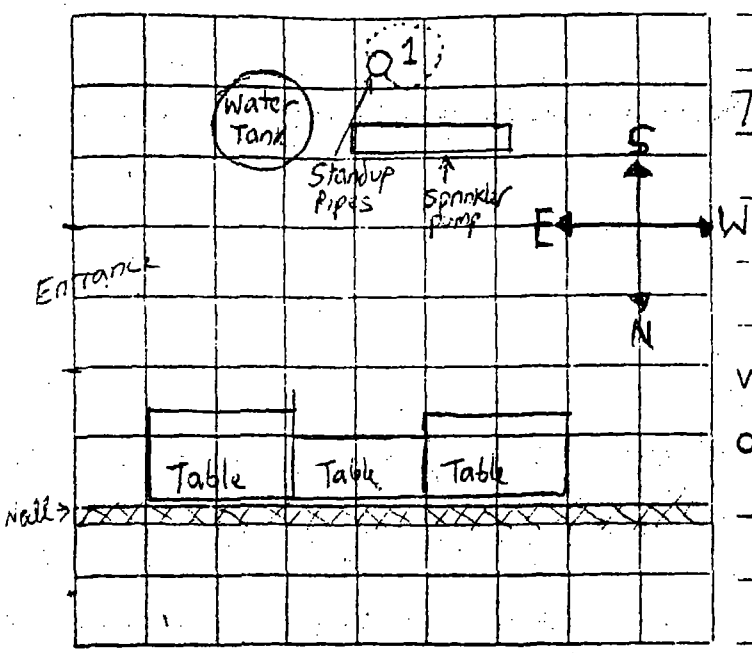
Although decontamination was terminated before completion, the most important occupied areas demonstrated a significant dose reduction consistent with the decontamination effort. Changing space utilization, particularly in the basement, may dictate further decontaminations to the levels recommended by 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

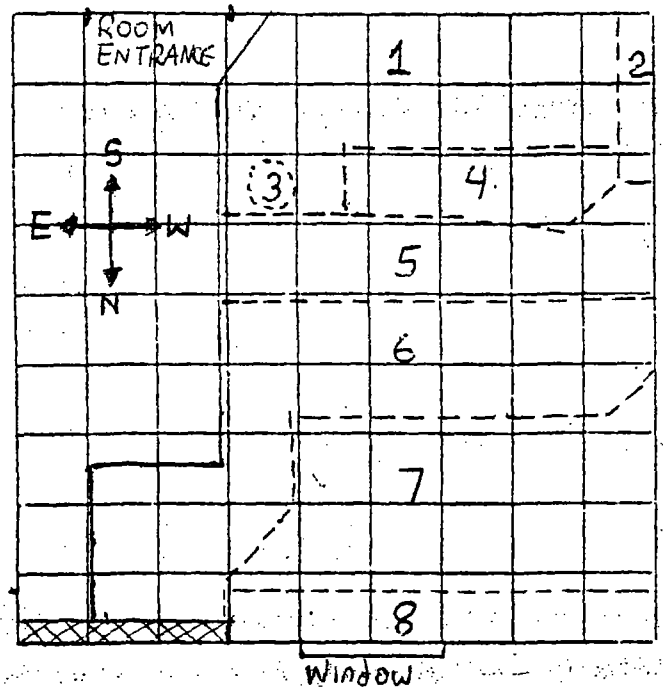
RECOMMENDATIONS:

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

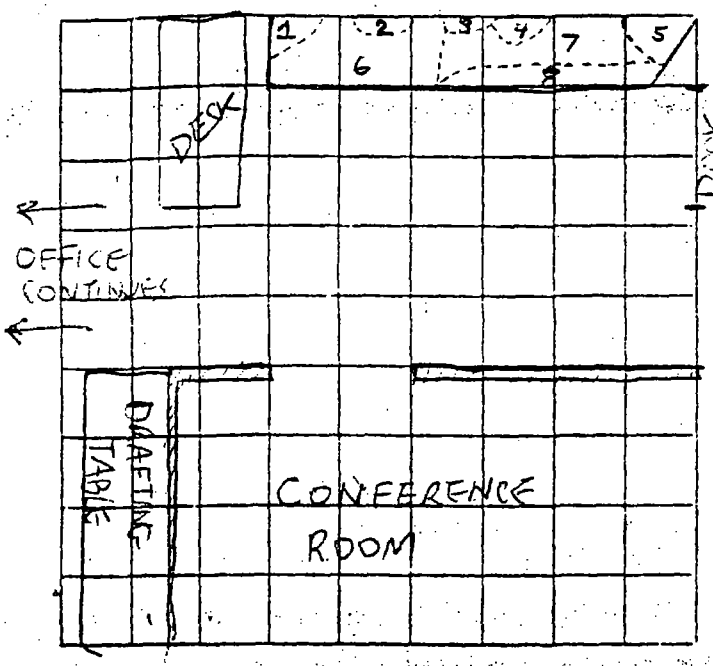
RECOMMENDATIONS:

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

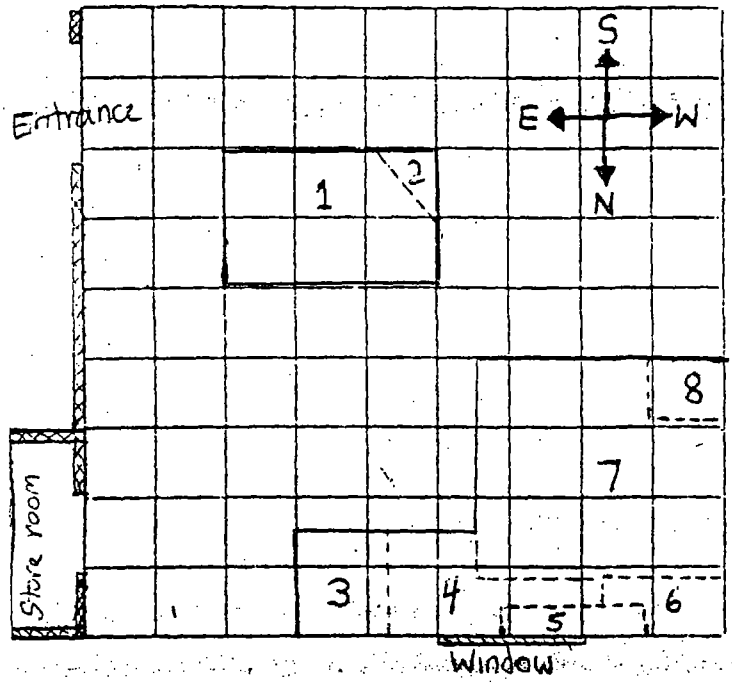
RECOMMENDATIONS:

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:

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)—

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. This ~~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.

TP 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 I 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.

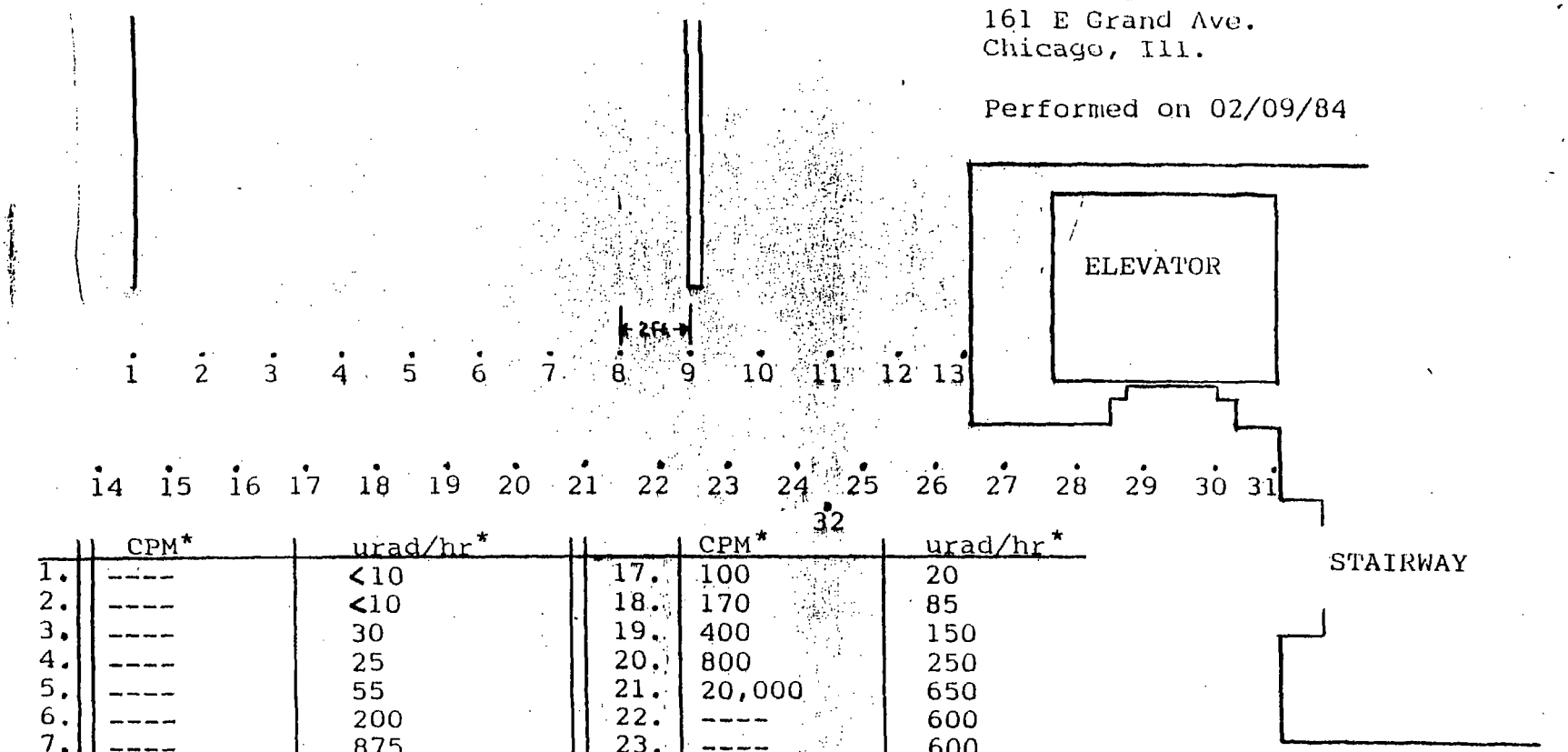
No contamination was detected on protective apparel or tools used during the construction. Results of air sampling by the EPA and RSSI did not indicate an increase in airborne radioactivity levels in the work area.

Appendix A

Radiation Survey Results

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.

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	→ 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 = 113 cpm

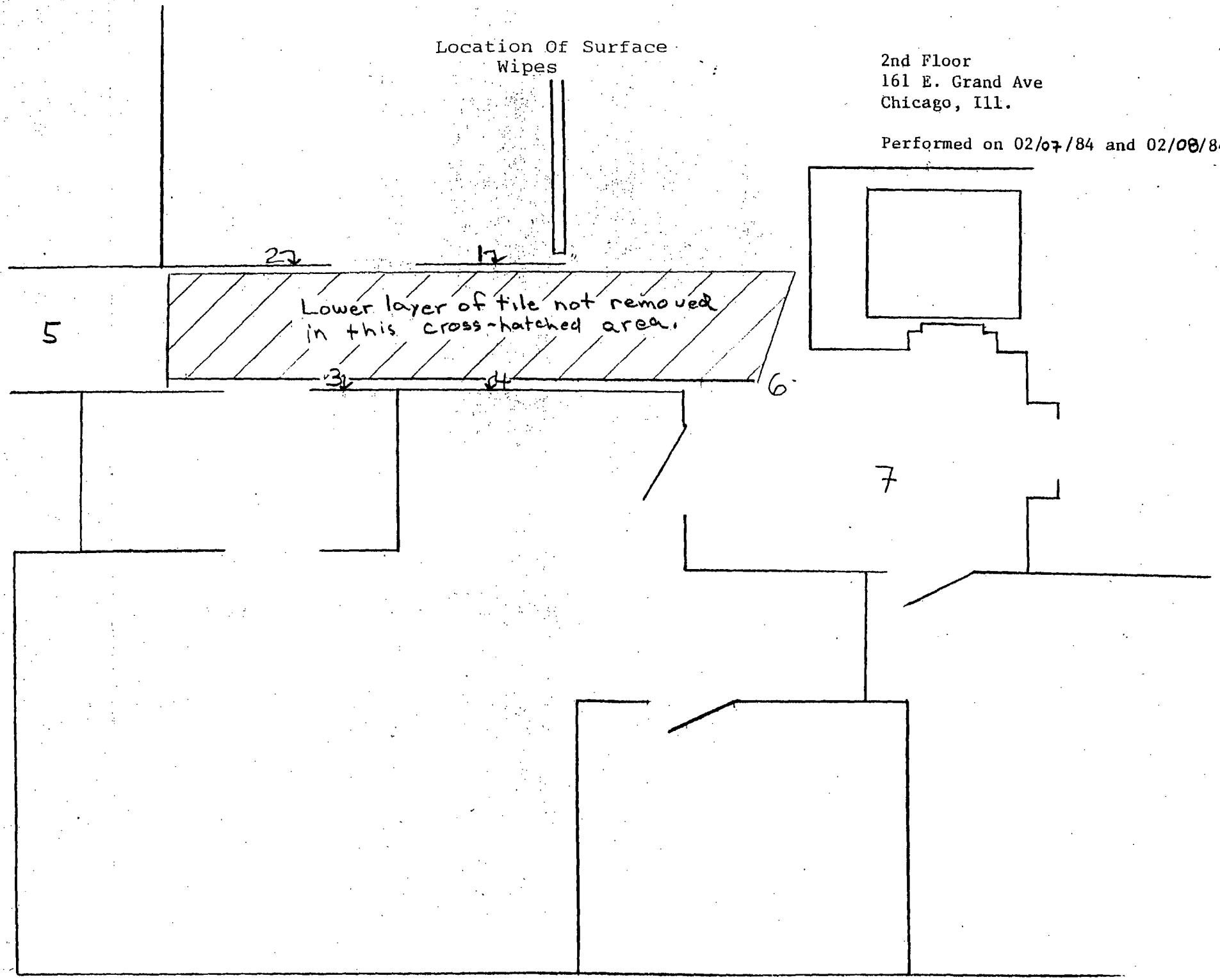
RECOMMENDATIONS:

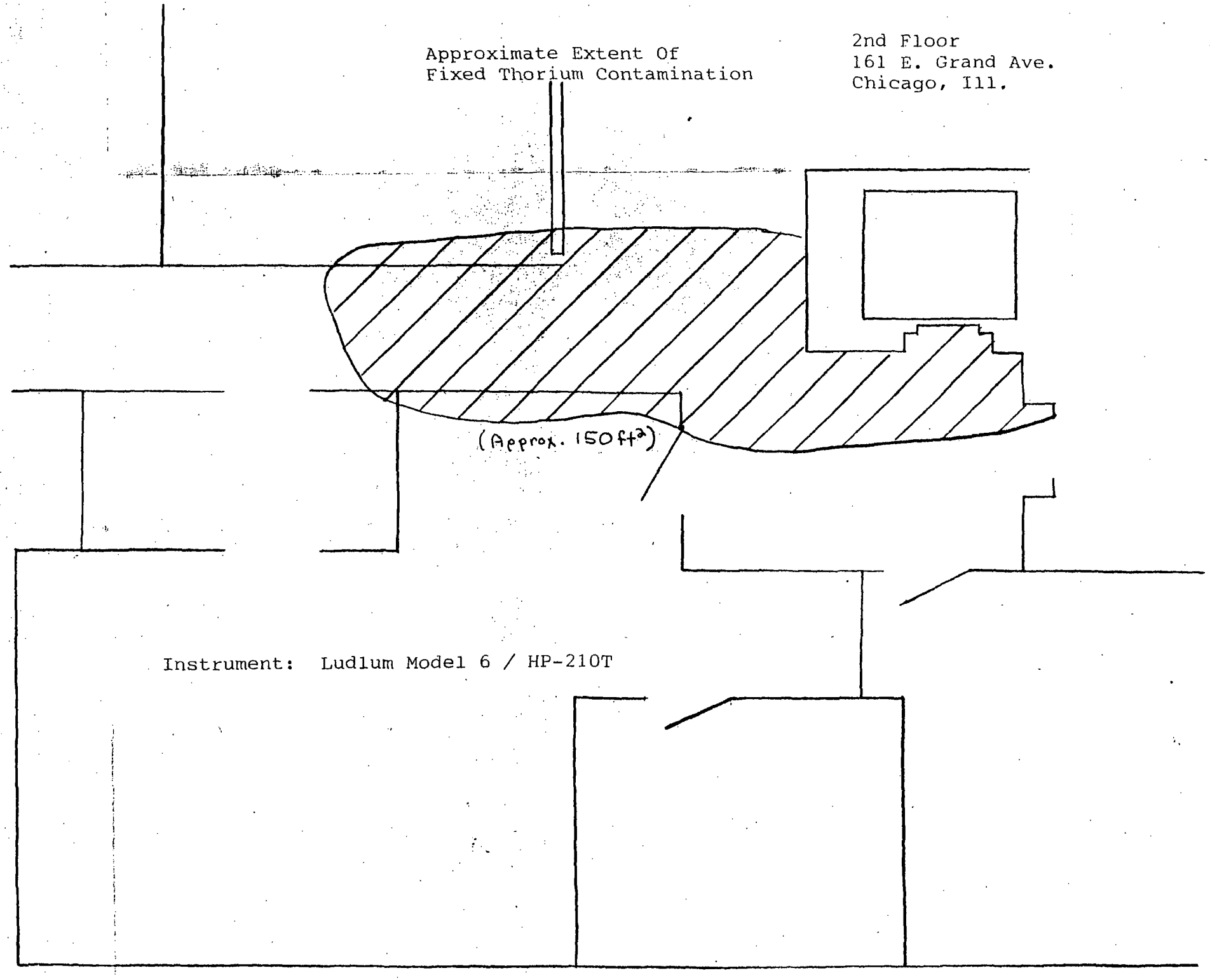
Ld 95% = 40.5 cpm ∴ Activity detected at 95% confidence level if 113 + 40.5 = 154 cpm is exceeded.

Radiation Safety Services, Inc.
827 Simpson, Evanston, IL 60201 (312) 866-7744

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

Appendix B.

USNRC Guidelines for the Release of Facilities for Unrestricted Use.

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

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

cc: Eli Port
Steve Rothblatt
Paul D. Eastvold
Bernadine Wright
James Barrett
George Wienold
John Evanoff

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

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.

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 mrem 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.

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
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.

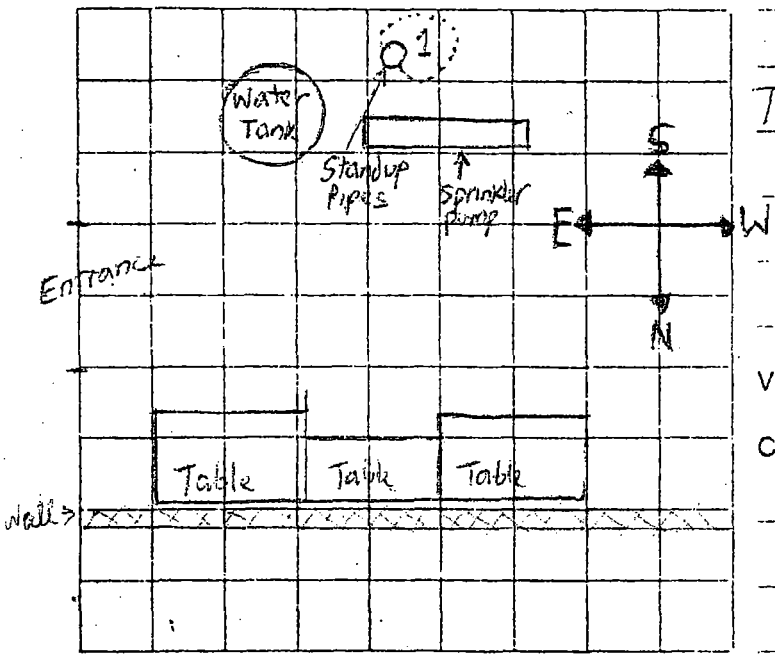
Although decontamination was terminated before completion, the most important occupied areas demonstrated a significant dose reduction consistent with the decontamination effort. Changing space utilization, particularly in the basement, may dictate further decontaminations to the levels recommended by 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

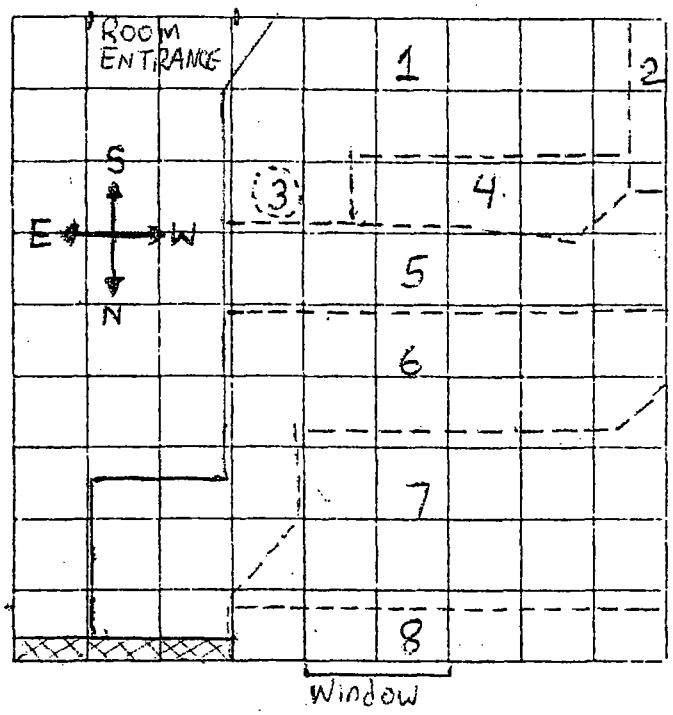
RECOMMENDATIONS:

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

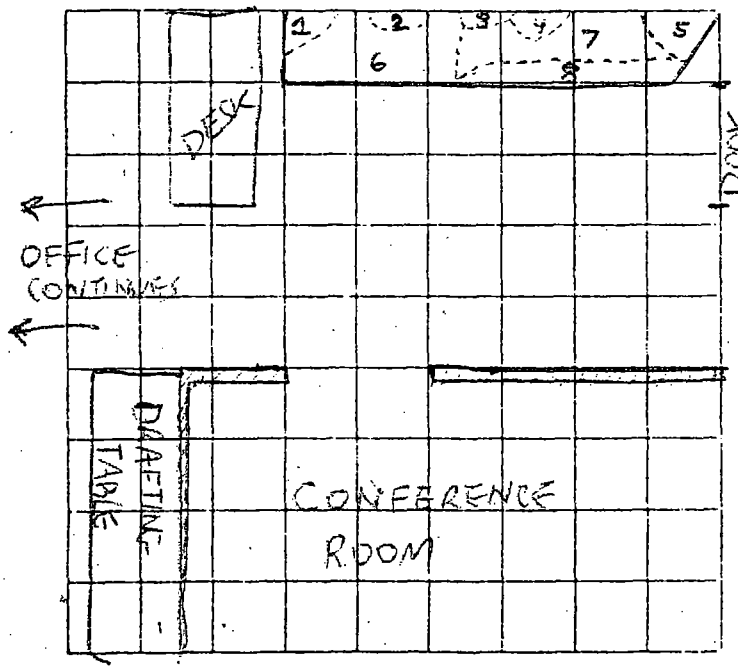
RECOMMENDATIONS:

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

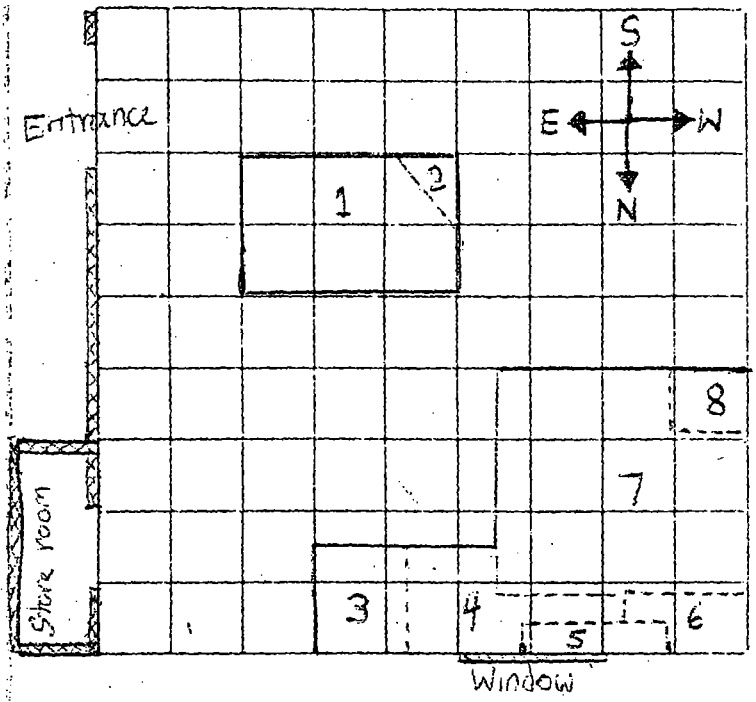
RECOMMENDATIONS:

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:

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

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

DECONTAMINATION ACTIVITIES

AT

LINDSAY LIGHT BUILDING
161 E. Grand Avenue
Chicago, Illinois

INTRODUCTION

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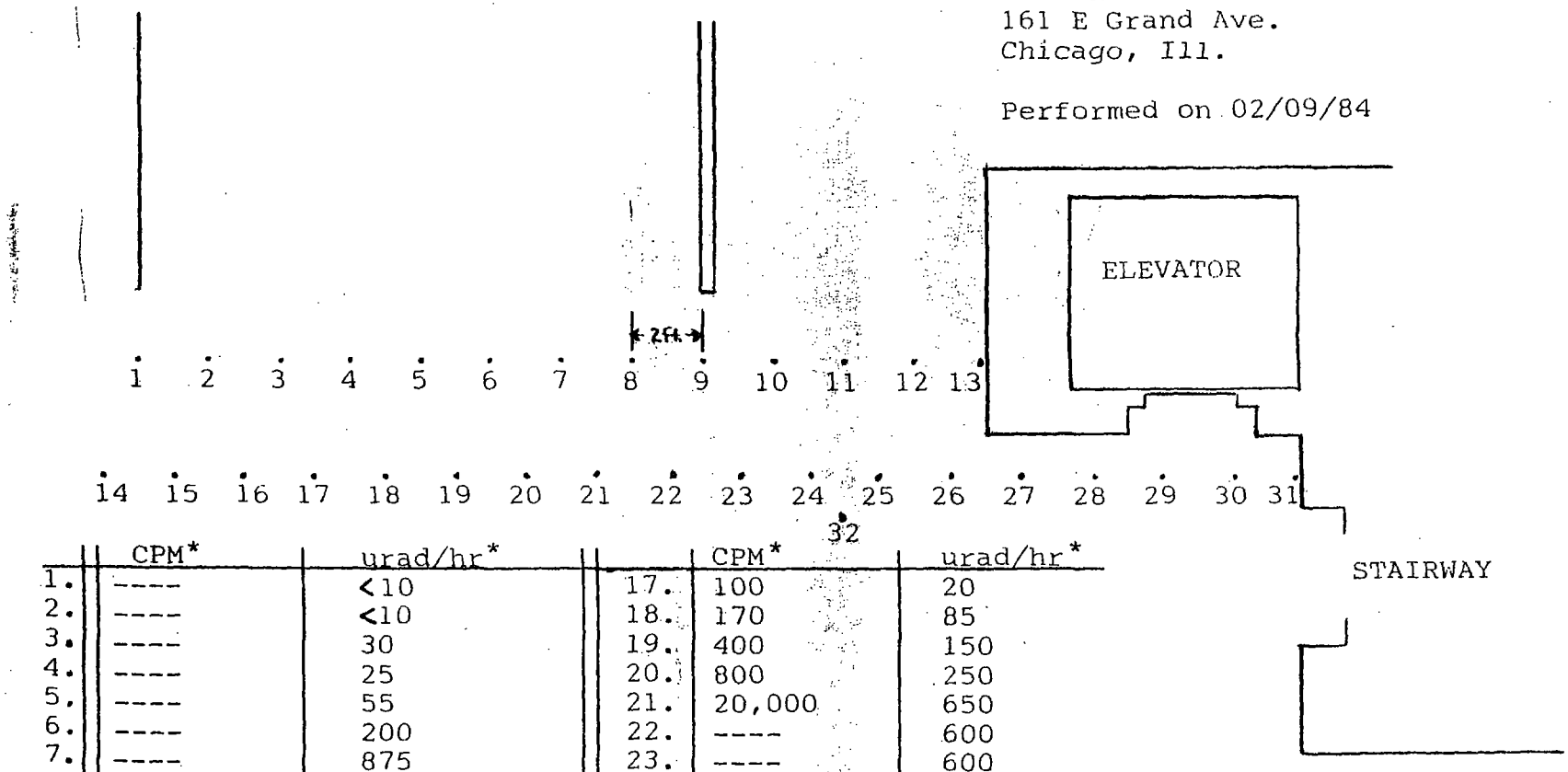
2nd Floor
161 E Grand Ave.
Chicago, Ill.

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.

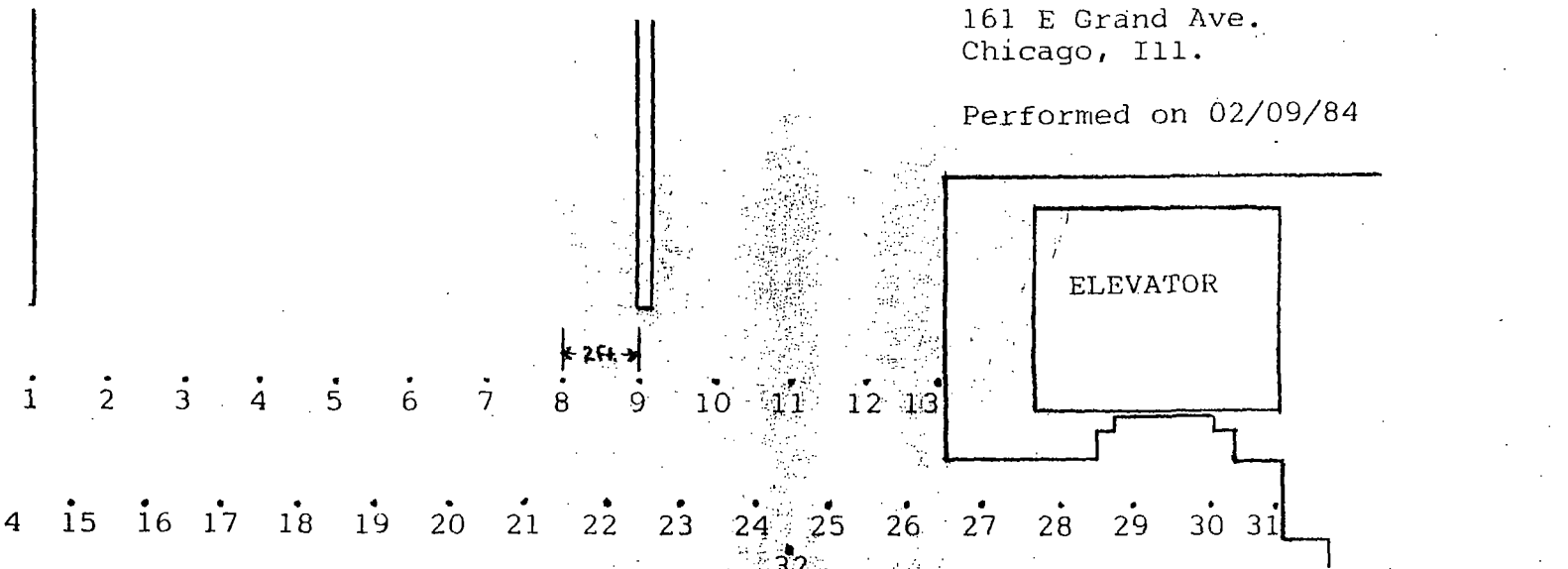
BACKGROUND: The background in relatively uncontaminated portions of the building are 10 to 15 urad/hr. In these areas the Model 16/HP-210T background was 50-70 CPM.

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.

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

Performed on 02/09/84



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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	---

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Radiation Safety Services, Inc.
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F. .DIATION SAFETY SERVICES, Inc.
1564 Ashland Avenue
Evanston, Illinois 60201
312/866-7744

March 15, 1984

Ron Klyber
Optimus, Inc.
161 East Grand Avenue
Chicago, IL 60611

Dear Ron:

This letter summarizes our recent telephone conversations regarding the amount of activity and weight of thorium in the building rubble scheduled for disposal as radioactive waste. The rubble contains an estimated 0.000001 Curies of thorium weighing approximately 0.02 pounds. This information is supplied to satisfy in part the requirements of Ted Kason's letter of January 31, 1984, and the request for information from ADCO.

Our report regarding the monitoring of decontamination activities will be submitted to you within the next ten days. Should you have any questions or require further information regarding the building rubble, please contact me at 866-7744.

Sincerely,

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

EAP:ts

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EAP:ts

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

Attendance List 161 E. Grand Ave.

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

APPENDIX B

RADIATION SURVEY RESULTS

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 ☐

Survey Instrument: Wipes-Ludlum 2220/HP-210 ~~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	→ 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 680c/6min = 113cpm

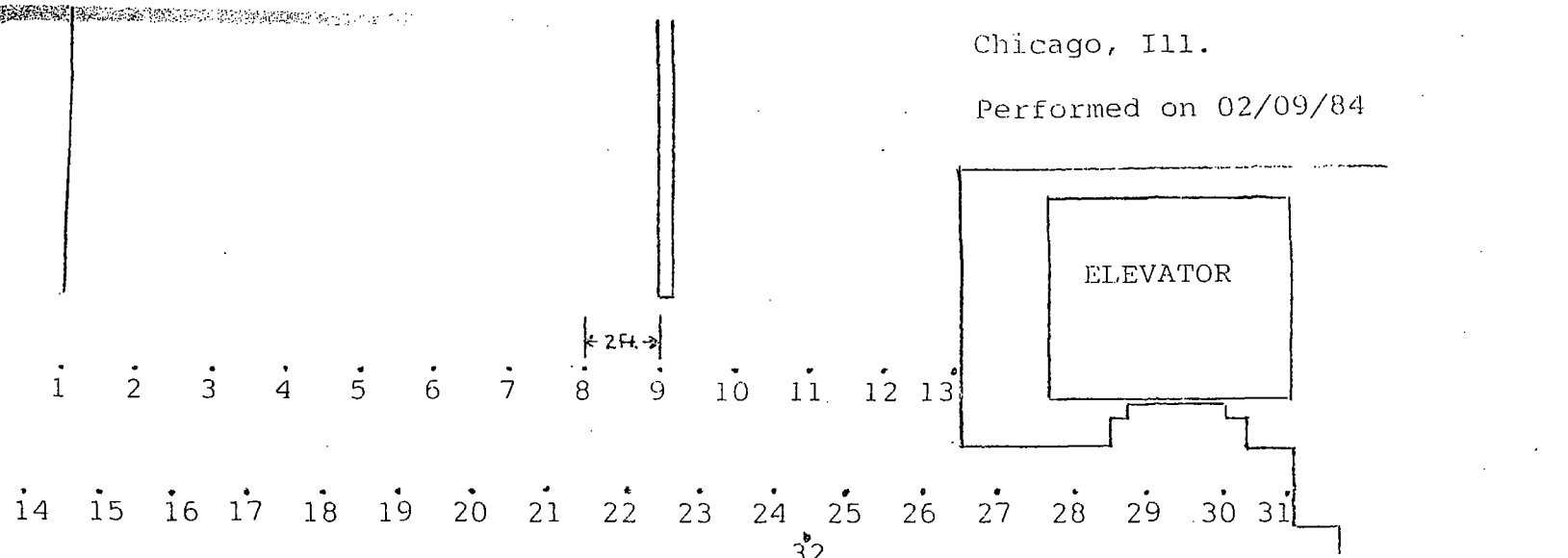
RECOMMENDATIONS:

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

Radiation Safety Services, Inc.

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.

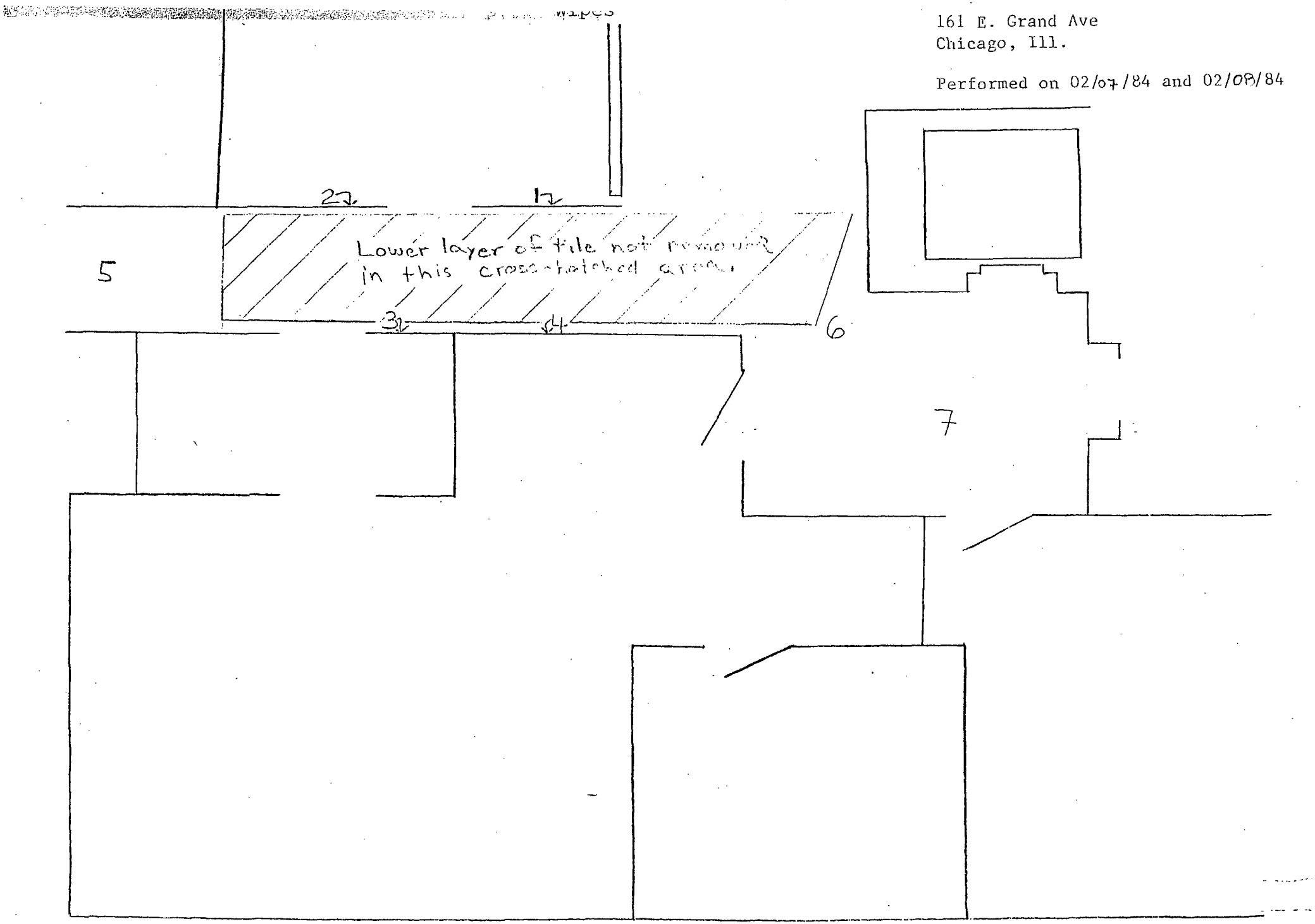
BACKGROUND: The background in relatively uncontaminated portions of the building are 10 to 15 urad/hr. In these areas the Model 16/HP-210T background was 50-70 CPM.

*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'

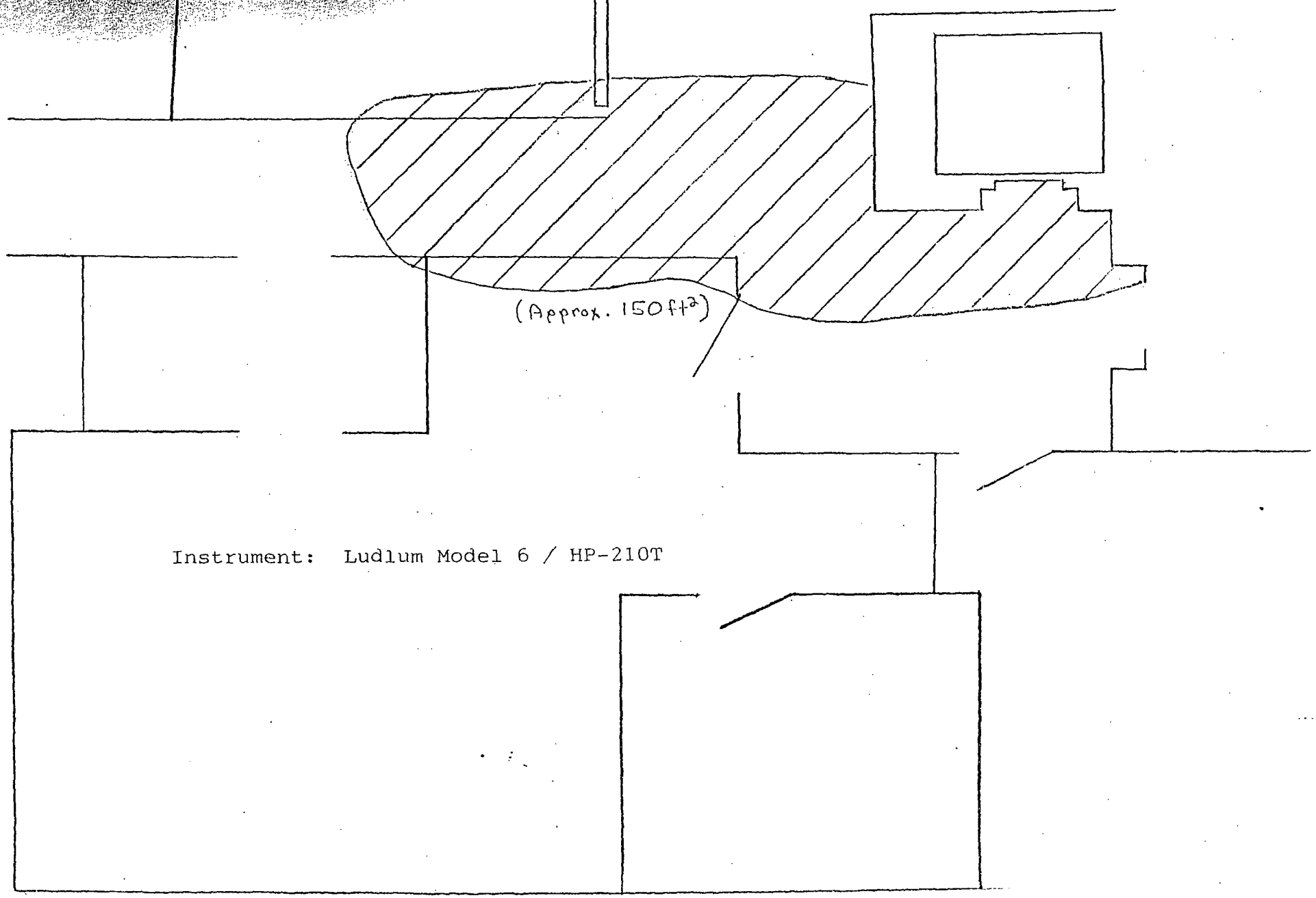
161 E. Grand Ave
Chicago, Ill.

Performed on 02/07/84 and 02/08/84



Fixed Thorium Contamination

Chicago, Ill.



Instrument: Ludlum Model 6 / HP-210T

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 collecte 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 Administrat 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 thor 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.

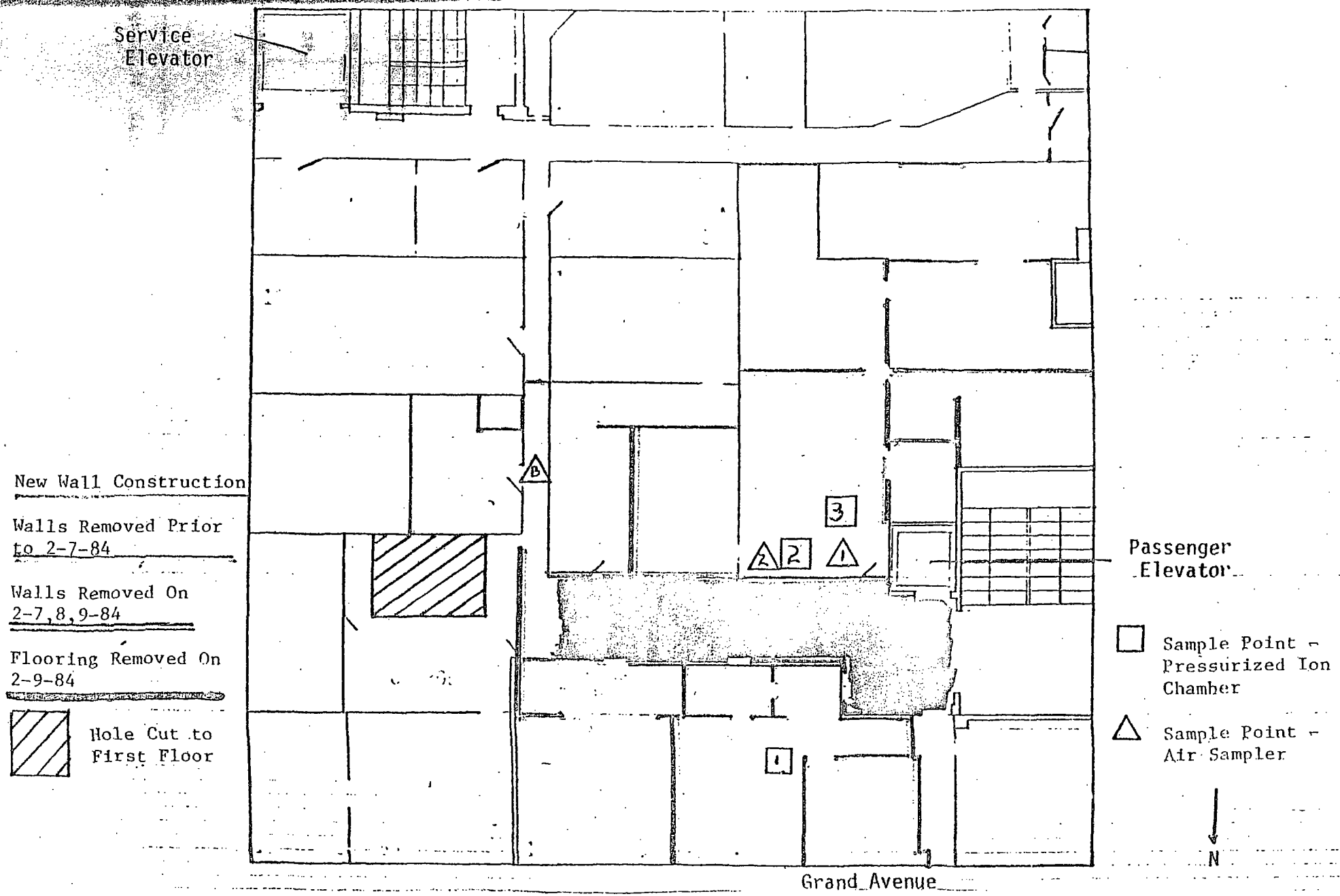
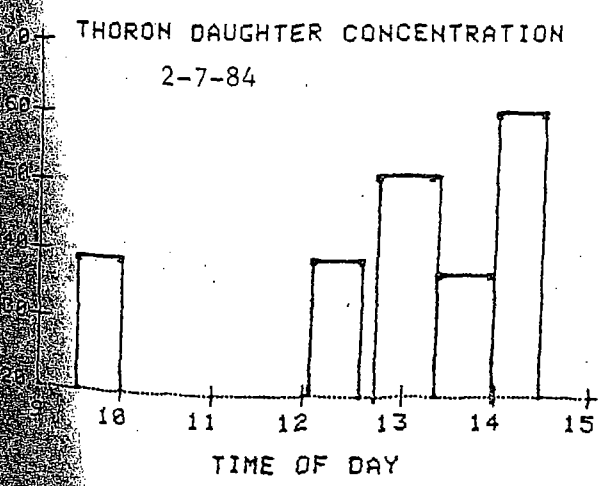


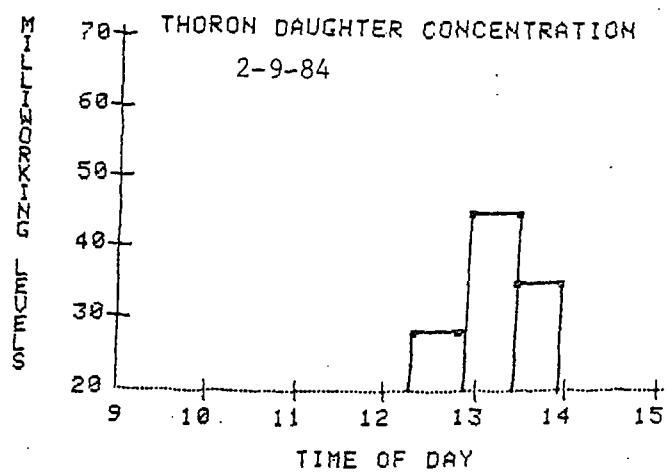
Figure 1: Floor Plan of Second Floor Showing Work Areas and Sample Collection Results

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

	DATE	TIME PERIOD	DAUGHTER CONCENTRATION RADON (MILLIWORKING LEVELS)	DAUGHTER CONCENTRATION THORON (MILLIWORKING LEVELS)	
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 - 2:39			
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





Radon/Thoron Daughter Concentrations - Air Sample Results

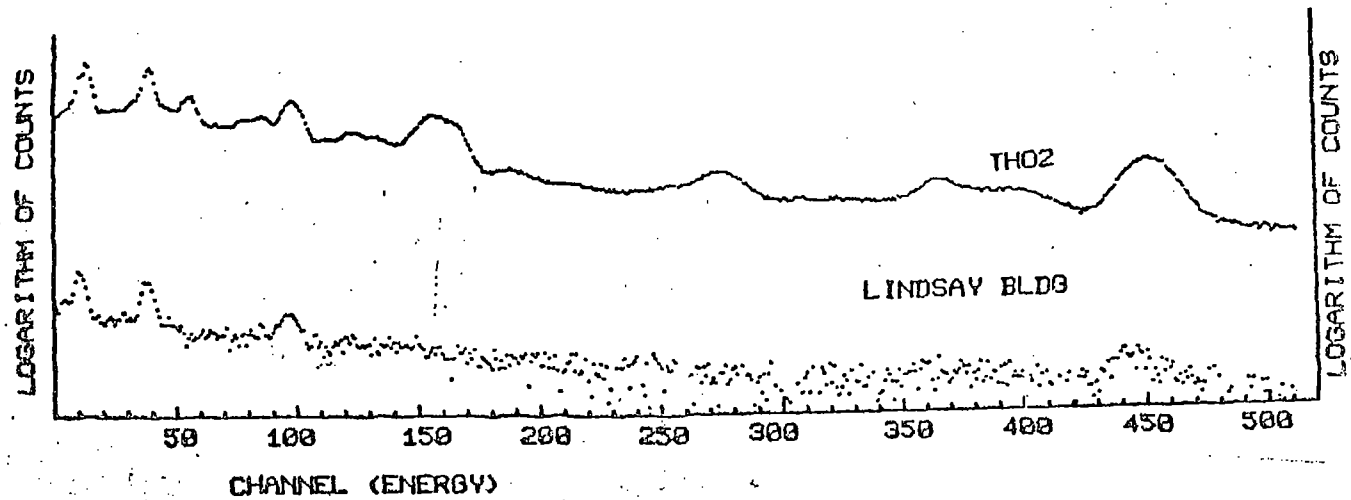


Figure 4: Gamma-ray Spectra - 2/8/84 Air Filters versus Thorium Oxide

APPENDIX D

USNRC GUIDELINES

FOR THE RELEASE OF FACILITIES

FOR UNRESTRICTED USE

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]
-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
ransuranics, Ra-226, Ra-228, h-230, Th-228, Pa-231, c-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
eta-gamma emitters (nuclides ith decay modes other than lpha emission or spontaneous ission) except Sr-90 and thers noted above.	5000 dpm βγ/100 cm^2	15,000 dpm βγ/100 cm^2	1000 dpm βγ/100 cm^2

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.

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.

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.

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

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.

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.

City of Chicago
Harold Washington, Mayor

Department of
Inspectional Services
Harry L. Monley
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

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

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

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.

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Feb 7, 1984 1 hr Training

Attendance List 161 E. Grand Ave.

Marge Theriault
Johnston Bell
Chester Brown
Ron Klyber
Ellen Manowicz
Joseph Stancle

APPENDIX B

RADIATION SURVEY RESULTS

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 ☐

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
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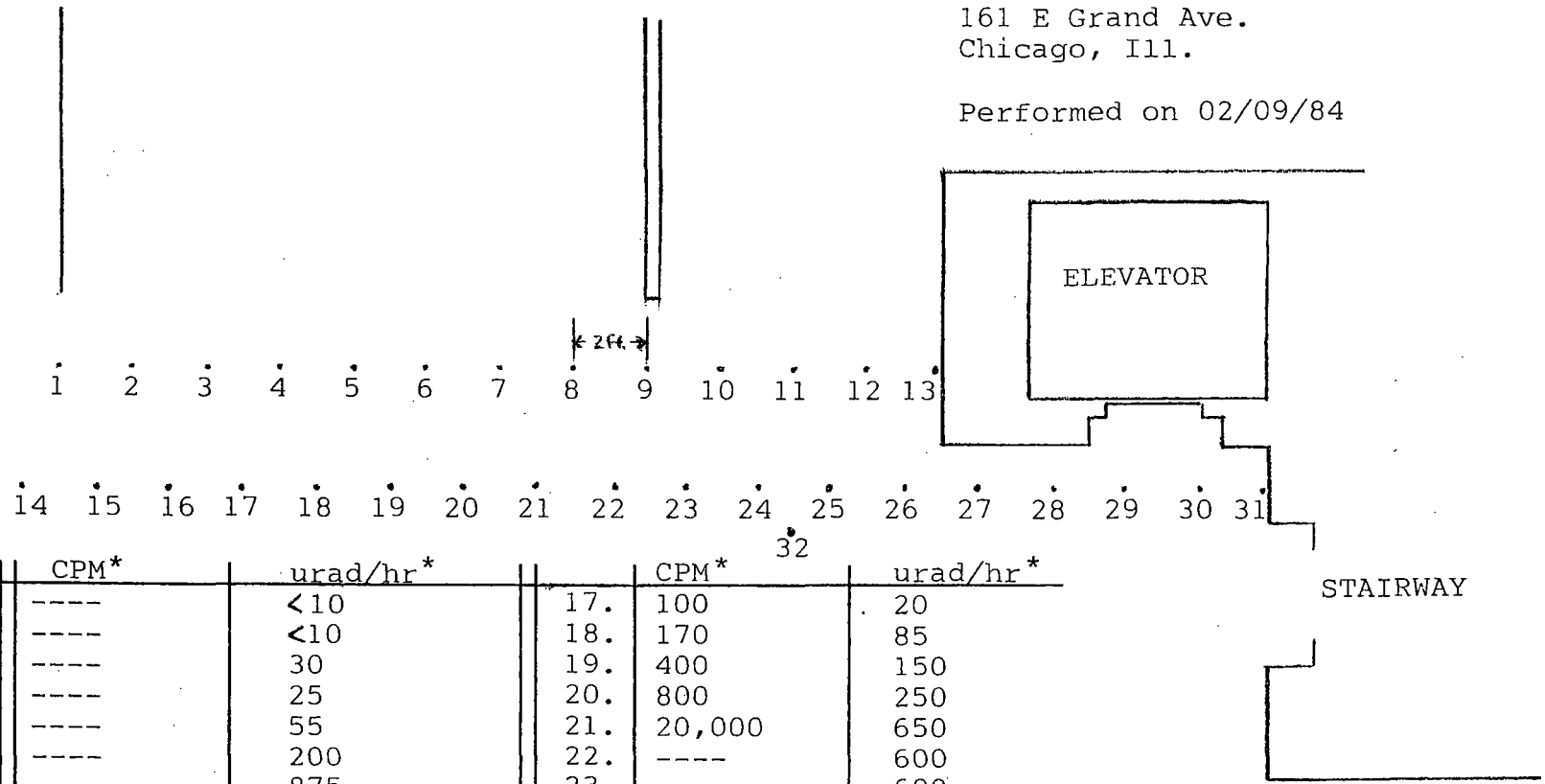
RECOMMENDATIONS:

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

Radiation Safety Services, Inc.

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

Performed on 02/09/84



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PERFORMED BY:
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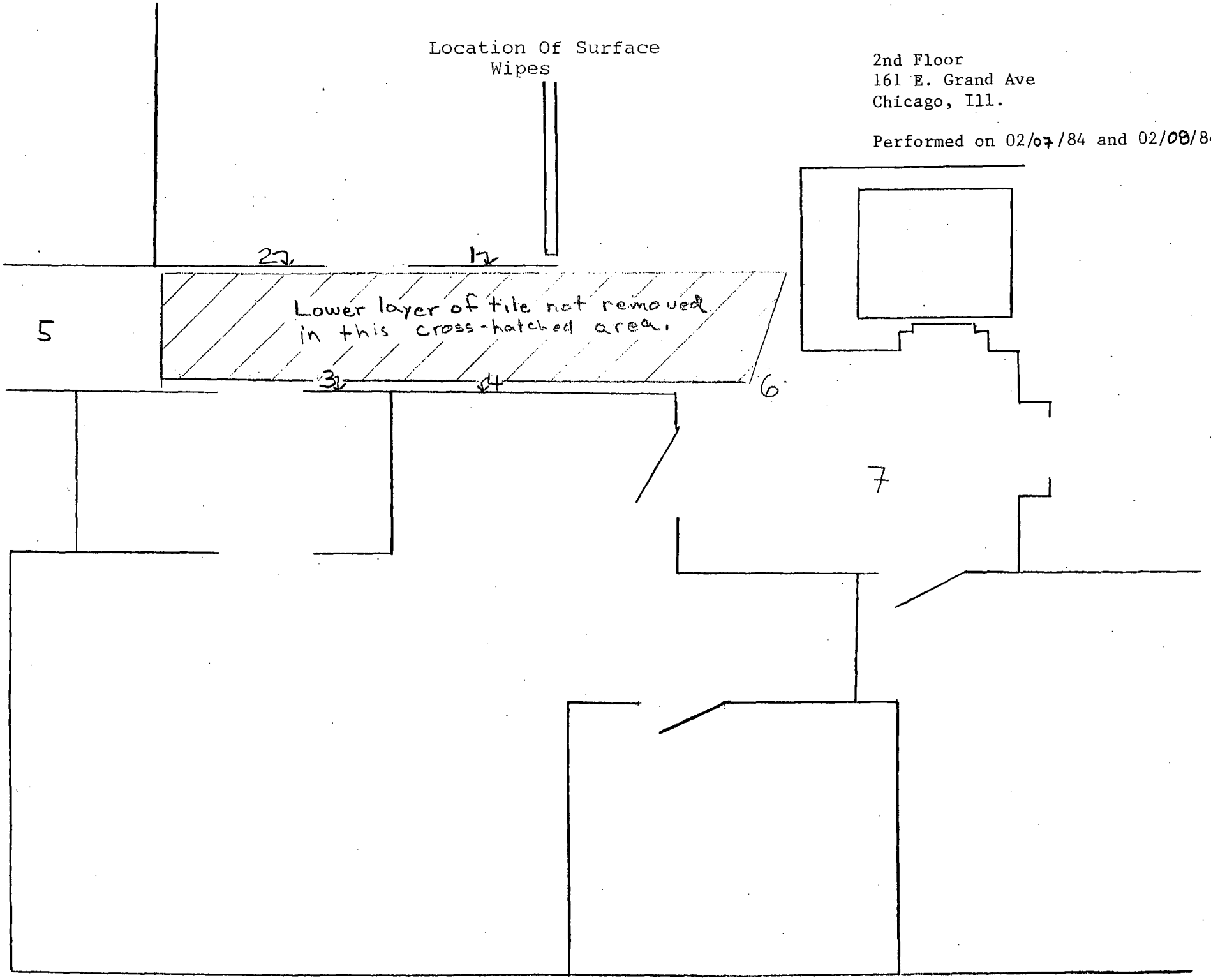
SCALE
1"=5'

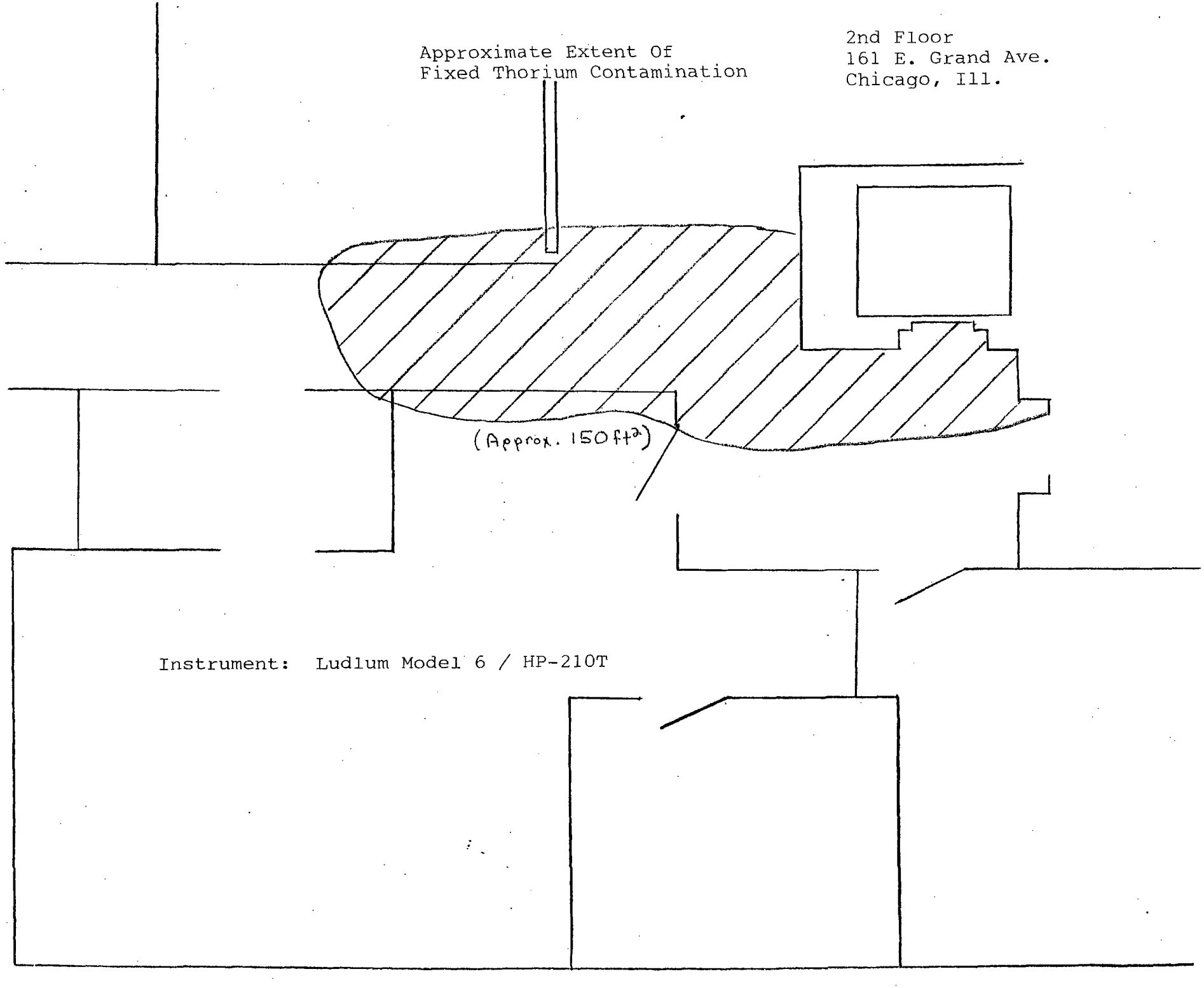
*Readings taken at the surface of the existing floor. The HPI 1010 chamber center is 2 5/16" from the floor with instrument on floor.

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

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.

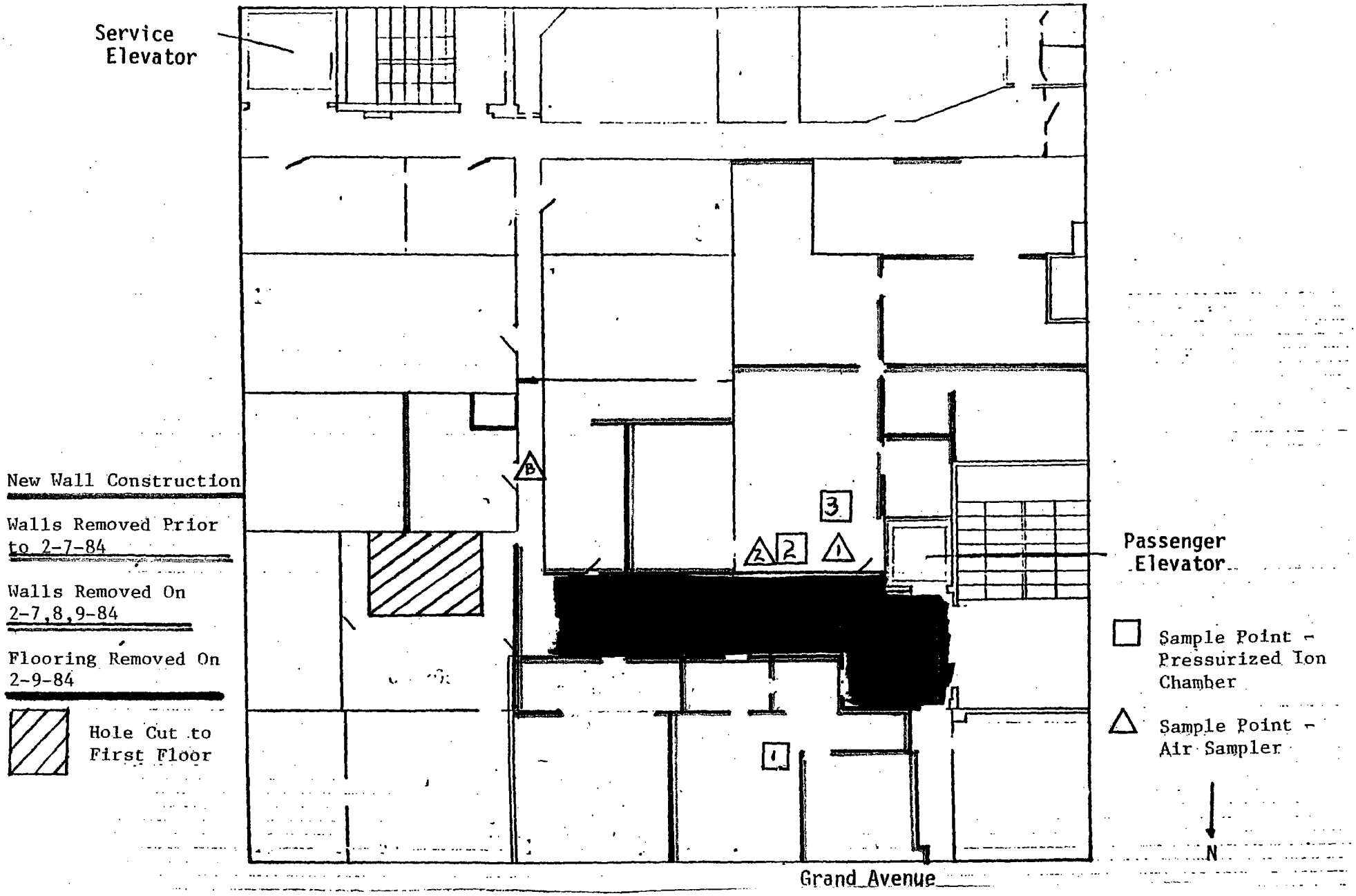
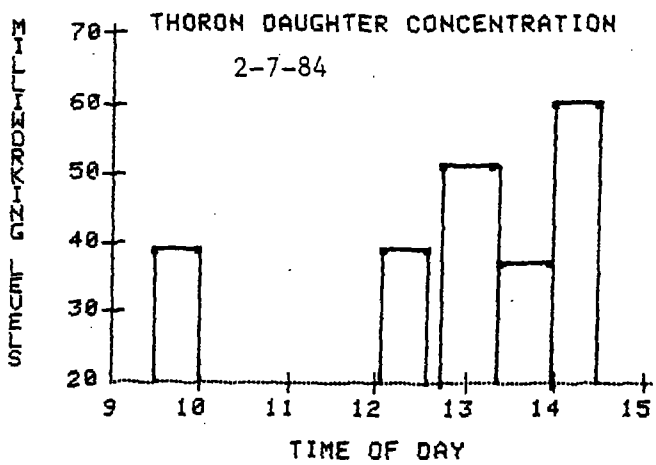


Figure 1: Floor Plan of Second Floor Showing Work Areas and Sample Collection Results

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

	DATE	TIME PERIOD	DAUGHTER CONCENTRATION RADON (MILLIWORKING LEVELS)	DAUGHTER CONCENTRATION THORON (MILLIWORKING LEVELS)	
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



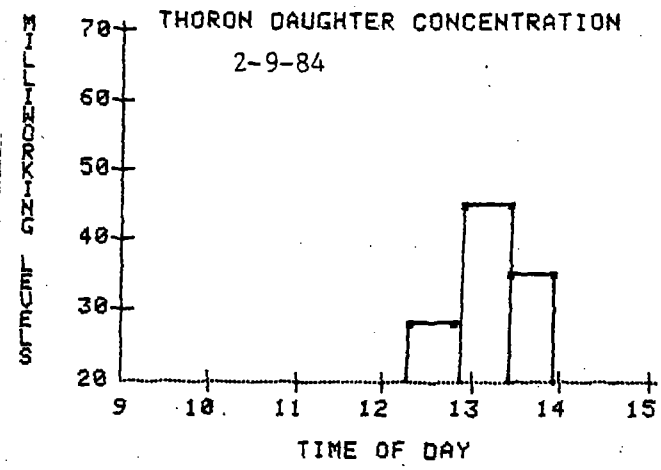


Figure 3: Radon/Thoron Daughter Concentrations - Air Sample Results

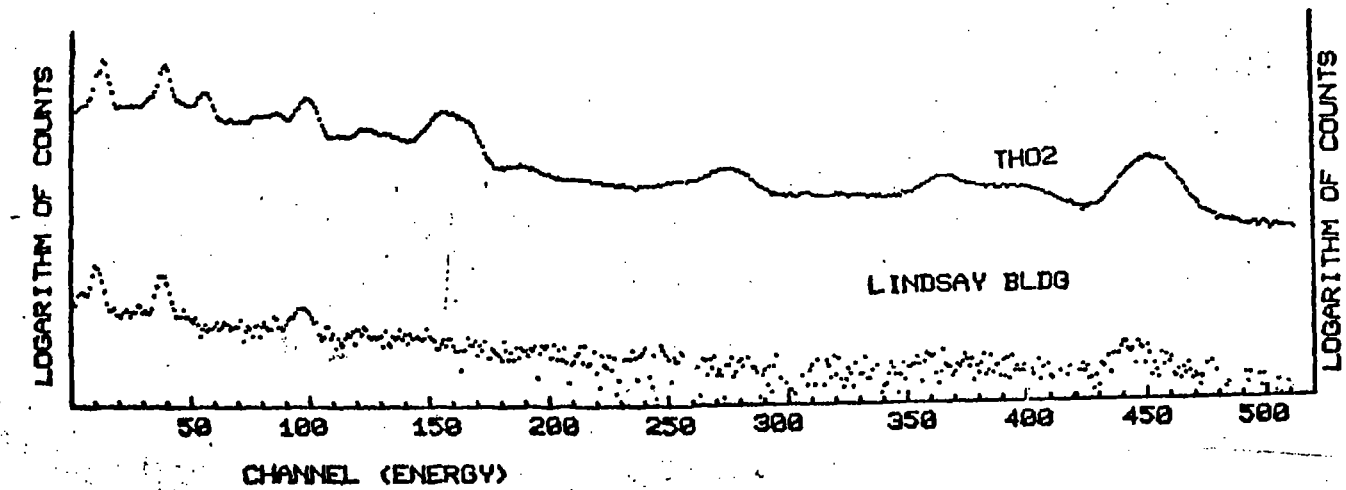


Figure 4: Gamma-ray Spectra - 2/8/84 Air Filters versus Thorium Oxide

APPENDIX D

USNRC GUIDELINES
FOR THE RELEASE OF FACILITIES
FOR UNRESTRICTED USE

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]
-nat, U-235, U-238, and ssociated 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 ners noted above.	5000 dpm $\beta\gamma$/100 cm^2	15,000 dpm $\beta\gamma$/100 cm^2	1000 dpm $\beta\gamma$/100 cm^2

here surface contamination by both alpha- and beta-gamma-emitting nuclides exists, the limits established for alpha- and beta-gamma-emitting 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 instrumentation.

easurements 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.

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

e amount of removable radioactive material per 100 cm^2 of surface area should be determined by wiping that area with dry filter or soft sorbent 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 oportionally and the entire surface should be wiped.

e 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 tal absorber.

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,

RSSI

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

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
twi\misc\steel01.let

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

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708-965-1999
Fax 708-965-1991

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

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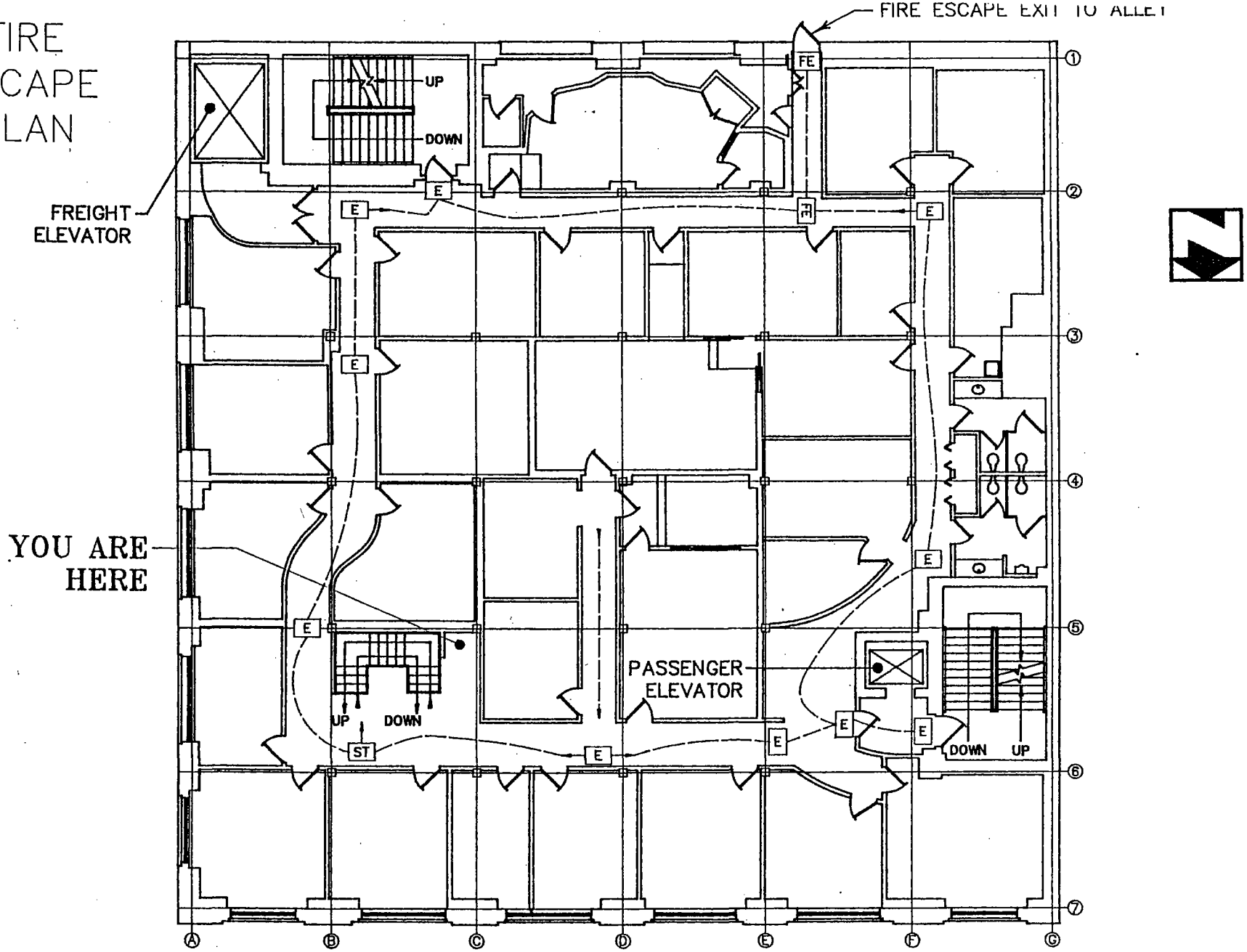
Sincerely,

Terry W. Liaboe, CIH
Vice-President

Enclosures
twi\misc\steel01.let

FIRE ESCAPE PLAN

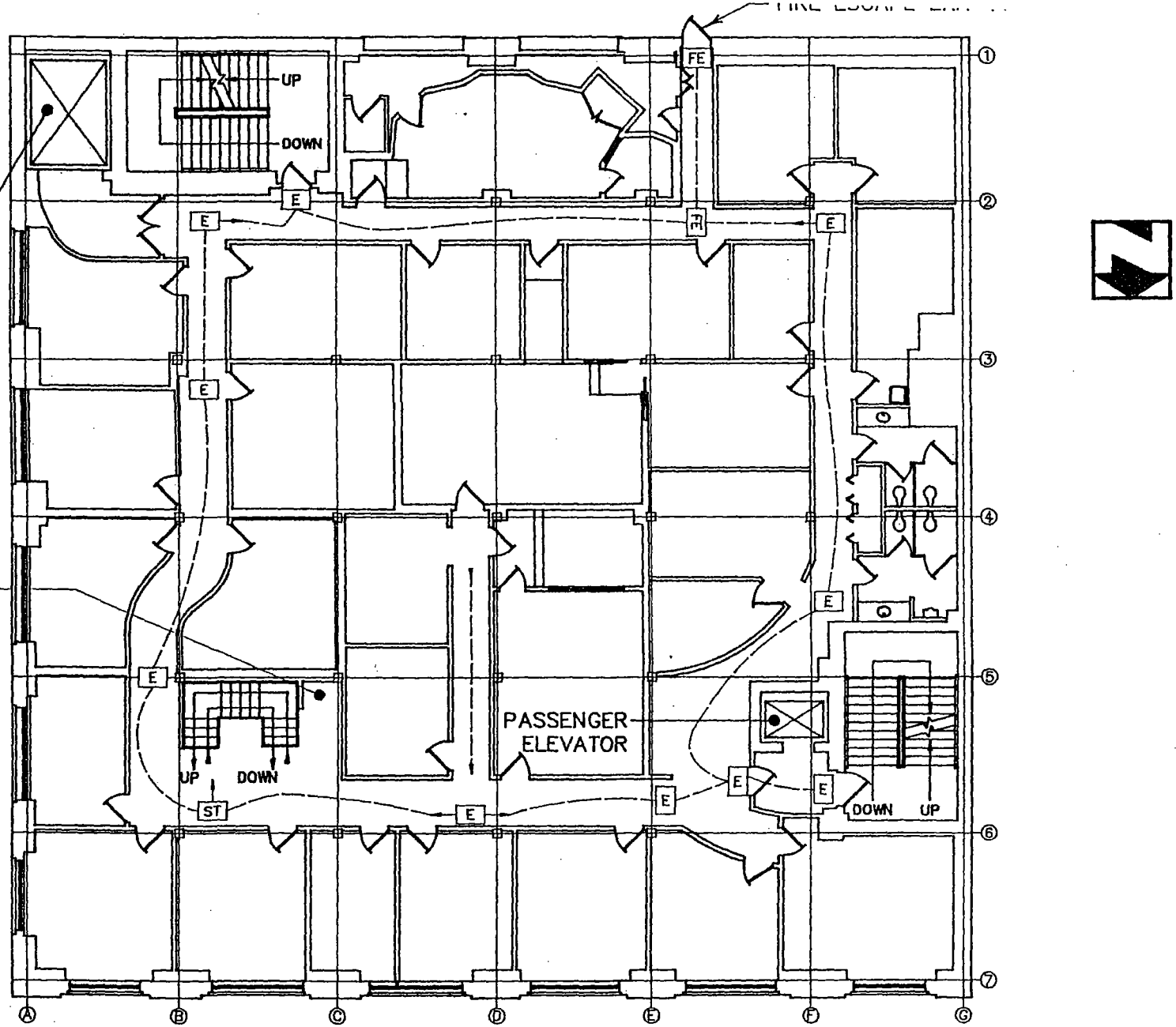


2nd FLOOR AREA
OPTIMUS
161 EAST GRAND AVE.
CHICAGO, IL. 60611

EXIT SIGNS
STAIR SIGN
FIRE ESCAPE SIGNS
HAZARDOUS MATERIALS

SCALE: 1/16"=1'

IRE
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'

RSSI

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

June 30, 1993

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

Dear Mr. Steele:

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

Sincerely,

Terry W. Liaboe, CIH
Vice-President

Enclosures
twi\misc\steel01.let

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, CIH, CHP, P.E.
steele03.let

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

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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

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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

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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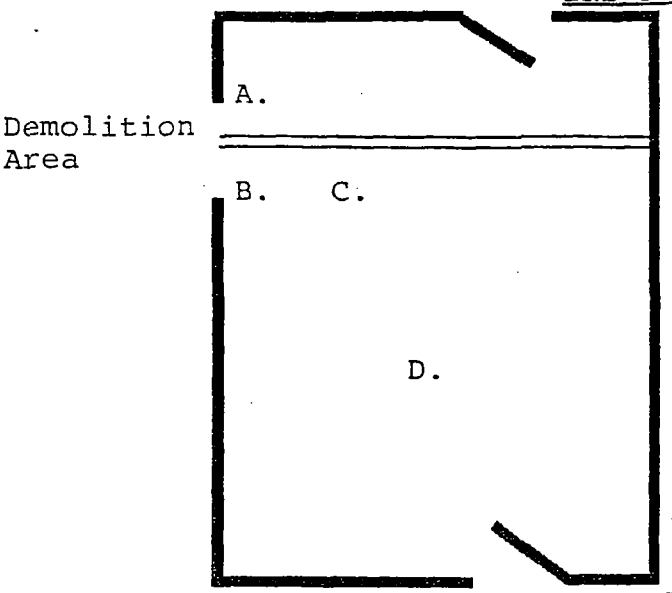
SURVEY REPORT

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	-

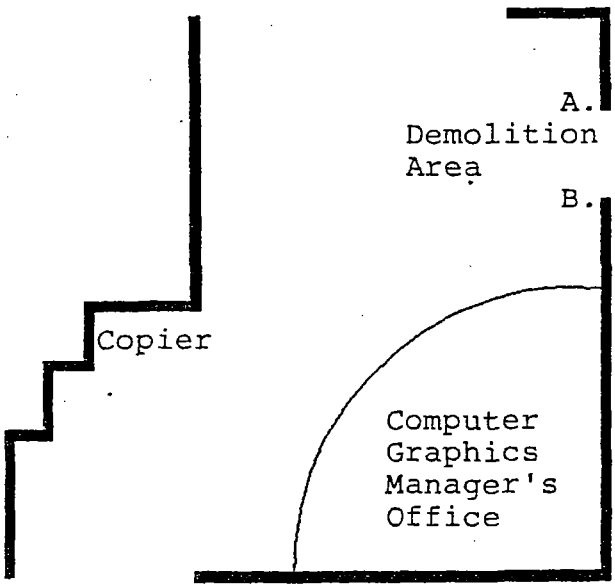
* Increases as floor is approached.

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

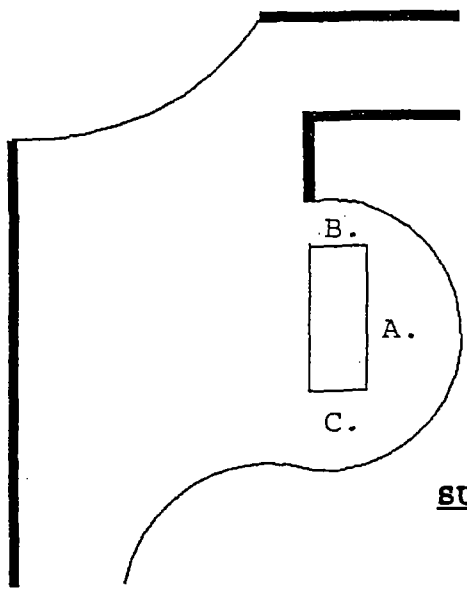
* Increases as floor is approached.

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.

D R A F T

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

December 16, 1983

To the Owner of Record
161 East Grand Avenue
Chicago, IL 60611

Re: Radioactive Thorium Radiation

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.K.

T. T. Kason
Deputy Commissioner

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.

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

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION V

DATE: FEB 21 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

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.

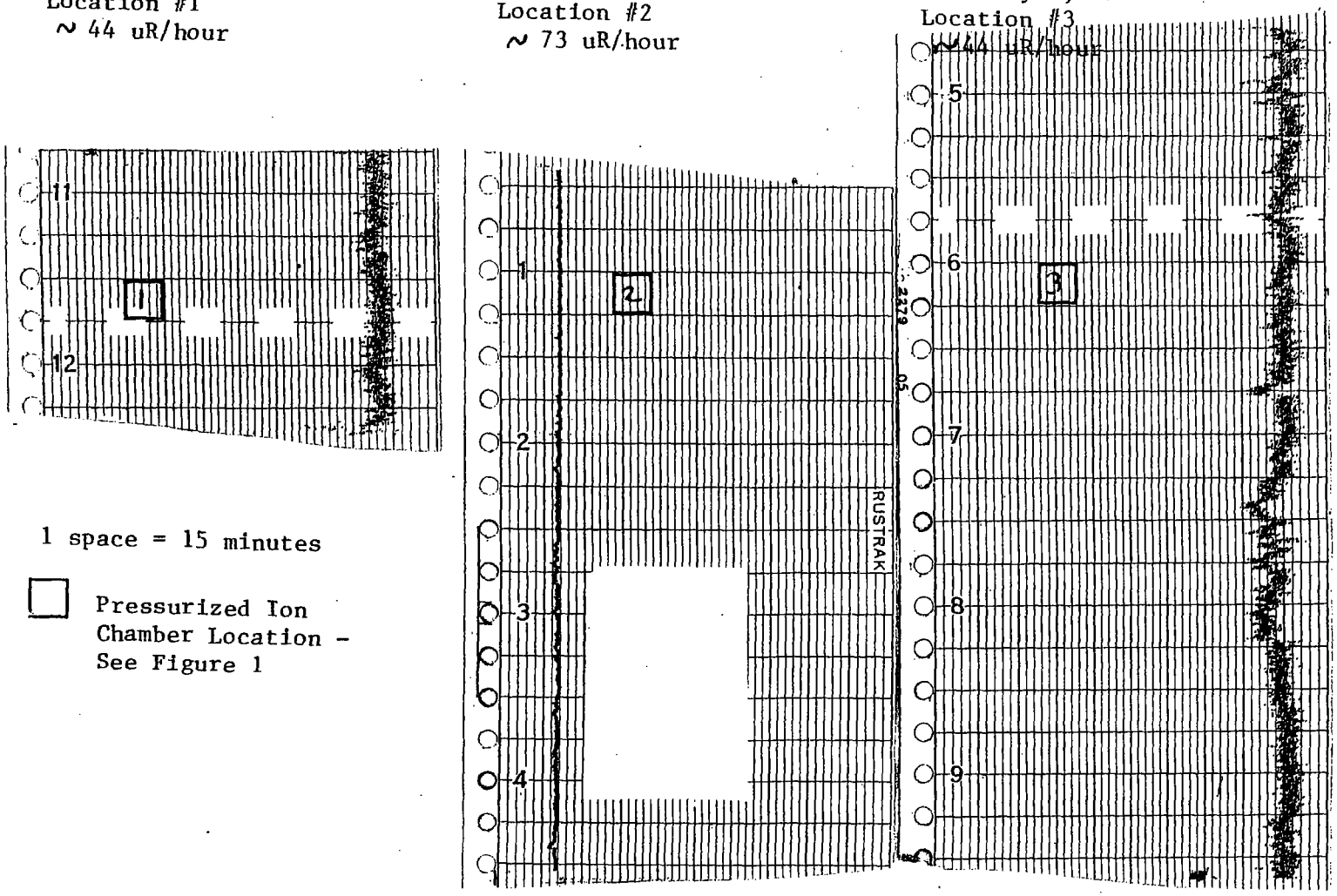
Attachment

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

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

APPENDIX A

City of Chicago Letter

to

161 East Grand Associates

D R A F T

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

December 16, 1983

To the Owner of Record
161 East Grand Avenue
Chicago, IL 60611

Re: Radioactive Thorium Radiation

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.K

T. T. Kason
Deputy Commissioner

U.S. ENVIRONMENTAL PROTECTION AGENCY

REGION V

AIR MANAGEMENT DIVISION

RECORD OF TELEPHONE CONVERSATION

DATE: February 24, 1984 TIME: 10:00 A.M.

RECORDED BY: Larry Jensen TALKED WITH: Eli Port
Radiation Safety Services

NATURE 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:

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

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. 01-0183

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. #36-2652895

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 (SNM) in quantities greater than 1 gram or source material greater than 1,000 kilograms that are being transfered, form AEC 741 must be completed. Our R.I.S. letters are VBQ.

MAKE CHECKS PAYABLE

ADCO SERVICES, INC.
P.O. BOX 1129
TINLEY PARK, IL 60477

TOTAL AMOUNT 10,307.50

ADCO Services, Inc.
17650 Duvan Drive, Tinley Park, IL 60477 • (708) 429-1660 FAX (708) 429-9759

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

✓ 5/15/00
address changed
to Ship to - 4th Ave Steele,
60611

F.E.I.N. #36-2652895

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 (SNM) in quantities greater than 1 gram or source material greater than 1,000 kilograms that are being transfered, form AEC 741 must be completed. Our R.I.S. letters are VBQ.

MAKE CHECKS PAYABLE TO:
ADCO SERVICES, INC.
P.O. BOX 1129
TINLEY PARK, IL 60477

TOTAL AMOUNT 10,307.50

ADCO Services, Inc.

17650 Duvan Drive, Tinley Park, IL 60477 • (708) 429-1660 FAX (708) 429-9759

INVOICE

064416 Page 1 of

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

5/15/00
address changed
to Ship to - Attn Ben Steele,
60611

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 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 (SNM) in quantities greater than 1 gram or source material greater than 1,000 kilograms that are being transfered, form AEC 741 must be completed. Our R.I.S. letters are VBQ.

MAKE CHECKS PAYABLE TO:
ADCO SERVICES, INC.
P.O. BOX 1129
TINLEY PARK, IL 60477

TOTAL AMOUNT 10,307.50

KUBA CLINIC
2724 West 47th Street
Chicago, IL 60632
Telephone (773)523-0361
Fax (773)523-7846

NAME: Sabino Hernandez **SS:** 368-860537

DATE OF EXAM: 4-20-00

In accordance with the Department of Labor Standards 1910.134 and O.S.H.A. standards 1926.58 (m) (1) regarding medical surveillance.

The Asbestos Physical for the above named examinee contained:

Annual Medical History Questionnaire X
Employment Physical X
Pulmonary Function Test X
Chest x-ray _____

The results of the medical examination of the above examinee have been reviewed. No medical conditions were detected which would place the individual at a health risk in continuing duties where possible asbestos exposure exists.

In accordance with O.S.H.A. requirements, I have informed the above named individual of the results of his/her medical examination.

The complete medical examination report and x-ray (if required) on the above named individual will be released and forwarded to the employer pending final conclusion and interpretation of any additional medical data collected during the examination.

We have determined that the examinee can perform work while wearing respiratory protection.

B.D. Horton DO
Physician's Name (Print)

Physician's Signature

Respirator Training Record

Your signature on this Respirator [illegible] received and understand the basic respirator training program which both DEM Services Incorporated and [illegible]

The basic respirator training [illegible]

- An [illegible] the respirator.
- A [illegible] to need effective and as a result, this respirator protection equipment is required.
- How [illegible] for this project.
- The li[illegible]
- How to [illegible]
- What the [illegible] of the care and maintenance program area.
- How to recognize and handle emergencies.
- When to use an Air Purifying Respirator.
- The purpose of the medical evaluation.
- How DEM Services Incorporated, conducts a proper fit test.
- A PAPR is available to you upon request, as long as it meets the protection factor for the hazards involved.

DEM Services Incorporated --- Respirator FIT TEST SUMMARY

Employee Signature:	Sabino Hernandez	Date:	12/15/99
Employee Printed Name:	SABINO HERNANDEZ	SSN:	368-86-0537
Person Conducting Test (Signature):	[signature], CHMM		
Person Conducting Test (Printed Name):	FRANK P. DEFRANZA		

Respirator Selected:

Manufacturer:	MSA	Size (circle One):	S (M) L
MSHA/NIOSH Approval #:	TC-21C-495	Model:	FULL FACE PAPR-45785
Type of Test Conducted:	Qualitative		
Testing Agent Used:	Smoke Irritant	Expiration Date:	6/14/00

OCCUPATIONAL HEALTH, INC.

TELEPHONE (312)641-1449 FAX (312)641-3714

3 WEST RANDOLPH STREET
H FLOOR
HICAGO, IL 60606

130 NORTH MICHIGAN AVENUE
SUITE 1400
CHICAGO, IL 60601

3434 SOUTH PULASKI ROAD
CHICAGO, IL 60632
PHONE (773) 767-8001 FAX (773) 767-3235

DOCUMENTATION: MEDICAL FITNESS FOR ASBESTOS REMOVAL AND RESPIRATOR USE

Case # 405683 Exam Date 11-23-99

Name Daniel Castillo Age 39 Sex (M) F

Date of Birth [redacted] Social Security # [redacted]

FITNESS CRITERIA

1. This is to certify, in accordance with the OSHA Asbestos Standard, 29 CFR 1926.58 (M)·(1) (2) (3) and (4) and 29 CFR 1910.1001, I have examined the above mentioned individual;

2. Based on my findings, I have determined this individual may use a respiratory device while performing his/her required employment services;

3. The results of my examination have not detected a medical condition which would place the employee at an increased risk of material health impairment from exposure to asbestos;

4. In accordance with OSHA requirement, I have informed the above named individual of the results of his/her medical examination and of any medical condition that may result from his/her exposure to asbestos, and

5. I have informed the above named individual of the health risks involved in smoking, of synergistic relationship between cigarette smoking and asbestos exposure in producing lung cancer, and that cessation of smoking will reduce the risk of lung cancer.

PHYSICIAN'S APPROVAL

It is my medical opinion that the above-named individual is medically fit to engage in asbestos removal and wear respiratory protective equipment as required by the Illinois Department of Public Health (Asbestos Abatement Act Rules and Regulations, Section 855.60) and OSHA 29 CFR 1926.58 M (1) (2) (3) (4) and OSHA 29 CFR 1910.1001.

Physician's Signature PA-C Date 11-23-99

Respirator Training Record

Your [illegible] and understand the basic respirator training program which both DEM Services [illegible]

The basic [illegible]

- An [illegible]
- A [illegible] and as a result, this respirator protection equipment is required.
- How [illegible] project.
- The [illegible]
- How to [illegible]
- What the [illegible] program area.
- How to [illegible]
- When to use an Air Purifying Respirator.
- The purpose of the medical evaluation.
- How DEM Services Incorporated, conducts a proper fit test.
- A PAPR is available to you upon request, as long as it meets the protection factor for the hazards involved.

DEM Services Incorporated --- Respirator FIT TEST SUMMARY

Employee Signature:	Daniel Castillo Jr.	Date:	4-17-00
Employee Printed Name:	DANIEL CASTILLO JR	SSN:	345561999
Person Conducting Test (Signature):	Paul R. Middleton		
Person Conducting Test (Printed Name):	Paul R. Middleton		

Respirator Selected:

Manufacturer:	MSA	Size (circle One):	S M L
MSHA/NIOSH Approval #:	TC-21C-495	Model:	FULL FACE PAPR-45785
Type of Test Conducted:	Qualitative		
Testing Agent Used:	Smoke Irritant	Expiration Date:	10-17-00

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}

\400001\161grand\161grand.xls

ADCO Services, Inc.

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	
Title	Title
5-10-00	5-10-00
Date	Date

17650 Duvan Drive • Tinley Park, Illinois 60477 • (708) 429-1660 • Fax (708) 429-9759

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): 847-966-1999

ORGANIZATION: 161 PARTNERS

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

3. TOTAL NUMBER OF PACKAGES IDENTIFIED ON THIS MANIFEST =====> 6

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
~~[illegible]~~ 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

SHIPMENT I.D. NUMBER: 01-0183 L

[ ] COLLECTOR
[ ] PROCESSOR
[X] GENERATOR TYPE (Specify) L

TELEPHONE NUMBER (Include Area Code): 847-966-1999

EPA I.D. NUMBER: ILD 047297364

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

AUTHORIZED SIGNATURE: [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; 7.5 FT3	01-0183-~~01~~ 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; 7.5 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; 7.5 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; 7.5 FT3	01-0183-04
NON-REGULATED MATERIAL	NA	NA	Solid RUBBLE	Th-232		3.7000E-02	1.0000E-03	NA	200. LBS; 7.5 FT3	01-0183-~~01~~ 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 (10-96)

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							WASTE DESCRIPTION FOR EACH WASTE TYPE IN CONTAINER							
							PHYSICAL DESCRIPTION			14. CHEMICAL DESCRIPTION		15 RADIOLOGICAL DESCRIPTION		16.WASTE CLASSIFICATION AS-Class A Stable AU-Class A Unstable B-Class B C-Class C
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	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)	CHEMICAL FORM/ CHELATING AGENT	WEIGHT % CHELATING AGENT if>0.1%	INDIVIDUAL RADIONUCLIDES AND ACTIVITY (MBq) AND CONTAINER TOTAL; OR CONTAINER TOTAL ACTIVITY AND RADIONUCLIDE PERCENT: RADIONUCLIDES	MBq	mCi	
01-0183-03 05 161 EAST GRAND CHICAGO, IL	4	0.2124	50.7186	.15	NP	NP	39-H	0.2124	100 100	RUBBLE NP	0.00	Th-232	3.7000E+00	1.0000E-01	AU
		7.5000	200.0000	15.0	NP	NP		7.5000				Subtotal	3.7000E+00	1.0000E-01	
												Total	3.7000E+00	1.0000E-01	
01-0183-02/ 161 EAST GRAND CHICAGO, IL	4	0.2124	50.7186	.03	NP	NP	39-H	0.2124	100 100	RUBBLE NP0	0.00	Th-232	3.7000E+00	1.0000E-01	AU
		7.5000	200.0000	3.0	NP	NP		7.5000				Subtotal	3.7000E+00	1.0000E-01	
												Total	3.7000E+00	1.0000E-01	
01-0183-03/ 161 EAST GRAND CHICAGO, IL	4	0.2124	50.7186	.01	NP	NP	39-H	0.2124	100 100	RUBBLE NP	0.00	Th-232	1.8500E+00	5.0000E-02	AU
		7.5000	200.0000	1.0	NP	NP		7.5000				Subtotal	1.8500E+00	5.0000E-02	
												Total	1.8500E+00	5.0000E-02	
01-0183-04/ 161 EAST GRAND CHICAGO, IL	4	0.2124	50.7186	.03	NP	NP	39-H	0.2124	100 100	RUBBLE NP	0.00	Th-232	1.8500E+00	5.0000E-02	AU
		7.5000	200.0000	3.0	NP	NP		7.5000				Subtotal	1.8500E+00	5.0000E-02	
												Total	1.8500E+00	5.0000E-02	
01-0183-05 01 161 EAST GRAND CHICAGO, IL	4	0.2124	50.7186	.002	NP	NP	39-H	0.2124	100 100	RUBBLE NP	0.00	Th-232	3.7000E-02	1.0000E-03	AU
		7.5000	200.0000	.2	NP	NP		7.5000				Subtotal	3.7000E-02	1.0000E-03	
												Total	3.7000E-02	1.0000E-03	
Shipment Totals		1.0620	453.5926										1.1137E+01	3.0100E-01	
		37.5000	1000.0000												

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

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

Note 1A: 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 Wax Binder

FORM 541 (10-96)

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 Gass Date: 8/5/93
Approved By: [illegible] Date: 8/5/93

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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

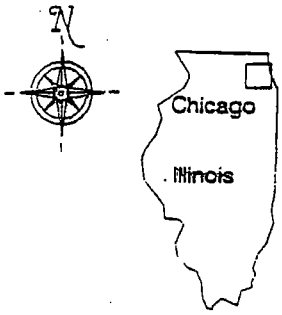
The Lindsay Light Company manufactured incandescent gas mantles for home and street lighting in this building from at least 1910 until 1936. Lindsay Light moved to West Chicago and was later purchased by American Potash, which was later purchased by Kerr McGee Chemical Company in 1967. The principal 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.



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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.

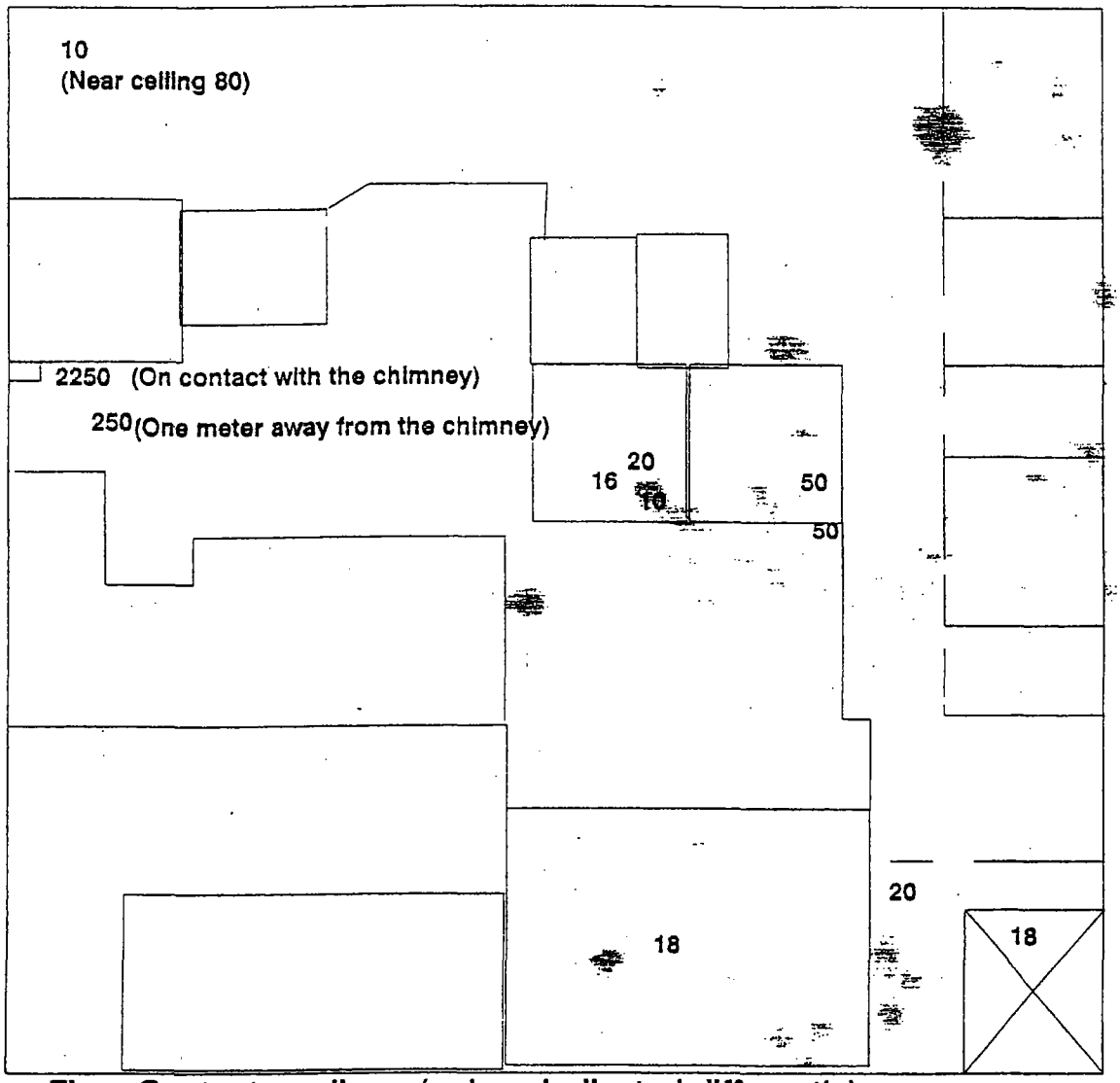
Due to the contaminant of concern, one may be exposed to radioactive isotopes and the effects may occur many years after exposure. Thorium occurs principally as the parent radionuclide thorium-232 in association with its daughter products in a decay sequence known as the Thorium Decay Series. Thorium-232 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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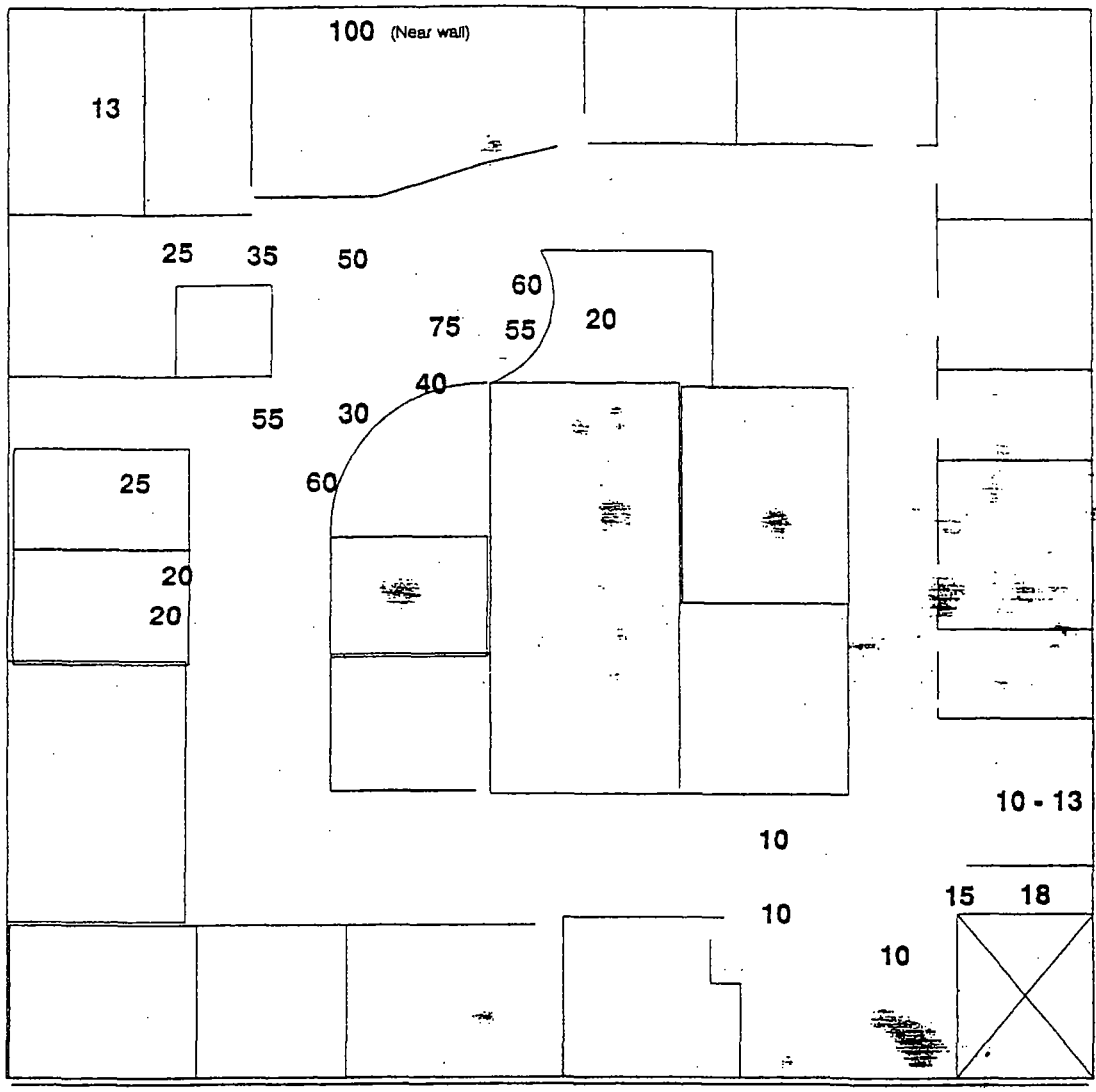
TITLE 161 E. Grand Ave. Basement (Optumus)	FIGURE # Figure 6
SITE Lindsay Light Company	TDD# T05-9305-014
CITY Chicago STATE IL	SCALE Not to Scale
SOURCE Instrument: Ludlum Model 19	DATE July 16, 1993
	REVISED

1



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

LEGEND

N

Readings: MicroR/Hr

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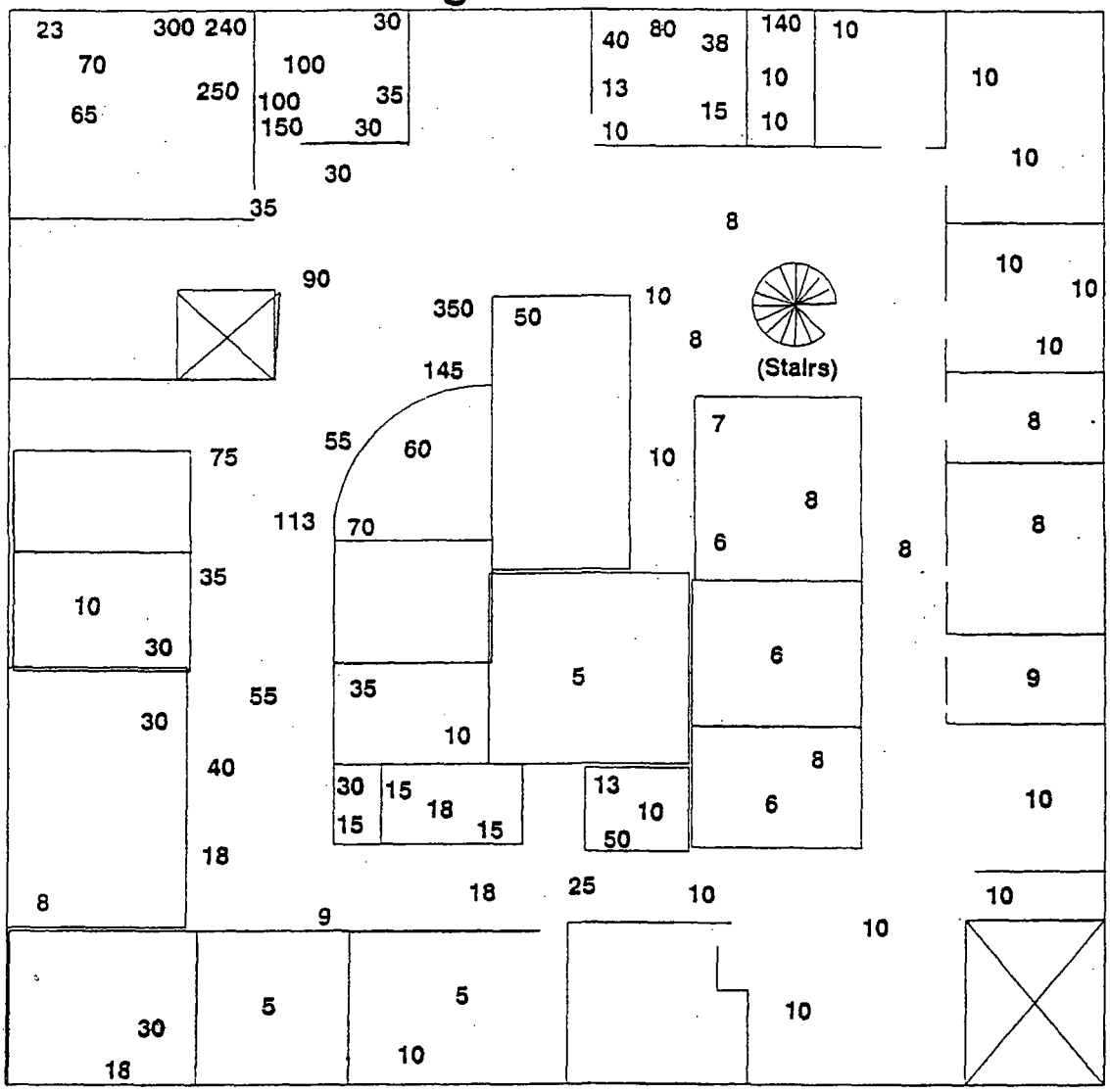
TITLE 161 E. Grand Ave. 1st Floor Readings Optumus	FIGURE Figure 5
SITE Lindsay Light Co.	SCALE T05-9305-014
CITY Chicago STATE IL	PAM Not to Scale
SOURCE Instrument: Ludlum Model 19	DATE REVISED

2

Reading: micro-R/hr



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

N

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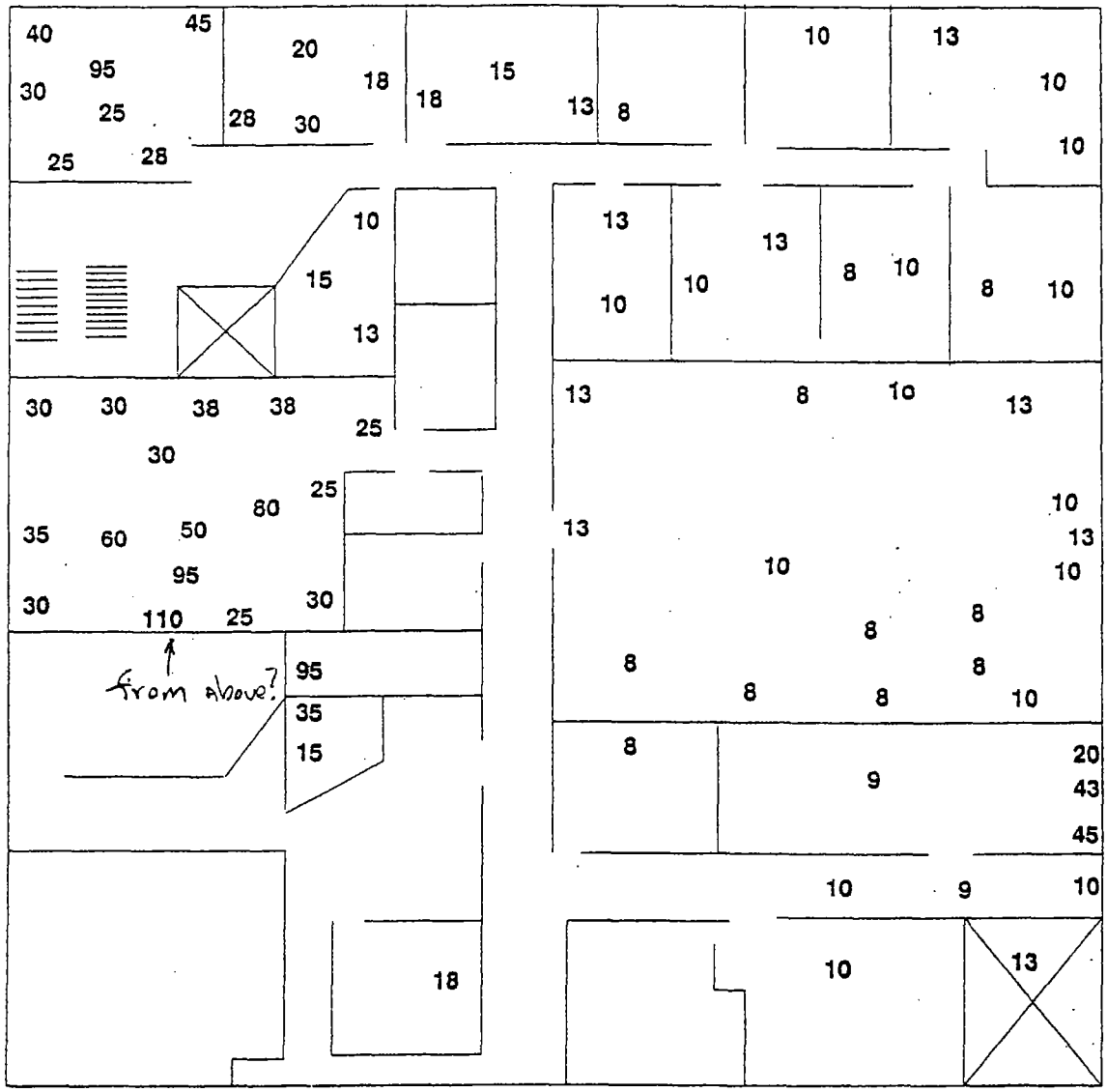
TITLE 161 E. Grand Ave. 2nd Floor (Optumus)	FIGURE # Figure 2
SITE Lindsay Light Company	TDD# T05-9305-014
CITY Chicago STATE IL	SCALE Not to Scale
SOURCE Instrument: Ludlum Model 19	DATE July 16, 1993
	REVISED

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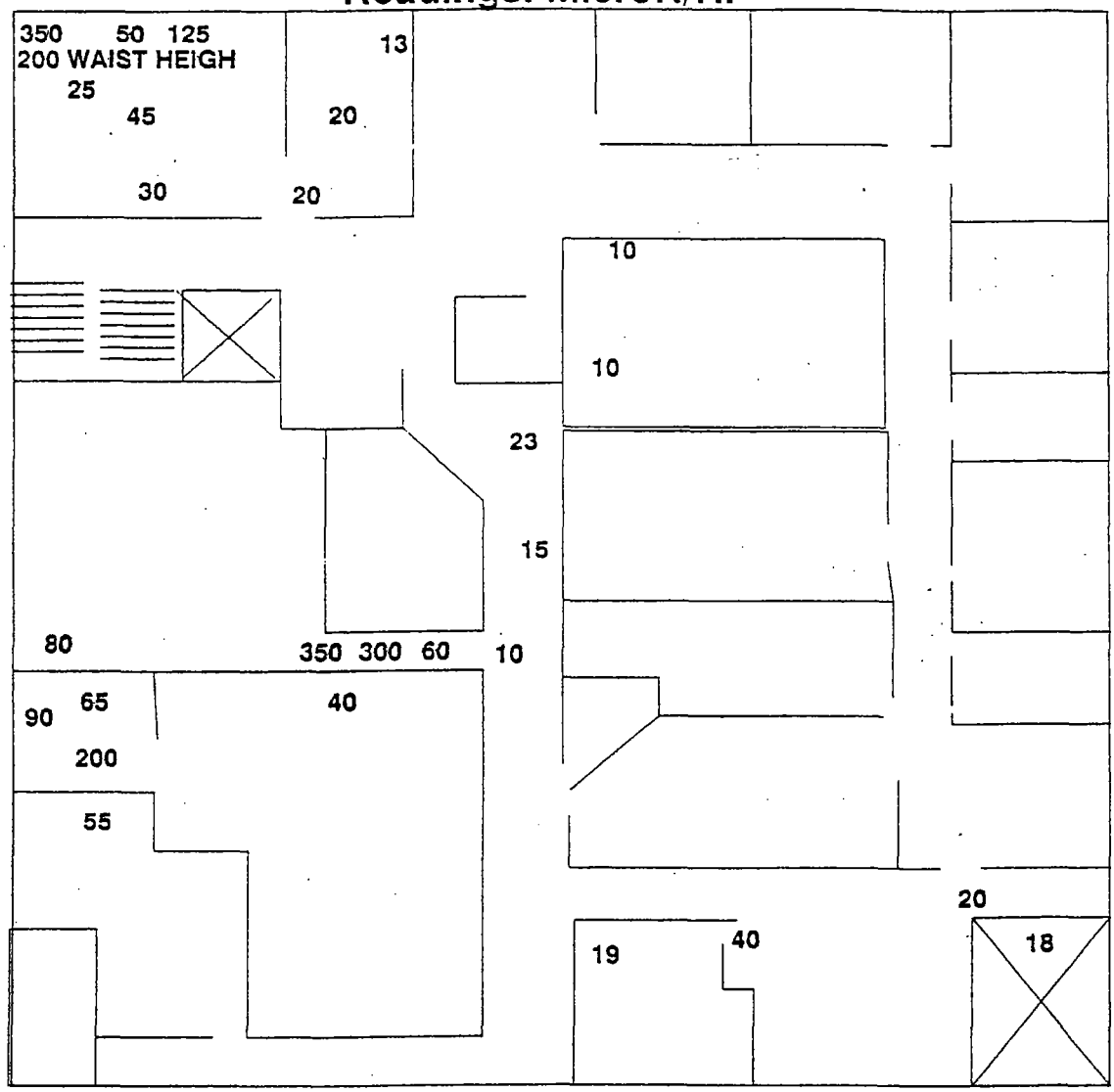
TITLE 161 E. Grand 3rd Floor (Optumus)	FIGURE # Figure 3
SITE Lindsay Light Company	TDD# T05-9305-014
CITY Chicago STATE IL	SCALE Not to Scale
SOURCE Instrument: Ludlum Model 19	DATE July 16, 1993
	REVISED

4

Readings: MicroR/Hr

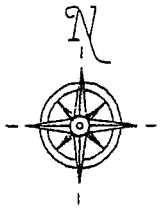


Floor Contact readings (unless indicated differently)

Readings include the correction factor

The instrument reads higher by a factor of 2.

LEGEND



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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

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

DATE: 6/2/93

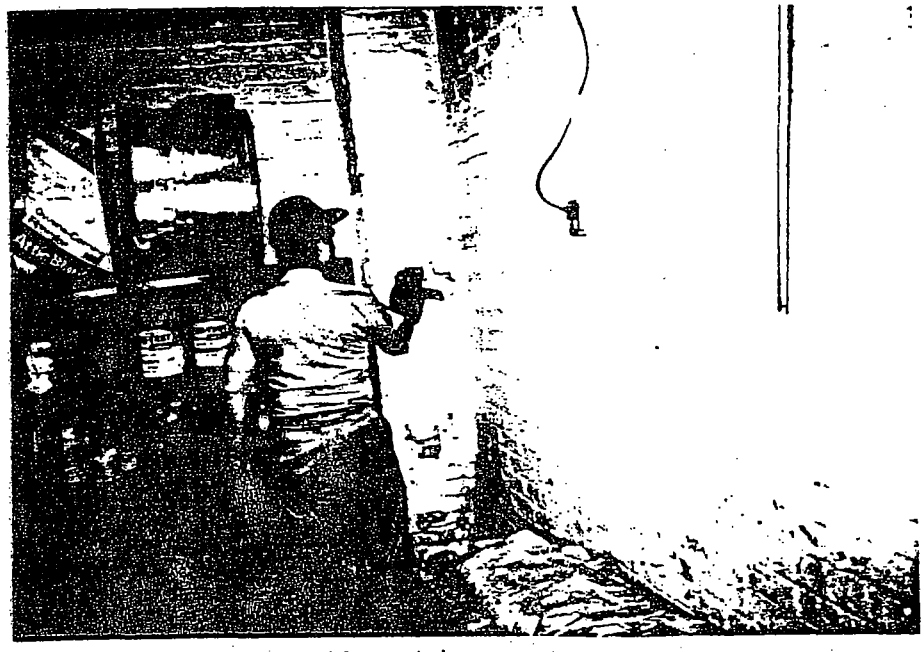
TIME: 2030

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

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

DATE: 6/2/93

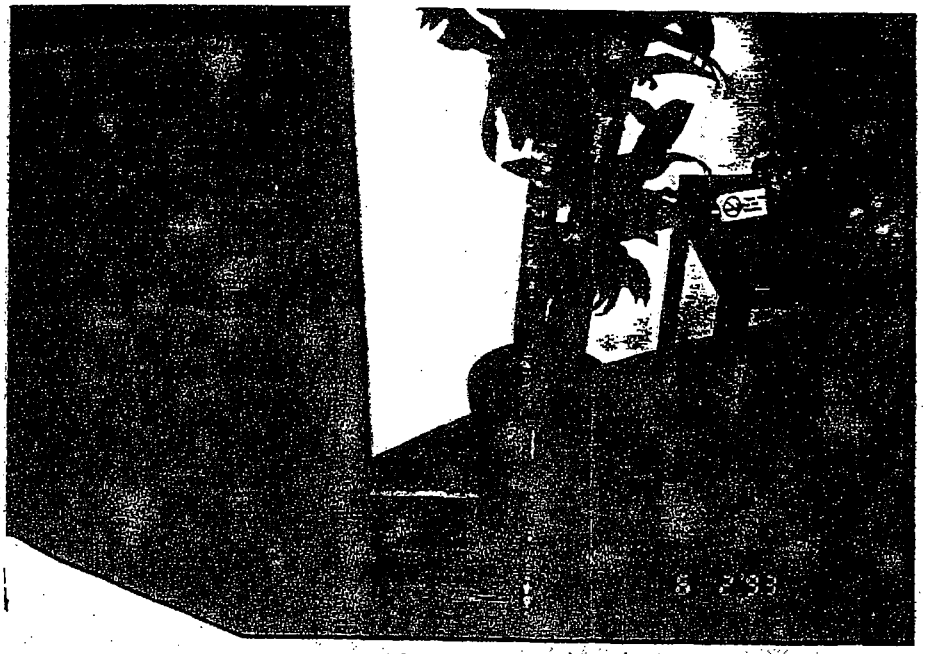
TIME: 1930

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

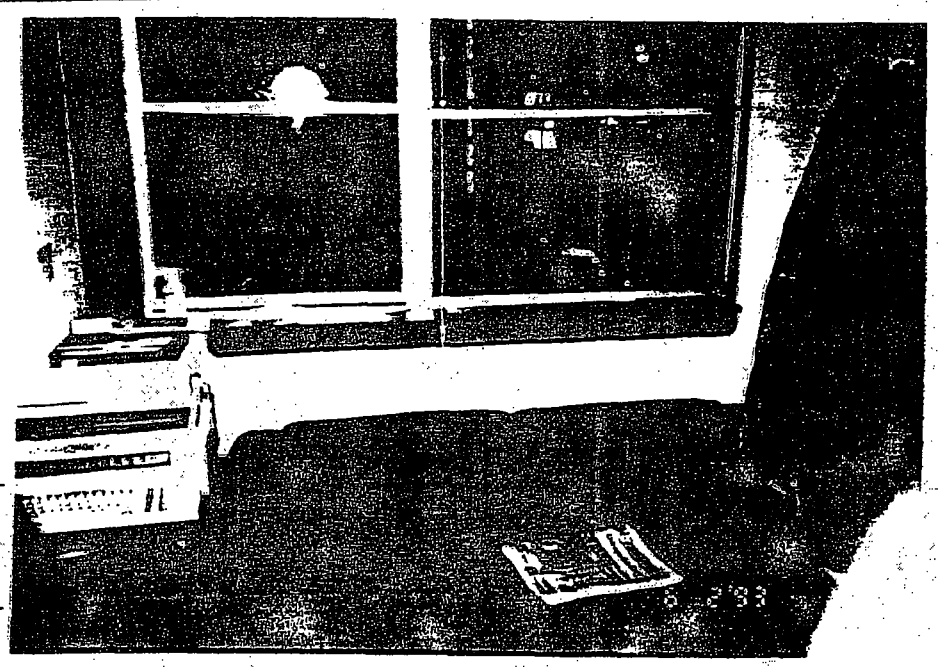
TIME: 2000

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

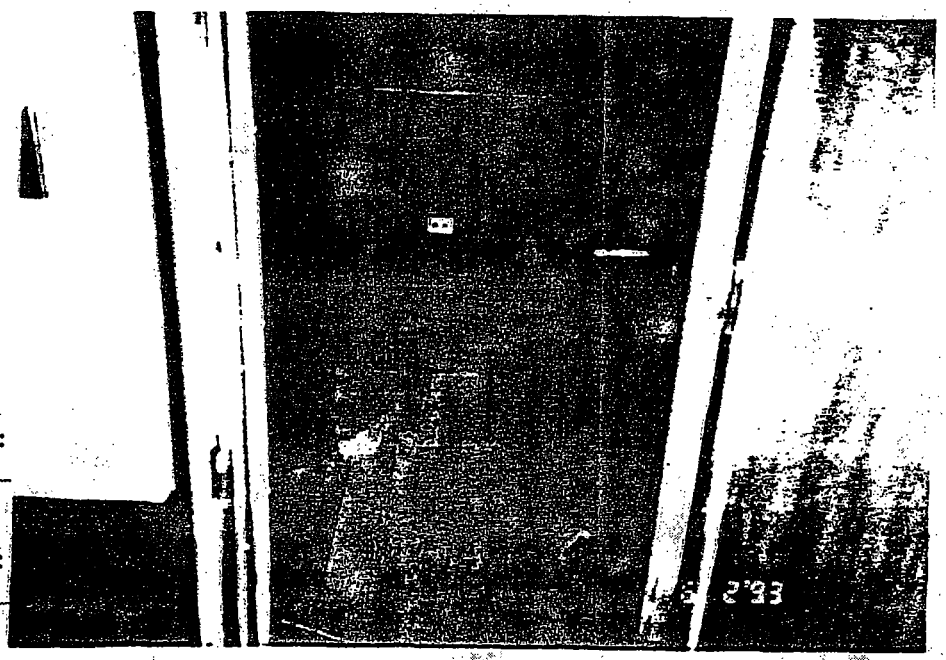
TIME: 1830

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

SITE NAME: Lindsay Light Company

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

DATE: 6/2/93

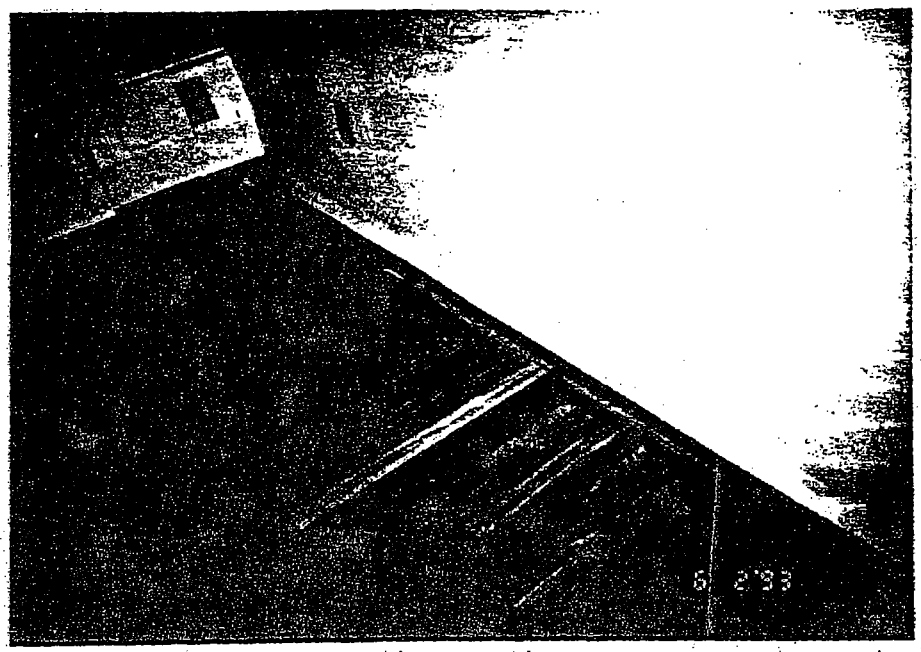
TIME: 1745

DIRECTION OF PHOTOGRAPH: North

WEATHER CONDITIONS: N/A

PHOTGORAPHED BY: Ron Bugg

SAMPLE ID (if applicable):



DESCRIPTION: Reading at contact near the 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

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

DATE: 6/2/93

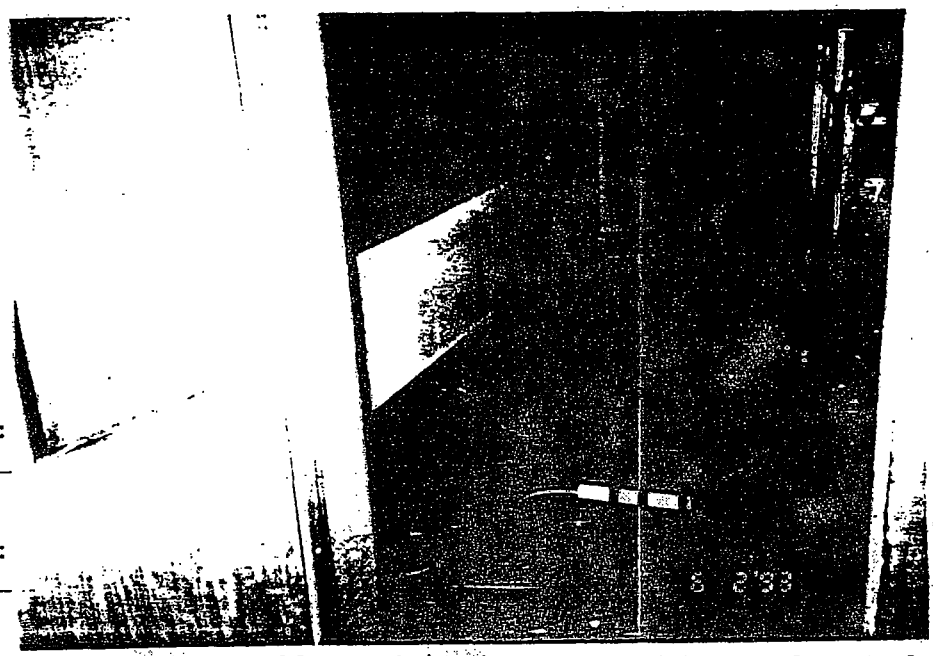
TIME: 1845

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

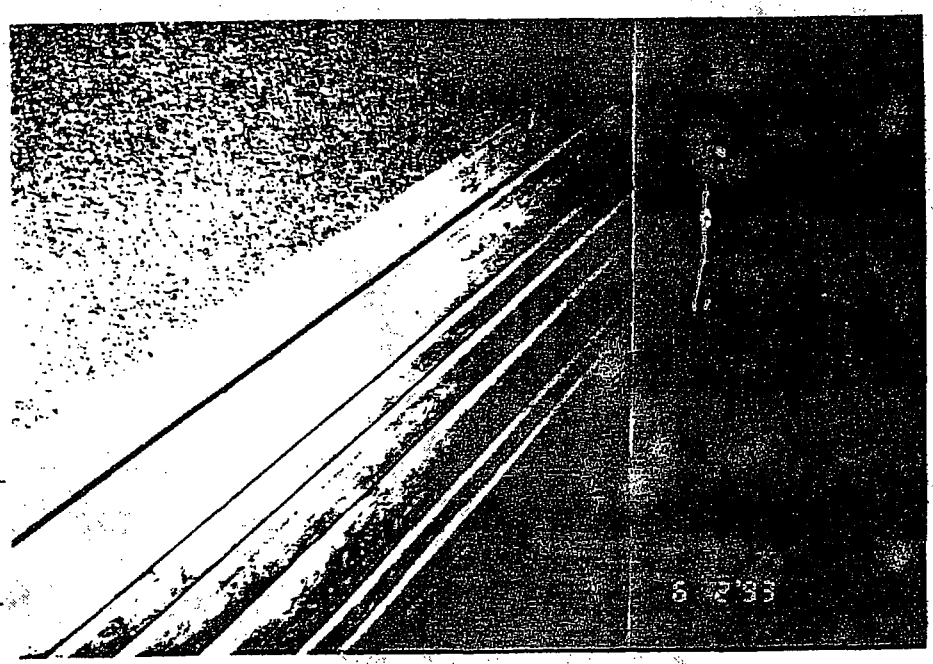
TIME: 1845

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 (4

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%)
$^{212}_{84}Po$ (64.0%)	Thorium C' ^{212}Po	304ns	8.78 (100%)	---	---
$^{208}_{81}Tl$ (36.0%)	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: $^{4n+32}_{90}Th$ (4n).....(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]).

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

These are a series of tests, on the same badge!

Thermo Analytical Inc.
TMA/Eberline
5635 Jefferson Street NE
Albuquerque NM 87109
(505) 345 0801

TLD ENVIRONMENTAL 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

BADGE NUMBER	IDENTIFICATION	DOSIMETER READINGS (mrem) FIRST	SECOND	THIRD	FOURTH	FIFTH	AVERAGE ±	2σ	MREM/WEEK *
9016		[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
9033	3- Corner Off (NW)	33	34	29	40	35	34.2	7.9	3.[illegible]
9018		[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
9019		[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
9020		[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
9021	B- Chimney	3280	3224	3253	3334	2921	3202.4	324.9	320.2
9022	B- Shelving (By Chimney)	182	245	208	226	190	210.2	51.7	21.0
9023	B- Shipping	33	26	32	39	31	32.2	9.3	3.2
9024	1- Window (200)	28	36	35	42	40	36.2	10.8	3.6
9025	1- Reception	35	36	44	42	39	39.2	7.7	3.9
9026	2- NE Office Corner	199	183	231	194	185	202.4	95.9	20.2
9027	2- Sm Office	432	548	436	442	535	478.6	115.4	47.8
9028	2- Center "	49	51	56	46	47	49.8	7.9	4.9
9029	2- Sm Office	46	43	35	41	35	40.0	9.8	4.0
9031	2- Core	17	14	14	12	16	14.6	3.9	1.4
9032	2- S Office	15	20	16	13	15	15.8	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
I - IRREGULAR

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

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

Draft 10/27/99

161 E. Grand Associates
Ron Steele, Manager
161 E. Grand
Chicago,Il. 60611

Dear Mr. Steele,

This letter is simply to confirm arrangements that have been made with your consultant, Eli Port, Concerning the 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 pay the costs for the transportation and disposal of such material at a properly licensed disposal site, up to a maximum of $20,0000.00. The work will be undertaken by your contractor under your supervision and all other costs associated with the remediation will be paid by you.

It is agreed by you that Kerr-McGee's undertaking to pay these costs does not represent 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. Grand Avenue or for its remediation.

I would appreciate it if you would countersign this letter and return it to me.

Very Truly Yours,

George B. Christiansen

AGREED TO:_____
Manager

n

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

Please call 270-2686 or 270-2384 for FAX transmittal problems.

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

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EMERGENCY PHONE NUMBERS

IN THE EVENT OF AN EMERGENCY DIAL: 911

AMBULANCE SERVICE	911
FIRE DEPARTMENT	911
EMERGENCY RESCUE SERVICE	911
POLICE DEPARTMENT	911
NATIONAL RESPONSE CENTER	1-800-424-8802
CHEMTREC	1-800-424-9300
POISON CONTROL CENTER	1-800-732-2200
NORTHWESTERN MEMORIAL HOSPITAL	(312) 908-2000
ILLINOIS DEPARTMENT OF NUCLEAR SAFETY (IDNS) EMERGENCY NUMBER	(217) 785-0600
OFFSITES MANAGER	(630) 293-6332
ILLINOIS EMERGENCY MANAGEMENT	(217) 782-7860
U.S. EPA REGION V 24-HOUR EMERGENCY NUMBER	(312) 353-2318

2. SAFETY MANAGEMENT

The following safety management structure will be utilized for the implementation, administration, and monitoring of the HASP.

2.1 HEALTH AND SAFETY COORDINATOR

The Health and Safety Coordinator (HSC) shall assume overall responsibility for the HASP. The HSC or designee shall monitor and maintain quality assurance of the HASP until project completion. Principal duties of the HSC include:

- Review project background data,
- Approve all HASP modifications,
- Administer and enforce the HASP,
- Evaluate the adequacy of personal protective equipment (PPE) to be used by Site personnel,
- Conduct required on-site training except tailgate safety meetings that will be conducted by the Field Team Leader,
- Brief visitors on work Site conditions, and
- Administer personnel and ambient air monitoring procedures.

The HSC or designee has the authority to stop work in the event conditions develop which pose an unreasonable risk to Site personnel or persons in the vicinity.

3. PERSONNEL RESPONSIBILITIES

The HSC or designee will administer and supervise the HASP at the work-site level. He will monitor all operations and will be the primary on-site contact for health and safety issues, and will have full authority to stop operations if conditions are judged to be hazardous to on-site personnel or the public.

The HSC will brief all Site personnel on the contents of the HASP. Personnel will be required to review the HASP, and have the opportunity to ask questions about the planned work or hazards. The Field Team Leader will conduct tailgate safety meetings to familiarize the Site personnel with Site conditions, boundaries, and physical hazards. Site personnel will conduct their assigned tasks in accordance with the HASP at all times.

If at any time Site personnel observe unsafe conditions, faulty equipment or other conditions which could jeopardize personnel health and safety, they are required to immediately report their observations to the HSC or Field Team Leader.

Work zones will be established at the Site. These zones include clean/support zones, decontamination zones, and exclusion zones. Although the clean/support zones are anticipated to remain fixed, other zones will move about the Site as drilling and excavation work progresses. Figure 3.1 shows the impacted areas where exclusion zones may be established during excavation activities.

4. HAZARD ASSESSMENT

The following represents potential hazards associated with this project.

4.1 PRINCIPAL CONTAMINANTS (KNOWN OR SUSPECTED)

- Thorium
- Uranium
- Radium
- Radon

The contaminants are present in the soil at low concentrations. These primary routes of entry to the body will be considered:

ROUTE	ENTRY MADE VIA:
Inhalation:	Airborne dust containing heavy metal radionuclides.
Ingestion:	Airborne dust containing heavy metal radionuclides/contaminants.
	Improper or poor personal hygiene practices.
Eye and Skin:	Direct contact with contaminants. Improper or poor personal hygiene practices.
	Airborne dust containing heavy metal/radionuclide contaminant.
	Cuts and abrasions.
Direct Exposure:	Penetrating gamma radiation in air and soil.

4.2 PHYSICAL HAZARDS

Before field activities begin, the HSC will conduct a Site reconnaissance to identify any real or potential hazards created from Site activities. Physical hazards inherent to construction activities and power-operated equipment may exist.

4.2.1 Heat Stress

Field activities in hot weather create a potential for heat stress. The warning symptoms of heat stress include fatigue; loss of strength; reduced accuracy, comprehension and retention; and reduced alertness and mental capacity. To prevent heat stress, personnel shall receive adequate water supplies and electrolyte replacement fluids, and maintain scheduled work/rest periods.

The Field Team Leader or designee shall continuously visually monitor personnel to note for signs of heat stress. In addition, field personnel will be instructed to observe for symptoms of heat stress and methods on how to control it. One or more of the following control measures can be used to help control heat stress.

- Provision of adequate liquids to replace lost body fluids. Employees must replace body fluids lost from sweating. Employees must be encouraged to drink more than the amount required to satisfy thirst, 12 to 16 ounces every half hour is recommended. Thirst satisfaction is not an accurate indicator of adequate salt and fluid replacement. Replacement fluids can be commercial mixes such as Gatorade.

- Establishment of a work regimen that will provide adequate rest periods for cooling down. This may require additional shifts of workers.

- Breaks should be taken in a cool and shaded rest area (77 degrees is best).

- Employees shall remove impermeable protective garments during rest periods.

- Employees shall not be assigned other tasks during rest periods.

- All employees shall be informed of the importance of adequate rest, acclimation, and proper diet in the prevention of heat stress.

4.2.2 Cold Stress

Field activities are not anticipated during cold weather; however, if the field activities occur during a period when temperatures average below freezing, the following guidelines will be followed.

Persons working outdoors in temperatures of 40 degrees and below may suffer from cold exposure. During prolonged outdoor periods with inadequate clothing, effects of cold exposure may even occur at temperatures well above freezing. Cold exposure may cause severe injury by freezing exposed body surfaces (frostbite) or result in profound generalized cooling, possibly causing death. Areas of the body which have

high surface area-to-volume ratios such as fingers, toes and ears are the most susceptible to frostbite.

Two factors influence the development of a cold injury: ambient temperature and the velocity of the wind. Wind chill is used to describe the chilling effect of moving air in combination with low temperature. For instance, 10° F with a wind of 15 miles per hour (mph) is equivalent in chilling effect to still air at -18°F.

As a general rule, the greatest incremental increase in wind chill occurs when a wind of 5 mph increases to 10 mph. Additionally, water conducts heat 240 times faster than air. Thus, the body cools suddenly when external chemical-protective equipment is removed if the clothing underneath is perspiration-soaked.

Local injury resulting from cold is included in the generic term "frostbite". There are several degrees of damage. Frostbite of the extremities can be categorized into:

- Frost nip or incipient frostbite: Characterized by sudden blanching or whitening of skin.
- Superficial frostbite: Skin has a waxy or white appearance and is firm to the touch, but tissue beneath is resilient.
- Deep frostbite: Tissues are cold, pale, and solid; extremely serious injury.

Prevention of frostbite is vital. Keep the extremities warm. Wear insulated clothing as part of one's protective gear during extremely cold conditions. Check for symptoms of frostbite at every break. The onset is painless and gradual--you might not know you have been injured until it is too late.

To administer first aid for frostbite, bring the victim indoors and rewarm the areas quickly in water 95° to 100°F. Give individual a warm drink--not coffee, tea, or alcohol. The victim should not smoke. Keep the frozen parts in warm water or covered with warm clothes for 30 minutes, even though the tissue will be very painful as it thaws; then elevate the injured area and protect it from injury. Do not allow blisters to be broken. Use sterile, soft, dry material to cover the injured areas. Keep victim warm and get immediate medical care.

4.2.3 Electrical Hazards

Overhead power lines, downed electrical wires, buried cables and improper use of electrical extension cords can pose a danger of shock or electrocution. All Site personnel should immediately report to the Field Team Leader any condition that could result in a potential electrical hazard.

The Field Team Leader will notify Site personnel during the safety meetings of the locations of known underground cables and utilities.

4.3 MEDICAL EVALUATION AND SURVEILLANCE PROGRAM

All field project personnel shall receive a medical evaluation in accordance with 29 CFR 1910.120 and Appendix A. Personnel who receive a medical evaluation will be notified by the medical contractor as to the outcome of their evaluation. This will be in the form of a confidential report addressed to the individual and will contain a breakdown of the clinical findings. In addition, it will indicate any areas of concern which would justify further medical consultation by the individual's personal physician. In the event that the areas of concern are of a severe nature, a follow-up notification will be made to the individual by the medical consultant to answer any questions the employee may have.

4.3.1 Dosimetry/Personnel Monitoring

All project personnel shall participate in a dosimetry program administered by the Project Health Physics Personnel. (The dosimetry program shall comply with 32 IAC 340[1], i.e. dosimeters shall be processed by a dosimetry processor accredited by the National Voluntary Laboratory Accreditation Program.) The Project Health Physics Personnel shall maintain records of all radiation exposures incurred by field personnel including all contractors. These records will be maintained in an up-to-date manner to comply with the requirements of 32 IAC 340.4010. The HSC shall review the results of personal exposure monitoring to determine compliance with exposure limit requirements.

4.3.2 Requirement for Dosimetry

Personal dosimetry is required for anyone who enters a radiologically controlled area in which he/she may receive in one calendar year a dose in excess of 10% of the limits in 32 IAC 340. Any person who works in a radiation area will be required to have a personal dosimeter. As a matter of policy, all individuals shall be required to use a dosimeter (either self-reading type, film badge or Thermoluminescence Detector (TLD)) whenever they enter the Exclusion Zone.

4.3.3 Bioassay

Bioassay is the determination of the types and amounts of radioactive materials which are inside the body. By analyzing the rate of deposition, the rate of excretion, and any other available information regarding placement in the body, internal exposures from radioactive materials can be estimated.

The Respondents will use procedures described in the Kerr-McGee Radiation Manual for bioassay. Determination for bioassay will be made by the Field Team Leader in

---

[1] The IDNS regulations are usually more restrictive than US Nuclear Regulatory Commission (NRC) regulations. However, if there is a conflict between IDNS and NRC regulations, the NRC regulations will be used to determine compliance.

conjunction with the requirements of the Kerr-McGee Radiation Manual. The following are requirements of bioassay.

Preliminary Bioassay: Bioassay performed before a person starts work in controlled areas is not necessary on a routine basis for the excavation and restoration activities. Workers who have had previous significant exposure to uranium or thorium daughters may require preliminary bioassay. Requirements for preliminary bioassay are determined on a case-by-case basis by the Project Health Physics Personnel. Evaluation of occupational exposure history as recorded on form KLA.002 (available in the Kerr-McGee Radiation Manual) will be made to determine the need for preliminary bioassay.

Routine Bioassay: Routine bioassay for workers on the excavation and restoration activities will be required infrequently, if at all. The principal nuclides for bioassay purposes are Ra-228 and Th-232.

Airborne materials are the most likely to be taken into the body, and routine bioassay will be determined on a case-by-case basis from the amount of airborne exposure an individual has had. Airborne radioactivity levels will be determined by air samples.

Routine bioassay will be required if an individual works in airborne radioactivity areas such that he or she is exposed to 2080 DAC hours or more in a calendar year as a result of chronic inhalation exposure and/or a series of small acute exposures to airborne thorium. The preferred bioassay method in this case is in-vivo (lung) counting using procedures with a minimum sensitivity of 6 to 8 mg of Th (natural) for persons with a typical chest wall thickness.

DAC hours are calculated using the appropriate Derived Air Concentration listed in Table I, Column I, Appendix A of 32 IAC 340. Exposure to the DAC in air for one hour is equal to one DAC-hour. Exposure to two times the DAC for one-half hour is also one DAC-hour. These figures assume that no respiratory protective equipment is worn by the individual.

Non-Routine Bioassay: Bioassay may be required in unusual or accidental circumstances including accidental ingestion of a quantity of materials, possible injection from being wounded by a highly contaminated object, or accidental inhalation of concentrated materials released by opening a tank or other closed system. Nasal swabs, sputum samples and direct monitoring will help show the need for bioassay. Non-routine bioassay is conducted for unusual acute inhalation exposures exceeding 2080 DAC hours. Fecal analysis is used to verify the exposure severity. Such verification will require follow-up in-vivo examination.

4.3.4 Emergency Medical Treatment

Emergency first aid should be administered on-site as appropriate. The individual should be decontaminated if possible, depending on the severity of the injury, and transported to the nearest medical facility, if needed. Treatment of the injury is of primary concern and decontamination a secondary concern. Levels of radioactive contamination at the Site could be acutely hazardous if decontamination is not undertaken during an emergency situation. The Field Team Leader will complete the appropriate incident report, if warranted. See Section 4.4, Accident and Incident Reporting.

An emergency first-aid station will be established and will include a first-aid kit for on-site emergency first aid.

Provisions for emergency medical treatment shall be integrated with the following guidelines:

- At least one individual qualified to render first aid and Cardiopulmonary Resuscitation (CPR) will be assigned to each shift.
- Emergency first aid stations in the immediate work vicinity.
- Conspicuously posted phone numbers and procedures for contacting ambulance services, fire department, police, and medical facilities.
- Maps and directions to medical facilities.
- Conspicuously posted evacuation routes and gathering area locations shall be posted around the Site.

4.4 ACCIDENT AND INCIDENT REPORTING

All accidents, injuries, or incidents will be reported to the HSC. This accident/incident will be reported as soon as possible to the employee's supervisor. An Accident/Incident Form will be completed by the Field Team Leader, and a copy will be forwarded to the Offsites Project Manager. A copy of the form is shown as Figure 4.1.

Figure 4.1

Accident/Exposure Investigation Report (Page 1 of 3)

Accident/Exposure Investigation Report

Company **Date**

Investigation Team

Employee's Name & ID

Sex **Age** **Job Description**

Department & Location

Accident Date & Time

Date & Time Accident Reported to Supervisor

Nature of Incident

Nature of Injury

Referred to Medical Facility/Doctor **Yes** **No**

Employee Returned to Work **Yes** **Date/Time** **No**

Injured Employee Interview/Statement—Attached

Witnesses

Witnesses Interviews/Statements—Attached

Photographs of Site—Attached

Diagrams of Site—Attached

Equipment Records—Attached—Reviewed **Yes** **No**

Accident/Exposure Incident Description

Make additional copies of this form as needed. (form provided courtesy of Safety Publications of California © 1990)

Figure 4.1

Accident/Exposure Investigation Report (Page 2 of 3)

Accident/Exposure Investigation Report

Accident Description

Date & Time **Location**

Employees Involved

Preventive Action Recommendations

Corrective Actions Completed	Manager Responsible	Date Completed

—Employee Lost Time—Temporary Help—Cleanup—Repair—Discussion—

Accident Cost Analysis	Investigation	Compliance	Total Cost
Medical			
Production Loss			

Report Prepared By **Date Completed**

Safety Committee Review **Yes** **No**

Corrective Action **Date Started**

Safety Communication Notice Prepared **Date**

Safety Director Signature

Make additional copies of this form as needed. (form provided courtesy of Safety Publications of California © 1990)

Figure 4.1

Accident/Exposure Investigation Report (Page 3 of 3)

Accident/Exposure Investigation Report

Accident Description

Date & Time **Location**

Employees Involved

Employee Interview/Statement—Injured Employee—Witness

Employee Name

Interviewed By

Accident Diagram/Photographs

Make additional copies of this form as needed. (form provided courtesy of Safety Publications of California © 1990)

5. TRAINING

All Site personnel shall be trained and certified in accordance with 29 CFR 1910.120 and Kerr-McGee's Medical Evaluation Program (Appendix A). The Kerr-McGee Medical Evaluation Program is an approved and established program that will be used by the Respondents.

5.1 PROJECT- AND SITE-SPECIFIC TRAINING

Prior to project start-up, all assigned personnel shall receive an initial project- and site-specific training session. This training shall include, but not be limited to, the following areas:

- Review of the Health and Safety Plan;
- Review of applicable radiological and physical hazards;
- PPE levels to be used by Site personnel;
- Site security control;
- Emergency response and evacuation procedures;
- Project communication;
- Required decontamination procedures;
- Prohibited on-site activities;
- Instructions to workers in accordance with 10 CFR 1912; and
- U.S. NRC Regulatory Guide 8.13 and Declared Pregnant Woman Policies (Females).

5.2 VISITOR ORIENTATION

All non-essential personnel and visitors who plan to enter the exclusion zone will be briefed on the HASP requirements and 10 CFR 1912 requirements prior to entry with a trained Site escort. In addition, female visitors will be instructed regarding U.S. NRC Regulatory Guide 8.13 and Declared Pregnant Woman Policies.

5.3 SAFETY "TAILGATE" MEETINGS

Before the start of work each day, the Field Team Leader will assemble the Site personnel for a brief safety meeting. The purpose of these meetings will be to discuss

project status, problem areas, conditions, safety concerns, PPE levels and to reiterate HASP requirements. The Field Team Leader will complete a Safety Meeting Report (Figure 5.1) to indicate the contents of the meeting and the attendees.

5.4 FIRST AID

At least one (1) individual, trained and qualified to administer first aid and CPR in accordance with American Red Cross requirements, will be present at the Site.

5.5 SAFE WORK PERMIT

Site workers in special work conditions such as confined space, hot work, trenching, or other physical hazards, must be skilled at such work and trained to recognize these as special work conditions. Confined space is defined by OSHA 1910.146. Section 13 of this HASP contains further information on the confined space program to be followed.

Figure 5.2 shows the Safe Work Permit to be completed by the HSC and signed by workers for special work conditions.

Figure 5.1

Safety Meeting Report (KM-4438-A, front side)

SAFETY MEETING REPORT KM-4438-A

DATE

DIVISION | DEPARTMENT/PLANT | DURATION OF MEETING TO ☐ A.M. ☐ P.M. ☐ A.M. ☐ P.M.

NUMBER PRESENT | NUMBER ABSENT | MEETING CONDUCTED BY | DID MEETING INCLUDE REQUIRED TRAINING? ☐ YES (DESCRIBE BELOW*) ☐ NO

*** SUPERVISOR'S PRESENTATION**

DISCUSSION OF SAFE/UNSAFE WORK PRACTICES, MATERIALS, JOB PRECAUTIONS, HAZARDS, EQUIPMENT FAMILIARIZATION, ETC.

EMPLOYEE FEEDBACK

COMMENTS, QUESTIONS, COMPLAINTS, ETC.

SUPERVISOR'S CORRECTIVE ACTION PLAN

KNOWN PLANS FOR CORRECTION, PARTS ON ORDER, ITEMS TO BE DISCUSSED WITH DEPT. HEAD, AND CORRECTION OF ITEMS PREVIOUSLY SUBMITTED

DEPARTMENT HEAD COMMENTS

RESOLUTION OF QUESTIONS, ITEMS OR ISSUES RAISED IN MEETING OR WITH SUPERVISOR

SUPERVISOR | DEPARTMENT HEAD

FACILITY MANAGER

Have employees attending sign on reverse side.
Forward a copy to the local Safety Department.

Figure 5.1

Safety Meeting Report (KM-4438-A, reverse side)

TO BE SIGNED BY ALL EMPLOYEES ATTENDING MEETING

I have received and understand the information and/or training indicated on the reverse side.

SIGNATURE	DATE	SIGNATURE	DATE

LIST ALL EMPLOYEES ABSENT FROM MEETING

Figure 5.2

Safe Work Permit (KM-2565-1-B, upper section of front side)

SAFE WORK PERMIT KM-2565-1-B

SHADED AREAS MUST BE COMPLETED.

COMPLETED PERMIT MUST BE POSTED AT THE ENTRY OR WORK SITE.

PLANT/DEPARTMENT	ISSUED BY	DATE	TIME (FROM) ☐ A.M. ☐ P.M.	(TO) ☐ A.M. ☐ P.M.
ACCEPTED BY		COMPANY/DEPARTMENT/CONTRACTOR		
RESPONSIBILITY TRANSFERRED TO (NAME)		CO-SIGNATURE (IF REQUIRED)		
LIST ALL WORKERS OR ATTACH ROSTER (OVER)		IS WORK AREA OSHA PSM REGULATED? ☐ Yes ☐ No		

AN ALERT, GAS RELEASE, EVACUATION, INTERRUPTION OF 8 HOURS OR MORE OR CHANGE IN WORKING CONDITIONS SUSPENDS THIS PERMIT. (Permit must be reissued or reauthorized)

SECTION 1 — GENERAL AREA WORK PERMIT

1. WORK LIMITED TO THE FOLLOWING: (DESCRIPTION & AREA/EQUIPMENT)

2. ON-SITE INSPECTION CONDUCTED/ALL LOCKS OR TAGS ATTACHED, IF REQUIRED/ENVIRONMENTAL IMPACT OF JOB CONSIDERED — PERMIT ISSUER INITIALS — PERMIT RECEIVER INITIALS

3. SPECIAL HAZARDS TO PROTECT AGAINST ☐ NONE MSDS AVAILABLE ☐ YES ☐ NO ☐ N/A

CHEMICALS (NAME)

☐ Flammable ☐ Noise ☐ Hot Water/Steam ☐ Thermal Burn ☐ Falls ☐ Pinch Pts./Srp. Edges
☐ Toxic ☐ Corrosive ☐ Heat Stress ☐ Elect./High Vltg. Line ☐ Asbestos ☐ Other _____
☐ Skin Contact ☐ Reactive ☐ High Pressure ☐ Inert Atmosphere ☐ Radiation _____

ENERGY TYPE(S): ☐ Electrical _____ volts ☐ Hydraulic/Pneumatic _____ psig ☐ Other (magnitude) _____

4. SAFETY EQUIPMENT (OTHER THAN AREA REQUIREMENTS) ☐ NONE

☐ Rain Suit ☐ Gloves ☐ Face Shield ☐ Ground Fault Circuit Int. ☐ Air Pack (SCBA) ☐ Fire Resistant Clothing
☐ Chemical Suit ☐ Hearing Protection ☐ Hood ☐ Barricades/Warning Signs ☐ Supplied Air ☐ Long Sleeves
☐ Rubber Boots ☐ Chemical Goggles ☐ Fall Restraint Device ☐ Communications Eqpt.(list) ☐ Respirator ☐ Other _____

5. THE PERSON RECEIVING THE PERMIT VERIFIES THAT ALL WORKERS :

A. Have been through the Plant Safety Orientation	☐ Yes	F. Know emergency alarms, evacuation, assembly points	☐ Yes
B. Understand Applicable HAZCOM requirements	☐ Yes	G. Know the Procedures for Safe Job Completion	☐ Yes
C. Have discussed hazards of the job and area	☐ Yes	H. Have inspected all tools/equipment/scaffolding	☐ Yes
D. Know the location/use of safety showers/eye wash stations	☐ Yes	I. Understand the Housekeeping Requirements	☐ Yes
E. Know the location of the phone or intercom	☐ Yes	PERMIT RECEIVER INITIALS	

6. POTENTIALLY AFFECTED AREA PERSONNEL AND WORKERS NOTIFIED OF WORK TO BE DONE ☐ YES ☐ N/A

7. *THE FOLLOWING RESPONSIBILITIES HAVE BEEN COMMUNICATED TO THE PERSON RECEIVING THIS PERMIT:*
☐ Conditions For Work Stoppage ☐ Performing The Work Safely ☐ Completion Of Section 8 And Permit Return
☐ Crew Accountability ☐ Reporting Changes That Affect Job Safety

SECTION 2 — AIR TESTS

PRIOR TO ENTRY OR HOT WORK — TEST IN ORDER INDICATED

1. Oxygen meter test performed	☐ Yes ☐ N/A	READING %O_2	RANGE 19.5-23.5% O_2	TESTED BY	LOCATION OF TEST	TIME ☐ A.M. ☐ P.M.
2. Combustible gases and vapors test	☐ Yes ☐ N/A	READING % LEL	MAXIMUM 10% LEL	TESTED BY	LOCATION OF TEST	TIME ☐ A.M. ☐ P.M.
3. Tests for toxics (Substance)	☐ Yes ☐ N/A	READING ☐ PPM ☐ mg/M	PEL/TLV ☐ PPM ☐ mg/M	TESTED BY	LOCATION OF TEST	TIME ☐ A.M. ☐ P.M.

☐ DOES NOT APPLY

SECTION 3 — OBSERVATION & RESCUE

1. ☐ Yes ☐ N/A	Continuous monitoring for _____ (SUBSTANCE)	TESTED BY	TIME (FROM) ☐ A.M. ☐ P.M.	TIME (TO) ☐ A.M. ☐ P.M.
☐ Yes ☐ N/A	Periodic tests for _____ (SUBSTANCE)	TESTED BY	TIME (FROM) ☐ A.M. ☐ P.M.	TIME (TO) ☐ A.M. ☐ P.M.
☐ Duration of work ☐ Personal	☐ Area ☐ Other _____			
2. ☐ Yes ☐ N/A	Fire/safety/confined space attendants	DESIGNATED PERSON(S)		HOW TO CONTACT
3. ☐ Yes ☐ N/A	Backup rescuer(s)	DESIGNATED PERSON(S)		HOW TO CONTACT
4. ☐ Yes ☐ N/A	Special rescue service/ equipment required	LOCATION OF SPECIAL EQUIPMENT		RESCUE SERVICE PHONE NUMBER

☐ DOES NOT APPLY

Figure 5.2

Safe Work Permit (KM-2565-1-B, lower section of front side)

SECTION 4 — HOT WORK

☐ DOES NOT APPLY

	YES	N/A		YES	N/A
1. Fire Extinguisher (Type) _____ Is it full?			8. Ground lead attached to work		
2. Survey area for combustibles and openings, holes, trenches etc			9. Prevention of heat exposure to gasket, seals, liners		
3. Combustible materials removed or protected			10. Other work in area which should be stopped		
4. Heat/spark control - tarps, covers, water, etc.			11. Material present which emits vapor when heated		
5. Precaution taken for hidden combustibles			12. Radiant heat transfer considered		
6. Purge gas used. Type _____			13. Equipment operating or contains original contents		
7. Adjacent areas safe/sewers protected			14. Ducts or conveyors plugged or protected		

SECTION 5 — ENERGY LOCKED/ TAGGED

☐ DOES NOT APPLY

	YES	NO	N/A		YES	NO	N/A
1. Line positively identified				9. Are all automatic valves secured in a safe position?			
2. Line/equip. drained/depressured, piping properly supported				10. Electrical panel switches locked, tagged and tested			
3. Line/equipment cleaned and purged				11. Field switches tested			
4. Blinds and/or block and bleed in place				12. Fuses removed/switches open			
5. Lock(s) required (list lockout points)				13. Are belts/couplings removed?			
6. Splash guards considered				14. Are rotating parts blocked?			
7. Adjacent area safe. (If limited, describe below)				COMMENTS			
8. Area roped/taped off							

SECTION 6 — CONFINED SPACE

☐ DOES NOT APPLY

	YES	NO	N/A		YES	NO	N/A
1. Confined space entry required?				5. Have authorized entrants signed opposite side of this form?			
2. Space to be entered _____				6. Have designated attendants signed opposite side of this form?			
3. Purpose of entry _____							
4. Is space a permit-entry space? If "YES", complete opposite column				7. Have all necessary hazard control measures been taken?			
				8. Has all required equipment been provided?			

SECTION 7 — TRENCHING/ EXCAVATION

☐ DOES NOT APPLY

	YES	NO	N/A		YES	NO	N/A
1. Has the area been inspected for underground power lines or product lines?				4. Have precautions been taken if the trench/excavation develops into a confined space?			
2. Does the trench require shoring/bracing/ support?				5. Have overhead power/product lines been removed or identified?			
3. Has the soil been evaluated for stability?				6. Will leaking water or rain water affect the stability of the trench/excavation?			

SECTION 8 — Questions to be Completed on Permit Expiration or Job Completion

WORKER CLOSEOUT SIGNATURE

TIME ☐ A.M. ☐ P.M.

	YES	NO	N/A		YES	NO	N/A
1. Has the job been completed?				5. Have safety devices been reinstalled?			
2. Has the area been cleaned of work material?				6. Has hot work area been surveyed for smoldering materials?			
3. Have department personnel been informed job is done?				7. Special precautions, concerns or remarks?			
4. Have all locks and/or tags been removed?				COMMENTS			

Figure 5.2

Safe Work Permit (KM-2565-1-B, reduction of reverse side)

OBSERVERS, WATCHERS, RESCUERS

I have been instructed as a confined space attendant, fire safety watcher or backup rescuer and understand my duties.

SIGNATURE	DATE	SIGNATURE	DATE

PERSONS AUTHORIZED TO PERFORM WORK AND/OR TO ENTER CONFINED SPACE

I have been instructed in and am aware of the possible hazards and conditions I may encounter in this entry work.

SIGNATURE	TIME IN	TIME OUT	DATE	SIGNATURE	TIME IN	TIME OUT	DATE

COMMENTS

AUDIT PURPOSE ONLY

NAME OF AUDITOR	TITLE	DEPARTMENT	DATE

CONCERNS

CORRECTIVE ACTIONS

COMPLETED BY

NAME	TITLE	DEPARTMENT	DATE	COMMENTS

6. COMMUNICATIONS

6.1 GENERAL COMMUNICATIONS

The Field Team Leader will have available at the Site the means for telephone communications, or an equivalent means of communication, for summoning emergency assistance from the fire/ambulance and police departments in the event they are required. The telephone will also act as a direct link to technical personnel for information pertaining to all phases of the project.

6.2 RADIOS/TELEPHONES

Short-range walkie talkies or cellular telephones will be made available to designated personnel working at the Site.

6.3 EMERGENCY WARNING

In the event of an emergency condition, the Field Team Leader will notify project personnel verbally if all are within immediate hearing and via a bull horn if the Site area is large. The Field Team Leader will also notify visitors present within the area. Site personnel will immediately proceed to a predesignated assembly area as designated by the Field Team Leader during the daily safety meeting. Personnel will remain in the designated area until further instructions are received by the Field Team Leader.

All communication equipment will be tested at the beginning of each day to verify operational integrity.

6.4 HAND SIGNALS

Hand signals will be used by field teams in conjunction with the buddy system. Hand signals shall be familiar to the entire field team before operations commence and should be reviewed during site-specific training.

Signal	Meaning
Hand gripping throat	Out of air; can't breathe
Grip partner's wrist	Leave area immediately; no debate
Hands on top of head	Need assistance
Thumbs up	OK; I'm all right; I understand
Thumbs down	No; negative

6.5 SITE SECURITY

Only authorized personnel will be permitted on the Site in accordance with the requirements of the Site Security Plan (Appendix E to the Removal Action Work Plan) and this HASP. Visitors and other non-essential personnel may enter the work area only upon authorization by the Field Team Leader. This restricted access will ensure that the Field Team Leader can communicate with each person authorized to enter the work area.

7. PERSONNEL EXPOSURE AND AIR QUALITY MONITORING

7.1 AIR QUALITY (DUST)

Due to the nature of the principal contaminants associated with the project, dust suppression will be important as a means of minimizing exposure levels and off-site migration of contaminants. The Field Team Leader will routinely monitor the project area. The OSHA personal exposure limit (PEL) for nuisance dust is 15 mg/m^3.

7.2 AIRBORNE RADIOACTIVITY MONITORING

Monitoring for airborne radioactivity exposure is as important as monitoring for external radiation exposure. Monitoring for airborne radioactivity exposure requires the following elements:

- Air sampling for radioactive particulates,
- Recordkeeping regarding personnel work locations and time in location, and
- Respiratory protective equipment records regarding devices used by workers in airborne radioactivity areas.

By closely monitoring these three elements, a continuous record of personnel exposure to airborne radioactivity is maintained.

Lapel samplers worn for personal air monitoring can be utilized for airborne radioactivity monitoring. Air filters shall be analyzed on a daily basis to determine potential contributions to dose from radionuclides. It is expected that naturally occurring radon and thorium daughters will interfere with analyses. Additional evaluation of samples shall be performed when determined necessary based upon elevated results. Such analyses shall be performed after allowing time for decay of some interfering radionuclides.

Downwind monitoring of the excavation areas for radioactive particulate activity also will be performed. High volume air samplers shall run continuously during operations and be evaluated on a daily basis for gross alpha activity. Comparisons will be made to 32 IAC 340 Appendix A to ensure that adequate radiological controls are in place for workers and the general public. As low as reasonably achievable (ALARA) concepts will be utilized when considering protective measures to ensure that internal exposures are minimized, while also considering the effects of such protective measures with respect to external exposures. Controls on the Site such as wetting of soils and procedural changes, will be employed prior to the prescription of respiratory protective equipment.

Time decay of interfering nuclides generally refers to radon-222 decay and daughters but may also include thoron decay. The specific times for decay of samples is best addressed in procedures rather than in the health and safety plan. Air samples will be decayed a minimum of 5 hours to allow for counting without interference from radon-222 and its daughters. Thoron (Rn-220), if present in significant amounts, will require decay for up to 4 days to allow for decay of it is Pb-212 daughter (10.6 hour half life).

After filters have been collected and decayed overnight, there will be a morning count of the filter that will serve to identify high gross counts for the previous day. This will alert health & safety staff of a potential problem which they can investigate more promptly. The count, after 4 days decay, will serve to be the official measurement of Th-Alpha.

7.3 INTERNAL MONITORING

Internal monitoring to determine intakes of radioactive material will be performed as needed based upon the results of the air sampling program. Bioassay methods to be considered should include in-vivo, as well as in-vitro, assessments. Routine bioassay of workers is not anticipated based upon the low concentrations of radioactivity in soils to be excavated.

7.4 EXTERNAL RADIATION MONITORING

External radiation monitoring of workers will be performed using film badges or thermoluminescent dosimeters. Dosimetry will be provided and processed by a service holding National Voluntary Laboratory Accreditation Program (NVLAP) certification. Pocket dosimeters may also be utilized for visitors and other infrequent personnel requiring access to the Site.

7.5 RADIOLOGICAL SURVEYS

Radiological surveys will be performed to ensure that radiation levels and contamination levels are within regulatory limits for workers and the general public. Radiation surveys will consist of ambient gamma surveys using micro-R meter or Geiger detectors, as appropriate, and contamination surveys. Airborne radioactivity measurements will be performed as described in the Air Monitoring Plan (Appendix B to the Removal Action Work Plan).

7.6 CONTAMINATION MONITORING

Samples shall be obtained periodically in work areas to ensure that radioactivity is present at acceptable levels and is prevented from leaving the Site. Decontamination of elevated areas will be performed to maintain contamination at levels that are ALARA.

Before leaving the exclusion zone, Site personnel shall be checked through use of a hand-held frisker to ensure that contamination is not present on skin or clothes. The Field Team Leader will be immediately informed regarding any contamination on individuals and will initiate appropriate decontamination techniques. Proper disposition of contaminated personal effects and clothing also will be the responsibility of the Field Team Leader.

7.7 TOTAL ORGANIC VAPOR MONITORING

In addition to the radiological contaminants, there is a slight potential of encountering organic vapors. Organic vapors were encountered near the water table during previous investigation at the Site. Routine screening for total organic vapors will be conducted with a photoionization detector (PID), or similar type equipment, on a daily basis. The screening will evaluate ambient photoionization volatile organic vapors and some semi-volatile organic vapors.

Total organic vapors in ambient air will be obtained periodically with a PID during daily field activities. The PID provides real-time readings of exposure to volatile organics and some semi-volatile organics. Measurements will be made daily, prior to activities, to determine background levels. Monitoring measurements will be taken when:

- operations change,
- work moves to a different portion of the Site, and
- personnel observe contaminated materials.

These screening operations will be used to identify conditions requiring an upgrade to full-face respirators as described in Section 7.8.2.

7.8 ACTION LEVELS

7.8.1 Radiological Action Levels

Radiological action levels for on-site workers will be determined by smear/swipe measurements as well as airborne particulate monitoring for the presence of radioactivity. The Field Team Leader will perform radiological monitoring. The radioactive contamination on the Site is particulate and insoluble in water. Therefore, there will be no fixed contamination on the workers. Action levels as determined by radioactive monitoring can be found in Table 7.1.

To avoid the need for upgrade of personal protection equipment due to airborne contamination, engineering controls such as the use of water to minimize dust levels will be implemented as necessary during excavation and restoration activities.

7.8.2 Organic Vapors Action Levels

Kerr-McGee is taking a conservative approach to organic vapor monitoring at the Site. A PID will be used to monitor for organic vapors. Operations will be discontinued if the PID reads 5 ppm[1] or greater and the area will be evacuated. The Site Health and Safety Officer will retest the area wearing a full-face respirator. Operations will not resume until the PID reads less than 5 ppm, and remains below 5 ppm.

---

[1]PID level obtained for Benzene from NIOSH Pocket Guide to Chemical Hazards.

TABLE 7-1

ACTION LEVELS AS DETERMINED BY RADIOACTIVITY

Note: Personnel shall not be exposed to airborne radioactivity such that their weekly intake exceeds 12 Derived Air Concentration (DAC)-hours without prior approval of the Field Team Leader or designee.

Level of protection may be increased to Level C (full-face air purifying respirator) when airborne monitoring indicates that contamination levels have reached 30% of the DAC. All assessments shall incorporate ALARA principles. Engineering controls shall be used prior to assignment of respiratory protective equipment.

Signs shall be posted at entrances to areas where airborne radioactivity levels exceed, or have the potential to exceed, 25% of the DAC.

Radiation Type	Action Level	Level of Respiratory Protection/Action
a. Contamination on smear samples	60 pCi/100 cm^2 gross alpha[a]	Consider modified Level C (full- face APR) based upon ALARA evaluation.
b. Airborne Radioactivity	30% DAC[b]	Consider Level C (full-face APR) based upon ALARA evaluation. Ensure proper posting. Consider internal monitoring
c. Ambient Gamma (work areas)	5 mrem/hr[c]	Consider procedures for shielding of soils. Ensure proper posting.
d. Ambient Gamma (off-site areas)	2 mrem/hr[d]	Implement immediate controls to reduce dose equivalent rate.

Notes

(a) This is approximately 3 times the unrestricted release criteria in the NRC Regulatory Guide 1.86. If any dry-brushing or otherwise abrasive-type decontamination of the sampled equipment is required, the Action Level shown shall require modified Level C (full-face APR).

(b) Potential Airborne Radioactivity Area as defined in 10 CFR 20. Workers with 1000 DAC-hours per year to date must wear modified Level C (full-face APR) until the end of the calendar year.

(c) The ambient gamma dose equivalent rate action level of 5 mrem/hr stems, from the 10 CFR 20 radiation area definition. If the ambient gamma dose equivalent rate reaches 2 mrem/hr, one or more of the following actions will be implemented: The source may be shielded; the working distance from the source may be increased; or the worker's exposure time may be limited.

(d) The ambient gamma action level for off-site is based upon the 10 CFR 20 requirements to maintain dose equivalent rates in unrestricted areas such that they do not exceed 0.002 rem in any one hour.

8. PERSONAL PROTECTIVE EQUIPMENT

It is anticipated that most excavation activities can be conducted in Level D personal protective equipment (PPE), with a contingency upgrade to Level C, based on the action levels listed in Section 7. Level C will be used when required by Special Work Permits, or when directed by the Field Team Leader.

Level D personal protective clothing and equipment for excavation activities includes:

- Coveralls,
- Hard hat,
- Chemical resistant, OSHA approved safety shoes/boots,
- Cotton or leather gloves,
- Safety glasses, and
- Dust mask (optional).

Level C protective clothing and equipment includes:

- Full-face air-purifying respirator (NIOSH/MSHA approved) fitted with radionuclides/HEPA cartridges and/or organic vapor cartridges, depending on which action levels are exceeded (see Section 7 of this HASP),
- Coveralls,
- Tyvek coveralls - required in areas when splashing by contaminated soils or water is a possibility,
- Cotton or leather gloves,
- Disposable latex inner gloves - required in areas when splashing by contaminated soils or water is a possibility,
- Nitrile outer gloves (taped) - required in areas when splashing by contaminated soils or water is a possibility,
- Chemical-resistant steel toe boots, and
- Hard hat.

Action levels used to determine the need to upgrade or downgrade the levels of protection are described in Section 7 of this HASP.

Respirator use will be in accordance with the Kerr-McGee Respiratory Protection Program. The Kerr-McGee Respiratory Protection Program is an approved and established program that will be used by the Respondents.

9. CONTAMINATION REDUCTION PROCEDURES

9.1 EQUIPMENT

Portable equipment will be decontaminated with soap and water and rinsed with tap water. Heavy equipment will be steam-cleaned with water and, if necessary, a detergent solution. It is not anticipated that chemical cleaning will be necessary for decontamination.

9.2 PERSONNEL

If levels of radioactivity show that individuals can remove coveralls and other personal protective clothing and equipment before leaving the work-site and, thus complete decontamination, the individuals may leave the Site. If, however, levels of radioactivity show that individuals cannot achieve decontamination by the removal of coveralls and showering is required, they will be dressed in clean coveralls, boots and gloves and be transported to the Rare Earths Facility Contamination Reduction Zone to complete decontamination.

If substantial skin contamination occurs on an individual working with radioactive materials, the following specific procedures should be followed to prevent fixation of the material in the skin or absorption of the radioactivity through the skin.

Immediate Action: Notify the HSC or Field Team Leader, who will supervise the decontamination. If contamination is spotty, the HSC or Field Team Leader will supervise the cleaning of the individual spots with swabs, soap, or water. If the contamination is general, the HSC or Field Team Leader may recommend washing the area gently in warm or cool water (not hot) using hand soap (not detergent) for one minute. Rinse, dry, and monitor for radioactivity. This soap wash step may be repeated three times.

Evaluation: If the above procedure fails to remove all the skin contamination, the treatment should cease. An evaluation of the skin contamination should be performed by the HSC or Field Team Leader including an estimate of the dose commitment to the skin, and the quantity and identity of the nuclides contaminating the skin. If additional decontamination steps are necessary, they are performed and documented by the HSC. The guidelines for Personnel Decontamination in the Radiological Health Handbook, HEW 1970, beginning on page 194, can be used as applicable. CAUTION: Do not use chemicals for personnel decontamination until full evaluation of the contamination is made by the HSC or Field Team Leader.

9.3 CONTAMINATION PREVENTION

Work practices that minimize the spread of contamination will reduce worker exposure and help ensure valid sample results by precluding cross-contamination. Procedures for contamination avoidance include:

- knowing the limitations of all personal protective equipment being used,
- avoiding walking through areas of obvious or known contamination,
- refraining from handling or touching contaminated materials directly. Do not sit or lean on potentially contaminated surfaces,
- ensuring personal protective equipment has no cuts or tears prior to donning,
- fastening all closures on suits, covering with tape if necessary,
- taking steps to protect against any skin injuries,
- staying upwind of airborne contaminants, and
- when working in contaminated areas, refraining from eating, chewing gum, smoking, or engaging in any activity from which contaminated materials may be ingested.

9.4 DISPOSAL PROCEDURES

All discarded materials, waste materials, or other field equipment and supplies should be handled in such a way as to preclude the spread of contamination, creating a sanitary hazard, or causing litter to be left on-site. All potentially contaminated waste materials (e.g., clothing, gloves) shall be monitored and segregated in accordance with monitoring results into either radioactive or non-radioactive waste. Appropriate labels shall be affixed to all containers of radioactive materials.

10. GENERAL WORK PRECAUTIONS

10.1 KERR-MCGEE SAFETY HANDBOOK

The Respondents will adopt the Kerr-McGee Safety Handbook for use at the Site. The handbook is a summary of general work precautions and is included as Appendix B. All personnel who will be present on the Site will be provided a copy the Kerr-McGee Safety Handbook. Receipt of the handbook shall be indicated by signing and submitting the form in the handbook.

10.2 PERSONNEL

In addition to general work precautions which are covered in the Kerr-McGee Safety Handbook, the following general work precautions apply to all Site personnel.

- Eating, drinking, chewing gum or tobacco, smoking, or any practice that increases the probability of hand-to-mouth transfer and ingestion of material is prohibited in the work area.
- Hands and face must be thoroughly washed upon leaving the work area. Wash water will be provided at the Site for this purpose.
- Whenever levels of radioactivity warrant, the entire body should be thoroughly washed, as soon as possible, after the protective coveralls and other clothing are removed as part of the decontamination process.
- No facial hair that interferes with a satisfactory fit of the mask-to-face-seal is allowed on personnel required to wear respirators.
- Contact with contaminated or suspected contaminated surfaces should be avoided. Whenever possible, do not walk through puddles, leachate, discolored surfaces, kneel on ground, lean, sit, or place equipment on drums, containers, or the ground.
- Medicine, drugs and alcohol may interfere with or impair judgment and reaction times. Therefore, usage of prescribed drugs must be specifically approved by a qualified physician and made known to the Field Team Leader prior to an individuals' presence on the work-site. Alcoholic beverage intake is strictly prohibited at the Site and prior to work in accordance with Kerr-McGee policy.
- All personnel must be familiar with standard operating procedures and any additional instructions and information contained in the HASP.

- All personnel must adhere to the requirements of the HASP.
- Contact lenses are not permitted when respiratory protection is required or where the possibility of a splash exists.
- Personnel must be cognizant of symptoms for radiological exposure on-site, for heat stress and cold stress, and knowledgeable regarding emergency measures contained in the Emergency Contingency Plan.
- Respirators shall be cleaned and disinfected after each day's use or more often, if necessary.
- Prior to donning, respirators shall be inspected for worn or deteriorated parts. Emergency respirators or self-contained devices will be inspected at least once a month and after each use.
- Each employee shall be familiar with Kerr-McGee's Respiratory Protection Program.

10.3 OPERATIONAL PRECAUTIONS

The following operational precautions must be observed at all times.

- All Site personnel shall be adequately trained and thoroughly briefed on anticipated hazards, equipment to be worn, safety practices to be followed, emergency procedures, and communications.
- All required respiratory protective devices and clothing shall be worn by all personnel going into areas designated for wearing protective equipment.
- All Site personnel shall use the buddy system when wearing respiratory protective equipment. At a minimum, a third person, suitably equipped as a safety backup, is required during extremely hazardous entries.
- During continual operations, on-site workers act as a safety backup to each other. Off-site personnel provide emergency assistance.
- Personnel should practice any unfamiliar operations prior to undertaking the actual procedure.
- Entrance and exit locations shall be designated and emergency escape routes delineated. Warning signals for Site evacuation must be established.
- Personnel and equipment in the contaminated work area should be minimized, consistent with effective Site operations.

- Work areas for various operational activities shall be established.
- Procedures for leaving a contaminated area shall be planned and implemented prior to going on-site. Work areas and decontamination procedures shall be established based on expected Site conditions.
- Frequent and regular inspection of Site operations will be conducted to ensure compliance with the HASP. If any changes in operation occur, the HASP will be modified to reflect those changes.

11. SANITARY FACILITIES

11.1 POTABLE WATER

a. An adequate supply of potable drinking water shall be maintained at all times immediately outside the Site. Drinking water shall meet all federal, state and local health requirements.

b. Drinking water shall be supplied to project personnel via approved dispensing sources.

c. Paper cups shall be permitted for the drinking of potable water supplies.

d. Drinking water dispensers shall be clearly marked and shall, in no way, have the potential for contamination from non-potable supplies.

e. Site personnel must be fully decontaminated prior to approaching the drinking water supply.

11.2 TOILET FACILITIES

a. Adequate toilet facilities shall be provided at the Site.

b. These facilities shall be in the form of portable chemical toilets.

c. Routine servicing and cleaning of the toilets should be established with the selected contractor and shall be in accordance with federal, state, and local health regulations.

d. Site personnel must be fully decontaminated prior to approaching the toilet facilities.

11.3 WASHING AREAS

a. Adequate washing areas shall be provided for personal use within the work area.

b. Washing areas shall be maintained in a sanitary condition and will be provided with adequate supplies of soap, towels for drying, and covered waste receptacles.

c. Washing areas shall be maintained and sanitized daily.

d. No eating, drinking or smoking shall be permitted in the work area. This policy will be strictly enforced by the Field Team Leader.

12. FIRE CONTROL EQUIPMENT

An adequate number of approved portable fire extinguishers (class rated A, B and C) shall be readily available at the Site at all times.

All Site personnel shall be trained in the use of the extinguishers. Extinguishers shall only be used on outbreak stage fires or fires of minor nature. The local fire department shall be contacted in the event of a larger fire and Site evacuation procedures should be commenced in accordance with the procedures described in the Emergency Contingency Plan.

13. CONFINED SPACE PROGRAM

13.1 PURPOSE

In the event that confined space work is a necessity, a Confined Space Program will be implemented. Training in the recognition of confined spaces is a component of the health and safety training program.

The purpose of the Confined Space Program is to establish procedures to protect personnel from this serious hazard in the course of their work; and at a minimum, to comply with 29 CFR OSHA 1910.146. This document assigns responsibilities and sets standards for personnel engaged in activities where confined spaces may be present.

13.2 RESPONSIBILITIES

13.2.1 Health and Safety Coordinator

The Health and Safety Coordinator administers the Confined Space Program. The Health and Safety Coordinator's responsibilities include:

- Review of the HASP for potential confined space hazards and design alternative approaches to accomplish the confined space tasks;
- Coordinating and managing the Confined Space Program in the event one is required;
- Establishing priorities for implementation of the program;
- Assisting with recognition and implementation of the Confined Space Program;
- Advising project management on confined space issues; and
- Communicating the Confined Space Program to personnel by training related to specific Site activities.

13.2.2 Offsites Manager

The Offsites Manager directs the application of the Confined Space Program to project work. The Offsites Manager is responsible for:

- Working with the Health and Safety Coordinator to prepare information describing activities that might be conducted in a confined space area;

- Assuring that all personnel engaged in project activities are familiar with the definition of a confined space;
- Assuring that personnel are familiar with the Confined Space Program, and that project activities are conducted in compliance with the Confined Space Program;
- Assuming the responsibilities of the Field Team Leader if another person is not assigned these responsibilities.

13.2.3 Field Team Leader

The Field Team Leader is responsible for the implementation of the Confined Space Program on-site during field activities. The Field Team Leader is responsible for:

- Overseeing implementation of the Confined Space Program during field operations; and
- Reporting confined space work activity, and any violations of the Confined Space Program, to the Offsites Project Manager and the Health and Safety Coordinator.

13.2.4 Personnel

Personnel are responsible for:

- Familiarizing themselves with the Confined Space Program and following it;
- Becoming familiar with the criteria for determining a confined space, and with the monitoring, permitting, and other requirements of the program; and
- Reporting immediately a confined space condition to the Field Team Leader.

13.3 DEFINITION OF A CONFINED SPACE

Confined space means a space that:

1. Is large enough and so configured that an employee can bodily enter and perform assigned work;
2. Has limited or restricted means for entry or exit (such as pits, storage bins, hoppers, crawl spaces, and storm cellar areas); and

3. Is not designed for continuous employee occupancy.

Any workspace meeting all of these criteria is a confined space and the Confined Space Program must be followed.

13.4 CONFINED SPACE ENTRY PROCEDURES

13.4.1 Safety Work Permit Required

All spaces shall be considered permit-required confined spaces until the pre-entry procedures demonstrate otherwise. The Safe Work Permit for entry into a confined space must be completed before work begins; it verifies completion of the items necessary for confined space entry. The Permit will be kept at the Site for the duration of the confined space work. If there is an interruption of work, or the alarm conditions change, a new Permit must be obtained before work begins.

A permit is not required when the space can be maintained for safe entry by 100% fresh air mechanical ventilation. This must be documented and approved by the Health and Safety Coordinator. Mechanical ventilation systems, where applicable, shall be set at 100% fresh air.

The Field Team Leader must certify that all hazards have been eliminated on the Entry Permit. If conditions change, a new permit is required.

13.4.2 Pre-entry Testing for Potential Hazards

a. Surveillance

Personnel first will survey the surrounding area to assure the absence of hazards such as contaminated water, soil, or sediment, barrels, tanks, or piping where vapors may drift into the confined space.

b. Testing

No personnel will enter a confined space if any one of these conditions exists during pre-entry testing. Determinations will be made for the following conditions:

1. Presence of toxic gases or dusts: Equal to or more than 5 parts per million (ppm) on the organic vapor analyzer with an alarm, above background outside the confined space area; or other action levels for specific gases, vapors, or dusts as specified in the Health and Safety Plan and the Confined Space Permit based on knowledge of Site constituents;

2. Presence of explosive/flammable gases: Equal to or greater than 10% of the Lower Explosive Limit (LEL) as measured with a combustible gas indicator or similar instrument (with an alarm); and

3. Oxygen Deficiency: A concentration of oxygen in the atmosphere equal to or less than 19.5% by volume as measured with an oxygen meter.

Pre-entry tests results will be recorded and kept at the Site for the duration of the job by the Field Team Leader. Affected personnel can review the test results.

c. Authorization

Only the Field Team Leader and the Health and Safety Coordinator can authorize any personnel to enter into a confined space. This is reflected on the Safe Work Permit for entry into a confined space. The Field Team Leader must assure that conditions in the confined space meet permit requirements before authorizing entry.

d. Safe Work Permit

An Safe Work permit for confined space entry must be filled out by the Health and Safety Coordinator or Field Team Leader. A copy of the Safe Work Permit is included as Figure 5.2.

e. Attendants

One worker will stand by outside the confined space ready to give assistance in the case of an emergency. Under no circumstances will the standby worker enter the confined space or leave the standby position. There shall be at least one other worker not in the confined space within sight or call of the standby worker.

f. Observation and Communication

Communications between standby worker and entrant(s) shall be maintained at all times. Methods of communication that may be specified in the Safe Work Permit and the HASP may include voice, voice by powered radio, tapping or rapping codes, signaling tugs on rope, and standby worker's observations that activity appears normal.

13.4.3 Rescue Procedures

Acceptable rescue procedures include entry by a team of rescuers only if the appropriate self-contained breathing apparatus (SCBA) is available; or use of public emergency services.

The standby worker must be trained in first aid, CPR, and respirator use. A first aid kit should be on hand and ready for emergency use. The standby worker must be trained in rescue procedures. Retrieval of an unconscious victim in a confined space will only be conducted by trained rescue personnel. An emergency call to 911 will be initiated to assist the victim.

13.5 TRAINING

Personnel who will engage in field activities will be given annual training on the requirements and responsibilities in the Confined Space Program and on OSHA 1910.146. Only trained personnel can work in confined spaces. Workers should be experienced in the tasks to be performed, instructed in proper use of respirators, lifelines and other equipment, and practice emergency procedures and self-rescue.

Before each Site activity, the determination of confined space work will be part of the Site characterization process. Training in the site-specific confined space activities will be part of the site-specific health and safety training.

13.6 SAFE WORK PRACTICES

- Warning signs should be posted. These include warnings for entry permits, respirator use, prohibition of hot work and emergency procedures and phone numbers.

- Cylinders containing oxygen, acetylene or other fuel such as gasoline must be removed a safe distance from the confined space work area.

- Purging and ventilating is done before work begins to remove hazardous vapors from the space. The space should be monitored to ensure that the gas used to purge the space (e.g. tank) has also been removed. Local exhaust should be used where general exhaust is not practical.

- The buddy system is used at all times. A standby person always must be posted within sight of, or in communication with, the person inside the confined space. The standby should not enter the confined space, but instead will call for help in an emergency and not leave the post. Communication should be maintained at all times with workers inside the confined space.

- Emergency planning in the HASP and an Safe Work Permit must be approved in advance and the proper rescue equipment must be immediately available.

14. ELECTRICAL LOCKOUT/TAGOUT

The Field Team Leader must approve all work in areas requiring lockout/tagout procedures. Specific procedures and permitting requirements will be specified in the HASP, or in a revised HASP based on the need for a worker to work around electrical equipment.

All systems must be locked out and tagged before the work begins. This includes pipes, air lines, electrical equipment and mechanical devices. The equipment must be start tested and approved for use by a worker by the Health and Safety Coordinator or the Field Team Leader by start-testing to make sure the locked-out equipment does not operate.

08/02/00

ALLADIN MANTLE LAMP

Burns Kerosene (Coal Oil)

The Mantle Lamp Co. of America, Inc.

Chicago, IL New York, NY Portland, OR Montreal, CA Winnipeg, CA

President – Victor S Johnson
Secretary – Bert S Presba

Address – 168 N Halsted

- Information was found from 3 advertisement pamphlets in the Chicago Historical Society from around 1910's.

H:\home\eb\AladinLamp08-00.doc

08/02/00

LINDSAY LIGHT COMPANY

Incandescent Gas Mantles & Lightning Supplies
Private Exchange All Departments Central-5552-5553
(included in the main advertisement 1906-1908)

President – Charles R Lindsay jr. (home address – 333 Rush)
Secretary – Joseph M Sherburne (home address – 387 N. State)

Company Address 1906-1908

195 and 197 Michigan Street

Company Address 1909

358 Indiana

Company Address 1910

157 E Indiana

Company Address 1914-1917

161 E Grand Ave

- Main Advertisement was only displayed in the 1906-1908 in these yellow pages, all other years the Co. was displayed in regular print with just the name and the address, sometimes the president and the secretary listed. The Books from 1911-1913 were missing the section where Lindsay Light would be displayed.
- NO Brochures Found,
- Only Reference to the Co. is in these Yellow Pages that were from 1833-1917 at the Chicago Historical Society.
-

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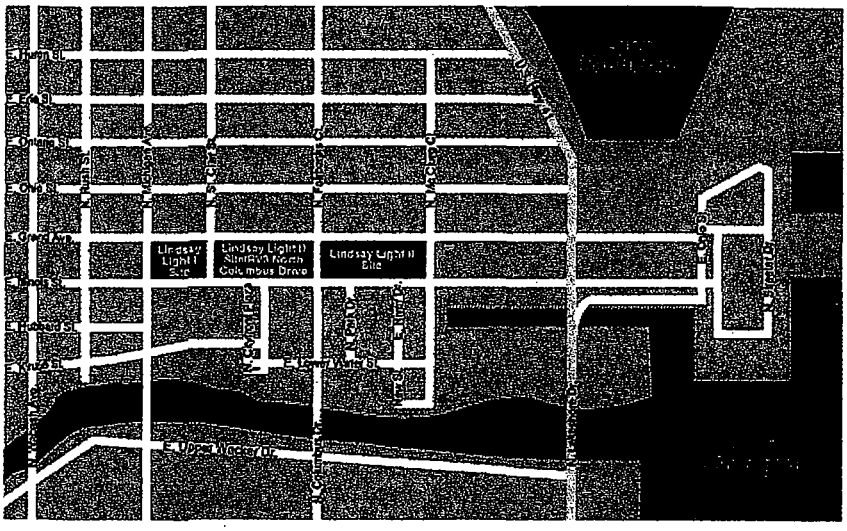
-

EPA United States Environmental Protection Agency

Lindsay Light
SUPERFUND SITES

Site Map



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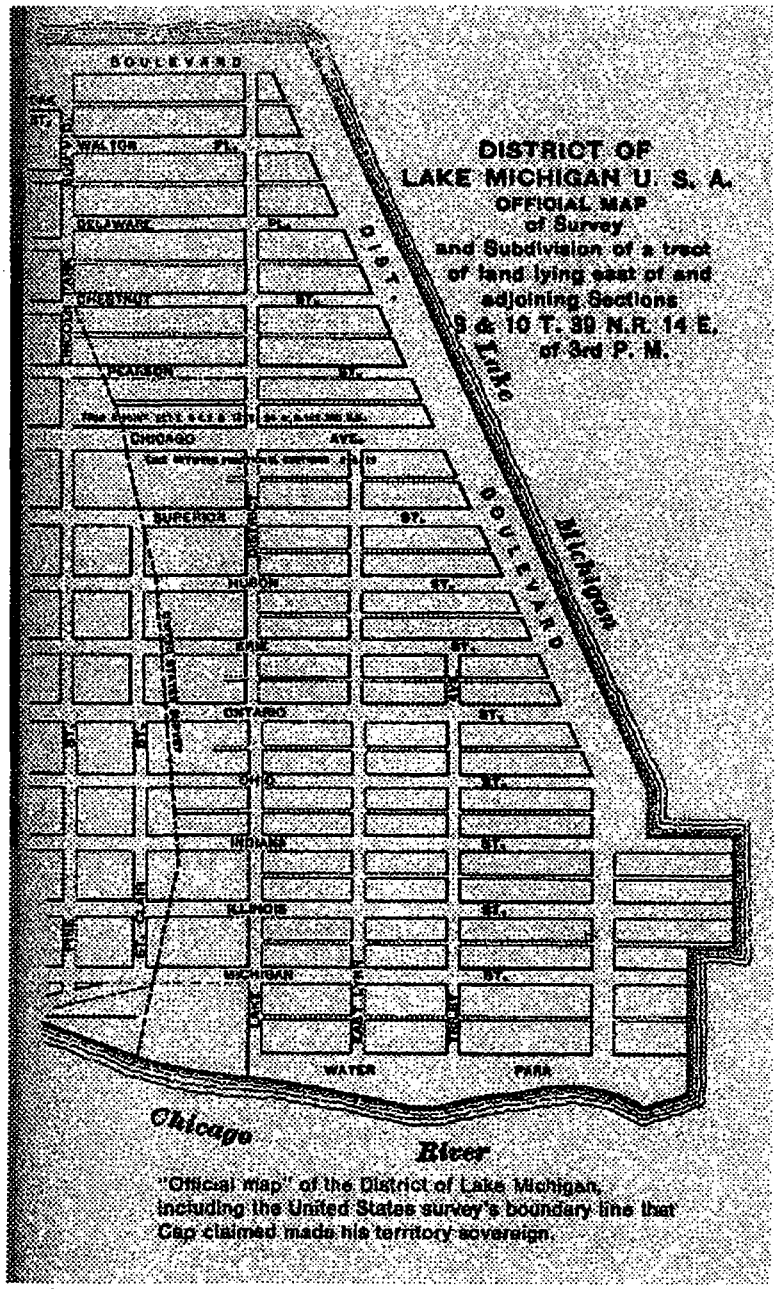
Map of Streeterville



"Official map" of the District of Lake Michigan, including the United States survey's boundary line that Cap claimed made his territory sovereign.

Previous picture - Mr. and Mrs. Streeter
Next picture - The boat
Back to the home of Streeter

United States
Environmental Protection
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Chicago, Illinois 60604

Illinois, Indiana
Michigan, Minnesota
Ohio, Wisconsin

Before You Dig - Tips for Construction Activities in the Streeterville Area

Chicago, Illinois

February 2001

INTRODUCTION

The purpose of this update is to provide basic background information on the history of thorium within the Streeterville area and basic procedures when uncovering or intruding into subsurface soils within the potentially contaminated area.

BACKGROUND

In the 1990's, U.S. EPA became involved in Streeterville due to the discovery and excavation of approximately 40,000 tons of radioactive thorium-contaminated soils that were located during property development and utilities installation and maintenance. Additional subsurface thorium contamination has been found in other Streeterville locations. This contaminated material must be managed in accordance with State and Federal environmental requirements. U.S. EPA believes that radioactive material from the Lindsay Light and Chemical Company (Lindsay Light) was disposed of in the Streeterville area, but there is no complete information where it was disposed.

Our historical research indicate that beginning in about 1904 and continuing, perhaps, through the mid 1930's, Lindsay Light manufactured thorium mantles impregnated with thorium in the City of Chicago. The Lindsay Light operation originated at 22 West Hubbard and later moved to 161 East Grand and 316 East Illinois Street in Chicago, Illinois. Ore was processed at the Illinois Street site and made into mantles at the East Grand site.

Details regarding Lindsay Light operations at 22 West Hubbard are very sketchy. From the early 1900s until the early 1920s, the 22 West Hubbard building was a five-story building occupied by Lindsay Light, however, it is not known which operations took place at this location. About 1932, Lindsay Light began moving to West Chicago, Illinois and closed its Streeterville operations by about 1936.

PROCEDURES

If subsurface thorium wastes are uncovered without proper environmental controls, workers and the public may be exposed to elevated radiation levels. Also, if not managed properly, the radioactive materials might be spread to other locations. If your work involves removing the asphalt, concrete or other materials covering subsurface soils or tunneling, digging or otherwise intruding into subsurface soils, the following radiation survey testing procedures must be followed. The results should be presented in a written report sent to U.S. EPA. This report should be detailed enough that someone not present would be able to follow the actions performed. Please call U.S. EPA 48 hours prior to performing a walkover survey so that we may observe. This report should be given to U.S. EPA prior to breaking ground in Streeterville.

- **Determine the site radiation level.** Hold a gamma-ray survey probe (sodium iodide detector) about 6 inches off the ground and walk the entire area along parallel lines about 3 - 4 feet apart. The site background level is determined by looking at the lowest count rate readings and looking for spots and regions of elevated radiation levels. If background readings appear to be elevated over expectations, U.S. EPA may ask for an off-site determination of background for the area.

- **Quantify exposure environment.** Take readings of 30 second counts, on contact with the ground, at intervals of 10 feet along parallel lines five feet apart to quantify the exposure environment (these include background levels). Next, take readings at selected spots where initial readings were over twice the background level.

- **Assess an anomaly.** If readings indicate anomalies, then subsurface gamma-ray count rate readings and soil samples will need to be collected. These samples will need to be analyzed for radionuclide identification and quantification. However, radioactive waste may be created here and workers and equipment could get contaminated, so this phase should not be done without a U.S. EPA approved health and safety plan and a means of disposing of contaminated soil, protective clothing, etc.

FOR ADDITIONAL INFORMATION

If you have questions about these procedures, equipment specifications, or thorium contamination in Streeterville, please contact:

Verneta Simon
On-Scene Coordinator
Superfund Division (SE-5J)
(312) 886-3601
simon.verneta@epa.gov

Fred Micke
On-Scene Coordinator
Superfund Division
(312) 886-5123
micke.fredrick@epa.gov

Larry Jensen
Senior Health Physicist
Superfund Division
(312) 886-5626
jensen.larry@epa.gov

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.

WEB SITE

This and additional updates can be found at the following web site:

www.epa.gov.region5/sites/

Scroll down through the list to find the Lindsay Light II/RV3 North Columbus Drive site.

EPA United States Environmental Protection Agency

Lindsay Light SUPERFUND SITES

Background

Maps
Photos
Fact Sheets
Contacts

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, IL.

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. EPA 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, EPA took dose measurements to determine what, if any, levels of radiation were present. On both occasions results were minimal.

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.

Lindsay Light II Site

The Lindsay Light II Site is a public parking lot 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 Light 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.

Lindsay Light III Site

Lindsay Light III is located at 22 West Hubbard Street. Records indicate that this location was once a home of the Lindsay Light Chemical Company. A site assessment occurred at 22 and 30 West Hubbard (adjacent buildings) which showed minimal levels that posed no immediate health and safety actions. Surveys were conducted at 30 West Hubbard due to the common wall shared by the two buildings.

Lindsay Light II Site/RV3 North Columbus Drive

The Lindsay Light II Site/RV3 Columbus Drive is located at 316 East Illinois Street directly across the street from the Lindsay Light II removal site. This property was detected during a EPA walkover radiation survey of the property. During this walkover the presence of thorium was discovered. These levels were cross-checked through the Argonne National Laboratory. As a result, EPA expanded the Lindsay Light II cleanup project to included the North Columbus Drive property (known as the Lindsay Light II Site/RV3 North Columbus Drive).

A workplan to cleanup this property was finalized and approved on March 24, 2000. Cleanup activities are scheduled to begin in early April 2000.

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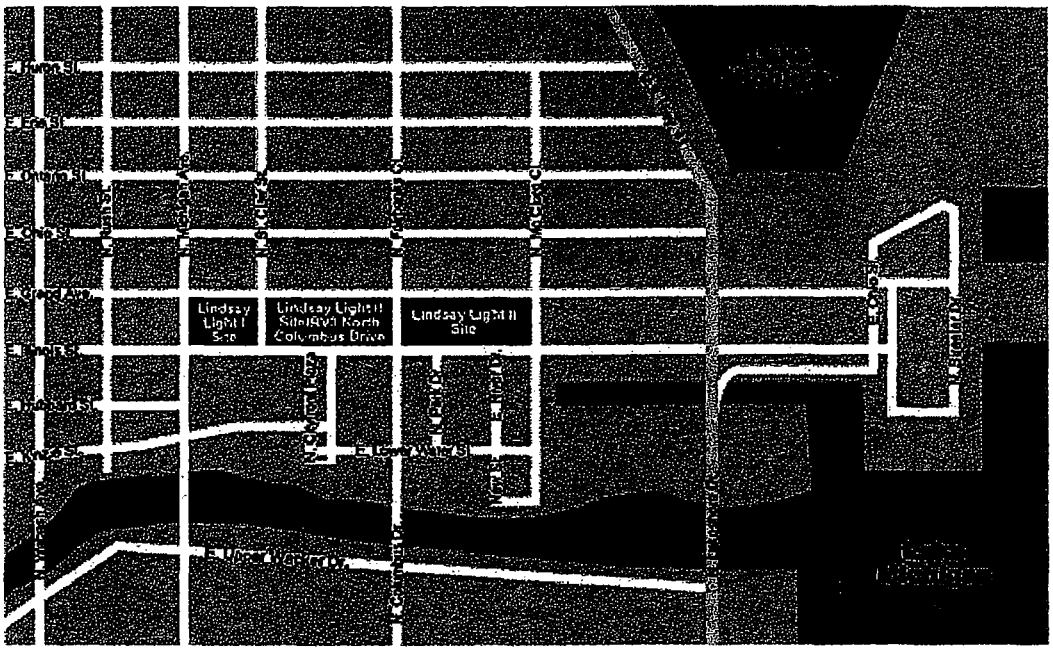
EPA United States Environmental Protection Agency

Lindsay Light SUPERFUND SITES

Chicago, Illinois

Site Map



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Region 5
77 West Jackson Blvd.
Chicago, Illinois 60604

Illinois, Indiana
Michigan, Minnesota
Ohio, Wisconsin

EPA Lindsay Light Sites Update

Chicago, Illinois 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.

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LINDSAY LIGHT II SITE/RV3 NORTH COLUMBUS DRIVE

The Lindsay Light II Site/RV3 Columbus Drive is located at 316 East Illinois Street directly across the street from the Lindsay Light II removal site. This property was detected during a U.S. EPA walkover radiation survey of the property. During this walkover the presence of thorium was discovered. These levels were cross-checked through the Argonne National Laboratory. As a result, U.S. EPA expanded the Lindsay Light II cleanup project to included the North Columbus Drive property (known as the Lindsay Light II Site/RV3 North Columbus Drive).

A workplan to cleanup this property was finalized and approved on March 24, 2000. Cleanup activities are scheduled to begin in early April 2000.

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

U.S. EPA Region 5
77 West Jackson Boulevard
Chicago, Illinois 60604-3590
(800) 621-8431

Lindsay Light site-related information is available at the following location:

Harold Washington Public Library
400 South State
Chicago, Illinois

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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.

United States
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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.

1906 same pres no sec
1907
1908 Lindsay Light Company
Inandercent Gas Mantles
& Lighting supplies
195 and 197 Michigan street
Port exch all Dept. Central-5552-5553

1909 Lindsay Light Co.
333 Rush Charles R Lindsay jr. pres
48 mgr Lasalle 387 N state Joseph M Sherburne sec 358 Indiana

1914 Lindsay Light Co. sereta
same as 1909 pres & sec
gas mantles 161 E Grand ave

1910 Same as 1909 & 1914
add- 157 E Indiana

1916 same as above
1917 add 161 E Grand ave

Clark Stree @ North Ave 312-642-4600

- Chicago Historical Society - Research Dept.
- Secretary of State

Looking for - Sanborn maps - area - Ohio - N of West of LSD + E of Mich ave S of River 2d. (Grand / Indiana)

Streeterville Area

Research Center Tue-Sat 10-4:30

1911 ~~Chicago Ave~~

Secretary of State #
Commerce #

Radiological safety

Vertical or Clipping files - ~~1833~~ 1900

for
- Carnotite Reduction Co.
- Streeterville
- Linsey Light

Chicago Tribune online that refer to it & its location

Carnegie

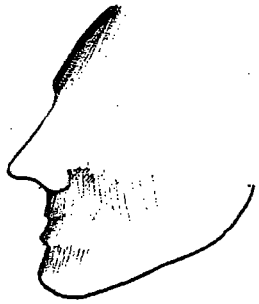
Monday

address: 1900-1960

phone book

Alladin Lamp Co.
Mantel Lamp Co.

Lindsey Light



UIUC Campus (217) 333-0827

Daniel

~10 sheets

1906 book has all of that area covered.

Layer map of whole area 1927

maybe some up till 1950 1941 book

policy - photographs except for photographic services here

Interlibrary loan IRRC

1) type up

web site

http://www.library.uiuc.edu/library/IRRC/lending/Lending_Main.STM

333-0832

left-photocopy request form

I Research 1958

Melany

Sanborn Maps Sketchville area of Chicago 1941

~~Lending dept~~

photocopies of maps

paper copy of request - ID map that you want.

large format copy

10x10 + photocopy 11x17 colored copies

Illinet

address #

company federal Employee ID #

authorization ~ 150-200

Carnotite Reduction Co.

Newberry Library - 10-6

60 West Walton Street Chicago 60610

312-943-9090

Sanborn maps for Steeterville area 1906-1950

Chicago Historical

Pat Morris (312) 255-3674

@NewbLib

1 set edited & revised

MAP8CG1409C4S31901 entire set

No vollume -

ask for Index maps - look vollumes that cover Steeterville

GS go to third floor & get lib card

then go to 4th for special section

Jean Bonano

photograph

~~No separate~~ packing houses

Alpha Track Kicks

Mark Kenesen

Alladin Mantle Lamp
Burns kerosene (Coal Oil)

The Mantle Lamp Co of America, Inc
Chicago IL NY Portland, OR Mordeall, CA Winnipeg, CA

Victor S. Johnson Pres;
Bert S. Presba Sec
168 N Halsted

1909 William Lindsey & Dagobert Gordon
elect supplies 805, 160
i-7 Washington

Dagobert Gordon
h 2333 Racine ave

th 11/16 -

08/02/00

ALLADIN MANTLE LAMP

Burns Kerosene (Coal Oil)

The Mantle Lamp Co. of America, Inc.

Chicago, IL New York, NY Portland, OR Montreal, CA Winnipeg, CA

President – Victor S Johnson
Secretary – Bert S Presba

Address – 168 N Halsted

- Information was found from 3 advertisement pamphlets in the Chicago Historical Society from around 1910's.

H:\home\eb\AladinLamp08-00.doc

H:\home\400001\KerrMcGee\final 05/01

Kerr-McGee Report.

1. introduce reader to context of rpt
   Discussion - why were doing this work.
   Historic Background.
2. Methods - what we did.
   ~~Fla~~ Microfil & Hadcopy files
   well examined.
3. Results find.
   what did we find.
4. Conclusion
5. recommendations addition work

INTRODUCTION

In order to assist in identifying thorium contamination in the Chicago Streeterville area left there by Lindsay Light Co. (LL) operations from 1910-1933, Sanborn Maps and addresses were researched to identify possible locations of the LL. During its years of operation, the Lindsay Light made incandescent gas mantles for home and street lighting. The process of manufacturing the gas mantles involves dipping gauze mantle bags into solutions containing thorium nitrate and small amounts of cerium, beryllium and magnesium nitrates. The foremost ingredient in thorium nitrate is radioactive thorium, thorium-232. This thorium came from purifying an ore called Monazite that is found in mineral deposits from India, Brazil, South Africa . . . etc. Monazite was shipped directly to Chicago and chemically purified to obtain thorium and other elements necessary to produce gas mantles. The unused ore and chemical wastes from the purification are the main contaminants of the site of Lindsay Light Co. These contaminants are radioactive and can raise the risk of cancer in specific organs, as well as raise the risk for the body as a whole. As a result, the areas of contamination need to be found and cleaned up. Sanborn Maps can help in locating the coordinates and details about the property to assist in the cleanup.

Sanborn Maps have been used since 1867 and were produced by the Sanborn Map Company to provide accurate, current, and detailed information to the fire insurance industry for risk assessment purposes. These maps show the shape, size, and construction of dwellings, commercial buildings and factories as well as fire walls, and locations of windows and doors. They would be able to indicate the width and names of streets and property boundaries of buildings. To find out the exact address for Lindsay Light, old yellow pages were used that dated from 1833-1917, and then they could be applied to the Sanborn Maps of the corresponding years in order to find the exact site.

current Rd
file

METHODS

Knowing the approximate location of Lindsey Light as being the Streeterville area, all possible locations that might carry Sanborn Maps for that area were reviewed. First, maps for the area were requested from Environmental Data Resources, Inc. on July 31st, for all possible maps pertaining to the Streeterville area for any available year. In the Chicago Area, the places that would carry the actual relevant Sanborn Maps archives would be the Harold Washington Public Library, the Chicago Historical Society, the Newberry Library, University of Illinois in Champagne, Illinois Regional Archives Depository (IRAD) at Northeastern University, and at the University of Illinois in Chicago. To find the exact address of the Company, records were available at the Chicago Historical Society in a form of Yellow Pages (1833-1923) that listed addresses for businesses, as well as for regular people. The Sanborn maps could be on microfilm or originally bound, as long as the information wasn't updated to the current year.

SANBORN MAPS FINDINGS

The Environmental Data Resources, Inc. sent a total of 78 maps for the Streeterville with the following distribution:

1903 – 1 map
1906 – 12 maps
1927 – 1 map
1950 – 12 maps
1974 – 13 maps
1988 – 13 maps
1990 – 13 maps
1994 – 13 maps

The map for 1903 and 1927 gave an aerial view of the whole Streeterville area, and since it was not very detailed, Lindsey Light was not found in 1903 because it didn't exist yet, and it wasn't found in 1927 because of lack of detail on the map itself. The aerial view was the only one available for 1927, the year that was actually needed for the research. Since Kerr-McGee existed only from 1910 to 1933, then all other maps that were sent could not be used for our research. The year 1906 was used to pinpoint the exact location of Lindsey Light on the map, the place where it would start up four years later.

At the Chicago Historical Society, the following things were found about Lindsey Light:

LINDSAY LIGHT COMPANY

Incandescent Gas Mantles & Lightning Supplies

Private Exchange All Departments Central-5552-5553

(included in the main advertisement 1906-1908)

President – Charles R Lindsay jr. (home address – 333 Rush)

Secretary – Joseph M Sherburne (home address – 387 N. State)

Company Address 1906-1908

195 and 197 Michigan Street

Company Address 1909

358 Indiana

Company Address 1910

157 E Indiana

Company Address 1914-1917

161 E Grand Ave

- Main Advertisement was only displayed in the 1906-1908 in these yellow pages, all other years the Co. was displayed in regular print with just the name and the address, sometimes the president and the secretary listed. The Books from 1911-1913 were missing the section where Lindsay Light would be displayed.
- NO Brochures Found.
- Only Reference to the Co. is in these Yellow Pages that were from 1833-1917 at the Chicago Historical Society.

The Sanborn Maps collection at the Chicago Historical Society were originally bound and had Volume 1N for 1906, that was updated up until 1911. However, the updates were not in the right areas to see Lindsay Light on the map. So, since Sanborn maps for 1906 were already complete, this information was not useful.

The Newberry Library had the most extensive collection of Sanborn Maps that were originally bound. Based on the addresses that were found in the Chicago Historical Society, the pages from volume 1N that were the most critical were 26-30, 49, and 50-54. For all the years that the library had the Sanborn maps for, the maps were updated to the year that they were dedicated to the library – 1990. So even if there was relevant information on these maps that were available between 1901 and 1950, it was written and pasted over for 1990, so no information could be gotten off those maps.

At the University of Illinois at Urbana-Champagne at their Map and Geography Library, we spoke to a librarian over the phone and she checked out all the 1N volumes that they had for the years between 1910 and 1933. The only year that they did end up having was 1906, which was not useful to us.

The Northeastern Illinois University had the Illinois Regional Archives Depository (IRAD) part as a part of their library. The IRAD featured Sanborn Maps from many years, but the bulk of the collection was between 1916 and 1950, all originally bound. Unfortunately, no Volume 1N was available for any of those years, they were all mostly for West and South Chicago.

The final destination in search for Sanborn Maps past 1906 for Volume 1N, lead us to University of Illinois in Chicago. That library only holds the Illinois portion of the Chadwyck-Healey Microfilm series reproducing the Library of Congress fire insurance atlas Collection, spanning between 1860 and 1950. Volume 1N was found to be in these holdings, but also only for 1906. All later years were for other areas of Chicago, and most of them were also updated to later years.

UNIFORM LOW-LEVEL RADIOACTIVE WASTE MANIFEST

ISOTOPES REPORT

For Manifest # 01-0183 L
ADCO SERVICES, INC.

Total Activity
(mCi)
3.0100E-01

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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	kg	453.5925	NP	NP	NP	NP
	ft3	37.5000	lb	1000.0000				

ACTIVITY	ALL NUCLIDES	TRITIUM	C-14	Tc-99	I-129	SOURC	
MBq	1.1137E+01	NP	NP	NP	NP	(kgs)	
mCi	3.0100E-01	NP	NP	NP	NP	(lbs)	

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

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	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%
01-0183-05 05 161 EAST GRAND CHICAGO, IL	4	0.2124	90.7185	.15	NP	NP	39-H	0.2124	100 100	RUBBLE NP	0.00
		7.5000	200.0000	15.0	NP	NP		7.5000			
01-0183-02/ 161 EAST GRAND CHICAGO, IL	4	0.2124	90.7185	.03	NP	NP	39-H	0.2124	100 100	RUBBLE NP0	0.00
		7.5000	200.0000	3.0	NP	NP		7.5000			
01-0183-03/ 161 EAST GRAND CHICAGO, IL	4	0.2124	90.7185	.01	NP	NP	39-H	0.2124	100 100	RUBBLE NP	0.00
		7.5000	200.0000	1.0	NP	NP		7.5000			
01-0183-04/ 161 EAST GRAND CHICAGO, IL	4	0.2124	90.7185	.03	NP	NP	39-H	0.2124	100 100	RUBBLE NP	0.00
		7.5000	200.0000	3.0	NP	NP		7.5000			
01-0183-06 01 161 EAST GRAND CHICAGO, IL	4	0.2124	90.7185	.002	NP	NP	39-H	0.2124	100 100	RUBBLE NP	0.00
		7.5000	200.0000	.2	NP	NP		7.5000			
Shipment Totals		1.0620	453.5925								
		37.5000	1000.0000								

NOTE 1: Container Description Codes. For containers/ waste requiring disposal in approved structural over-

Note 1A: Barnwell Specific Container Description Codes. (Choose one code as may be applicable.)

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

20. Charcoal — 29. Demolition Rubble — 38. Evaporator Bottoms/Sludges/

Note 2A: Barnwell Specific Waste Descriptor Codes (Choose all applicable codes.)

Note 3: Sol Codes. (Cl by volume. structural

ATG

1101 E. GRAND ASSOCIATES

FORM 540 — ADCO SERVICES, INC.

UNIFORM LOW-LEVEL RADIOACTIVE WASTE MANIFEST

SHIPPING PAPER

1. EMERGENCY TELEPHONE NUMBER (Include Area Code): 847-966-1999

ORGANIZATION: 161 PARTNERS

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

3. TOTAL NUMBER OF PACKAGES IDENTIFIED ON THIS MANIFEST =====> 6

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
~~161 PARTNERS~~ /FOR THE ACCOUNT OF
ADCO SERVICES, INC.
161 EAST GRAND
CHICAGO, IL

SHIPMENT I.D. NUMBER: 01-0183 L

[ ] COLLECTOR
[ ] PROCESSOR
[X] GENERATOR TYPE (Specify) I

SC PERMIT: NA

SHIPMENT NUMBER: 01-0183 L

CONTACT: ELI PORT

TELEPHONE NUMBER (Include Area Code): 847-966-1999

6. CARRIER – Name and Address
ADCOM EXPRESS, INC.
17650 DUVAN DRIVE
TINLEY PARK, IL 60477

EPA I.D. NUMBER: ILD 047267364

SHIPPING DATE: 5-10-00

CONTACT: BOB BASSETT

TELEPHONE NUMBER (Include Area Code): 708-429-3013

SIGNATURE – Authorized carrier acknowledging waste receipt: [signature]

DATE: 5-10-00

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

9. CONSIGNEE - Name and Facility Address
ADCO SERVICES, INC.
17650 DUVAN DRIVE
TINLEY PARK, IL 60477

SIGNATURE - Authorized consignee acknowledging

10. CE

This is to certify that the herein-named materials are pr
in proper condition for transportation according to the a
certifies that the materials are classified, packaged, m
disposal as described in accordance with the requirem

AUTHORIZED SIGNATURE: [signature]

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
~~NON-REGULATED MATERIAL~~ RADIOACTIVE MATERIAL, LSA, NOS, 7, UN2912	NA	NA	Solid RUBBLE	Th-232		3.7000E+00	1.0000E-01
~~NON-REGULATED MATERIAL~~ RADIOACTIVE MATERIAL, LSA, NOS, 7, UN2912	NA	NA	Solid RUBBLE	Th-232		3.7000E+00	1.0000E-01
~~NON-REGULATED MATERIAL~~ RADIOACTIVE MATERIAL, LSA, NOS, 7, UN2912	NA	NA	Solid RUBBLE	Th-232		1.8500E+00	5.0000E-02
~~NON-REGULATED MATERIAL~~ RADIOACTIVE MATERIAL, LSA, NOS, 7, UN2912	NA	NA	Solid RUBBLE	Th-232		1.8500E+00	5.0000E-02
NON-REGULATED MATERIAL	NA	NA	Solid RUBBLE	Th-232		3.7000E-02	1.0000E-03

FOR CONSIGNEE USE ONLY

Packages listed as "NON-REGULATED" MATERIAL" on this manifest are

20. Customer represents and warrants that all data set forth in this Uniform Low-Level Radioactive Manifest is true and cor

Date 5-10-00 Signature [signature]

Title and Organization: _____

Telephone No. (____) _____

ADCO Services, Inc.

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 Barsen	
Signature	Signature
Tech	
Title	Title
5-10-00	5-10-00
Date	Date

17650 Duvan Drive • Tinley Park, Illinois 60477 • (708) 429-1660 • Fax (708) 429-9759

ADCO Services, Inc.

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 Barsell	
Signature	Signature
Tech	
Title	Title
5-10-00	5-10-00
Date	Date

17650 Duvan Drive • Tinley Park, Illinois 60477 • (708) 429-1660 • Fax (708) 429-9759

ATG

161 E. Grand

FORM 540 — ADCO SERVICES, INC.

UNIFORM LOW-LEVEL RADIOACTIVE WASTE MANIFEST

SHIPPING PAPER

1. EMERGENCY TELEPHONE NUMBER (Include Area Code): 847-966-1999

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 [redacted] /FOR THE A
ADCO SERVICES, INC.
161 EAST GRAND
CHICAGO, IL

SC PERMIT: NA

CONTACT: ELI PORT

6. CARRIER – Name and
ADCOM EXPRESS, INC.
17650 DUVAN DRIVE
TINLEY PARK, IL 60477

CONTACT: BOB BASSETT

SIGNATURE – Authorized c

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	P CH
~~NON-REGULATED MATERIAL~~ RADIOACTIVE MATERIAL, LSA, NOS, 7, UN2912	NA	NA	Solid RUBE
~~NON-REGULATED MATERIAL~~ RADIOACTIVE MATERIAL, LSA, NOS, 7, UN2912	NA	NA	Solid RUBE
~~NON-REGULATED MATERIAL~~ RADIOACTIVE MATERIAL, LSA, NOS, 7, UN2912	NA	NA	Solid RUBE
~~NON-REGULATED MATERIAL~~ RADIOACTIVE MATERIAL, LSA, NOS, 7, UN2912	NA	NA	Solid RUBE
NON-REGULATED MATERIAL	NA	NA	Solid RUBE

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.

FORM 540 (10-96)

TOTAL
NP
I-129
NP
NP
EACH WASTE TYPE IN CONTAIN
14. CHEMICA
SOLIDIFICATION OR STABILIZATION MEDIA (See Note 3 & Note 3A)
100
100
0.2124
7.5000
0.2124
7.500

DEM Services, Inc.
1018 S. Oakley Blvd.
Lower Level
Chicago, IL. 60612
USA
312-421-2352 phone
312-421-2369 fax
DEMservice@aol.com

Company name: RSSI	From: Paul Middleton.
Attention: Eli Port	Date: 5-11-00
Office location:	Office location:
Fax number: 847-965-1991	Phone number:

☐ Urgent ☐ Reply ASAP ☐ Please comment ☒ Please review ☐ For your information

Total pages, including cover: 5

COMMENTS

Eli, if you need more info, Please call. I Need from you a copy of all Sampling Results. Please call if we can be of assistance on future Ventures, I'm interested.

Thank you
Paul

KUBA CLINIC
2724 West 47th Street
Chicago, IL 60632
Telephone [illegible]
Fax [illegible]

NAME: Sabino Hernandez **SS:** 368-86 0537

DATE OF EXAM: 4-20-00

In accordance with the Department of Labor Standards 1910.134 and O.S.H.A. standards 1926.58 (m) (1) regarding medical surveillance.

The Asbestos Physical for the above named examinee contained:

Annual Medical History Questionnaire X
Employment Physical X
Pulmonary Function Test X
Chest x-ray _____

The results of the medical examination of the above examinee have been reviewed. No medical conditions were detected which would place the individual at a health risk in continuing duties where possible asbestos exposure exists.

In accordance with O.S.H.A. requirements, I have informed the above named individual of the results of his/her medical examination.

The complete medical examination report and x-ray (if required) on the above named individual will be released and forwarded to the employer pending final conclusion and interpretation of any additional medical data collected during the examination.

We have determined that the examinee can perform work while wearing respiratory protection.

B.D. Horton DO
Physician's Name (Print)

Physician's Signature

Respirator Training Record

Your signature on this [redacted] received and understand the basic respirator training program which both DEM Services Incorporated and [redacted]

The basic respirator [redacted]

- [redacted] the respirator.
- A [redacted] effective and as a result, this respirator protection equipment is required.
- How [redacted] project.
- The [redacted]
- How to [redacted]
- What the [redacted] maintenance program area.
- How to [redacted]
- When to use an Air Purifying [redacted]
- The purpose of the [redacted]
- How DEM Services Incorporated, conducts a proper fit test.
- A PAPR is available to you upon request, as long as it meets the protection factor for the hazards involved.

DEM Services Incorporated --- Respirator FIT TEST SUMMARY

Employee Signature:	Sabino Hernandez	Date:	12/15/99
Employee Printed Name:	SABINO HERNANDEZ	SSN:	368-86-0537
Person Conducting Test (Signature):	CHMM		
Person Conducting Test (Printed Name):	FRANK P. DEFRANZA		

Respirator Selected:

Manufacturer:	MSA	Size (circle One):	S (M) L
MSHA/NIOSH Approval #:	TC-21C-495	Model:	FULL FACE PAPR-45785
Type of Test Conducted:	Qualitative		
Testing Agent Used:	Smoke Irritant	Expiration Date:	6/14/00

OCCUPATIONAL HEALTH, INC.

TELEPHONE (312)641-1449 FAX (312)641-1714

WEST RANDOLPH STREET
H FLOOR
HICAGO, IL 60606

130 NORTH MICHIGAN AVENUE
SUITE 1400
CHICAGO, IL 60601

CHICAGO, IL
PHONE (773) 767-8001 FAX (773) 767-3235

DOCUMENTATION: MEDICAL FITNESS FOR ASBESTOS REMOVAL AND RESPIRATOR USE

Case # 405683 Exam Date 11-23-99

Name Daniel Castillo Age 39 Sex (M) F

Date of Birth [redacted] Social Security # [redacted]

FITNESS CRITERIA

1. This is to certify, in accordance with the OSHA Asbestos Standard, 29 CFR 1926.58 (M)··(1) (2) (3) and (4) and 29 CFR 1910.1001, I have examined the above mentioned individual;

2. Based on my findings, I have determined this individual may use a respiratory device while performing his/her required employment services;

3. The results of my examination have not detected a medical condition which would place the employee at an increased risk of material health impairment from exposure to asbestos;

4. In accordance with OSHA requirement, I have informed the above named individual of the results of his/her medical examination and of any medical condition that may result from his/her exposure to asbestos, and

5. I have informed the above named individual of the health risks involved in smoking, of synergistic relationship between cigarette smoking and asbestos exposure in producing lung cancer, and that cessation of smoking will reduce the risk of lung cancer.

PHYSICIAN'S APPROVAL

It is my medical opinion that the above-named individual is medically fit to engage in asbestos removal and wear respiratory protective equipment as required by the Illinois Department of Public Health (Asbestos Abatement Act Rules and Regulations, Section 855.60) and OSHA 29 CFR 1926.58 M (1) (2) (3) (4) and OSHA 29 CFR 1910.1001.

Physician's Signature DA-C Date 11-23-99

[illegible] Training Record

Your [illegible] Services [illegible] and understand the basic respirator training program which took place [illegible]

The basic [illegible]

- [illegible]
- A [illegible] ive and as a result, this respirator protection equipment is required.
- [illegible] this project.
- The [illegible]
- How [illegible]
- What the [illegible] care and maintenance program area.
- How to [illegible]
- When to use an Air Purifying Respirator.
- The purpose of the medical evaluation.
- How DEM Services Incorporated, conducts a proper fit test.
- A PAPR is available to you upon request, as long as it meets the protection factor for the hazards involved.

DEM Services Incorporated --- Respirator FIT TEST SUMMARY

Employee Signature:	[signature] Date: 4-17-00
Employee Printed Name:	DANIEL CASTILLO JR SSN: 345561999
Person Conducting Test (Signature):	[signature]
Person Conducting Test (Printed Name):	Paul R. Middleton

Respirator Selected:

Manufacturer:	MSA (circled)	Size (circle One):	S M (circled) L
MSHA/NIOSH Approval #:	TC-21C-495	Model:	FULL FACE PAPR-45785
Type of Test Conducted:	Qualitative		
Testing Agent Used:	Smoke Irritant	Expiration Date:	10-17-00

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. 01-0183

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. #36-2652885

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 (SNM) in quantities greater than 1 gram or source material greater than 1,000 kilograms that are being transfered, form AEC 741 must be completed. Our R.I.S. letters are VBO.

MAKE CHECKS PAYABLE

ADCO SERVICES, INC.
P.O. BOX 1129
TINLEY PARK, IL 60477

TOTAL AMOUNT 10,307.50

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

ADCO Services, Inc.

17650 Duvan Drive, Tinley Park, IL 60477 • (708) 429-1660 FAX (708) 429-9759

INVOICE

264416 Page 1 of 1

CUSTOMER ORDER NO. VERDAL ELI

LOT NO. 01 0183

DATE 05/11/00

Bedy.

BILL TO
RSSI
ATTN ELI PORT
6312 W. OAKTON STREET
MORTON GROVE IL 60053

SHIP TO
1st GRAND ASSOCIATES
161 EAST GRAND
CHICAGO IL

TERMS: Account Number: 3582
Net 10

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

✓ 5/15/00
address changed
to Ship to - Attn Ross Steele,
60611

PLEASE RETURN GOLD COPY WITH YOUR PAYMENT

F.E.I.N. #IS 2852895

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 (SNM) in quantities greater than 1 gram or source material greater than 1,000 kilograms that are being transfered, form AEC 741 must be completed. Our R.I.S. letters are VBQ.

MAKE CHECKS PAYABLE TO:
ADCO SERVICES, INC.
P.O. BOX 1129
TINLEY PARK, IL 60477

TOTAL AMOUNT 10,307.50

KERR-McGEE
KERR-McGEE CENTER • P.O. BOX 25861 • OKLAHOMA CITY, OKLAHOMA 73125

November 30, 1999

BY FEDERAL EXPRESS

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% EKO, Second Floor
205 East Grand Avenue
Chicago, IL 60611

Re: 161 E. Grand Avenue, Chicago, Illinois

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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

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. 01-0183

DATE 05/11/00

Ready.

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

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✓ 5/15/00
address changed
to Ship to - Attn Ron Steele,
60611

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F.E.I.N. #36-2652895

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MAKE CHECKS PAYABLE TO:
ADCO SERVICES, INC.
P.O. BOX 1129
TINLEY PARK, IL 60477

TOTAL AMOUNT 10,307.50

KERR-McGEE
KERR-McGEE CENTER • P.O. BOX 25861 • OKLAHOMA CITY, OKLAHOMA 73125

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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

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

Draft 10/27/99

161 E. Grand Associates
Ron Steele, Manager
161 E. Grand
Chicago,Il. 60611

Dear Mr. Steele,

This letter is simply to confirm arrangements that have been made with your consultant, Eli Port, Concerning the 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 pay the costs for the transportation and disposal of such material at a properly licensed disposal site, up to a maximum of $20,0000.00. The work will be undertaken by your contractor under your supervision and all other costs associated with the remediation will be paid by you.

It is agreed by you that Kerr-McGee's undertaking to pay these costs does not represent 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. Grand Avenue or for its remediation.

I would appreciate it if you would countersign this letter and return it to me.

Very Truly Yours,

George B. Christiansen

AGREED TO:_____
Manager

n

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

Please call 270-2686 or 270-2384 for FAX transmittal problems.

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

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George D. Christiansen
Vice President

AGREED TO:_____
Ronald Steele, OWNER

_____
Dated

cc: Mark Krippel

BCC: W.O. Green
T.P. Goresen

KERR-McGEE CORPORATION

SAFETY & ENVIRONMENTAL AFFAIRS DIVISION

123 Robert S. Kerr, MT-2003
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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

Please call 270-2686 or 270-2384 for FAX transmittal problems.

ekO
sign company

East Grand Avenue
cago, Illinois

one: 312-467-5440
x: 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

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 Gass Date: 8/5/93
Approved By: [illegible] 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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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

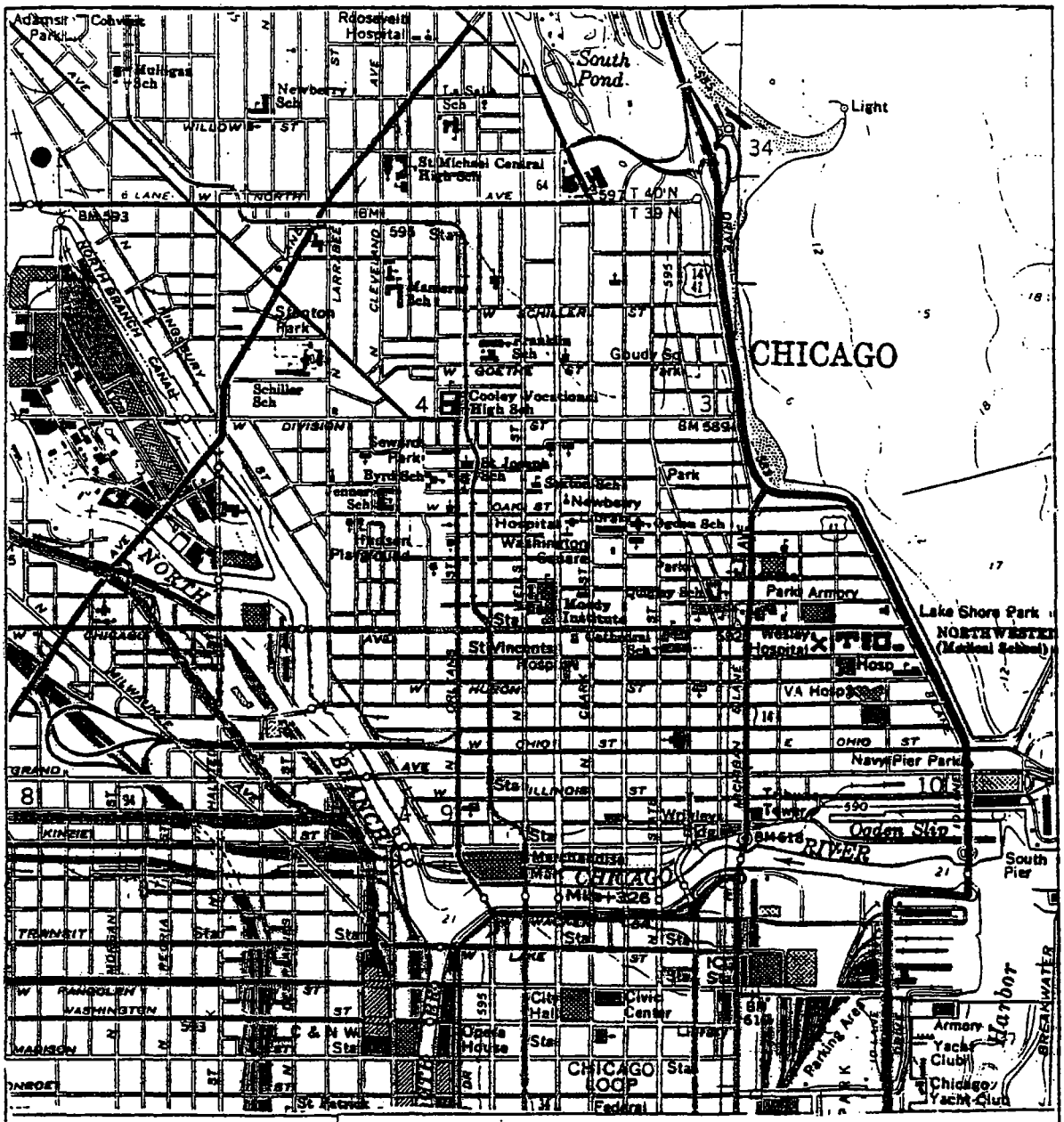
The Lindsay Light Company manufactured incandescent gas mantles for home and street lighting in this building from at least 1910 until 1936. Lindsay Light moved to West Chicago and was later purchased by American Potash, which was later purchased by Kerr McGee Chemical Company in 1967. The principal 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.

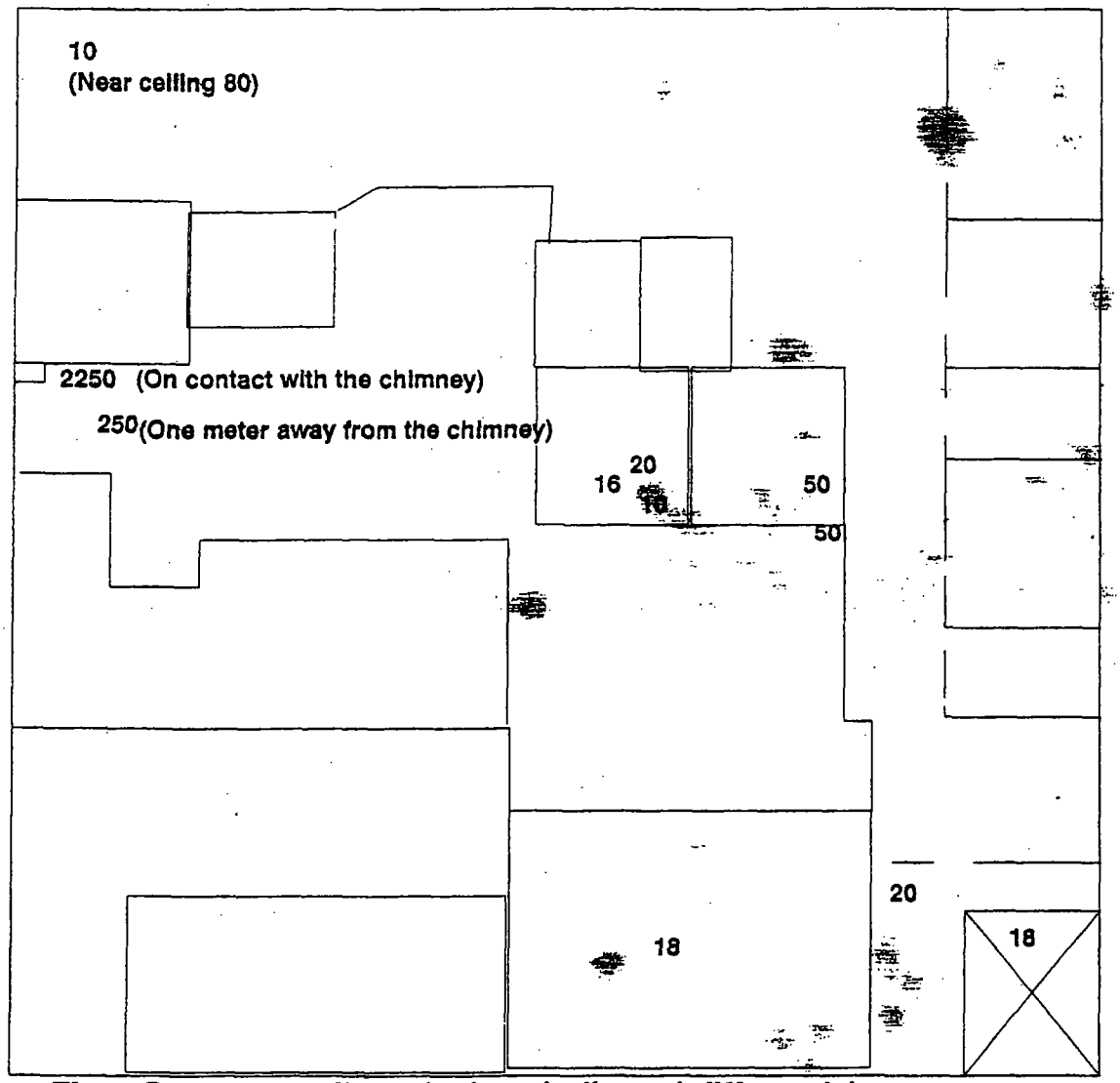
Due to the contaminant of concern, one may be exposed to radioactive isotopes and the effects may occur many years after exposure. Thorium occurs principally as the parent radionuclide thorium-232 in association with its daughter products in a decay sequence known as the Thorium Decay Series. Thorium-232 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

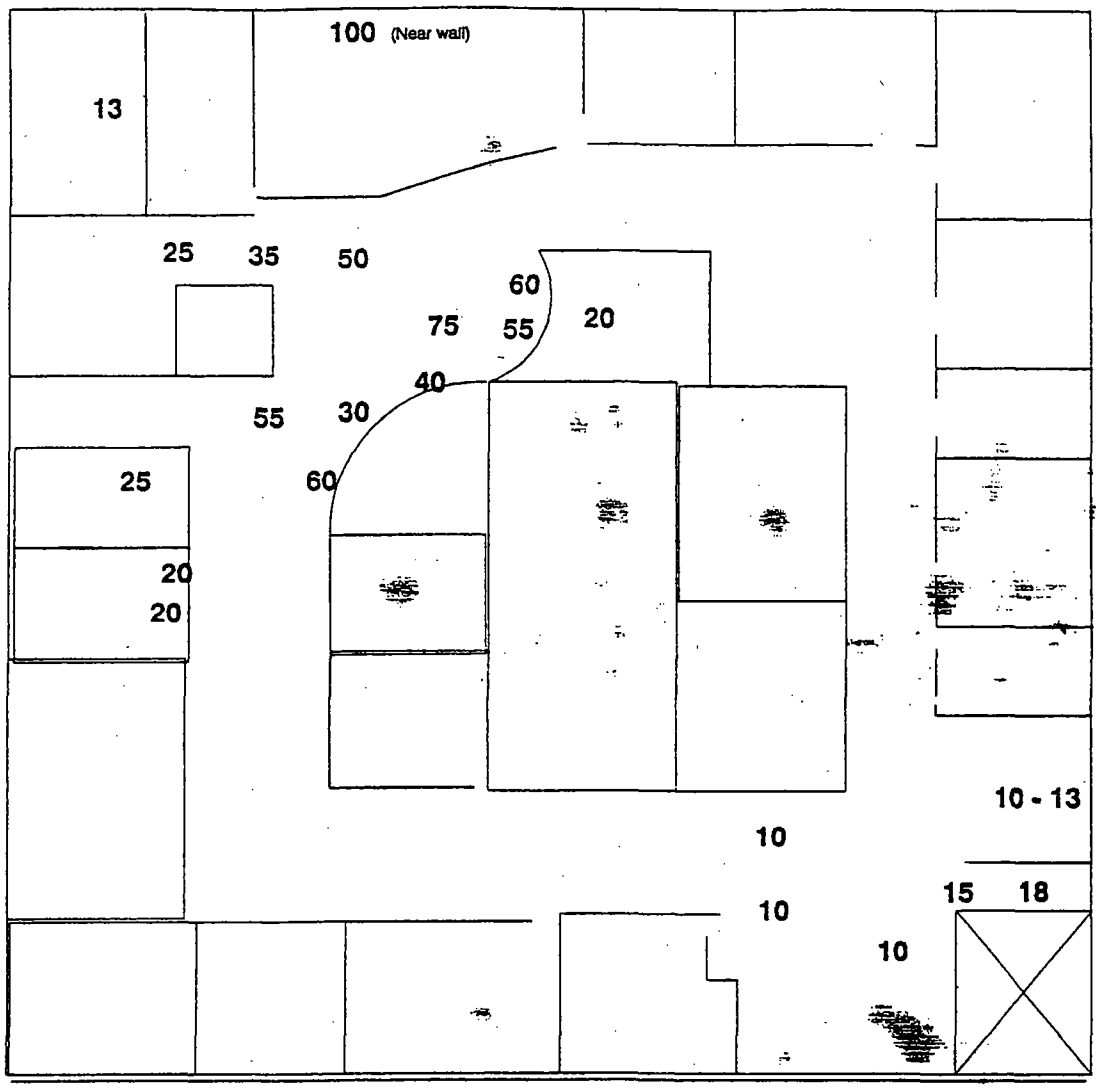
N

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

1



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

LEGEND

N

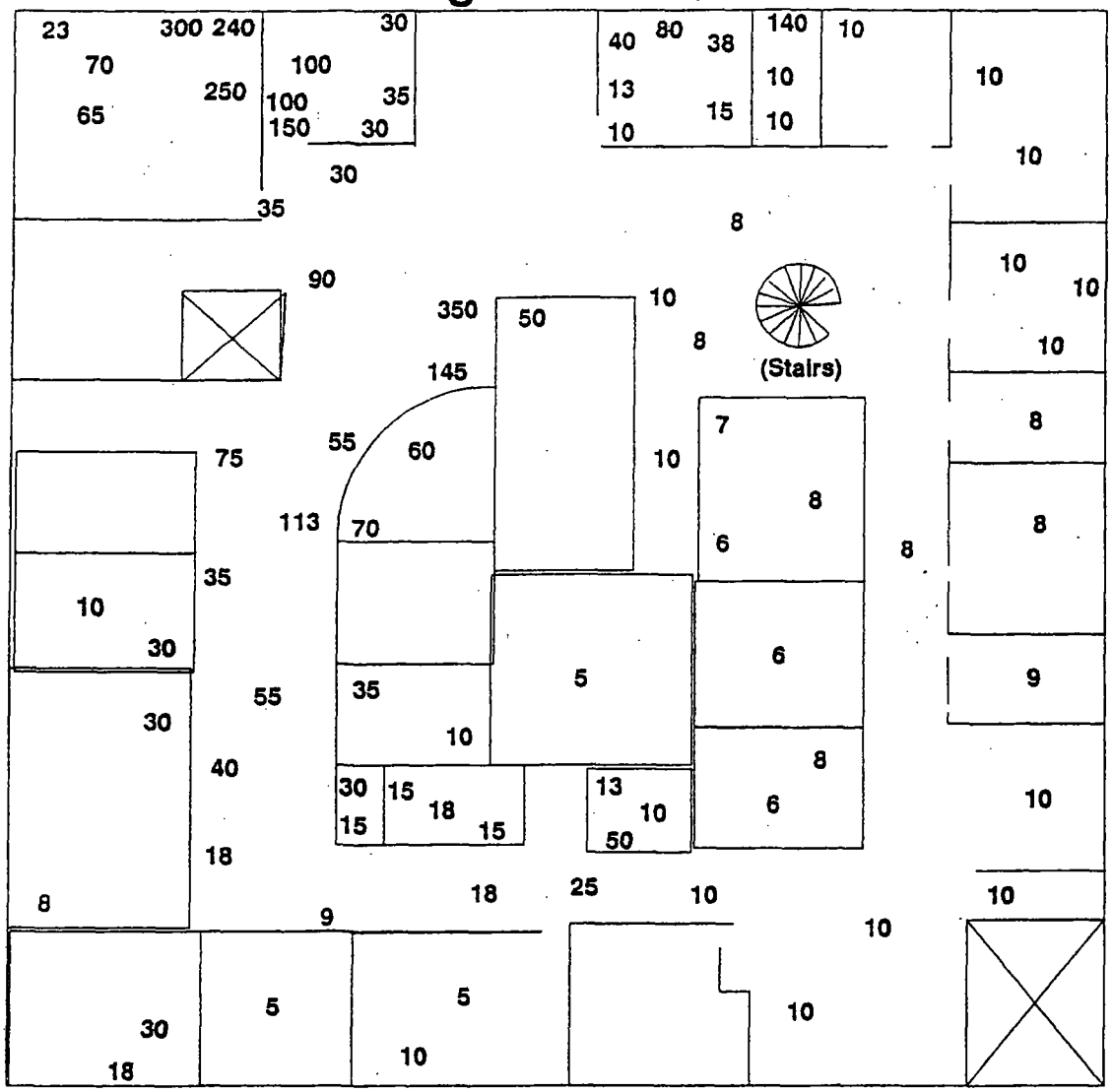
Readings: MicroR/Hr

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	PAN 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

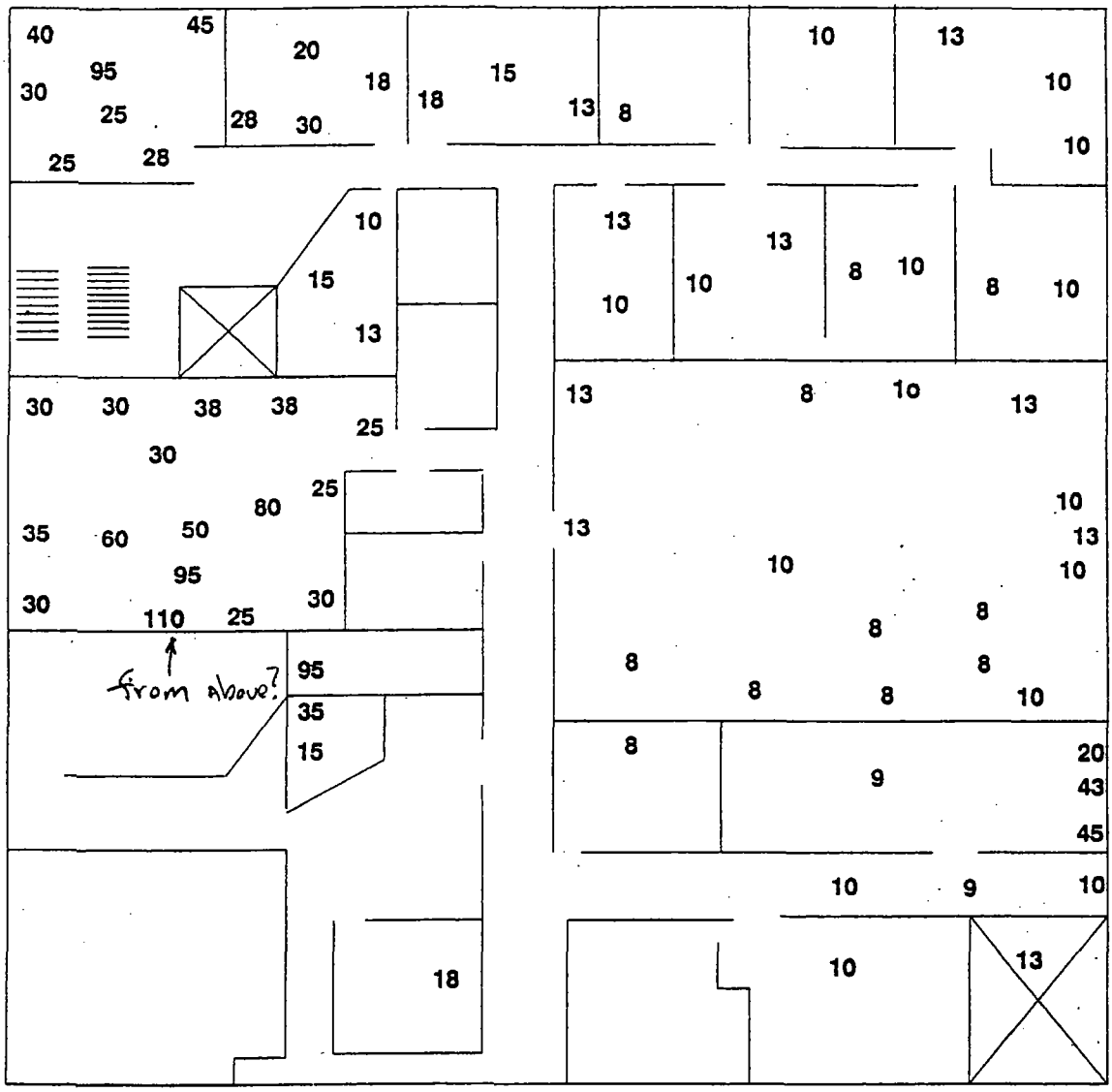
N

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 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

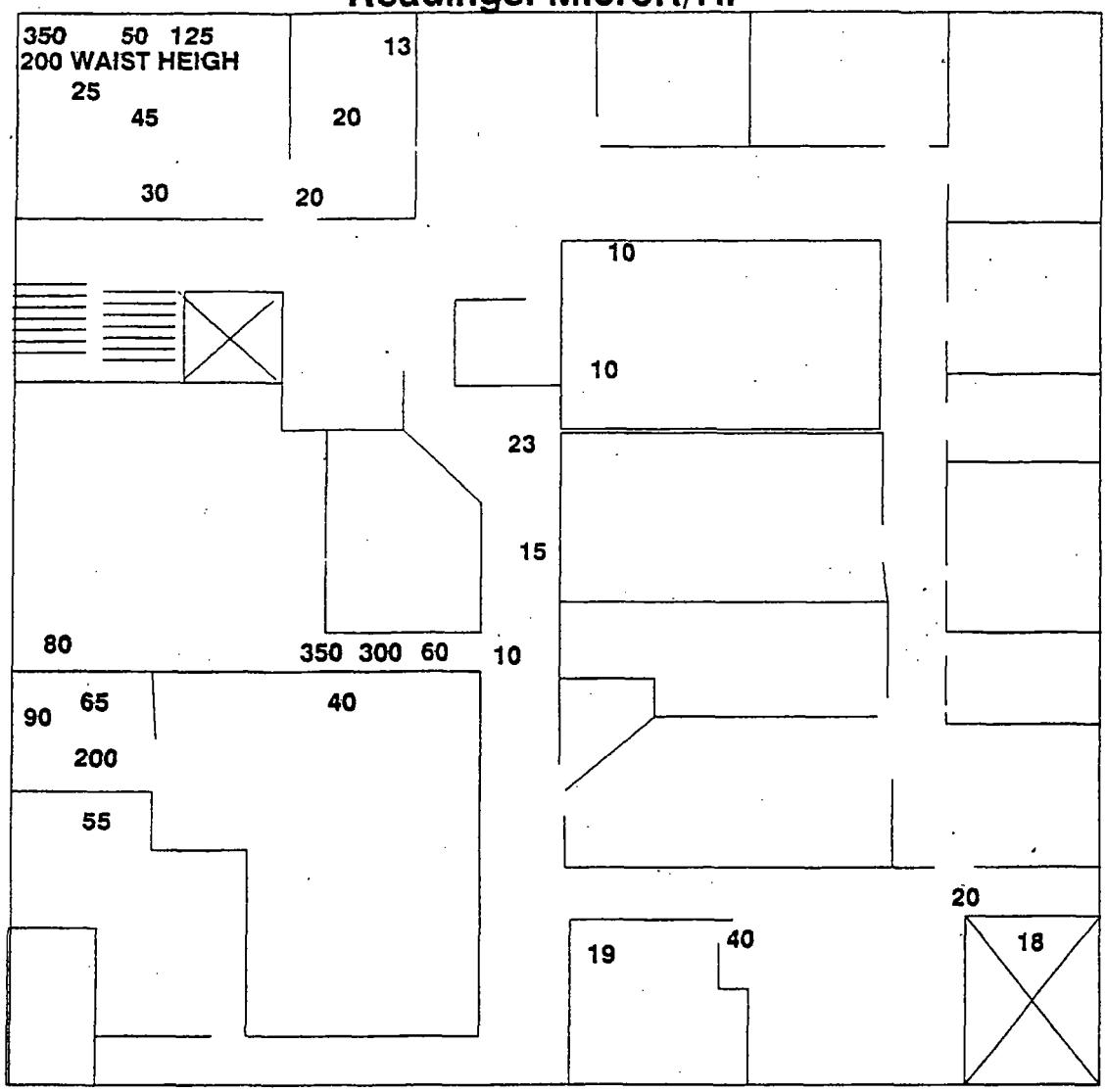
N

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 Instrument: Ludlum Model 19	DATE July 16, 1993
	REVISED

4

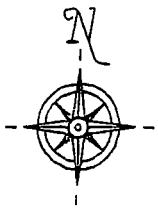
Readings: MicroR/Hr



Floor Contact readings (unless indicated differently)

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

LEGEND



ecology and environment, inc.
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

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

DATE: 6/2/93

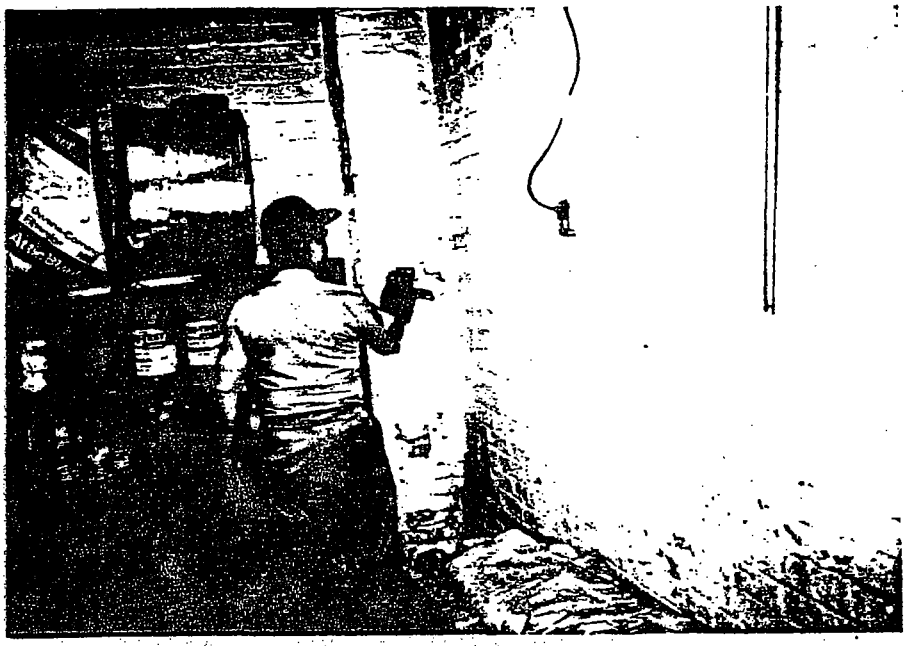
TIME: 2030

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

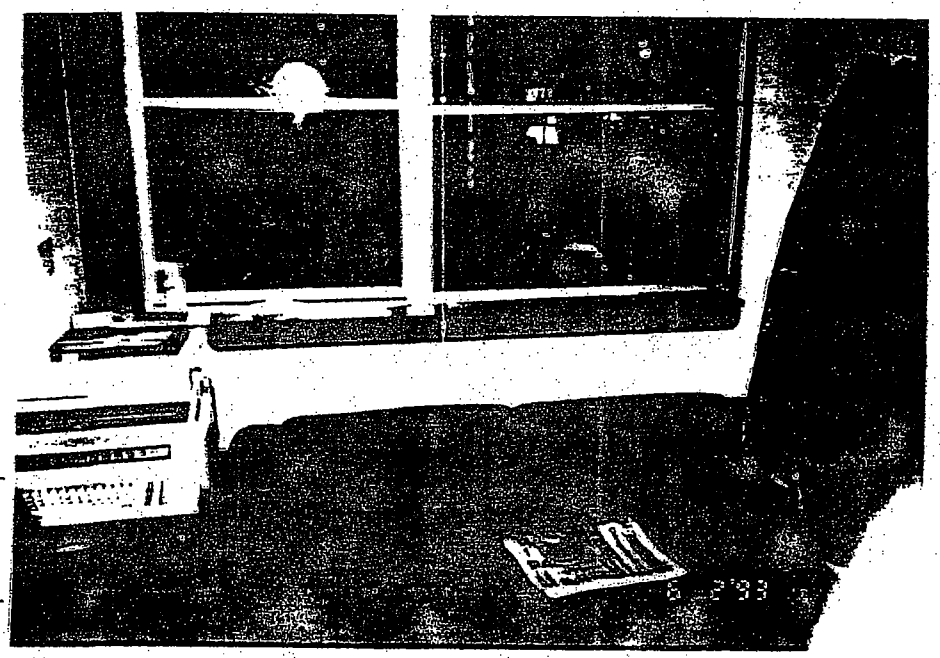
TIME: 2000

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

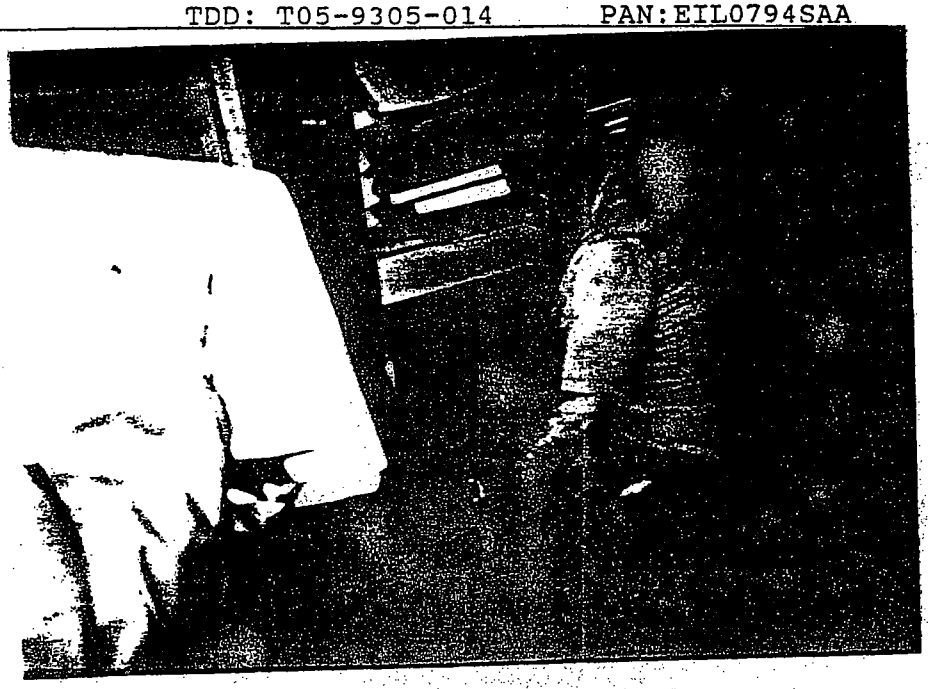
TIME: 1745

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

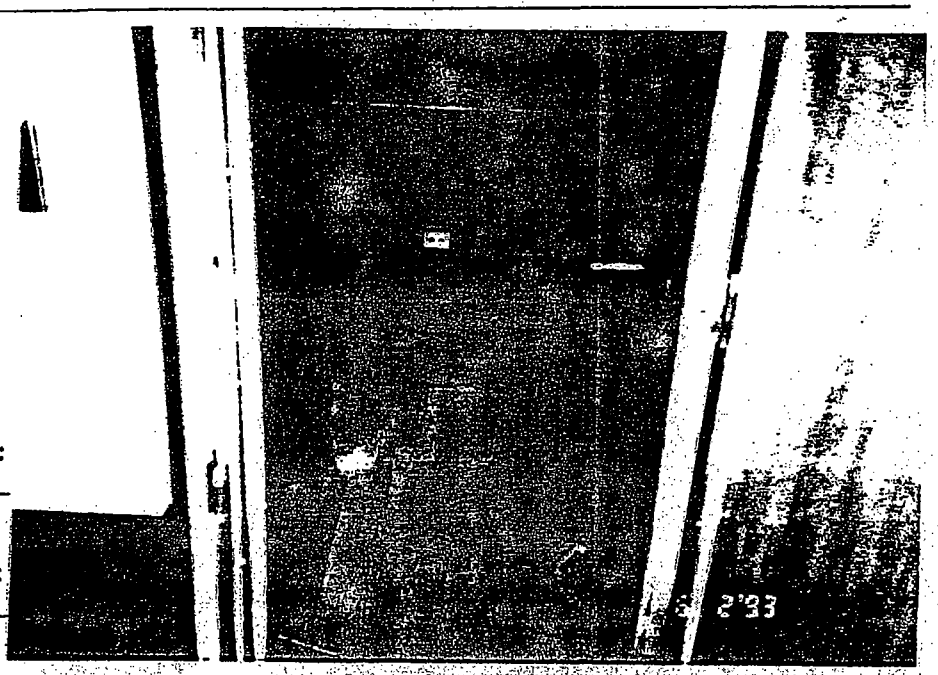
TIME: 1830

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

SITE NAME: Lindsay Light Company

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

DATE: 6/2/93

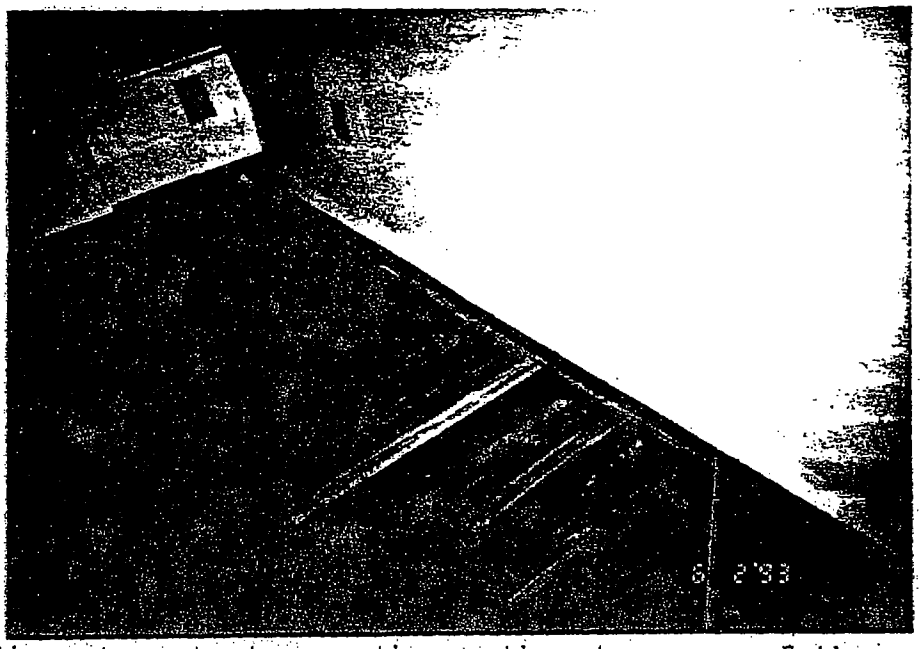
TIME: 1745

DIRECTION OF PHOTOGRAPH: North

WEATHER CONDITIONS: N/A

PHOTGORAPHED BY: Ron Bugg

SAMPLE ID (if applicable):



DESCRIPTION: Reading at contact near the 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

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

DATE: 6/2/93

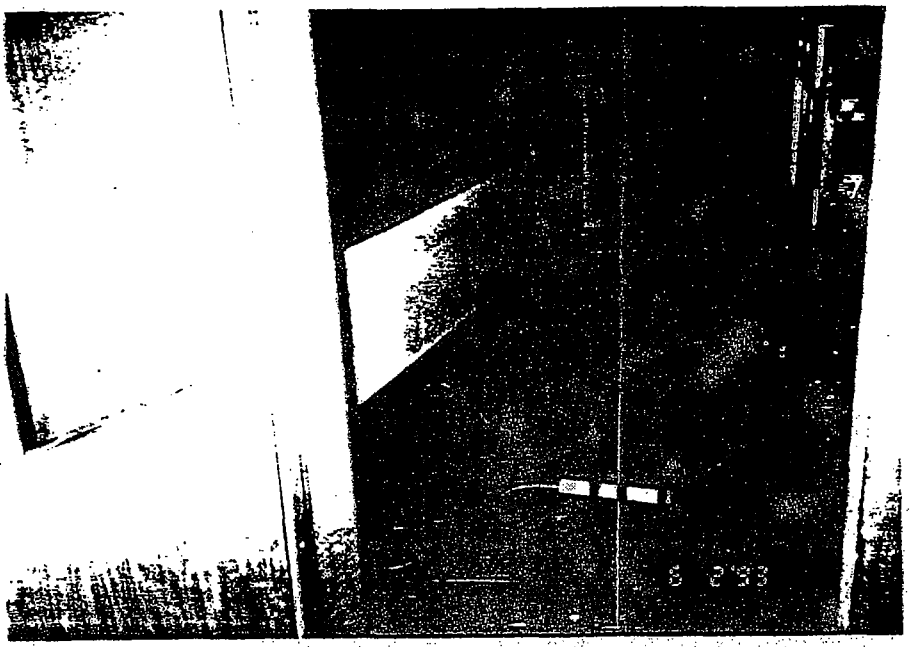
TIME: 1845

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

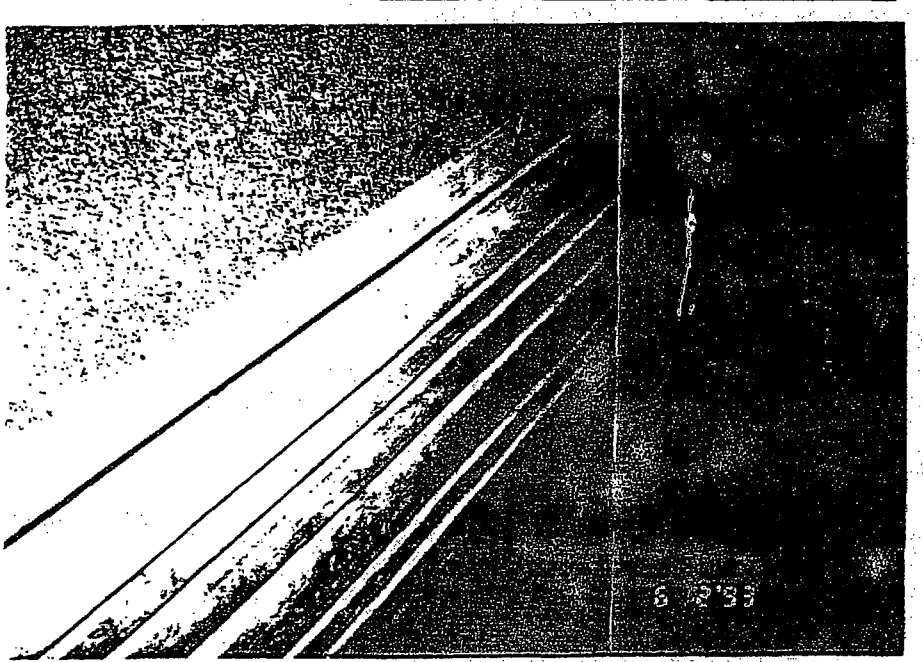
TIME: 1845

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 (4

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%)
$^{212}_{84}Po$	Thorium C'	304ns	8.78 (100%)	---	---
$^{208}_{81}Tl$	Thorium C''	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	---	---	---

64.0% 36.0%

*This expression describes the mass number of any member in this series, where n is an integer.
Example: $^{232}_{90}Th$ (4n).....→(58) = 212

†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]).

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

Thermo Analytical Inc.
TMA/Eberline
5635 Jefferson Street NE
Albuquerque NM 87109
(505) 345-0857

These are a series of tests, on the same badge!

TLD ENVIRONMENTAL 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

10CFR20 Limits = 100

BADGE NUMBER	IDENTIFICATION	DOSIMETER READINGS (mrem) FIRST	SECOND	THIRD	FOURTH	FIFTH	AVERAGE	± 2σ	MREM/WEEK *
9016		[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
9033	3- Corner Off (NW)	33	34	29	40	35	34.2	7.9	3.1
9018		[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
91[illegible]		[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
9020		[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
9021	B- Chimney	3280	3224	3253	3334	2921	3202.4	324.9	320.2
9022	B- Shelving (By Chimney)	182	243	208	226	190	210.2	31.7	21.0
9023	B- Shipping	33	26	32	39	31	32.2	9.3	3.2
9024	1- Window (200)	28	36	35	42	40	36.2	10.8	3.6
9025	1- Reception	35	36	44	42	39	39.2	7.7	3.9
9026	2- NE Office Corner	199	183	231	194	185	202.4	35.9	20.2
[illegible]	2- Sm Office	432	548	436	442	535	478.6	115.4	47.8
9028	2- Center "	49	51	36	46	47	49.8	7.9	4.9
9029	2- Sm Office	46	43	35	41	35	40.0	9.8	4.0
9031	2- Core	17	14	14	12	16	14.6	3.9	1.4
9032	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
I - IRREGULAR

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

09/01/1993 09:09 FROM US EPA EMERGENCY RESP. BR 15807268 P.02

To EL1 ☐ URGE

Date 5/15/20 Time 12:10 A.M. P.M.

WHILE YOU WERE OUT

From Paul Middleton

of DEM

Phone 312 421 2352
Area Code Number Ext.

Fax
Area Code Number

Telephoned	✓	Please call	✓
Came to see you		Wants to see you	
Returned your call		Will call again	

Message
Re: 161 E Grand
need copy of sampling results
to close out job file
also talk to Debbie

Signed

To EL1 ☐ URGE

Date 5/11/20 Time 7:35 A.M. P.M.

WHILE YOU WERE OUT

From Bob Bassett

of ADCO

Phone 708 2059236
Area Code Number Ext.

Fax
Area Code Number

Telephoned	✓	Please call	✓
Came to see you		Wants to see you	
Returned your call		Will call again	

Message
Re: waste pickup yesterday,
important, not urgent
Please call ASAP
Tell Bassett

Signed

To EL1 ☐ URGE

Date 5/10/20 Time 4:16 A.M. P.M.

WHILE YOU WERE OUT

From Paul Middleton

of DEM SERVICES

Phone 312-421-2352
Area Code Number Ext.

Fax
Area Code Number

Telephoned	✓	Please call	✓
Came to see you		Wants to see you	
Returned your call		Will call again	

Message
tell Debbie what you
need fixed to him; will need
copy of sample results
Fax 312-421-2369

Signed

To EL1 ☐ URGENT

Date 5/11/20 Time 1:50 A.M. P.M.

WHILE YOU WERE OUT

From Ron Steel

of 161 E Grand

Phone 312-467-5440
Area Code Number Ext.

~~Fax~~ (Joe 312-644-6112)
Area Code Number

Telephoned	✓	Please call	✓
Came to see you		Wants to see you	
Returned your call		Will call again	

Message
- Joe (Bldg guy)
has it; works
7-10AM; other times,
make arrangements
with Ron

Signed

U_Th_K.lib

RSSI, Morton Grove, Illinois 847-965-1999

Quantum Technology
GDR_C Version 6.0

Sample ID : 161 East Grand

Sample Size . . . . . 2.43e+002 g	Spectrum File . . h:\pcaspec\992338.spm
Sampling Start. 00-00-00 00:00	Counting Start. 00-00-00 00:00
Sampling Stop 00-00-00 00:00	Live Time . . . . . 43200 Sec
Current Date. 07-28-99 16:03	Real Time . . . . . 0 Sec

Detector #: 1

Energy(keV)= -3.55 + 0.191*Ch + 1.23e-008*Ch^2 + 0.00e+000*Ch^3 07-09-99 12:30

FWHM(keV) = 1.18 + 0.031*En + 0.00e+000*En^2 + 0.00e+000*En^3 11-21-97 12:00
Where En = Sqrt(Energy in keV)

Sensitivity 2.00	Search Start / End. . . . . 0 / 8191
Sigma Multiplier. 1.00	

PEAK SEARCH RESULTS

PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET COUNTS	UN-CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
1	75.73	414.76	12988	516	1038	54458	2.00	a
2	78.24	427.90	61002	767	1545	87973	3.19	b
3	88.38	480.96	6840	770	1661	77724	1.50	a
4	90.70	493.07	8388	405	789	40948	2.68	b
5	94.61	513.52	3881	647	1355	76329	1.52	c
6	101.00	547.00	0	898	1949	106805	0.00	d NET < CL
7	106.99	578.29	359	641	1380	60019	1.20	e NET < CL
8	130.62	701.92	13042	720	1512	84275	3.00	
9	155.27	830.89	3307	587	1231	61997	1.85	
10	210.67	1120.72	17884	603	1250	57575	2.61	
11	234.22	1243.93	43644	709	1484	53262	3.62	a
12	240.18	1275.10	276469	877	1539	55722	3.65	b
13	271.83	1440.67	13819	532	1131	32963	2.34	a
14	278.95	1477.90	8165	503	1078	31070	2.46	b
15	301.62	1596.49	11042	407	838	25053	2.72	
16	329.13	1740.38	5140	368	759	24488	2.35	
17	339.83	1796.39	39714	483	945	29036	3.07	
18	353.26	1866.64	2914	318	667	16375	2.75	
19	410.72	2167.19	4858	297	613	14336	2.68	
20	464.43	2448.13	10434	323	656	14405	3.11	
21	506.61	2668.75	4214	339	725	13974	5.65	a
22	511.89	2696.34	19102	379	772	15066	2.75	b
23	578.61	3045.31	9514	332	691	12501	3.13	a
24	584.43	3075.72	67232	427	742	13651	3.34	b
25	610.53	3212.26	1817	263	558	10115	2.64	
26	728.60	3829.72	11777	285	565	10393	3.05	
27	773.59	4065.00	2252	228	480	7080	3.63	
28	796.30	4183.78	6312	225	453	6469	2.82	
29	837.11	4397.14	2216	207	440	5120	2.80	a
30	841.48	4420.03	1088	149	310	3342	2.44	b

				890	2.93
			382	5077	3.49 a
		193	414	7126	3.30 b
	56[illegible]8	209	549	5307	4.06 a
	6983	322	429	5037	3.25 b
861.84 4526.44	41017	222	411	2565	3.40
906.36 4759.24	10101	243	297		
912.32 4790.40	22678	154			
965.75 5069.79	4918				
970.15 5092.79					
1461.53 7661.63					

RSSI, Morton Grove, Illinois 847-965-1999

Quantum Technology
GDR_C Nuclide Activity Summary

Sample ID: 161 East Grand

Sample Size . . . . . 2.43e+002 g	Spectrum File . . h:\pcaspec\992338.spm
Sampling Start. 00-00-00 00:00	Counting Start. 00-00-00 00:00
Sampling Stop 00-00-00 00:00	Buildup Time. . . . . 0.00e+000 Hrs
Current Date. 07-28-99 16:03	Decay Time. . . . . 0.00e+000 Hrs

Efficiency Fileh:\pcaspec\gdr\kmu_th.	Library File. h:\pcaspec\gdr\u_th_k.lib
ID. . . . . STS Samples	ID. . . . . .U & Th SERIES & K-40

Eff.= 1/[6.66e+000*En^-1.57e+000 + 2.39e+002*En^8.48e-001] 06-07-99 12:00

Gamma Fraction Limit >= . . . 10.00 %	Decay Limit <=. . . . 8.000 Halflives
Library Energy Tolerance. . . 6.00	

FINAL ACTIVITY REPORT

Nuclide	Energy (keV)	Conc +- 1.00sigma (uCi/g)	Halflife (hrs)	Peaks Found
Th-232	125.00	1.73e-002 +-9.58e-004	1.23e+014	1 of 2
Th-234	Average:	1.13e-004 +-1.34e-005	5.78e+002	2 of 3
	92.38	1.13e-004 +-1.88e-005		
	92.80	1.14e-004 +-1.90e-005		
Pb-212	Average:	3.07e-004 +-9.37e-007	1.06e+001	5 of 5
	74.82	8.15e-004 +-1.05e-005		
	77.11	4.84e-004 +-6.25e-006		
	87.30	1.23e-004 +-6.04e-006		
	238.63	3.08e-004 +-9.78e-007		
	300.09	1.57e-004 +-5.78e-006		
Pb-214	Average:	5.00e-005 +-5.43e-006	4.47e-001	5 of 6
	74.82	5.01e-005 +-2.34e-004		
	77.11	5.00e-005 +-1.39e-004		
	87.30	5.01e-005 +-1.34e-004		
	241.98	5.00e-005 +-7.53e-005		
	351.92	5.00e-005 +-5.46e-006		
Tl-208	Average:	5.55e-003 +-3.30e-005	5.09e-002	5 of 5
	74.97	5.61e-003 +-3.72e-003		
	277.35	6.61e-003 +-4.08e-004		
	510.84	5.76e-003 +-1.14e-004		
	583.14	5.61e-003 +-3.56e-005		
	860.37	4.17e-003 +-1.43e-004		
Th-228	Average:	4.87e-004 +-4.70e-005	1.68e+004	2 of 2
	84.37	4.87e-004 +-5.48e-005		
	215.98	4.87e-004 +-9.13e-005		
Pa-234	Average:	4.24e-005 +-2.19e-006	6.70e+000	5 of 14
	94.66	3.39e-005 +-5.65e-006		
	98.44	2.09e-005 +-3.49e-006		
	131.20	5.94e-005 +-3.28e-006		
	272.10	2.60e-004 +-3.07e-005		

31	861.84	4526.44	56[illegible]8	193	382	[illegible]890	2.93	
32	906.36	4759.24	6983	209	414	5077	3.49	a
33	912.32	4790.40	41017	322	549	7126	3.30	b
34	965.75	5069.79	10101	222	429	5307	4.06	a
35	970.15	5092.79	22678	243	411	5037	3.25	b
36	1461.53	7661.63	4918	154	297	2565	3.40	

RSSI, Morton Grove, Illinois 847-965-1999

Quantum Technology
GDR_C Nuclide Activity Summary

Sample ID: 161 East Grand

Sample Size . . . . . 2.43e+002 g	Spectrum File . . h:\pcaspec\992338.spm
Sampling Start. 00-00-00 00:00	Counting Start. 00-00-00 00:00
Sampling Stop 00-00-00 00:00	Buildup Time. . . . . 0.00e+000 Hrs
Current Date. 07-28-99 16:03	Decay Time. . . . . 0.00e+000 Hrs
Efficiency Fileh:\pcaspec\gdr\kmu_th.	Library File. h:\pcaspec\gdr\u_th_k.lib
ID. . . . . STS Samples	ID. . . . . .U & Th SERIES & K-40

Eff.= 1/[6.66e+000*En^-1.57e+000 + 2.39e+002*En^8.48e-001] 06-07-99 12:00

Gamma Fraction Limit >= . . . 10.00 %	Decay Limit <=. . . . 8.000 Halflives
Library Energy Tolerance. . . 6.00	

FINAL ACTIVITY REPORT

Nuclide	Energy (keV)	Conc +- 1.00sigma (uCi/g)	Halflife (hrs)	Peaks Found
Th-232	125.00	1.73e-002 +-9.58e-004	1.23e+014	1 of 2
Th-234	Average:	1.13e-004 +-1.34e-005	5.78e+002	2 of 3
	92.38	1.13e-004 +-1.88e-005		
	92.80	1.14e-004 +-1.90e-005		
Pb-212	Average:	3.07e-004 +-9.37e-007	1.06e+001	5 of 5
	74.82	8.15e-004 +-1.05e-005		
	77.11	4.84e-004 +-6.25e-006		
	87.30	1.23e-004 +-6.04e-006		
	238.63	3.08e-004 +-9.78e-007		
	300.09	1.57e-004 +-5.78e-006		
Pb-214	Average:	5.00e-005 +-5.43e-006	4.47e-001	5 of 6
	74.82	5.01e-005 +-2.34e-004		
	77.11	5.00e-005 +-1.39e-004		
	87.30	5.01e-005 +-1.34e-004		
	241.98	5.00e-005 +-7.53e-005		
	351.92	5.00e-005 +-5.46e-006		
Tl-208	Average:	5.55e-003 +-3.30e-005	5.09e-002	5 of 5
	74.97	5.61e-003 +-3.72e-003		
	277.35	6.61e-003 +-4.08e-004		
	510.84	5.76e-003 +-1.14e-004		
	583.14	5.61e-003 +-3.56e-005		
	860.37	4.17e-003 +-1.43e-004		
Th-228	Average:	4.87e-004 +-4.70e-005	1.68e+004	2 of 2
	84.37	4.87e-004 +-5.48e-005		
	215.98	4.87e-004 +-9.13e-005		
Pa-234	Average:	4.24e-005 +-2.19e-006	6.70e+000	5 of 14
	94.66	3.39e-005 +-5.65e-006		
	98.44	2.09e-005 +-3.49e-006		
	131.20	5.94e-005 +-3.28e-006		
	272.10	2.60e-004 +-3.07e-005		

	768.70	3.32e-004 +-3.62e-005			
Ac-228	Average:	1.48e-004 +-8.68e-007	6.13e+000	10 of	10
	209.28	1.59e-004 +-9.03e-006			
	270.23	1.59e-004 +-9.09e-006			
	327.64	9.89e-005 +-7.09e-006			
	338.32	2.17e-004 +-2.64e-006			
	409.51	1.49e-004 +-9.14e-006			
	463.00	1.63e-004 +-5.03e-006			
	794.70	1.33e-004 +-4.72e-006			
	911.07	1.59e-004 +-1.25e-006			
	964.60	1.59e-004 +-5.26e-006			
	969.11	1.04e-004 +-1.65e-006			
Ra-224	240.98	2.53e-003 +-8.04e-006	8.69e+001	1 of	1
Tl-210	298.00	1.80e-003 +-6.62e-005	2.17e-002	1 of	3
Bi-212	727.17	4.09e-004 +-9.89e-006	1.01e+000	1 of	2
Bi-214	Average:	4.35e-005 +-6.26e-006	3.32e-001	2 of	6
	609.31	4.35e-005 +-6.30e-006			
	768.36	4.35e-005 +-5.89e-005			
K-40	1460.80	2.93e-005 +-1.47e-006	1.12e+013	1 of	1

TOTAL: 2.89e-002 uCi/g

UNKNOWN PEAKS

Energy (keV)	Centroid Channel	Net Counts	Un-Certainty	C.L. Counts	Bkg. Counts	FWHM (keV)	Net Gamma/sec
75.73	414.76	12988	516	1038	54458	2.00	1.245e+002
155.27	830.89	3307	587	1231	61997	1.85	1.334e+001
234.22	1243.93	43644	709	1484	53262	3.62	1.366e+002
506.61	2668.75	4214	339	725	13974	5.65	1.499e+001
578.61	3045.31	9514	332	691	12501	3.13	3.656e+001
837.11	4397.13	2216	207	440	5120	2.80	1.099e+001
841.48	4420.03	1088	149	310	3342	2.44	5.419e+000
906.35	4759.24	6983	209	414	5077	3.49	3.679e+001
965.75	5069.79	10101	222	429	5307	4.06	5.589e+001

RSSI, Morton Grove, Illinois 847-965-1999

Quantum Technology
GDR_C Background Subtract Results

Sample ID : 161 East Grand

Bkg File: . . .h:\pcaspec\gdr\cal.bkg | Counting Start. 00-00-00 00:00
ID.:. . . . . 97mari.spmh:\p | Current Date 07-28-99 16:03

PK#	ENERGY (keV)	FWHM (keV)	OLD NET COUNTS	OLD UN-CERTAINTY	NEW NET COUNTS	NEW UN-CERTAINTY	FLAG
36	1461.53	3.40	4918	154	3643	183	

(ra2Nrg.lib)

RSSI, Morton Grove, Illinois 847-965-1999

Quantum Technology
GDR_C Version 6.0

Sample ID : 161 East Grand Brick Sample

Sample Size . . . . . 2.43e+002 g	Spectrum File . . h:\pcaspec\992338.spm
Sampling Start. 00-00-00 00:00	Counting Start. 00-00-00 00:00
Sampling Stop 00-00-00 00:00	Live Time . . . . . 43200 Sec
Current Date. 07-28-99 15:35	Real Time . . . . . 0 Sec

Detector #: 1

Energy(keV)= -3.55 + 0.191*Ch + 1.23e-008*Ch^2 + 0.00e+000*Ch^3 07-09-99 12:30

FWHM(keV) = 1.18 + 0.031*En + 0.00e+000*En^2 + 0.00e+000*En^3 11-21-97 12:00
Where En = Sqrt(Energy in keV)

Sensitivity 2.00	Search Start / End. . . . . 0 / 8191
Sigma Multiplier. 1.00	

PEAK SEARCH RESULTS

PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET COUNTS	UN-CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
1	75.73	414.76	12988	516	1038	54458	2.00	a
2	78.24	427.90	61002	767	1545	87973	3.19	b
3	88.38	480.96	6840	770	1661	77724	1.50	a
4	90.70	493.07	8388	405	789	40948	2.68	b
5	94.61	513.52	3881	647	1355	76329	1.52	c
6	101.00	547.00	0	898	1949	106805	0.00	d NET < CL
7	106.99	578.29	359	641	1380	60019	1.20	e NET < CL
8	130.62	701.92	13042	720	1512	84275	3.00	
9	155.27	830.89	3307	587	1231	61997	1.85	
10	210.67	1120.72	17884	603	1250	57575	2.61	
11	234.22	1243.93	43644	709	1484	53262	3.62	a
12	240.18	1275.10	276469	877	1539	55722	3.65	b
13	271.83	1440.67	13819	532	1131	32963	2.34	a
14	278.95	1477.90	8165	503	1078	31070	2.46	b
15	301.62	1596.49	11042	407	838	25053	2.72	
16	329.13	1740.38	5140	368	759	24488	2.35	
17	339.83	1796.39	39714	483	945	29036	3.07	
18	353.26	1866.64	2914	318	667	16375	2.75	
19	410.72	2167.19	4858	297	613	14336	2.68	
20	464.43	2448.13	10434	323	656	14405	3.11	
21	506.61	2668.75	4214	339	725	13974	5.65	a
22	511.89	2696.34	19102	379	772	15066	2.75	b
23	578.61	3045.31	9514	332	691	12501	3.13	a
24	584.43	3075.72	67232	427	742	13651	3.34	b
25	610.53	3212.26	1817	263	558	10115	2.64	
26	728.60	3829.72	11777	285	565	10393	3.05	
27	773.59	4065.00	2252	228	480	7080	3.63	
28	796.30	4183.78	6312	225	453	6469	2.82	
29	837.11	4397.14	2216	207	440	5120	2.80	a
30	841.48	4420.03	1088	149	310	3342	2.44	b

31	861.84	4526.44	56[illegible]8	193	382	[illegible]890	2.93	
32	906.36	4759.24	6983	209	414	5077	3.49	a
33	912.32	4790.40	41017	322	549	7126	3.30	b
34	965.75	5069.79	10101	222	429	5307	4.06	a
35	970.15	5092.79	22678	243	411	5037	3.25	b
36	1461.53	7661.63	4918	154	297	2565	3.40	

RSSI, Morton Grove, Illinois 847-965-1999

Quantum Technology
GDR_C Nuclide Activity Summary

Sample ID: 161 East Grand Brick Sample

Sample Size . . . . . 2.43e+002 g	Spectrum File . . h:\pcaspec\992338.spm
Sampling Start. 00-00-00 00:00	Counting Start. 00-00-00 00:00
Sampling Stop 00-00-00 00:00	Buildup Time. . . . . 0.00e+000 Hrs
Current Date. 07-28-99 15:35	Decay Time. . . . . 0.00e+000 Hrs

Efficiency Fileh:\pcaspec\gdr\kmu_th.	Library File. h:\pcaspec\gdr\ra2nrg.lib
ID. . . . . STS Samples	ID. . . . . .Ra-226 + Ra-228, MCL Soils

Eff.= 1/[6.66e+000*En^-1.57e+000 + 2.39e+002*En^8.48e-001] 06-07-99 12:00

Gamma Fraction Limit >= . . . 10.00 %	Decay Limit <=. . . . 8.000 Halflives
Library Energy Tolerance. . . 6.00	

FINAL ACTIVITY REPORT

Nuclide	Energy (keV)	Conc +- 1.00sigma (uCi/g)	Halflife (hrs)	Peaks Found
Ra-226	351.92	2.69e-006 +-2.93e-007	1.40e+007	1 of 1
Ra-228	911.07	8.72e-005 +-6.84e-007	1.23e+014	1 of 1
TOTAL:		8.98e-005 uCi/g		

UNKNOWN PEAKS

Energy (keV)	Centroid Channel	Net Counts	Un-Certainty	C.L. Counts	Bkg. Counts	FWHM (keV)	Net Gamma/sec
75.73	414.76	12988	516	1038	54458	2.00	1.245e+002
78.24	427.90	61002	767	1545	87973	3.19	5.586e+002
88.38	480.96	6840	770	1661	77724	1.50	5.293e+001
90.70	493.07	8388	405	789	40948	2.68	6.269e+001
94.61	513.52	3881	647	1355	76329	1.52	2.742e+001
130.62	701.92	13042	720	1512	84275	3.00	6.242e+001
155.27	830.89	3307	587	1231	61997	1.85	1.334e+001
210.67	1120.72	17884	603	1250	57575	2.61	5.843e+001
234.22	1243.93	43644	709	1484	53262	3.62	1.366e+002
240.18	1275.10	276469	877	1539	55722	3.65	8.589e+002
271.83	1440.67	13819	532	1131	32963	2.34	4.189e+001
278.95	1477.90	8165	503	1078	31070	2.46	2.469e+001
301.62	1596.49	11042	407	838	25053	2.72	3.334e+001
329.13	1740.38	5140	368	759	24488	2.35	1.564e+001
339.83	1796.39	39714	483	945	29036	3.07	1.214e+002
410.72	2167.19	4858	297	613	14336	2.68	1.567e+001
464.43	2448.13	10434	323	656	14405	3.11	3.550e+001
506.61	2668.75	4214	339	725	13974	5.65	1.499e+001
511.89	2696.34	19102	379	772	15066	2.75	6.833e+001

578.61	3045.31	9514	332	691	12501	3.13	3.656e+001
584.42	3075.72	67232	427	742	13651	3.34	2.600e+002
610.53	3212.26	1817	263	558	10115	2.64	7.223e+000
728.60	3829.73	11777	285	565	10393	3.05	5.279e+001
773.59	4065.00	2252	228	480	7080	3.63	1.054e+001
796.30	4183.78	6312	225	453	6469	2.82	3.017e+001
837.11	4397.13	2216	207	440	5120	2.80	1.099e+001
841.48	4420.03	1088	149	310	3342	2.44	5.419e+000
861.84	4526.44	5638	193	382	4890	2.93	2.859e+001
906.35	4759.24	6983	209	414	5077	3.49	3.679e+001
965.75	5069.79	10101	222	429	5307	4.06	5.589e+001
970.15	5092.79	22678	243	411	5037	3.25	1.259e+002
1461.53	7661.63	3643	183	297	2565	3.40	2.811e+001

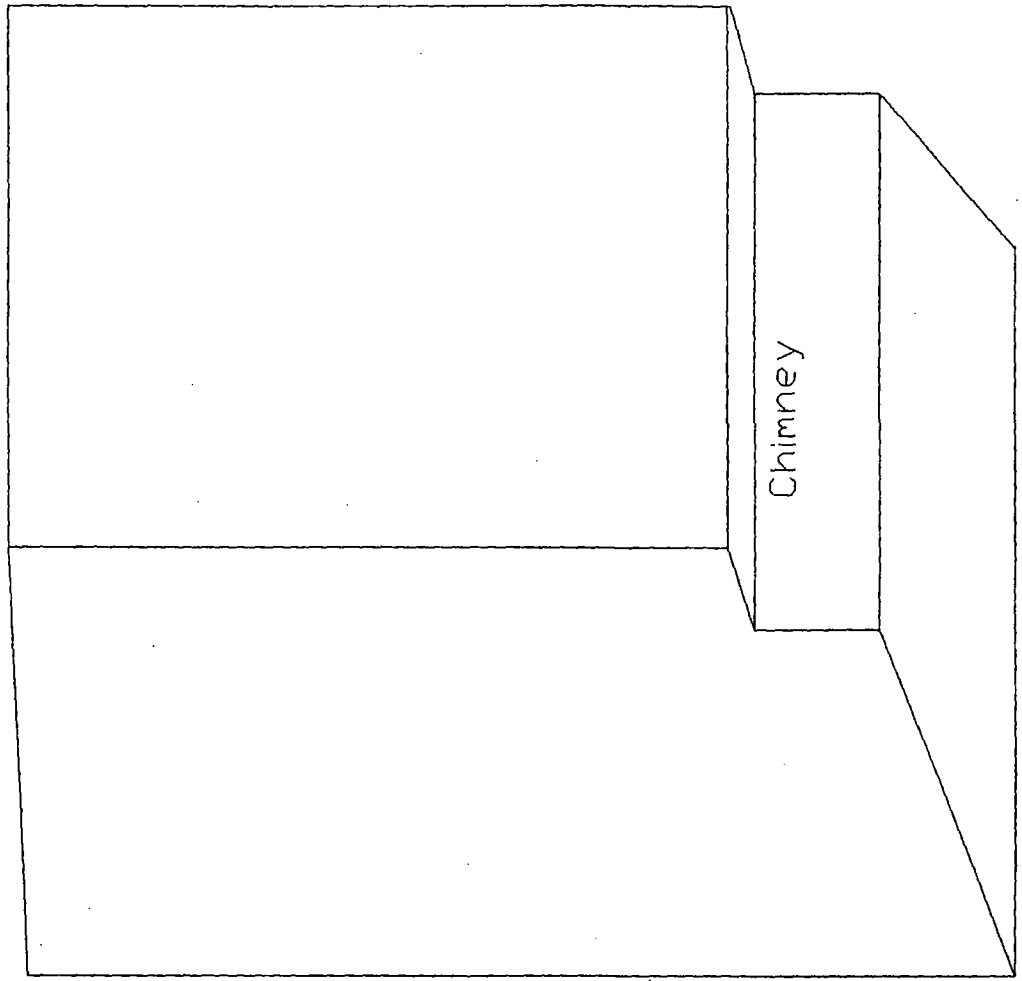
RSSI, Morton Grove, Illinois 847-965-1999

Quantum Technology
GDR_C Background Subtract Results

Sample ID : 161 East Grand Brick Sample

Bkg File: . . .h:\pcaspec\gdr\cal.bkg | Counting Start. 00-00-00 00:00
ID.:. . . . . 97mari.spmh:\p | Current Date 07-28-99 15:35

PK#	ENERGY (keV)	FWHM (keV)	OLD NET COUNTS	OLD UN-CERTAINTY	NEW NET COUNTS	NEW UN-CERTAINTY	FLAG
36	1461.53	3.40	4918	154	3643	183	



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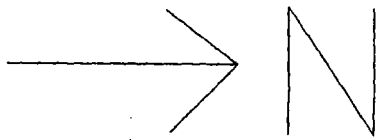
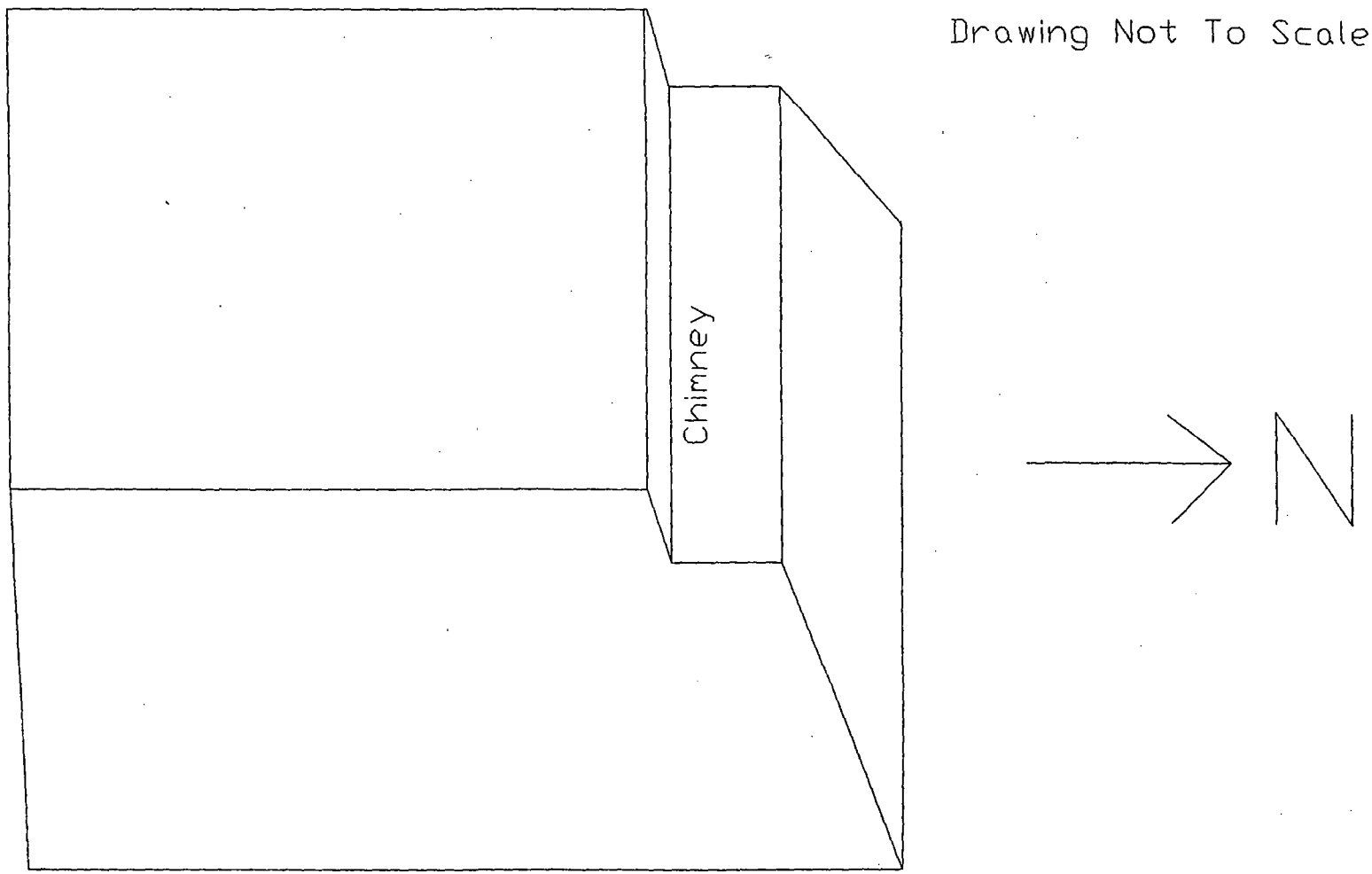
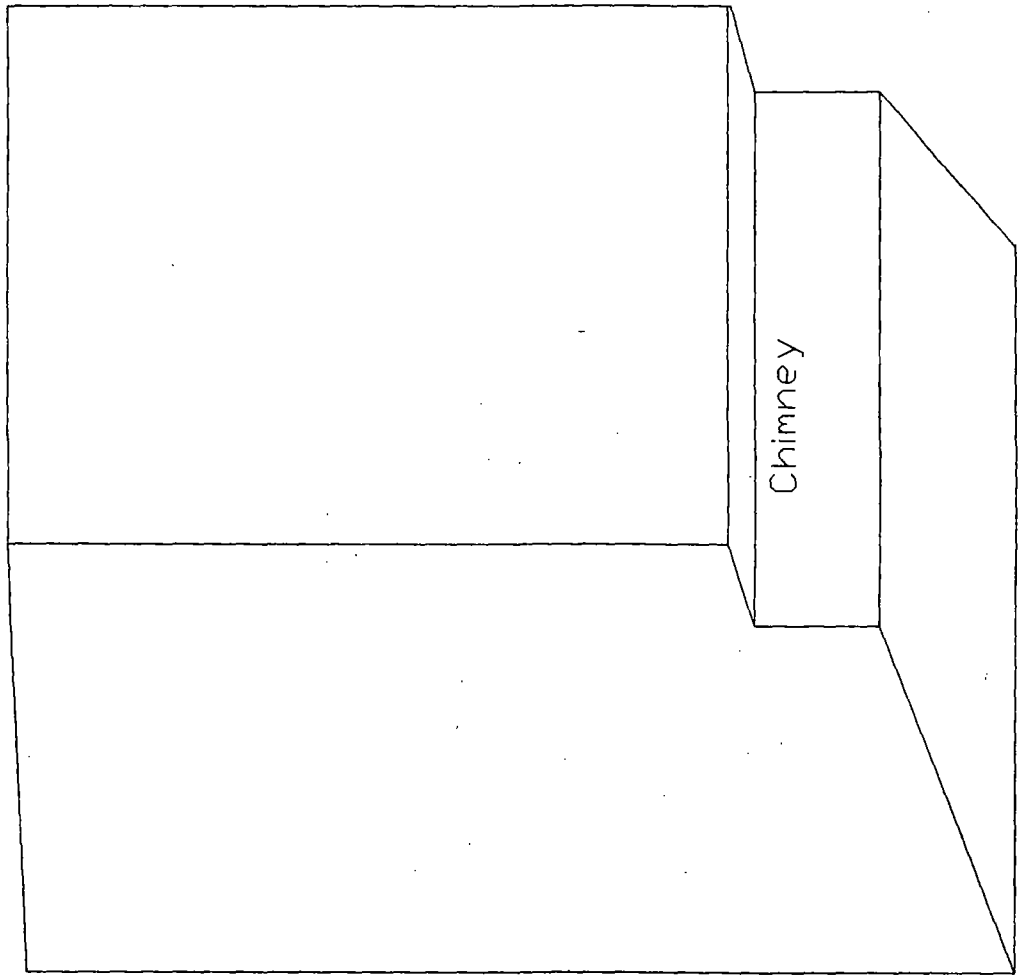




Drawing Not To Scale

Drawing Not To Scale



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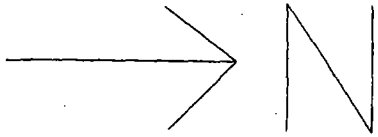


August 5, 1999

Ron Steele
161 East Grand
Chicago, IL 60616

RE: Thorium Contamination Survey

Dear Mr. Steele:

On Tuesday, July 27, 1999 Noy Pascual performed a radiological survey of the basement near a chimney in the building at 161 East Grand. The chimney was reported to have been used in the production of thorium containing mantles for illumination. An earlier EPA survey reported elevated dose rates. This survey was performed to determine the extent of residual thorium contamination from the Lindsay Light operations. The results will be used in planning remediation of the contamination.

A Ludlum Model 193 with a 44-9 NaI(Tl) probe was used to measure gamma radiation levels. A Ludlum Model 14-C with a 44-9 pancake probe was used to measure total surface contamination. The surface of the walls were wiped with paper wipes that were analyzed for removable contamination (See Figure 1). A small sample of brick was removed from the wall for analysis by gamma spectroscopy to determine if thorium-containing material was leaching through the brick. An HPI Model 1010 Tissue Equivalent Dose Meter was used to measure dose rates around the chimney (See Figure 2).

The NaI(Tl) detector had the highest count rate around the chimney and adjacent walls. Similarly the count rate from the pancake probe was highest in the same areas. This is in agreement with the USEPA study. The dose rate measured over 3 mR/hr. Surface wipes, analyzed using a Nuclear Chicago Planchette Counter, showed no significant levels of removable contamination. The brick sample analyzed by gamma spectroscopy had significant Thorium 232 and progeny. The analyzed sample contained over 28,000 pCi/g.

Our recommendations are that the chimney and adjacent walls be removed before free contamination is produced by the thorium and its daughters by leaching through the brick. It is apparent that this has already occurred due to the

extremely high concentration of thorium in our brick sample. To remove this contamination we must completely enclose the area to prevent particulate contamination from spreading to other areas of the building. After the brick has been removed we will take samples from behind the wall to determine if any contamination exists. If contamination is present we will remove the soil.

We have contacted the Kerr-McGee Corporation and inquired on the prospect of the company paying for complete removal of the contaminated materials, which could be upwards of $625.00 a pound. If you have any questions please call me at 847-965-1999.

Sincerely,

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

RSSI

6312 West Oakton St.
Morton Grove, IL 60053-2723
847-965-1999

RADIOACTIVE MATERIAL SURVEY REPORT

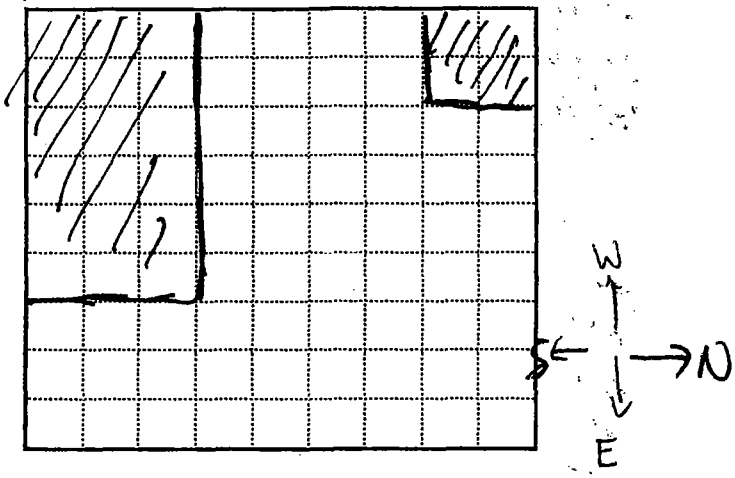
FACILITY 161 E. GRAND BUILDING OPTIMUS AREA Chimney BASEMENT

Routine ☐ Spot Check ☐ Close Out ☐ Follow Up ☐ Other ☐ _____

Instrument A: Make/Model Ludlum 193 Probe 44-10 Serial No. 149080 Check Source ☐

Instrument B: Make/Model Ludlum 14C Probe 44-9 Serial No. 30486 Check Source ☐

Wipes Counted On: Make Nuclear Chicago Model _____ Serial No. _____ Check Source ☐



Radioactive material		
Nuclide	Form	Activity

Surface Contamination Measurement Below Based Upon Efficiency for Nuclide indicated with * or *

*Direct_____ *Removable_____

SURVEY FINDINGS

Area	Instr.	Dose/Exposure Rate ( )		Direct Surface Emission Rate		Removable Activity		
		Surface	@ 1 m.	cpm	dpm/ 100cm²	Wipe #	cpm	dpm/ 100cm²
Background ~~5000~~	A			5000 cpm				
1. Westwall 1				100,000		1		
2. 2				45,000		2		
3. 3				75,000		3		
4. 4				470,000		4		
5. 5				50,000		5		
6. Chimney 6				65,000		6		
7. 7				190,000		7		
8. 8				500,000		8		
9. 9				off scale		9		
10. 10				200,000		10		

Comments _____

By [signature] Date 7/27/99 Page ____ of ____

H:\home\400001\forms\ramsurv1.frm

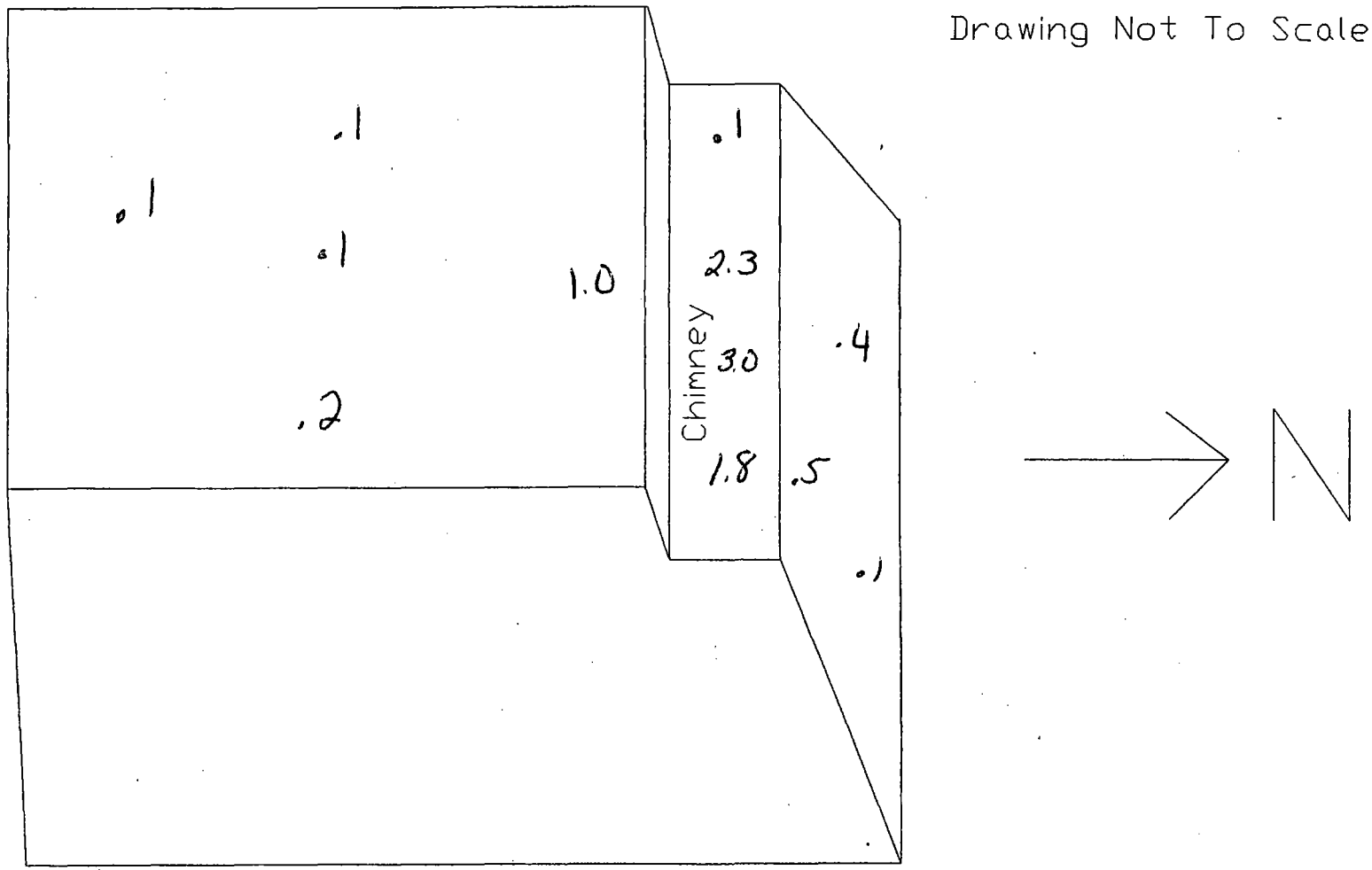
7/27/99 13:50:29

161 east grand wipes

992322	2	27	300	1
992323	2	34	300	2
992324	0	21	300	3
992325	1	27	300	4
992326	0	17	300	5
992327	4	25	300	6
992328	8	39	300	7
992329	6	44	300	8
992330	10	36	300	9
992331	4	20	300	10
992332	3	31	300	11
992333	11	25	300	13
992334	2	17	300	14
992335	10	25	300	15
992336	1	18	300	16
992337	5	39	300	17

HPI 1010 SN 305
Tissue dose rates mRAD/hr

Drawing Not To Scale



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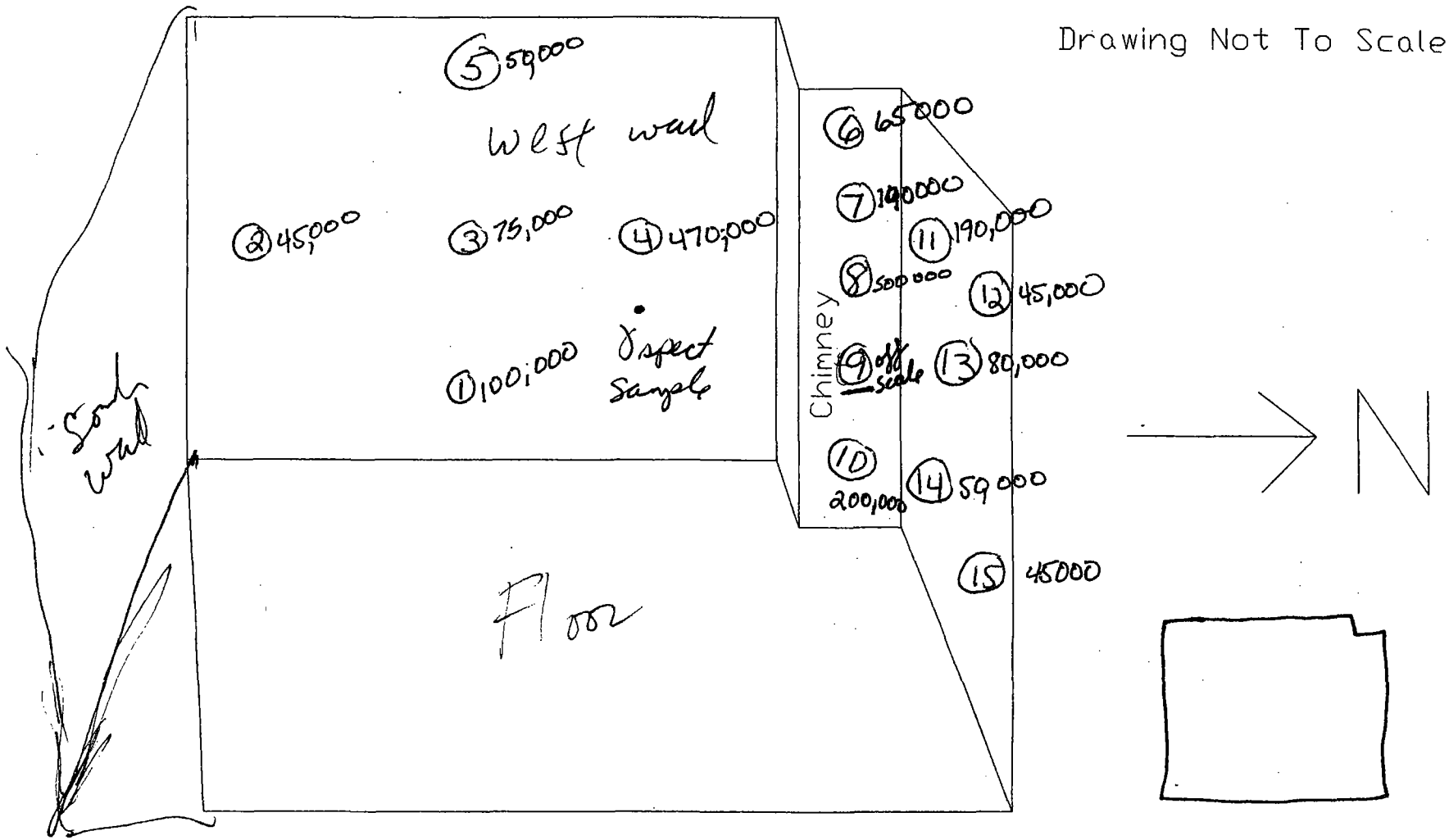

Ron Steele

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,

RSSI

6312 West Oakton Street
Morton Grove, IL 60053-2723
847-965-1999
Fax 847-965-1991

FAX COVER SHEET

DATE: MAY 23, 2000

TO: RON SREEZE

COMPANY: 161 E Grand Associates

FAX#: 312-467-0867 PH 312-467-5440

FROM: ELI A. PORT

COMMENTS: ADCO Waste Manifest

Total number of pages 5 *(including this page)*

If you have trouble receiving this transmission, please call George at 847-965-1999.

gpe\faxtran.doc

ADCO Services, Inc.

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	
Title	Title
5-10-00	5-10-00
Date	Date

17650 Duvan Drive • Tinley Park, Illinois 60477 • (708) 429-1660 • Fax (708) 429-9759

ATG

01-0183

FORM 540 — ADCO SERVICES, INC.

UNIFORM LOW-LEVEL RADIOACTIVE WASTE MANIFEST

SHIPPING PAPER

1. EMERGENCY TELEPHONE NUMBER (Include Area Code): 847-866-1999

ORGANIZATION: 161 PARTNERS

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
~~161 PARTNERS~~ FOR THE ACCOUNT OF
ADCO SERVICES, INC.
161 EAST GRAND
CHICAGO, IL

161 E. GRAND ASSOCIATES

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): 847-866-1999

EPA I.D. NUMBER: ILD 047297364

SHIPPING DATE: 5-10-00

TELEPHONE NUMBER (Include Area Code): 708-425-3013

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

AUTHORIZED SIGNATURE: [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; 7.5 FT3	~~01-0183-01~~ 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; 7.5 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; 7.5 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; 7.5 FT3	01-0183-04
NON-REGULATED MATERIAL	NA	NA	Solid RUBBLE	Th-232		3.7000E-02	1.0000E-03	NA	200. LBS; 7.5 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 (10-96)

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 453.5925 / 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							WASTE DESCRIPTION FOR EACH WASTE TYPE IN CONTAINER							
							PHYSICAL DESCRIPTION			14. CHEMICAL DESCRIPTION		15. RADIOLOGICAL DESCRIPTION		16. WASTE CLASSIFICATION AS-Class A Stable AU-Class A Unstable B-Class B C-Class C
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	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)	CHEMICAL FORM/ CHELATING AGENT	WEIGHT % CHELATING AGENT IF>0.1%	INDIVIDUAL RADIONUCLIDES AND ACTIVITY (MBq) AND CONTAINER TOTAL; OR CONTAINER TOTAL ACTIVITY AND RADIONUCLIDE PERCENT — RADIONUCLIDES	MBq	mCi	
01-0183-03 03 161 EAST GRAND CHICAGO, IL	4	0.2124	90.7185	.15	NP	NP	39-H	0.2124	100 100	RUBBLE NP	0.00	Th-232	3.7000E+00	1.0000E-01	AU
												Subtotal	3.7000E+00	1.0000E-01	
		7.5000	200.0000	15.0	NP	NP		7.5000				Total	3.7000E+00	1.0000E-01	
01-0183-02/ 161 EAST GRAND CHICAGO, IL	4	0.2124	90.7185	.03	NP	NP	39-H	0.2124	100 100	RUBBLE NP0	0.00	Th-232	3.7000E+00	1.0000E-01	AU
												Subtotal	3.7000E+00	1.0000E-01	
		7.5000	200.0000	3.0	NP	NP		7.5000				Total	3.7000E+00	1.0000E-01	
01-0183-03/ 161 EAST GRAND CHICAGO, IL	4	0.2124	90.7185	.01	NP	NP	39-H	0.2124	100 100	RUBBLE NP	0.00	Th-232	1.8500E+00	5.0000E-02	AU
												Subtotal	1.8500E+00	5.0000E-02	
		7.5000	200.0000	1.0	NP	NP		7.5000				Total	1.8500E+00	5.0000E-02	
01-0183-04/ 161 EAST GRAND CHICAGO, IL	4	0.2124	90.7185	.03	NP	NP	39-H	0.2124	100 100	RUBBLE NP	0.00	Th-232	1.8500E+00	5.0000E-02	AU
												Subtotal	1.8500E+00	5.0000E-02	
		7.5000	200.0000	3.0	NP	NP		7.5000				Total	1.8500E+00	5.0000E-02	
01-0183-05 01 161 EAST GRAND CHICAGO, IL	4	0.2124	90.7185	.002	NP	NP	39-H	0.2124	100 100	RUBBLE NP	0.00	Th-232	3.7000E-02	1.0000E-03	AU
												Subtotal	3.7000E-02	1.0000E-03	
		7.5000	200.0000	.2	NP	NP		7.5000				Total	3.7000E-02	1.0000E-03	
Shipment Totals		1.0620	453.5925										1.1137E+01	3.0100E-01	
		37.5000	1000.0000												

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

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

FORM 541 (10-96)

UNIFORM L .V-LEVEL RADIOACTIVE WASTE MAI EST

ISOTOPES REPORT

For Manifest # 01-0183 L

ADCO SERVICES, INC.

Isotope	Total Activity (mCi)
Th-232	3.0100E-01

ATG

**********-IND. XMT JOURNAL- ********** DATE MAY-23-2000 ***** TIME 17:53 ********

DATE/TIME = MAY-23-2000 17:49

JOURNAL No. = 03

COMM.RESULT = OK

PAGE(S) = 005

DURATION = 00:04'03

FILE No. =

MODE = TRANSMISSION

DESTINATION = 13124670867

RECEIVED ID = /

RESOLUTION = FINE

-RSSI MORTON GROVE IL USA -

**********(FAX-900 V1.12)** -RSSI 18479651991- ***** - 1 847 965 1991- *********

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}

\400001\161grand\161grand.xls

161 East Grand Air Sampling Results

with PF = 200

	Location or Name	RSSI Number	Activity present (µCi)	Total time (min)	Flow rate (liter/min)	Sample Volume (ml)	Result (µCi/ml)	µCi/ml
1.5×10^{-14}	Outside	1094	1.7×10^{-5}	340 5.66	9.35	3179000	5.3×10^{-12}	3×10^{-11}
2.4×10^{-14}	Inside	1095	2.7×10^{-5}	340 5.66	9.43	3206200	8.4×10^{-12}	4.8×10^{-11}
6.0×10^{-15}	Hernandez	1096	$< 1.4 \times 10^{-6}$	332 5½	1.96	650720	2.2×10^{-12}	1.2×10^{-11}
4.2×10^{-13}	Castillo	1097	9.4×10^{-5}	332 5½	1.93	640760	1.5×10^{-10}	8.3×10^{-10}
$3. \times 10^{-14}$	Port	1098	7.2×10^{-6}	336 5½	1.94	651840	1.1×10^{-11}	6.1×10^{-11}

h:\home\400001\161 Grand\161Grand.xls

OSHa 4 ohm @ 3×10^{-11} = 1.2×10^{-10} µCi/ml

IDNS 2000 ml @ 1×10^{-12} = 2×10^{-9} µCi/ml

161 East Grand
Air Sampling Log

Sample ID Number	Date Collected	Date Analyzed	Time ON	Time OFF	Total Time (m	Pump Number	Total Liters Sampled	Location or Name	Area or Personnel	Area lpm	PAM lpm Start (4/28/00)	PAM lpm Stop (5/1/00)	PAM lpm Average
161-1	04/29/2000	05/02/2000	830	1410	340	691	3179.00	Outside	Area	9.35	N/A	N/A	N/A
161-2	04/29/2000	05/02/2000	830	1410	340	591	3206.20	Inside	Area	9.43	N/A	N/A	N/A
161-3	04/29/2000	05/02/2000	842	1415	332	15179	650.72	Hernandez, Sabrino	Personnel	N/A	1.98	1.93	1.96
161-4	04/29/2000	05/02/2000	842	1415	332	15183	640.76	Castillo, Daniel	Personnel	N/A	1.98	1.87	1.93
161-5	04/29/2000	05/02/2000	843	1420	336	15185	651.84	Port, Eli	Personnel	N/A	1.98	1.9	1.94

h:\home\400001\
161 Grand\ air sampling log.xls

161 East Grand
Air Sampling Log

368860537
Sabino Hernandez
Dan Castillo
Ei:
745-56-1999

Sample ID Number	Date Collected	Time ON	Time OFF	Total Time	Pump Number	Total Liters Sampled	Location or Name of Person	Area or Personnel	PAM l/m Start	PAM l/m Stop
161-1	4/29/00	0830	1410		69@9.35		[illegible]	outside		
161-2	"	0830	1410		59@9.43		[illegible]	Inside		
161-3	"	0842	1415	15179	@1.98		Sabino Hernandez			
161-4	"	0842	1415	15183	@1.98	325 m	Daniel Castillo			
161-5	"	0847	1420	15185	@1.98		PORT			
161-6										
161-7										
161-8										
161-9										
161-10										
161-11										
161-12										
161-13										
161-14										
161-15										
161-16										
161-17										
161-18										
161-19										
161-20										
161-21										
161-22										
161-23										
161-24										
161-25										
161-26										
161-27										
161-28										
161-29										
161-30										

Turn off with [illegible]

29 Ag 08 161 Gen

UN 1A/2/~~A~~/24/00/02

Drums are

UN 1A 2Y 1.2/100

2-4 bags
of white
Powder

2200 cpm in dia
3500 cpm at wall opposite
dia

Drums max 1K in long + at wall

1	68	116	164	304	484	83
	x	x		x	x	1
2	x	x		x	x	x
3	x	x	x	~~36~~	x	
						5
4	x	x	x	x	484	8
5	x	120	168	312	484	856

12 68 116 164 296 372 472 816

Much lower

11 338 = 662

161 Grand

Draft 10/27/99

Post-It™ brand fax transmittal memo 7671	# of pages ▸ 1
To Mark Krippe	From Eli Port
Co.	Co. R S I
Dept.	Phone # 847 965 1998
Fax # 630 231 3990	Fax #

161 E. Grand Associates
Ron Steele, Manager
161 E. Grand
Chicago,Il. 60611

Dear Mr. Steele,

This letter is simply to confirm arrangements that have been made with your consultant, Eli Port, Concerning the 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 pay the costs for the transportation and disposal of such material at a properly licensed disposal site, up to a maximum of $20,0000.00. The work will be undertaken by your contractor under your supervision and all other costs associated with the remediation will be paid by you.

It is agreed by you that Kerr-McGee's undertaking to pay these costs does not represent 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. Grand Avenue or for its remediation.

I would appreciate it if you would countersign this letter and return it to me.

Very Truly Yours,

George B. Christiansen

AGREED TO:_____
Manager

n

RSSI

6312 West Oakton Street
Morton Grove, IL 60053-2723
847-965-1999
Fax 847-965-1991

FAX COVER SHEET

DATE: 10/28/99

TO: NINA

COMPANY: Envirocare

FAX#: 801-537-7345

FROM: ERIC PITTMAN

COMMENTS: Following is the information you told me you needed to generate a quote. If any additional information is required please contact me at the number below

Total number of pages 2 *(including this page)*

If you have trouble receiving this transmission, please call GEORGE at 847-965-1999.

gpe\faxtran.doc

Describe the Material and Volume

- Brick, mortar and soil.
- Approximately 5-7.5 cubic yards of material.

History of Site

- Originally, the site had facilities that produced materials containing thorium-232.
- The building has been passed from owner to owner, until the current owner, our client, wants the material removed.

State

- The building is located in Chicago, IL.

Delivery Time Frame

- The project is slated to start in November of 1999. Therefore, delivery of the material would be around the end of November to the beginning of December.

Nuclides in the Material

- Th-232
- Th-234
- Pb-212
- Pb-214
- Tl-208
- Th-228
- Ac-228
- Ra-224
- Tl-210
- Bi-212
- Bi-214
- K-40

Container

- The container would be rented from a company, lined with plastic and shipped. Actual size is unknown at this time.

********** -IND. XMT JOURNAL- ********** DATE OCT-28-1999 ***** TIME 17:37 ********

DATE/TIME = OCT-28-1999 17:29

JOURNAL No. = 04

COMM.RESULT = OK

PAGE(S) = 002

DURATION = 00:00'52

FILE No. =

MODE = TRANSMISSION

DESTINATION = 18015377345

RECEIVED ID = /

RESOLUTION = FINE

-RSSI MORTON GROVE IL USA-

**********(FAX-900 V1.12)** -RSSI 18479651991- ***** - 1 847 965 1991- *********

RSSI

6312 West Oakton Street
Morton Grove, IL 60053-2723
847-965-1999
Fax 847-965-1991

FAX COVER SHEET

DATE: October 27, 1999

TO: Ron Steele

COMPANY: 161 Grand

FAX#: 312-467-0867

FROM: Eli Port

COMMENTS: copy of draft letter to IDNS as faxed to Kara McGee, Carrington & Burling & yourself

copy of draft letter to you as faxed from Carrington & Burling & revised - (sent to yourself also) (also faxed to C&B)

Total number of pages 6 *(including this page)*

If you have trouble receiving this transmission, please call GEORGE at 847-965-1999.

gpe\faxtran.doc

RSSI

6312 West Oakton Street
Morton Grove, IL 60053-2723
847-965-1999
Fax 847-965-1991

FAX COVER SHEET

DATE: Oct 20, 1995

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 cleaning 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 Mesure CGB 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 portion of the 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 that portion of 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.

\400001\idns04.doc

Draft October 21, 1999

Ronald Steele, owner
~~Mr. OWNER~~
161 E. Grand Avenue
Chicago, Illinois ~~XXXXX~~ 60611

Dear Mr. ~~OWNER~~: Steele

This letter is simply to confirm the arrangements that have been made with your ~~agent,~~ consultant ~~Dr.~~ Eli Port, concerning the removal of certain radiological material from your building at 161 E. Grand Avenue. Kerr-McGee Chemical L.L.C. ("Kerr-McGee") agrees to pay the costs for the transportation and disposal of such material at a properly licensed disposal site, up to a maximum of $20,000. The work will be undertaken by your contractor under your supervision and all other costs associated with the remediation will be paid by you.

It is agreed by you that Kerr-McGee's undertaking to pay these costs does not represent an admission by Kerr-McGee that it has any liability or responsibility for the presence of radiological material at or about the property at 161 E. Grand Avenue or for its remediation.

I would appreciate it if you would countersign this letter and return it to me.

Very truly yours,

George B. Christiansen

AGREED TO: _____
Ronald Steele, OWNER

Dick
We will have a better cost estimate next week
Eli

COVINGTON & BURLING
1201 Pennsylvania Avenue, N.W.
P. O. Box 7566
Washington, D.C. 20044-7566

Fax Numbers: 202-662-6291 or 202-737-0528
Fax Operator: 202-662-6280

Please Call 202-662-6280 If There Are Transmission Problems

London Office
Leconfield House
Curzon Street
London W1Y8AS England
Tel: 011-44-71-495-5655
Fax: 011-44-71-495-3101

Brussels Office
44 Avenue des Arts
Brussels 1040 Belgium
Tel: 011-32-2-549-5230
Fax: 011-32-2-502-1598

San Francisco Office
601 California Street
San Francisco, CA 94108
Tel: 415-591-6000
Fax: 415-591-6091

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DATE: October 21, 1999

TO: Eli Port

FROM: Richard A. Meserve

ROOM: 921E

__2__ Pages (including cover page)

REMARKS:

Eli,

Is the attached draft OK? Please give me the owner's name and a cap for the cost.

Dick Meserve

If there is a transmission problem, please call the number checked below:

__X__ (202) 662-6280 (Telecommunications)

_____ (202) 662-5895 (Mr. Meserve's Secretary)

********** -IND. XMT JOURNAL- ********** DATE OCT-27-1999 ***** TIME 11:30 *****

DATE/TIME	= OCT-27-1999 11:25
JOURNAL No.	= 17
COMM.RESULT	= OK
PAGE(S)	= 006
DURATION	= 00:04'15
FILE No.	=
MODE	= TRANSMISSION
DESTINATION	= 13124670867
RECEIVED ID	=
RESOLUTION	= FINE

-RSSI MORTON GROVE IL USA-

**********(FAX-900 V1.12)** -RSSI 18479651991- ***** - 1 847 965 1991- *********

RSSI

6312 West Oakton Street
Morton Grove, IL 60053-2723
847-965-1999
Fax 847-965-1991

FAX COVER SHEET

DATE: October 22, 1999

TO: Ron Steele

COMPANY:

FAX#: 312-467-0867

FROM: Eli Port

COMMENTS: Re: fax to Richard Meserve - copy attached

Total number of pages 5 *(including this page)*

If you have trouble receiving this transmission, please call Gene at 847-965-1999.

gpe\faxtran.doc

RSSI

6312 West Oakton Street
Morton Grove, IL 60053-2723
847-965-1999
Fax 847-965-1991

FAX COVER SHEET

DATE: October 21, 1999

TO: Richard Messere

COMPANY: CB

FAX#: 202 778 5304

FROM: Eli A. Port

COMMENTS:

Total number of pages 2 *(including this page)*

If you have trouble receiving this transmission, please call _____ at 847-965-1999.

gpe\faxtran.doc

Draft October 21, 1999

Ronald Steele, owner
~~Mr. OWNER~~
161 E. Grand Avenue
Chicago, Illinois ~~XXXXX~~ 60611

Dear Mr. ~~OWNER~~: Steele

This letter is simply to confirm the arrangements that have been made with your ~~agent,~~ consultant ~~Dr.~~ Eli Port, concerning the removal of certain radiological material from your building at 161 E. Grand Avenue. Kerr-McGee Chemical L.L.C. ("Kerr-McGee") agrees to pay the costs for the transportation and disposal of such material at a properly licensed disposal site, up to a maximum of $20,000.00. The work will be undertaken by your contractor under your supervision and all other costs associated with the remediation will be paid by you.

It is agreed by you that Kerr-McGee's undertaking to pay these costs does not represent an admission by Kerr-McGee that it has any liability or responsibility for the presence of radiological material at or about the property at 161 E. Grand Avenue or for its remediation.

I would appreciate it if you would countersign this letter and return it to me.

Very truly yours,

George B. Christiansen

AGREED TO: _____
Ronald Steele, OWNER

Dick
we will have a better cost estimate next week
Eli

********** -IND. XMT JOURNAL- ********** DATE OCT-21-1999 ***** TIME 15:44 ********

DATE/TIME	= OCT-21-1999 15:21
JOURNAL No.	= 14
COMM.RESULT	= OK
PAGE(S)	= 002
DURATION	= 00:00'58
FILE No.	=
MODE	= TRANSMISSION
DESTINATION	= 12027785304
RECEIVED ID	= / Covington & Burling
RESOLUTION	= FINE

-RSSI MORTON GROVE IL USA-

**********(FAX-900 V1.12)** -RSSI 18479651991- ***** - 1 847 965 1991- *********

COVINGTON & BURLING
1201 Pennsylvania Avenue, N.W.
P. O. Box 7566
Washington, D.C. 20044-7566

Fax Numbers: 202-662-6291 or 202-737-0528
Fax Operator: 202-662-6280

Please Call 202-662-6280 If There Are Transmission Problems

London Office
Leconfield House
Curzon Street
London W1Y8AS England
Tel: 011-44-71-495-5655
Fax: 011-44-71-495-3101

Brussels Office
44 Avenue des Arts
Brussels 1040 Belgium
Tel: 011-32-2-549-5230
Fax: 011-32-2-502-1598

San Francisco Office
601 California Street
San Francisco, CA 94108
Tel: 415-591-6000
Fax: 415-591-6091

This facsimile transmission is intended only for the addressee shown below. It may contain information that is privileged, confidential or otherwise protected from disclosure. Any review, dissemination or use of this transmission or its contents by persons other than the addressee is strictly prohibited. If you have received this transmission in error, please notify us immediately and mail the original to us at the above address.

DATE: October 21, 1999

TO: Eli Port

FROM: Richard A. Meserve

ROOM: 921E

__2__ Pages (including cover page)

REMARKS:

Eli,

Is the attached draft OK? Please give me the owner's name and a cap for the cost.

Dick Meserve

If there is a transmission problem, please call the number checked below:

__X__ (202) 662-6280 (Telecommunications)

_____ (202) 662-5895 (Mr. Meserve's Secretary)

********** -IND. XMT JOURNAL- ********** DATE OCT-22-1999 ***** TIME 11:41 ********

DATE/TIME	= OCT-22-1999 11:05
JOURNAL No.	= 22
COMM.RESULT	= OK
PAGE(S)	= 005
DURATION	= 00:03'26
FILE No.	=
MODE	= TRANSMISSION
DESTINATION	= 13124670867
RECEIVED ID	=
RESOLUTION	= FINE

-RSSI MORTON GROVE IL USA-

**********(FAX-900 V1.12)** -RSSI 18479651991- ***** - 1 847 965 1991- *********

RSSI

6312 West Oakton Street
Morton Grove, IL 60053-2723
847-965-1999
Fax 847-965-1991

FAX COVER SHEET

DATE: October 21, 1999

TO: Richard Meserve

COMPANY: CIB

FAX#: 202 7785304

FROM: Eli A. Port

COMMENTS:

Total number of pages 2 *(including this page)*

If you have trouble receiving this transmission, please call _____ at 847-965-1999.

gpe\faxtran.doc

Draft October 21, 1999

Ronald Steele, owner
~~Mr. OWNER~~
161 E. Grand Avenue
Chicago, Illinois ~~XXXXX~~ 60611

Dear Mr. ~~OWNER~~: Steele

This letter is simply to confirm the arrangements that have been made with your ~~agent,~~ consultant ~~Dr.~~ Eli Port, concerning the removal of certain radiological material from your building at 161 E. Grand Avenue. Kerr-McGee Chemical L.L.C. ("Kerr-McGee") agrees to pay the costs for the transportation and disposal of such material at a properly licensed disposal site, up to a maximum of $20,000.00. The work will be undertaken by your contractor under your supervision and all other costs associated with the remediation will be paid by you.

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Very truly yours,

George B. Christiansen

AGREED TO: _____
Ronald Steele, OWNER

Dick,
we will have a better cost estimate next week
Eli

********** -IND. XMT JOURNAL- ********** DATE OCT-21-1999 ***** TIME 15:44 ********

DATE/TIME = OCT-21-1999 15:21

JOURNAL No. = 14

COMM.RESULT = OK

PAGE(S) = 002

DURATION = 00:00'58

FILE No. =

MODE = TRANSMISSION

DESTINATION = 12027785304

RECEIVED ID = / Covington & Burling

RESOLUTION = FINE

-RSSI MORTON GROVE IL USA-

**********(FAX-900 V1.12)** -RSSI 18479651991- ***** - 1 847 965 1991- *********

COVINGTON & BURLING
1201 Pennsylvania Avenue, N.W.
P. O. Box 7566
Washington, D.C. 20044-7566

Fax Numbers: 202-662-6291 or 202-737-0528
Fax Operator: 202-662-6280

Please Call 202-662-6280 If There Are Transmission Problems

London Office
Leconfield House
Curzon Street
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Tel: 011-44-71-495-5655
Fax: 011-44-71-495-3101

Brussels Office
44 Avenue des Arts
Brussels 1040 Belgium
Tel: 011-32-2-549-5230
Fax: 011-32-2-502-1598

San Francisco Office
601 California Street
San Francisco, CA 94108
Tel: 415-591-6000
Fax: 415-591-6091

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DATE: October 21, 1999

TO: Eli Port

FROM: Richard A. Meserve

ROOM: 921E

__2__ Pages (including cover page)

REMARKS:

Eli,

Is the attached draft OK? Please give me the owner's name and a cap for the cost.

Dick Meserve

If there is a transmission problem, please call the number checked below:

__X__ (202) 662-6280 (Telecommunications)

_____ (202) 662-5895 (Mr. Meserve's Secretary)

RSSI

6312 West Oakton Street
Morton Grove, IL 60053-2723
847-965-1999
Fax 847-965-1991

FAX COVER SHEET

DATE: Oct 20, 1995

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 cleaning 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 Mancuso CGB 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.

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********** -IND. XMT JOURNAL- ********** DATE OCT-20-1999 ***** TIME 14:26 ******

DATE/TIME	= OCT-20-1999 14:24
JOURNAL No.	= 26
COMM.RESULT	= OK
PAGE(S)	= 003
DURATION	= 00:02'05
FILE No.	=
MODE	= TRANSMISSION
DESTINATION	= 13124670867
RECEIVED ID	= /
RESOLUTION	= FINE

-RSSI MORTON GROVE IL USA-

**********(FAX-900 V1.12)** -RSSI 18479651991- ***** - 1 847 965 1991- *********

********** -IND. XMT JOURNAL- ********** DATE OCT-20-1999 ***** TIME 14:32 ******

DATE/TIME = OCT-20-1999 14:29

JOURNAL No. = 28

COMM.RESULT = OK

PAGE(S) = 004

DURATION = 00:01'39

FILE No. =

MODE = TRANSMISSION

DESTINATION = 16302313990

RECEIVED ID = / 630 231 3990

RESOLUTION = FINE

-RSSI MORTON GROVE IL USA-

**********(FAX-900 V1.12)** -RSSI 18479651991- ***** - 1 847 965 1991- **********

Post-it™ brand fax transmittal memo 7671	# of pages ▸ 4
To Mark Kippel	From Eli Part
Co.	Co. RSSI
Dept.	Phone # 847-965-1999
Fax # 630-231-3990	Fax # 847-965-1991

********** -IND. XMT JOURNAL- ********** DATE OCT-20-1999 ***** TIME 15:24 ********

DATE/TIME = OCT-20-1999 14:36

JOURNAL No. = 29

COMM.RESULT = OK

PAGE(S) = 003

DURATION = 00:01'23

FILE No. =

MODE = TRANSMISSION

DESTINATION = 12027785304

RECEIVED ID = / Covington & Burling

RESOLUTION = FINE

Post-it™ brand fax transmittal memo 7671 | # of pages ▸ 3

To Richard Mezure	From Eli Port
Co.	Co. RSSI
Dept.	Phone # 8479651999
Fax # 202-778-5304	Fax # 8479651991

-RSSI MORTON GROVE IL USA-

**********(FAX-900 V1.12)** -RSSI 18479651991- ***** - 1 847 965 1991- **********

161 Grand

Owner wants to remove
some material.

What

ATSDR

Agency for Toxic Substances and Disease
Registry.

Meet fee

Rudnick Mesa

Lensky Project / site

probably some material

do work Slip. K-M will

make primal contribution.

---

will find a number of firms.

who would be be.

1999

IGIE Grand

161 Grand

site agreement c̄ buildg own

Call Mesene

300 x 400 1 yd

by product { 6 K pCi/g Th
2 K pCi/g Ra

1102

10 CFR 40

[illegible]

Ron Steele

312-467-5440

EKO

This is a nice pen
It writes very fast
I would pay up to $5.00 for hey.

Jon