ISOTOPES, INC.
A TELEDYNE COMPANY

IWL-1638-123

DECONTAMINATION AND DEMOLITION OF THE CANADIAN RADIUM & URANIUM CORPORATION FACILITY

69 Kisco Avenue

Mount Kisco, New York

FINAL REPORT

for the

MOUNT KISCO URBAN RENEWAL AGENCY

Municipal Building

Mount Kisco, New York

J. M. Matuszek

January 19, 1968

ISOTOPES, A Teledyne Company

50 Van Buren Avenue

Westwood, New Jersey 07675

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DECONTAMINATION AND DEMOLITION OF THE CANADIAN RADIUM & URANIUM CORPORATION FACILITY

FINAL REPORT

I. INTRODUCTION

During the period November 14 to December 15, 1966, the Canadian Radium and Uranium Corporation (Can-Rad) facility at 69 Kisco Avenue, Mr. Kisco, New York was decontaminated and demolished. The decontamination, demolition, and disposal of contaminated material was carried out by ISOTOPES and its subcontractor Rossi-Halmar Construction Corporation according to specifications set forward in Item I, Contract Unit II (October 21, 1965) and Item I, Contract Unit II A, Amendment No. 1 (February 15, 1966) for Kisco Avenue-Suttons Lane Urban Renewal Project and the burial exemption provided to the Mt. Kisco Urban Renewal Agency by the New York State Department of Health.

Specific requirements for radiological protection of personnel, for final limits of contamination of the site and equipment, and for handling of debris were set forward in the ISOTOPES license application No. 2238 (March 31, 1966) to the New York State Coordinating Council on Atomic Energy supporting correspondence of May 18, 1966 and the letter of approval of June 10, 1966 from the New York State Department of Labor. The three documents were used for all operational guidelines during decontamination, demolition and waste removal. Because these documents detailed the safety precautions to be taken, they were given precedence over any conflicting requirements imposed by the original specifications set up

II. DECONTAMINATION AND DEMOLITION

A. Monitoring Equipment

In addition to the heavy construction equipment provided by Rossi-Halmar, ISOTOPES used several types of personnel monitoring equipment for radiological protection. The equipment used on-site included two Eberline PAC-3G α-monitors, one Eberline FM-3G α-floor-monitor, a Victoreen Thyac, a Ludlum γ-scintillation monitor, a Baird Atomic Cutie-Pie, an Eberline E510 β-γ survey meter, two Unico personnel air monitors, pocket dosimeters, and a ZnS(Ag) α-scintillation counter with RIDL Designer Series electronics.

Urinalyses and breath analyses were performed using counting equipment available at the Westwood facility of ISOTOPES.

Film badges from R. S. Landauer film badge service were provided to all personnel on-site as well as the truck drivers and the bulldozer operator at the dump.

B. Pre-operational Survey and Decontamination

Figure 1 provides a general site-plan of buildings, grounds and surrounding structures. Figure 2 shows the results of the initial survey of the second floor of the main building. All readings were taken at one centimeter above the floor. The entire floor surface was monitored at one meter intervals by "walking" the area. On this "scan" one spot at ~ 4 mR/hr and one at ~ 2 mR/hr were found. These were removed into a high level waste drum. Readings were then taken at ten foot intervals across the back section of the building for record purposes. These were all below one mR/hr except for a 60 sq ft area along the northeast wall party to the Haggerty Millwork building. The contamination in this area was found to be quite firmly fixed in paint and concrete. Rather than create a more serious dust

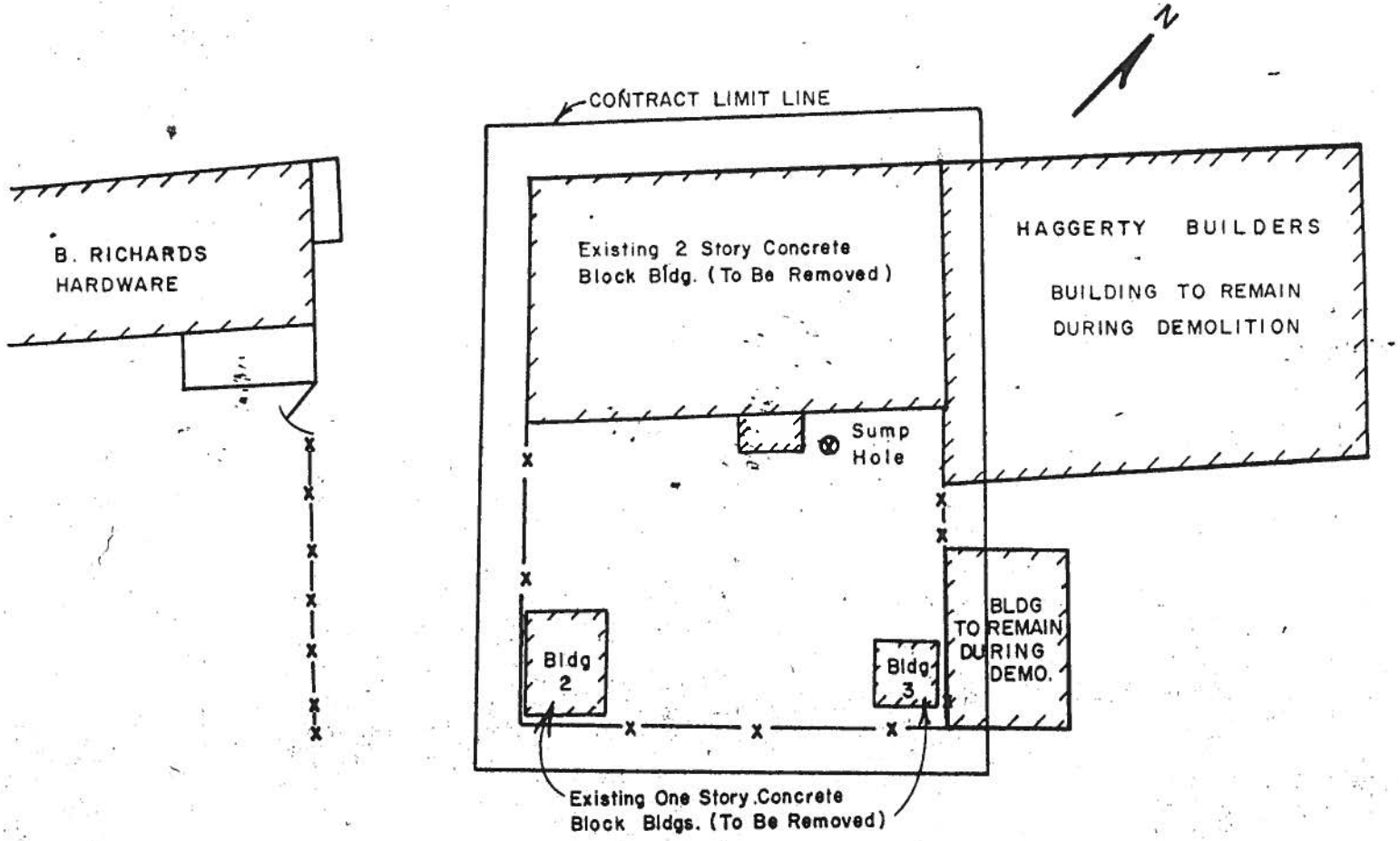

FIGURE 1. CANADIAN RADIUM AND URANIUM FACILITY SITE PLAN

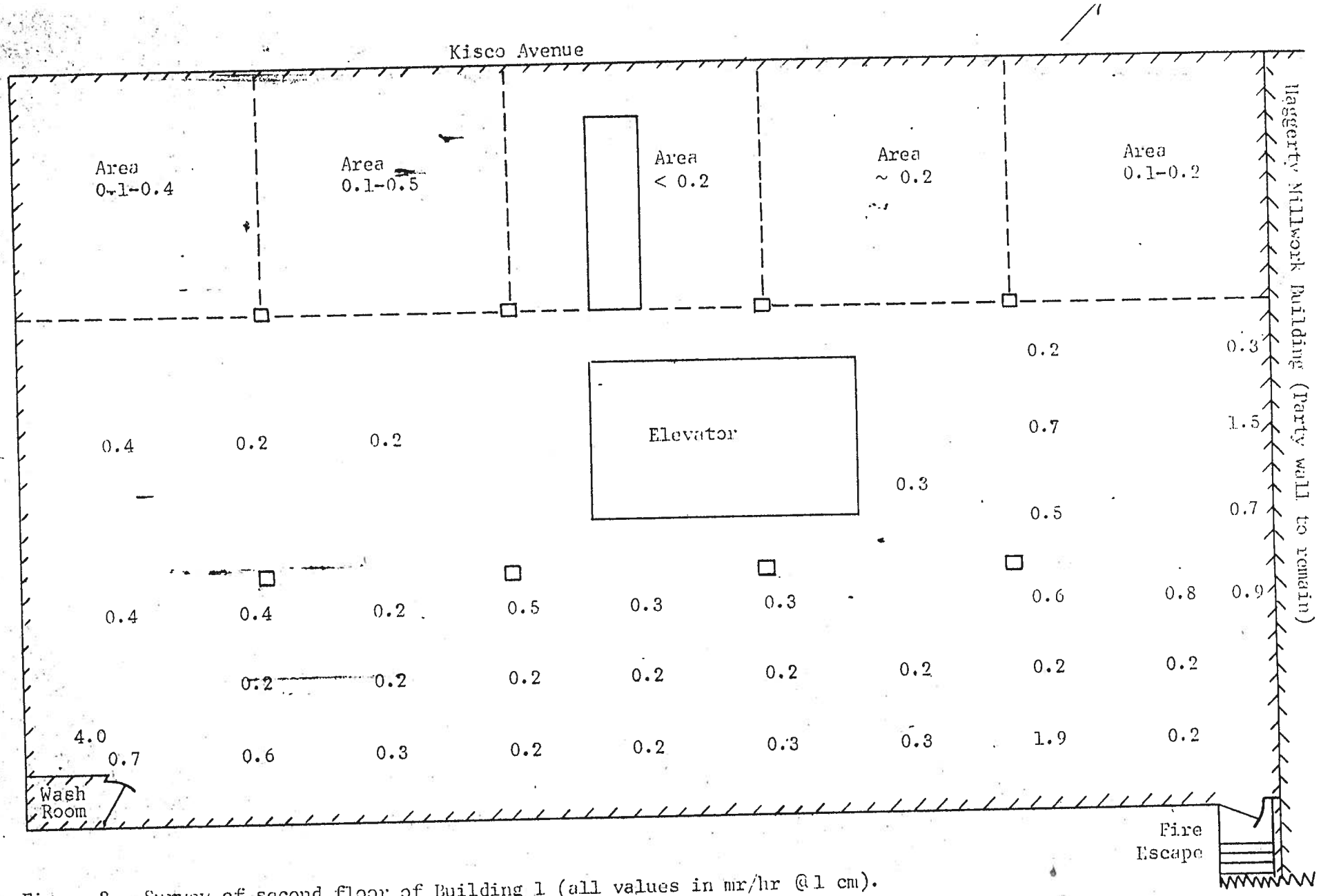

Figure 2. Survey of second floor of Building 1 (all values in mr/hr @1 cm).

problem it was decided to leave this activity fixed for demolition. This plan received the approbation of Messrs. Paul and Weber prior to start of demolition. The total amount of radium to be buried at Croton Point Dump was estimated from this survey to be ~ 3 mg.

The first floor showed only small amounts of radium contamination, mostly encapsulated in small vials. When these were removed no further contamination requiring separate removal existed on the first floor.

The cellar was found to be filled with ~ 18 inches of water, precluding a careful survey for sources. A general survey of the cellar with the Ludlum γ-survey meter indicated that no appreciably high-level sources were left in the cellar.

A small appendage to the back of the main building had apparently been used for initial separation of radium sources with wastes being discharged into a small sump hole beside the building. A few pieces of contaminated glassware (< 10 mR/hr on each) were removed from the building into the hot waste drum. The silt in the sump hole was also shoveled into the waste drum until the activity level for a probe lowered into the hole registered < 1 mR/hr.

Building 3 on the east corner of the lot contained no high level contamination. A small spot in the soil in front of the door registered 2 mR/hr and was shoveled into the high-level waste drum.

Building 2 on the south corner of the lot contained 2.5 to 3 mg of radium as loose sources, mostly in contaminated glassware in a large storage cabinet and on a lab bench. These sources were removed into the high-level waste drum. Lab benches and several areas of the floor and walls were sponged with Turco cleaner and water to decontaminate removable-activity levels up to 5 mR/hr at 1 cm. This operation decreased contamination levels sufficiently.

so that the building and all contents could be safely removed to Croton Point Dump per license specifications. Wash rags and sponges were removed into the high-level waste drum.

In general, most surfaces in Building 1 exhibited removable activity < 50 dpm/100 cm^2. After removal of the loose sources mentioned previously, a few small areas on both floors of the main building were sponged with Turco cleaner and water until all smears indicated levels below 50 dpm/100 cm^2. As added protection against loose activity spreading as dust during demolition, the interior of each building was thoroughly wet down with a fog spray prior to start of demolition. The additional water produced in this spraying operation did not materially change the water level in the cellar; nor did any obvious change in radium concentration occur in the cellar water.

The preoperational survey and decontamination effort consumed the effort of a 4-man team for the entire week November 14-18, 1966. Actual demolition and removal of materials did not begin until the following week when assurance had been achieved that all conditions specified in the license application had been reached.

All off-site areas suspected to be contaminated were found to be below license limits and did not require further decontamination. Also, Kisco Avenue was surveyed with the Ludlum γ-scintillation monitor to Route 133 to establish background levels along the roadway.

C. Demolition, Removal and Burial

Prior to the major demolition effort, a large section of clay-tile wall forming the northeast wall of the main building (party to Haggerty Millworks) was demolished by hand since it could not be cleaned to meet final site specifications. The reinforced-concrete ceiling and floors were then severed using an air-hammer.

The outbuildings were first to be demolished using a crane with a 60-foot boom and clamshell. All material was monitored with the Thyac as it was picked up with the clamshell or bulldozer shovel. Throughout the demolition operation, including the main building, no excessively high-level contamination was found and all debris constituted "pile B" as defined in the license application. Most of the surface soil on the lot also fell into this category, though decreasing in level to "pile C" material at increased depth.

All buildings were demolished and material checked and piled up during the week of November 21-25. All debris met the specification requiring < 1 mR/hr with most ≤ 0.1 mR/hr at one foot.

Loading operations commenced on November 28 and continued until December 5. The delay between start of demolition and loading was necessitated by the limited working space on the site.

The first 3 trucks were lined with polyethylene sheeting prior to loading. However, severe wind and rain throughout this operation made the lining operation a safety hazard. At the request of Mr. Paciello and the concurrence of Commissioner Quinn and Mr. Paul this operation was discontinued. The tailgate lining was maintained to insure that debris did not sift out; the welded steel bodies insured that no other leakage could occur. Trucks were continually monitored on return from Croton Point Dump to insure that discontinuance of the lining did not cause undue increase in contamination of the trucks. All trucks were loaded to approximately two-thirds normal capacity (no debris standing above the sideboards) and covered with canvas tarpaulins. Contamination of the trucks proved to be so slight that only hosing was required to remove small amounts of contaminated loose debris. The tarpaulins were monitored with the FM-3G and were returned to normal service without any need for decontamination.

Since there was limited space on-site, the trucks were loaded in the dirt road between the Can-Rad Facility and the L. B. Richards Hardware Store. After loading ceased each day the road was scraped down to remove any debris that may have dropped from the dozer shovel. At the end of the job the entire road surface was scraped and monitored until it was reduced to background levels. These scrapings were also buried at Croton Point Dump. Kisco Avenue was monitored to the south end of the Richards Company Building each night.

Burial at Croton Point was made at a location specified by authorities from the Westchester County Department of Parks. The Mt. Kisco Urban Renewal Agency took responsibility for the burial work. No serious problems were encountered at the burial site.

Some sources which were loaded onto one truck by the Westchester County Department of Health (Appendix A) resulted in a minor variation above background at the burial site. Although the readings were quite low (~ 0.2 mR/hr above background when covered by approximately two feet of soil), ISOTOPES requested that the Agency add another three feet of clean fill over the general area under which these sources were buried. Once completed this reduced the readings at the burial site to background.

All trucks were required to follow a prearranged route between the site and dump. The entire 14-mile route was monitored visually and with the Ludlum survey meter each evening on completion of work. On the first day of hauling, a single concrete block fell off one truck onto Route 133 in Mt. Kisco. No contamination occurred, and the problem was rectified by reiterating the requirements for underloading to the bulldozer operator. No other losses occurred during the burial operation. The high-level waste drum was removed on December 5 by Nuclear Diagnostic Laboratories of Peekskill, New York.

D. Post-Operational Survey

On completion of demolition and burial of the building and scraping of the site and surrounding areas to required depths, the site was surveyed for final record (Figure 3). Two locations on the Haggerty Millwork wall were found to be above specifications. One was removed by chiseling out the masonry. The second appeared to be the tailings from a leaking waste drum which Can-Rad had apparently stored on the second floor fire escape. A streak of activity roughly 12 ft. x 1 ft. showed a contamination level of 1-2 mR/hr at 1 cm. Removal of these load-bearing blocks would have severely strained the integrity of the building creating a serious safety problem to the occupants. Since the contamination level was so low (< 0.1 mg Ra) that the interior of the wall was at background, the activity was sealed in with 1 to 2 inches of mortar. This coating of concrete reduced the external dose to levels permissable for release to the general public. Since this structure was to be demolished within a year, such disposition did not present any long term radiological hazard. Nor did it present a problem for future demolition since, as well as being a small amount, spread over a relatively large area, it was so firmly fixed into the pores of the concrete block that washing prior to coating resulted in no change in activity level. No further radiological health precautions need be considered for future demolition work on the site. At this point Messrs. Weber and Paul approved the start of the backfilling and grading.

A manhole, and surroundings, several hundred yards east of the Can-Rad site was originally suspected of having sufficient contamination to require disposal since it connected into the main waste line from the Can-Rad facility. However, on lowering the Thyac probe into the manhole, no activity above the limits required for use by the general public could be detected. The highest reading along one side was ~ 0.5 mR/hr at 1 cm and the interior of the manhole

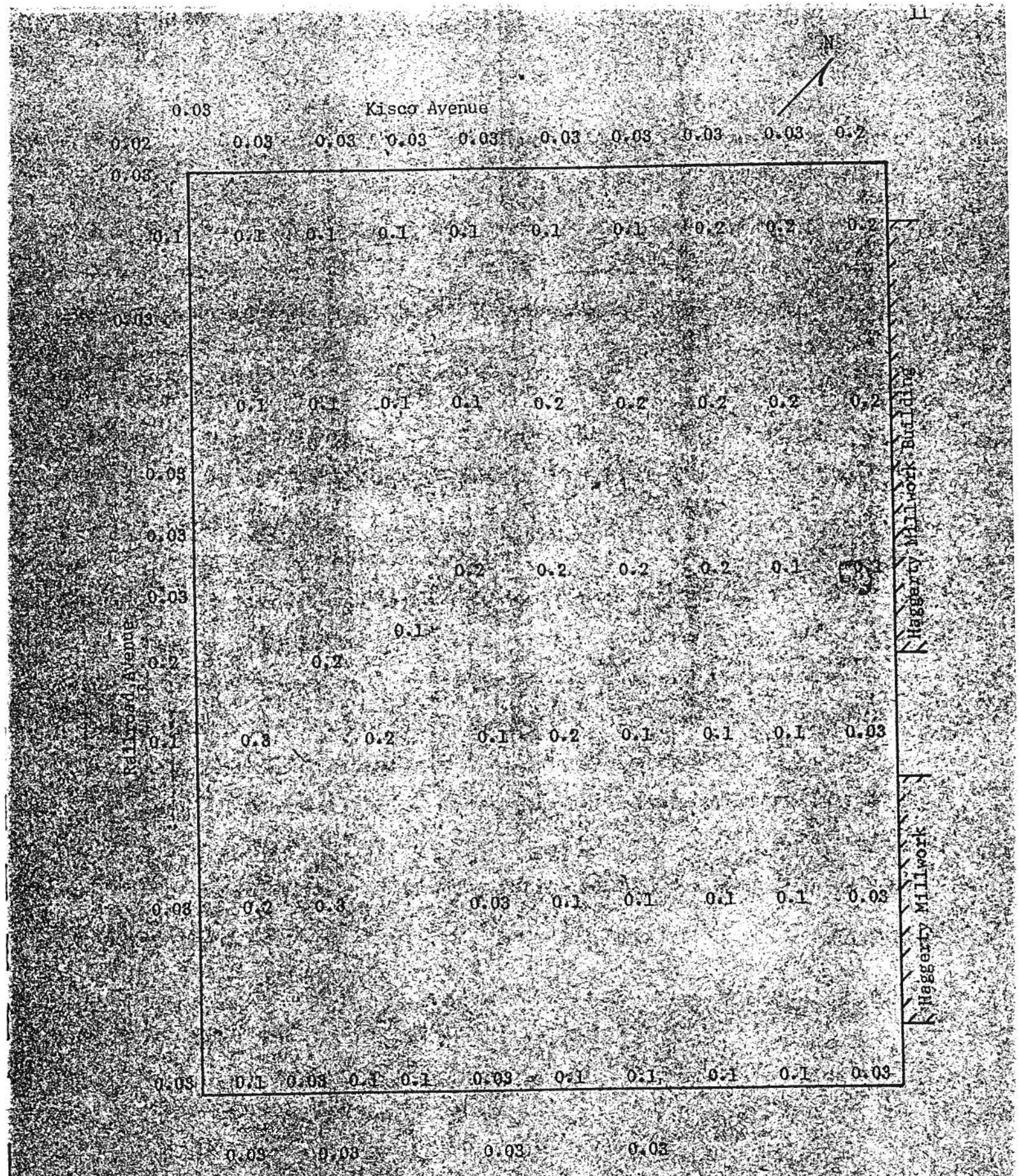

Figure 3. Survey of Canadian Radium site just prior to backfilling and grading (all values in mr/hr @ 1 cm).

averaged ~ 0.1 mR/hr at 1 cm. The surroundings to the manhole were mostly loose mud and water heavily interspersed with solid hummocks of soil and grass over an area approximately 500 sq ft. These hummocks and the raised soil around the manhole were surveyed and six spots (each < 2 cm diam.) were found with dose rates 0.5-0.8 mR/hr at 1 cm. All other areas were < 0.2 mR/hr at 1 cm, with most at background. A survey with the Ludlum indicated no high level sources existed in the area. The total amount of radium left around the manhole was calculated to be comparable to the amount of radium naturally present in the soil that was to be used to backfill the area. In any case, the average for the entire area was well below the 0.2 mR/hr required for use by the general public.

All equipment was surveyed prior to release from the job. Only the wrecking ball required more than hosing for complete decontamination, and this only requiring a vigorous brushing with a wire-brush, Turco cleaner and water.

Kisco Avenue was resurveyed to Route 133 by walking the route with the Ludlum probe held at one foot above road level. All readings some distance from the Can-Rad site were identical with the background data previously obtained; those close in were actually lower than those for the original survey because of the removal of the facility.

On completion of backfilling and grading of the site, a final survey was made for record (Figure 4).

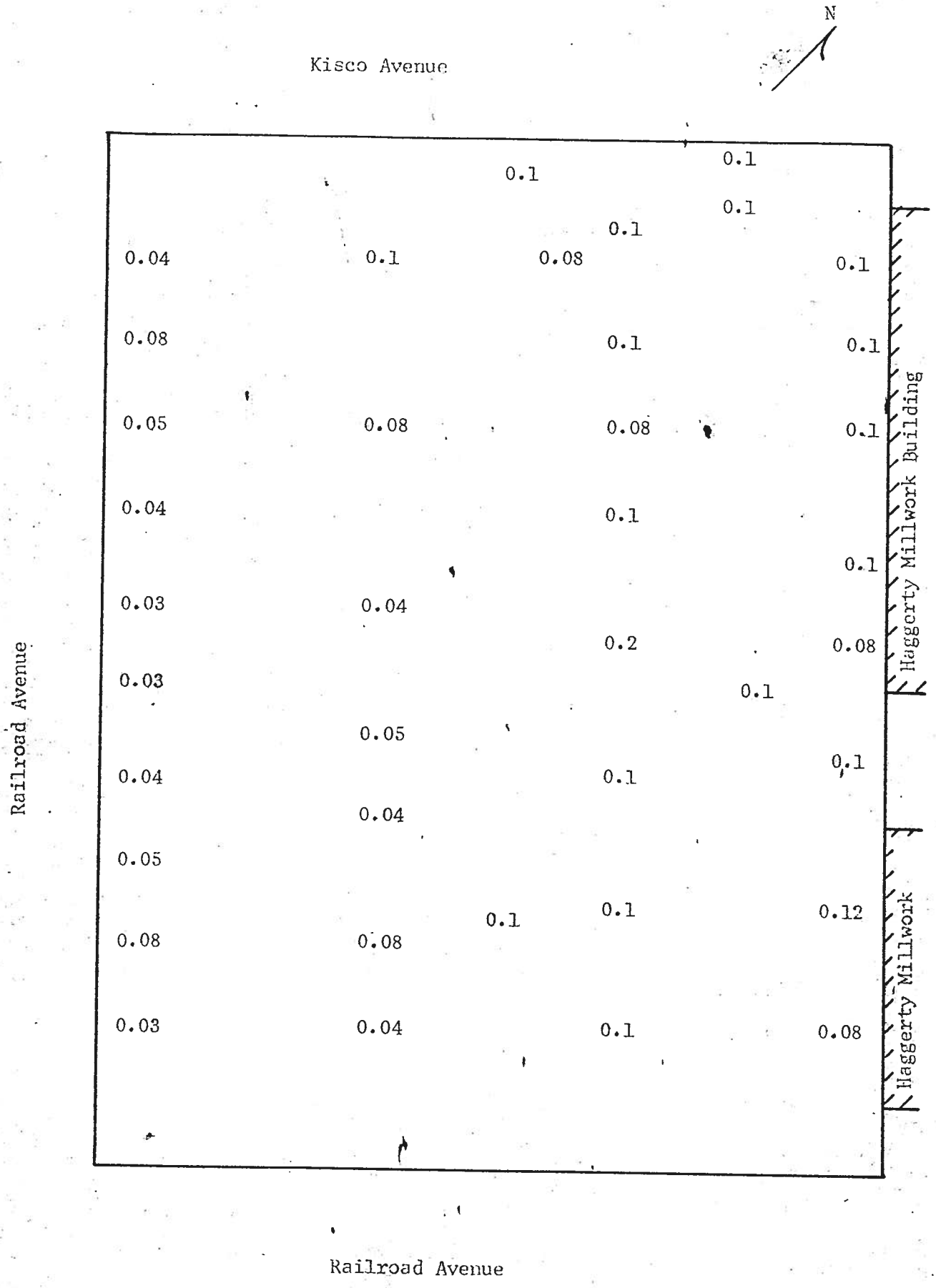

Figure 4. Survey of Canadian Radium site after backfilling and grading (all values in mr/hr @ 1 cm).

III. PERSONNEL PROTECTION

A. Precautions

All personnel, including the truck drivers, were required to wear one-piece coveralls, gloves and boots over their normal clothing. In addition, all workers on-site were required to wear face masks (American-Optical half-masks) throughout the operation. A change/wash room was provided and all personnel were monitored with the PAC-3G's each time they left the site. External personal clothing was monitored after the coveralls and boots were removed, no detectable activity ever being found on personal clothing. Occasionally a small amount of activity was found on the hands but was removed by washing with soap and water. The external coverings were left on-site each evening and were monitored by the ISOTOPES staff. Whenever the coveralls were found to be contaminated to levels one order of magnitude greater than levels allowable for release of personal clothing, they were washed by Standard Uniform Company prior to reuse.

The usual precautions against eating, drinking or smoking on-site were imposed. The specific instructions given each man are indicated in Appendix B. These instructions were carefully explained to each man before he started work. He was then required to sign a copy of the document to indicate full understanding of the precautions to be imposed.

Prior to allowing any new worker on-site, a urine sample and a one-liter breath sample were collected. All workers, including the truck drivers, were required to wear a film badge throughout the operation. Breathing-zone personnel air monitors (UNICO) were used on the air-hammer and crane operators during the demolition to insure that no undue levels of contamination were being created by dust. On completion of the job, breath and urine samples were again collected from each worker.

B. Results

1. Breathing zone monitors. All samples taken compared statistically with a background sample taken prior to start of demolition.

2. Film badges. All personnel badges showed MINIMAL dose except for John Tekin (30 mR) and Armen Sahagian (80 mR) of ISOTOPES who removed all the loose sources into the high level waste drum. These results were consistent with pocket dosimeter readings taken during operation.

3. Urinalysis. All urine samples were screened at ISOTOPES by evaporating 10 ml of the sample into a 2-inch planchet and counting in a Nuclear Measurements Corporation internal proportional counter. Since all samples were more than two orders of magnitude below the guide levels [1] for a single exposure, no further analyses were required (Table 1).

4. Radon-breath analysis. The results of the radon-breath analyses (Table 2) provide some very interesting information as to the efficacy of the personnel protection. The sample for this analysis is collected by having the person blow up a large balloon, collecting the breath from the balloon into a one-liter evacuated flask (all done in the field), then transferring the one-liter sample into a 1.6 liter ZnS(Ag) coated counting chamber [2] at ISOTOPES. Following a four-hour ingrowth period for radon-daughter equilibration, the sample is counted on RIDL Designer Series electronics using baseline discrimination to minimize background.

The MPB for radium of 0.1 µgm Ra results in radon-breath levels of 1 pCi/liter, and the "average" level for unexposed persons is roughly 0.06 pCi/liter [3]. Most of the personnel showed levels statistically at this level or slightly below. Of greatest interest are the four showing measurable levels of radon in breath. In three of the four cases a decrease in body burden

TABLE 1. RESULTS FOR GROSS-ALPHA ANALYSES OF URINE SAMPLES

Employee	Gross-Alpha Activity (pCi/liter) Preoperational	Postoperational
Bisignano	< 3.4	< 4.8
Dileo		< 2.4
Eisenhouer	< 2.4	< 1.8
Fulchino	< 1.5	< 3.5
Harcourt	< 2.7	< 2.3
Limato	< 3.7	< 3.1
Nino	< 3.7	< 3.2
Samarco	< 4.2	< 4.4
Stufano	< 2.4	< 3.2
Wiggins	< 2.7	< 2.4
Zaccari	< 5.8	< 5.0

TABLE 2. RESULTS FOR RADON-BREATH ANALYSES

Employee	Lung Radon Activity (pCi/liter) Preoperational	Postoperational
Bisignano	< 0.02	< 0.04
Dileo	< 0.05	< 0.03
Eisenhouer	< 0.04	< 0.02
Harcourt	0.08 ± 0.01	< 0.05
Limato	< 0.04	< 0.04
Nino	0.08 ± 0.02	0.08 ± 0.01
Samarco	0.08 ± 0.01	< 0.04
Stufano	< 0.07	0.03 ± 0.01
Wiggins	0.23 ± 0.04 (preoperational) 0.14 ± 0.04 (follow-up)	0.08 ± 0.03
Zaccari	< 0.02	< 0.04

occurs, the most marked being the results for Mr. Willie Wiggins, the air-hammer operator. Because Mr. Wiggins' preoperational sample was so high, a second sample was collected a week after he started work. This sample, and the post-operational sample, showed markedly decreasing breath-radon levels. The decrease can be related to the more extensive effort made to keep his face mask on at all times. Mr. Wiggins had just completed a job where he had been working in excessive soil and rock dust, but he preferred not to use the face mask because he found it too uncomfortable. However, on the Can-Rad job the "radioactivity" caused him enough concern that he did not violate the operational guidelines. As a result, the marked decrease in radon activity indicates a gradual clearing from the upper respiratory tract of the natural radium accumulated on the previous job. Similar, but less marked, trends for the others are ascribable to the same history.

C. Summary

The personnel monitoring data clearly indicates the minimal hazard presented by this demolition effort once the loose source material had been properly removed. It also tended to justify the choice made by ISOTOPES not to disturb the "borderline" case where the radium was firmly fixed in paint and/or concrete but exceeded the dumping limit of 1 mR/hr. Because the main area in question had a general smear of activity across its surface the integral effect on the probe was such that dose rate measurements on the survey meters did not decrease appreciably when the probe was lifted from one centimeter to one foot from the surface. Therefore, the "point source" specifications were not considered strictly applicable for this case. Since none of these contaminated areas exceeded 1.5 mR/hr and were mostly around the limit of 1 mR/hr, disruption of their integrity for the sake of the minor variation from specifications might have created a much more hazardous working situation. Also, the area involved (500 sq ft of floor

along the north wall) was such a small fraction of the total amount of debris, that no appreciable effect was expected to occur at the burial site, and indeed did not occur. In every case where steps were taken to insure personnel safety on the job in favor of preordained specifications, no hazard to the general populace ever appeared as a result.

IV. REFERENCES

(1) Nuclear Radiation Guide, Technical Documentary Report No. MRL-TDR-62-61 (November 1962). Prepared by Biomedical Laboratory, 6570th Aerospace Medical Research Laboratory, Aerospace Medical Division, Air Force Systems Command, Wright Patterson Air Force Base, Ohio.

(2) J. M. Matuszek, Health Physics 10, 607 (1964).

(3) Manual of Standard Procedures, NYO-4700 (1967). Edited by John H. Harley, Health and Safety Laboratory, U. S. Atomic Energy Commission, 376 Hudson Street, New York, New York 10014.

Appendix A

County of Westchester
DEPARTMENT OF HEALTH
County Office Building
White Plains, N. Y. 10601

WILLIAM A. BRUMFIELD, JR., M.D.
COMMISSIONER

JACK J. GOLDMAN, M.D.
FIRST DEPUTY

December 15, 1966

Mr. John M. Matuszek, Ph.D., Associate Manager
Scientific Services Department
Isotopes, Inc.
123 Woodland Avenue
Westwood, New Jersey 07675

Dear Dr. Matuszek:

Reference is made to our telephone conversation of December 7, 1966 relative to the material added to the demolition debris disposed of at the Croton Point Sanitary Landfill from the demolition of the former Canadian Radium and Uranium building in the Village of Mount Kisco.

Please be advised that the Westchester County Department of Health included the following items in this burial:

1. A wooden x-ray film box which had been used for storage of a lead pig containing a radium plaque. This box contained no detectable activity but was disposed of to prevent its further use for x-ray film.

2. A manila envelope containing several small bottles of chemicals obtained from a household in Westchester County. Beta activity of .02 mr/hr was detected on contact with the open top of one of these bottles. No detectable activity was obtained on the other vials.

3. Two metal cans obtained by this Department from the Canadian Radium and Uranium building several years ago for demonstration purposes. Unfortunately, the activity levels on these cans was marked on the wrapping and was disposed of with the debris. It is recalled, however, that the levels were below those specified for disposal of this material at West Valley, New York.

I trust the above is the information desired.

Very truly yours,

C. E. Weber, P.E.
Senior Sanitary Engineer
Division of Environmental Sanitation

CEW:T
cc: Office of Urban Renewal
Mt. Kisco

Appendix B

CODE OF PROCEDURES FOR RADIATION CONTROL AREA

Canadian Radium & Uranium Corp. Facility
69 Kisco Avenue
Mt. Kisco, N. Y.

1. There will be no eating or drinking in the Radiation Area. Smoking will be permitted by authorization of the health physicist. Smoking may be prohibited if the contamination levels in air and surface require this additional precaution.
2. Protective clothing, including shoe covering, face mask, head cover, lab coat and gloves if necessary, shall be worn as directed by the health physicist.
3. No item of any description shall be removed from the Radiation Area except as directed and cleared by the health physicist.
4. Before starting to work and at the completion of the job, the undersigned agrees to submit a urine and breath sample as directed by the health physicist.
5. Radiation monitoring equipment, such as film badges, pocket dosimeters and personnel air monitoring devices shall be worn as directed by the health physicist. If any of these devices are worn or misplaced, it will be immediately reported to the health physicist. The undersigned will not willfully expose any of these devices to radiation not received by the person assigned the device.
6. It is the understanding of the undersigned that he will be removed from work in the Radiation Area if he willfully disregards the above instructions.

I fully understand the above regulations and agree to abide by them.

_____

(Signed) _____

Date _____

Company _____