PRELIMINARY SURVEY OF THE UNION CARBIDE CORPORATION METALS DIVISION PLANT, NIAGARA FALLS, NEW YORK

Work performed
by the
Health and Safety Research Division
Oak Ridge National Laboratory
Oak Ridge, Tennessee 37830

December 1980

OAK RIDGE NATIONAL LABORATORY
operated by
UNION CARBIDE CORPORATION
for the
DEPARTMENT OF ENERGY
as part of the
Formerly Utilized Sites--
Remedial Action Program

PRELIMINARY SURVEY OF THE UNION CARBIDE CORPORATION METALS DIVISION PLANT, NIAGARA FALLS, NEW YORK

B. A. Berven and R. W. Doane

Introduction

On September 24, 1980, two representatives from Oak Ridge National Laboratory visited Union Carbide Corporation's Metal Division Plant (UCC-MD) in Niagara Falls, New York. The purpose of the visit was to perform a radiological survey of property where anomalously high levels of radiation were observed during an earlier preliminary survey of this site (see attachment). This report presents the results of this radiological survey.

A diagram of the technology area of the UCC-MD plant is shown in Fig. 1. The location of the anomalous radiation levels was between Buildings 163 and 166 where beta-gamma dose-rate levels were measured at 0.1 mrad/h at the ground surface.

Survey Methods

The preliminary radiological survey of the UCC-MD Technology Area consisted of the following measurements or samples: (1) a gamma-ray scan of the outside ground surface; (2) two bias surface soil samples from outside locations where external gamma radiation levels were significantly above background; (3) a gamma-ray scan of the inside floor and wall surfaces of Building 163; (4) bias alpha measurements inside Building 163 where external gamma radiation levels were significantly above background; (5) five smear samples from inside Building 163 measuring transferable alpha and beta contamination.

Portable instrumentation used in this survey included a gamma-ray scintillator [NaI (Tl)] survey meter, an alpha scintillation [ZnS (Ag)] counter, and a Geiger-Mueller (G-M) survey meter.

Survey Results

Outside

The gamma-ray scanning of the ground surface in the Technology Area at UCC-MD indicates wide-spread contamination over an extensive portion of this property (see shaded area in Fig. 2). Relatively high concentrations

of gamma-emitting radionuclides were observed in localized areas. External gamma exposure rates on ground surfaces were measured, ranging from background (approximately 10 μR/h) to a maximum of 3 mR/h. The contamination appeared to be low-level but uniform under several asphalt pads, and high-level and "spotty" following two railroad spurs traversing the property.

The highest external gamma levels (3 mrad/h)* observed in the area where surface soil sample NF_1 (see Fig. 3) was located. Potentially contaminated material appeared to be located beneath the asphalt pads surrounding Buildings 163 and 171. Surface exposure rates were a general 30 μR/h around Building 171, but appeared to be highly variable around Building 163, ranging from 17 to 100 μR/h.

The location of two surface soil samples (0-15 cm) taken in the Technology Area are shown in Fig. 3. The results are listed below:

Sample	External Gamma Exposure Rate at Ground Surface (μR/h)	Radionuclide Concentration (pCi/g)		
		^{238}U	^{226}Ra	^{232}Th
NF_1	3000	3200 ± 3%	3300 ± 4.8%	860 ± 7.1%
NF_2	83	81 ± 3%	72 ± 1.7%	190 ± 7.2%

The highest external gamma readings were found at the surface of the soil, with the levels decreasing rapidly with increasing depth.

Inside Building 163

Low-level contamination was found inside Building 163 during a cursory survey. The surface external gamma levels from the walls and floor were within typical background ranges (13 to 17 uR/h). The alpha activity on the walls and floor were elevated but not significantly above background levels at 68 dpm/100 cm^2.

Cracks in the floor of Building 163 exhibited elevated radiation levels, with external gamma activities ranging from 17 to 50 μR/h, and alpha activity over these cracks ranging from 100 to 150 dpm/100 cm^2.†

*This exceeds Nuclear Regulatory Commission's maximum beta-gamma level guideline of 1.0 mrad/h at 1 cm (see Ref. 1).

†This exceeds Nuclear Regulatory Commission's guideline of 100 dpm/100 cm^2 for alpha activity originating from ^{226}Ra (see Ref. 1).

Five smear samples were taken to determine the amount of transferable alpha and beta contamination. The location of the smear samples are identified in Fig. 4. The levels of transferable alpha and beta-gamma contamination were all at background levels.

At location "b", surface external gamma levels measured 83 μR/h and alpha activity measured approximately 530 dpm/100 cm^2 (also above NRC guidelines). At location "c", beta-gamma levels of 0.12 mrad/h were observed.

Discussion

Relatively high concentrations of radionuclides in the ^{232}Th and ^{238}U decay chains exist in the surface soil in the Technology Area at UCC-MD in Niagara Falls, New York. These materials also appear in cracks and seams in the walls and floor of Building 163.

Dr. C. R. Allenback, Manager of Environmental, Health, and Product Safety Affairs at the UCC-MD, indicated thorium-bearing ores were used during operations at this site, however, these operations were unrelated to Manhattan Engineer District (MED)/Atomic Energy Commission (AEC) activities. In view of the nature of past MED/AEC operations (limited to reacting of UF_4 to uranium metal), it seems unlikely that the present contamination on-site is related to those MED/AEC activities. However, because uranium appears to be present in the soil in significant amounts, contamination due to MED/AEC activities cannot be eliminated, but only considered improbable.

Recommendations

Based on the results of this preliminary survey, it is recommended that a formal detailed radiological survey of the Technology Area at the UCC-MD Plant in Niagara Falls, New York, be conducted by some responsible agency since radiation levels exceed Nuclear Regulatory Commission guidelines for unrestricted use.

References

Nuclear Regulatory Commission, "Guidelines for Decontamination of Facilities or Equipment Prior to Release for Unrestricted Use or Termination of Licenses for By-Product, Source, or Special Nuclear Material," November 1976.

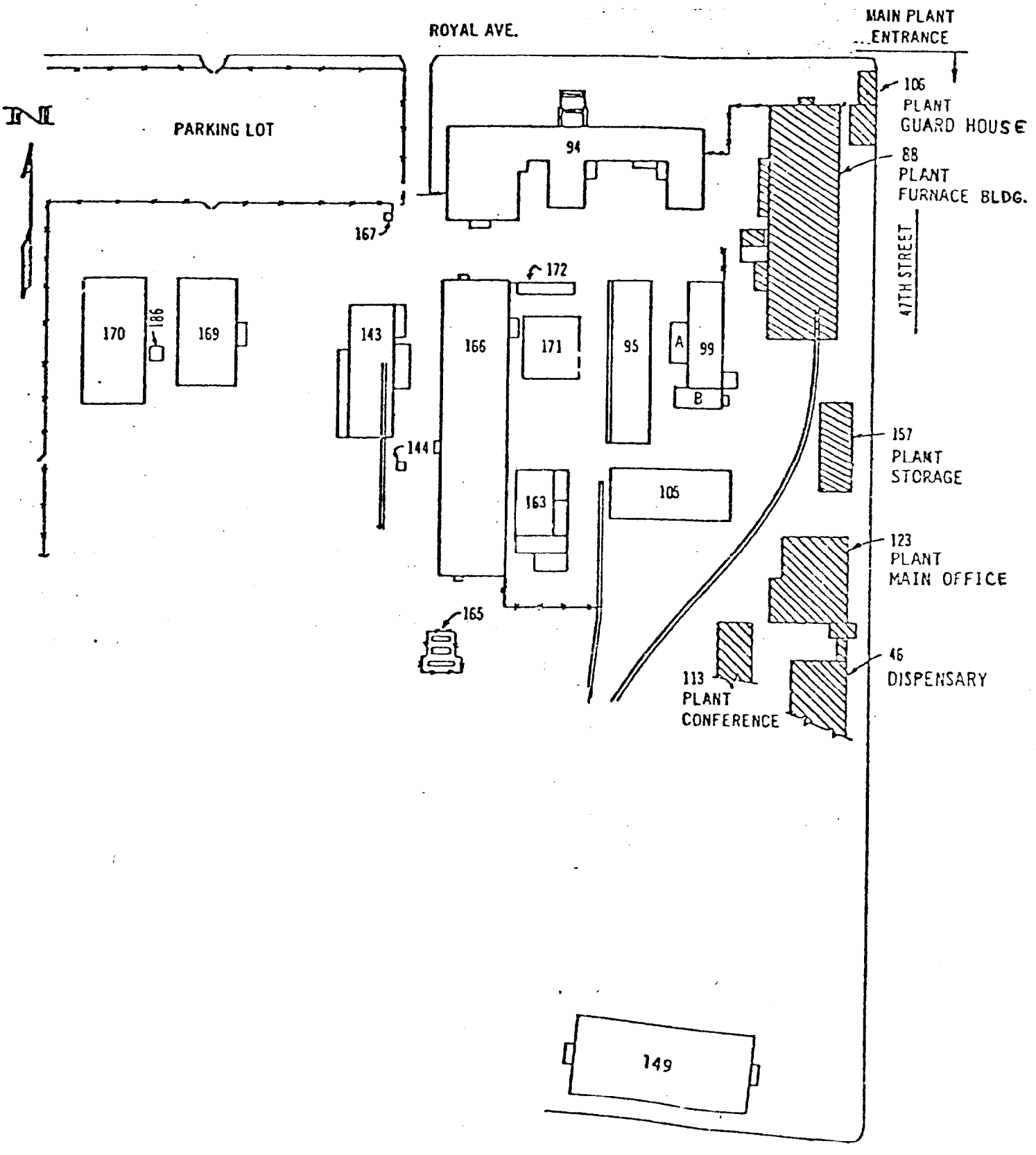

Fig. 1. Technology Area at the Union Carbide Corporation - Metals Division Plant (former Electromet site) in Niagara Falls, NY (adapted from UCC-MD drawing).

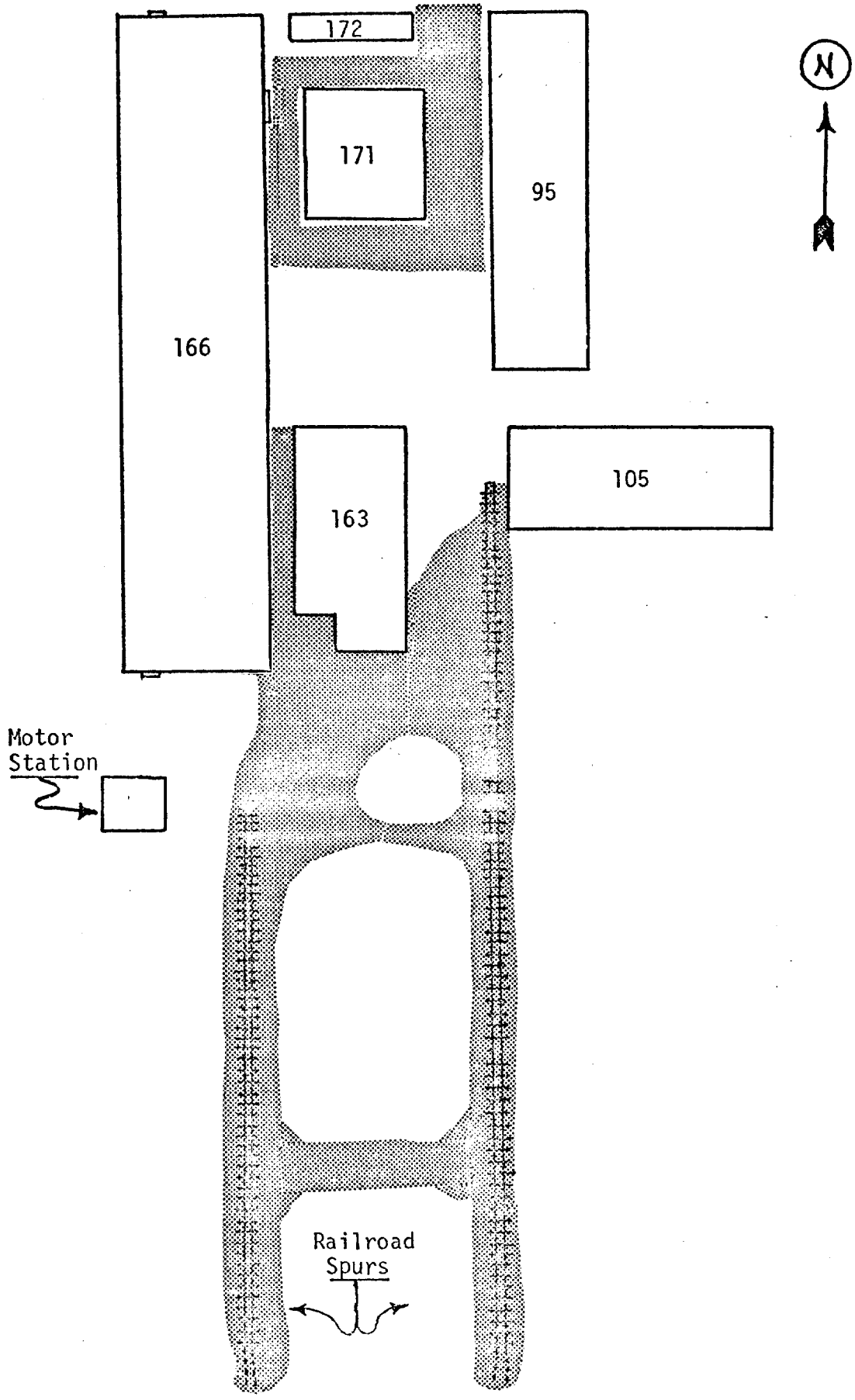

Fig. 2. Location of elevated surface gamma-ray levels (indicated by shading) in the Technology Area at UCC-MD, Niagara Falls, NY.

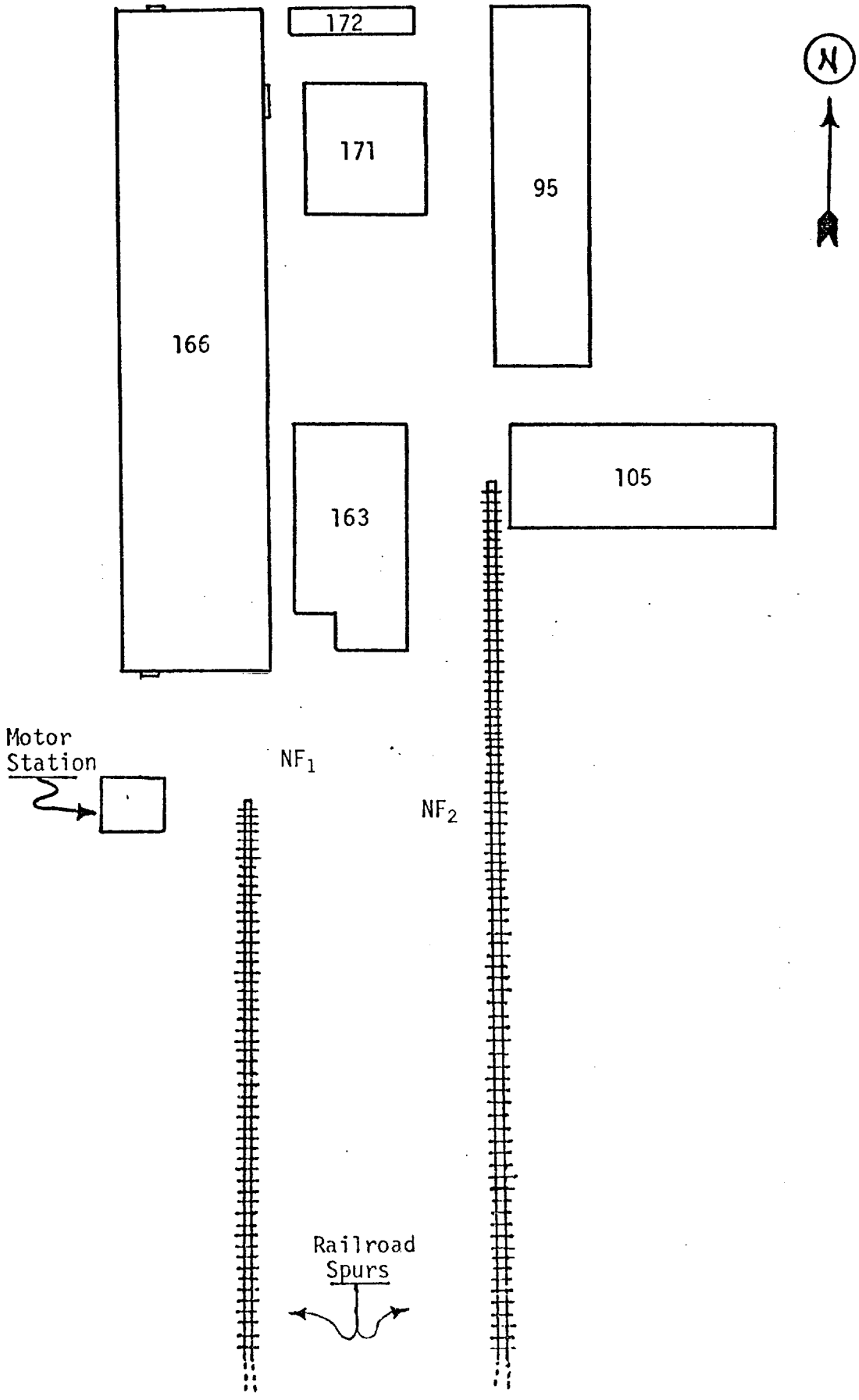

Fig. 3. Location of surface soil samples taken in the Technology Area of UCC-MD in Niagara Falls, NY.

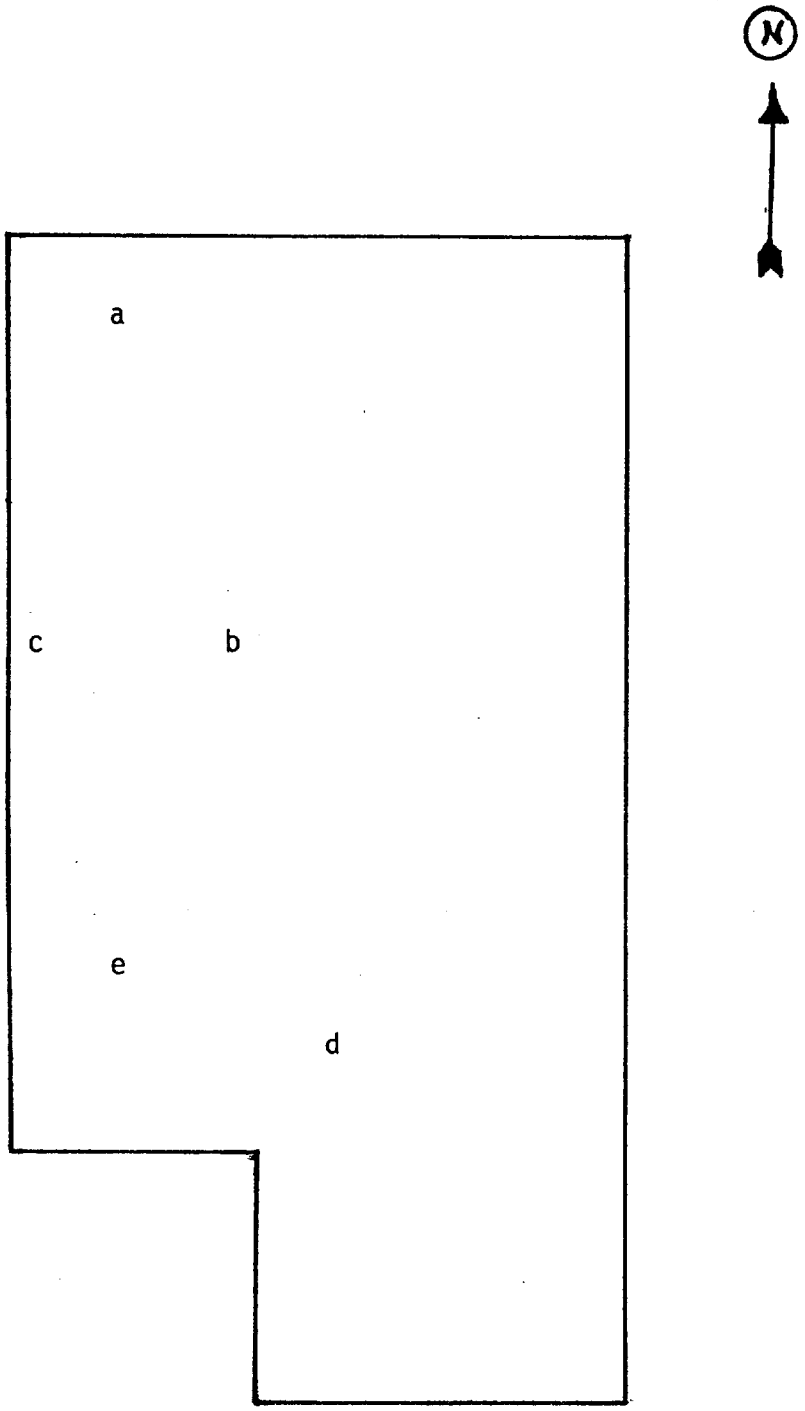

Fig. 4. Location of smear samples in Buiiding 163 in the Technology Area of UCC-MD in Niagara Falls, NY.

ATTACHMENT

PRELIMINARY SURVEY OF ELECTROMET CORPORATION UNION CARBIDE METALS DIVISION NIAGARA FALLS, NEW YORK

Work performed
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Health and Safety Research Division
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Oak Ridge, Tennessee 37830

March 1980

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ELECTROMET CORPORATION
UNION CARBIDE METALS DIVISION
NIAGARA FALLS, NEW YORK

At the request of the Department of Energy (DOE, then ERDA), a preliminary survey was performed at the former Electromet Plant (currently Union Carbide Corporation - Metals Division plant) in Niagara Falls, New York (see Fig. 1), on August 24, 1976, to assess the radiological status of those facilities utilized under Manhattan Engineer District (MED) contract during the period 1943 through 1946. Robert D. Forgeng, Plant Manager, provided information about the contract operations and identified the former site of the one building (a cinder block and wood structure) utilized in the process. C. R. Allenbach and Don Hawkes also provided information as to the building location and project operations. Also, Bill Chynoweth, an employee at the plant during the MED contract period, provided information about operational processes and assisted in identifying the location of the building which was demolished about 1958.

The project involved receiving Green Salt (UF_4) in drums from the Linde Air plant at Tonawanda, New York, reacting the Green Salt in furnaces, converting it to metal, and then recasting it into ingots. The building was formerly located where Building 166 now stands and just west of Building 163 (see Figs. 2 and 3) which existed at the time of the project. The former process building was constructed of wood and cinder block and was about 18 x 46 m at one end and 14 x 46 m at the opposite end. Waste from the operation was disposed at the Lake Ontario Ordnance Works depot. Residues of dolomite slag liners (MgF_2 slag), uranium chips, and crucible dross associated with the process were shipped to other sites for uranium recovery.

Present Use of Facilities

The building utilized in the MED project was washed, vacuumed, and, in some locations, the concrete floor and some wood platforms were removed (see Report NO4600). Following the project (post-1946), the building was used for zirconium processing from 1947 to 1948, and later titanium was processed prior to demolition. Building 166 (see Fig. 4)

was constructed on the site of the former process building, and it is currently used by Union Carbide's Metal Division operations.

Results of Preliminary Survey

The preliminary survey was performed by H. W. Dickson of the Oak Ridge National Laboratory and W. T. Thornton of the DOE/Oak Ridge Operations Office (then ERDA). Accompanying Dickson and Thornton during the survey was C. R. Allenbach, Don Hawkes, and Bill Chynoweth. Measurements taken at this site included external gamma-ray exposure rates taken at 1 m in height and beta-gamma dose rate taken at 1 cm from the surface. Results of the survey measurements were within background levels with the exception of slightly elevated background with maximum beta-gamma dose-rate readings of 0.1 mrad/hr at a location between Buildings 163 and 166. Survey measurements in sections of the old Union Carbide dump (200 to 300 acres and now owned by CECOS International, Inc.) located to the north of Pine Avenue (see Figs. 5 and 6) resulted in radiation levels that were not significantly above background levels. Some of the waste from the process and rubble from the demolition of the old building has been buried at this dump.

In view of the near background radiation measurements taken at this site, a comprehensive, formal survey will probably not be required. However, it is suggested as a precautionary measure to (1) obtain further measurements between Buildings 163 and 166 to define extent of elevated readings, (2) obtain a soil sample at location in (1) where maximum β-γ and external gamma measurements are observed, (3) drill core samples in the old Union Carbide dump to determine if any radioactive material has been deposited in this area.

A formal survey of this facility was performed as part of the dismantlement and decommissioning of Electromet by the Health and Safety Division of the AEC on August 11 and 14, 1953. The results of this survey are reported in the attached document.

R. L. Kirk, Director,
Production Division

September 28, 1953

W. B. Harris, Chief,
Industrial Hygiene Branch, Health & Safety Division

DISMANTLEMENT OF ELECTROMET CO.-CONTRACT NO. W-7405-ENG-14
DECONTAMINATION SURVEY OF AUGUST 11th and 14th, 1953.

SYMBOL: HSH:PBK

A resurvey of contamination was made by the Health and Safety Division in the standby green to metal plant of the Electromet Company, Niagara Falls, New York. This survey was made at the request of Mr. B. F. Fields, Electromet Plant Superintendent and our Administrative Operations and Legal Divisions in order to determine whether the radiation levels are being met before release from commission control.

On the visit of August 11, 1953, it was found that Electromet personnel were in the process of removing wooden structures around the vacuum casting furnaces, piping and other structural equipment. The results of the radiation survey of December 10-12 and the recommendations contained in the memo dated February 3, 1953, to F. M. Belmore from W. B. Harris re Decontamination were reviewed with Mr. Fields. In addition, decontamination procedures for removal of uranium contamination were discussed with plant personnel.

On August 14, 1953, a revisit to the plant was made to determine:

1. The degree of contamination of remaining equipment and the building proper.

2. Need for any additional recommendation for plant cleanup.

PROCEDURES

Direct radiation measurements were taken on all equipment, floors and walls of the plant using Eltronic and Detectron Beta-Gamma survey meters. Smear samples were taken from those locations and equipment at which high smears were found in the December, 1952 survey. The smears were taken over an area of 150 sq. cm. using 1-1/8" Whatman filter paper.

During cleanup operations and the contamination study general air samples were collected on 1-1/8" Whatman #41 filter paper, employing a universal sampler at 20 liters per minute as the basic equipment. The samples were taken in such former operations areas as the graphite burnout, vacuum casting as billet saw areas.

RESULTS OF SURVEY

Radiation target levels for decontamination have been revised since the December, 1952 survey due to a recommended increase in any beta exposures of five times the previous level. The criteria for decontamination which must be met by any buildings before release by NYOO are now:

1. The average gamma radiation at 3 feet from the floors or walls should not exceed 0.3 mr/hr. The average beta-gamma radiation measured in a like manner should not exceed 1.5 mrep/hr.

2. The maximum gamma radiation measured from the floors or walls should not exceed 0.6 mr/hr. The maximum beta-gamma radiation measured in a like manner should not exceed 3.0 mreps/hr.

3. No gamma radiation measured in contact with the floor should exceed 0.9 mr/hr. The maximum beta-gamma radiation measured in a contact with the floor should not exceed 4.5 mrep/hr.

Due to the nature of the survey instrument employed and the material measured, the field beta gamma intensities must be computed to the actual beta-gamma value using the expression:

$$\beta\gamma \text{ actual} = 2\beta\gamma \text{ Field} - \gamma \text{ Field}$$

The attached table which contains the results of the computed direct radiation measurements and smear samples taken on equipment, walls, floors and other building structures reveals the following:

(a) The highest gamma reading (0.1 mr/hr) was found on the floor of the old graphite burnout area. The concommitant $\beta\gamma$ measurement was only 1.7 mrep/hr.

(b) The highest beta gamma contamination (4.4 mreps/hr) was found on the racine cutting machine #931. Gamma contamination was negligible.

(c) Mechanical saw #1630 was found to be contaminated with 4.0 mreps/hr beta gamma.

(d) A high beta-gamma reading of 5.0 mreps/hr was found on the Lancaster mixer. Gamma contamination was negligible.

(e) Vacuum casting equipment wooden platforms, and the former green mixing equipment were removed from the building at the time of this survey. This equipment and contaminated wood partitions were checked and found to be uranium contaminated. It was agreed by Mr. Fields and Dr. Spedding, project leader, that the wood partitions would be burned and ashes buried. Other equipment, such as furnace casting equipment and parts was to be sent to LOSA for storage and disposal.

(f) All other equipment was found to meet the radiation target levels.

Of the eleven general air samples taken in the standby green to metal plant during cleanup operations only one sample (117 α d/m/M^3) exceeded the present acceptable level of 70 α d/m/M^3. However, the average general air concentration for the eleven samples was only 18 α d/m/M^3. The following table shows the average high and low general air concentrations found at specific locations:

Location	Concentration d/m/M^3			Number of Samples
	Average	High	Low	
Center of area 20 ft South of Machine Saw	12	25	2	4
Center of area 10' South vacuum casting area	7	14	3	3
At graphite burnout area	40	117	2	4

α d/m/M^3 = alpha disintegrations per minutes per cubic meter of air.

CONCLUSION

This survey shows that a negligible degree of contamination both to equipment and to building has been measured. Since this contamination study was made during such major cleanup operations as demolition of floor by air hammer, sweeping, etc., and inasmuch as the criteria for uranium contamination has still been met by the plant, it is recommended that the plant be released by the government.

Three pieces of equipment, namely the Racine Cutter, Mechanical Saw and Lancaster mixer found to contain beta-gamma up to 5.0 mreps/hr was scrubbed and sand blasted by Electromet personnel since this survey. Beta-gamma survey measurements by Dr. R. Spedding revealed no reduction in beta-gamma contamination.

The Electrometallurgical Co., according to Dr. Spedding, intends to use the aforementioned equipment in connection with their own radio metallurgy program. It is recommended that Electromet notify the NYOO they will agree not to sell the contaminated equipment to any third party and will not hold the NYOO responsible for any damage incurred by Electromet personnel in using this equipment.

Att:
Table of Radiation Readings and Smear Results.

cc: J. Quidor, Admin. Op.
J. Maffucci, Prop. Mgmt.
M. Medwin, Asst. Gen'l. Counsel

TABLE OF DIRECT RADIATION READINGS AND SMEAR RESULTS

Location	Direct Radiation βγ (mrep/hr)	Direct Radiation γ mr/hr	Smear Sample α d/m/sample
Entrance to Lab. 3' level	neg.	neg.	
Entrance to Lab. Floor (Kentile)	.04	neg.	74
Chem. Lab.-Lab Desk near door	.06	neg.	57
Chem. Lab. Cupboard	0.1	neg.	1.8
Chem. Lab. 3' level	neg.	neg.	
Chem. Lab.-Office Floor	.06	0.02	107
Chem. Lab. Office Wall	neg.	neg.	1.1
Corridor in front of Chem. lab. floor	neg.	neg.	
Vicinity Men's room-3' level	neg.	neg.	
Vicinity Men's room-floor	.06	neg.	52
Wall near men's room	0.1	neg.	72
Old graphite area-3' level	.18	neg.	
Old graphite area-floor	1.7	0.1	187
Floor inside graphite burnout area	0.16	.04	10
3' level between vacuum furnace and wall	.07	.03	
Floor between vac. furnace and wall	.55	.04	432
Wall between vac. furnace and wall	.27	.03	234
3' level-Main entrance to plant	.02	neg.	
Floor-Main entrance	.12	neg.	174
Floor around cut-off saw 931	.12	neg.	44
Floor around cut-off saw 1630	.11	.01	38
Saw area 3' level	.04	neg.	
Near storage room 3' level	neg.	neg.	
Near storage room-floor	neg.	neg.	216
Floor under former vac. furnace platform	.75	.05	234
3' level at former vac. furnace platform area	.29	.01	
Buffalo room 3' level	neg.	.01	
Near Buffalo room (floor entrance)	.09	neg.	338
Lancaster Room-3' level	.06	.01	
Lancaster room-Wall	neg.	neg.	
Lancaster room-floor	.09	.01	
Ice crusher room-3' level	neg.	neg.	
Ice crusher room-floor	.18	neg.	
Old GFF furnace	.42	.02	
Vicinity of old GFF furnace	.35	.01	657
Old bomb breakout room-floor	.11	.01	66
Old jolter area of old break-out room-floor	.10	.01	66
Old jolter area of old break-out room-wall	.09	.01	21
Near main entrance of old break-out room-3' level	1.54	.04	
Buffalo room-3' level	0.08	.01	
Buffalo room-floor	1.06	neg.	338

TABLE OF DIRECT RADIATION READINGS AND SMEAR RESULTS

Name of Item	Govt. No.	Direct Radiation βγ (mrep/hr)	Direct Radiation γ mr/hr	Smear Sample α d/m/sample
Lancaster mixer	--	5.0	neg.	
Mechanical Saw	1630	4.0	neg.	
Racine cutting machine	931	4.4	neg.	
Fire Blanket	481	.12	neg.	
Stretcher	804	0.2	neg.	
Hydraulic lifter	165	2.0	neg.	
Crusher	1025	0.1	neg.	140
Hydrowhirl	483	.8	neg.	36
Truck	1220	.24	.01	291
Piping to Buffalo Forge		.12	.02	41
Buffalo forge	83	.44	.02	283
Buffalo Forge canister		.10	neg.	60

R. L. Kirk, Director, Production Division November 9, 1953

W. B. Harris, Chief, Industrial Hygiene Branch,
Health & Safety Division

DISMANTLEMENT OF ELECTROMET COMPANY - CONTRACT NO. W-7405-ENG-14

SYMBOL: HSH:PBK

This is to supplement and to clarify certain doubts in the memo Harris to Kirk dated August 28, 1953, re Electromet Decontamination.

1. The decontamination survey of Electromet was pursuant to Contract AT (30-1)-8-23 and the maximum tolerances as stated in the contract have been met and the property therefore recommended for release to Electromet.

2. It was stated in the memo that radiation target levels for decontamination have been revised since the December, 1952 survey due to a recommended increase in any beta exposure of 5 times the previous level. This does not mean, however, that the property we have released to Electromet exceeded the tolerance levels prescribed and is unsafe.

3. It was not known at the time the August 28th memo was written that the held harmless clause was included in the contract and therefore said clause was referred to in the "conclusion" of the memo.

cc: Asst. Gen. Counsel (Medwin)
J. S. Quidor, Dir., Adm. Op.
J. Maffucci, Adm. Op.

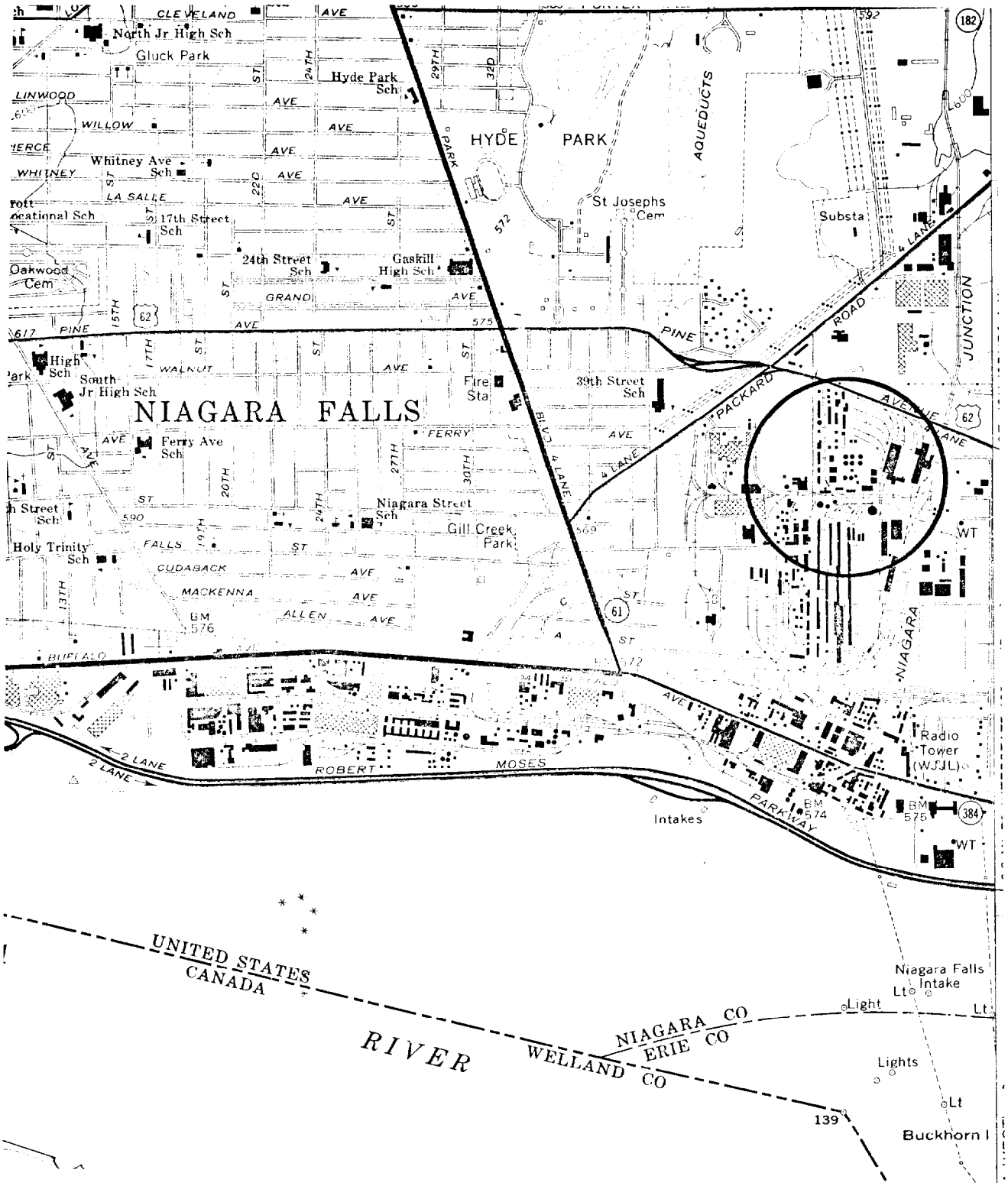

Fig. 1. Location of the Electromet Corporation - Union Carbide Metals Division site in Niagara Falls, New York.

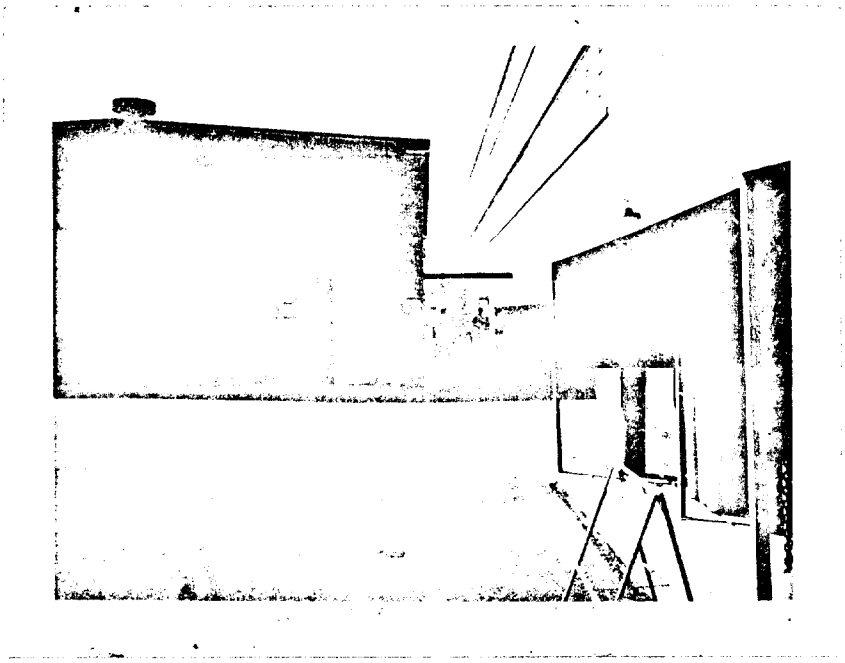

Fig. 2. North end of Building 163 and east side of Building 166.

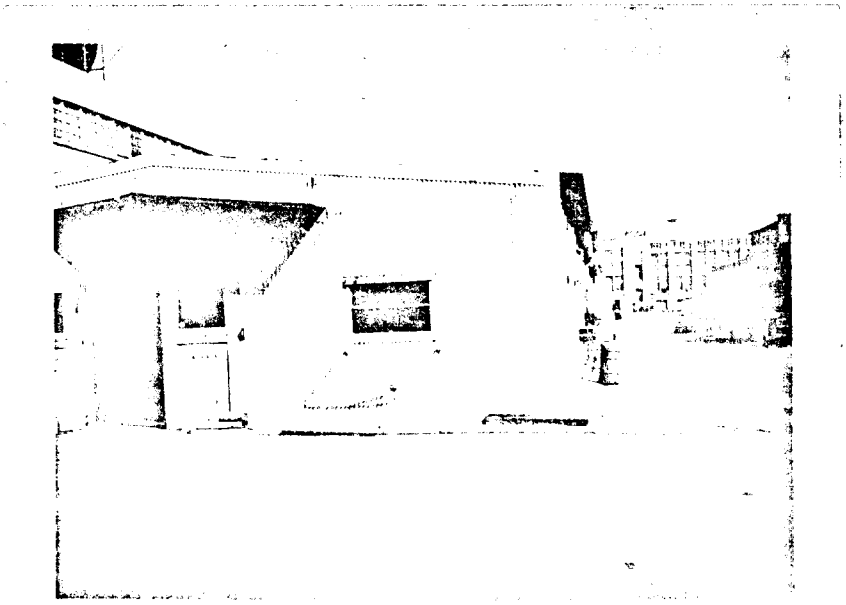

Fig. 3. South end of Building 163 and east side of Building 166.

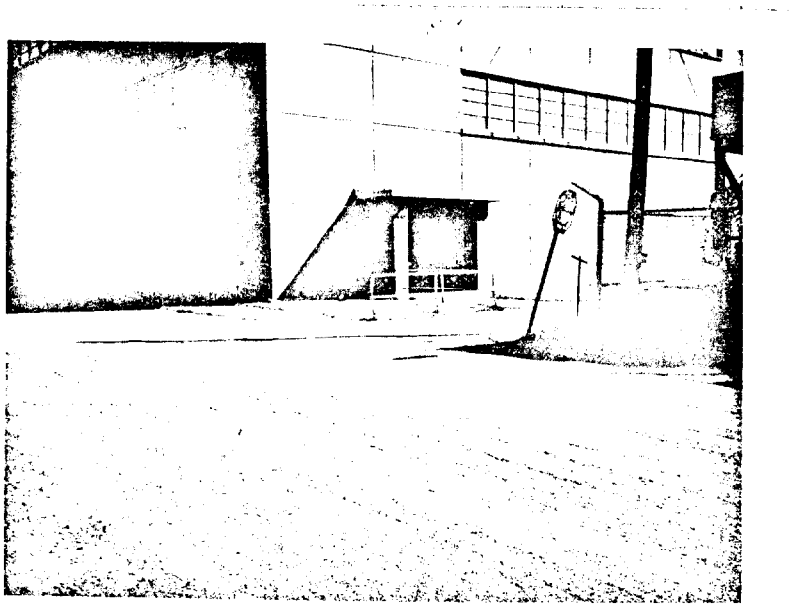

Fig. 4. Building 166.

Fig. 5. Old Carbide Dump (now "Niagara Recycling").

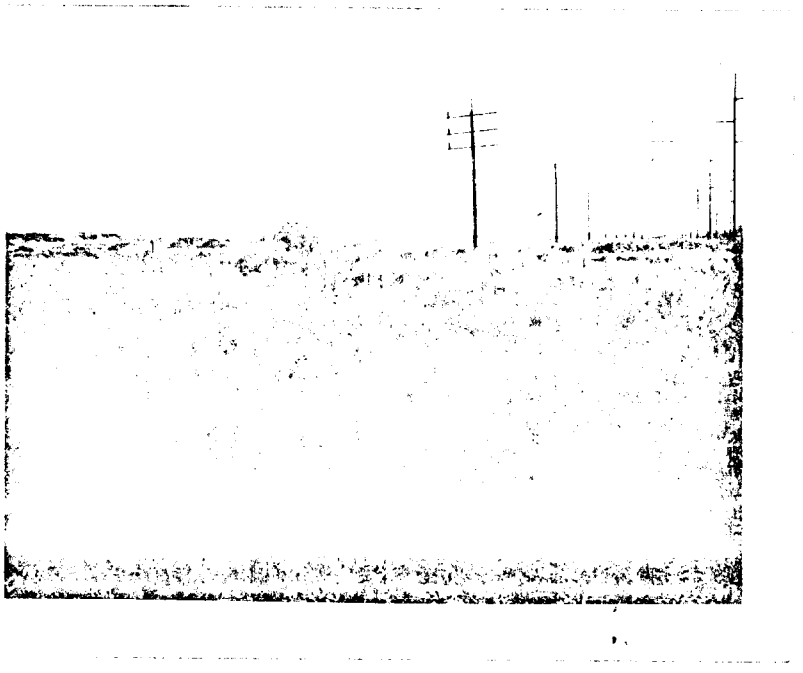

Fig. 6. Old Carbide Dump (now "Niagara Recycling").