NPS Form 10-900
(Oct. 1990)

OMB No. 10024-0018

MP-1584

United States Department of the Interior
National Park Service

National Register of Historic Places Registration Form

This form is for use in nominating or requesting determinations for individual properties and districts. See instructions in *How to Complete the National Register of Historic Places Registration Form* (National Register Bulletin 16A). Complete each item by marking "x" in the appropriate box or by entering the information requested. If an item does not apply to the property being documented, enter "N/A" for "not applicable." For functions, architectural classification, materials, and areas of significance, enter only categories and subcategories from the instructions. Place additional entries and narrative items on continuation sheets (NPS Form 10-900a). Use a typewriter, word processor, or computer to complete all items.

1. Name of Property

historic name **LINDE AIR PRODUCTS FACTORY**

other names/site number Chandler Street Plant

name of related multiple property listing Historic Resources of the Black Rock Planning Neighborhood, Buffalo

2. Location

street & number 155 Chandler Street [ ] not for publication

city or town Buffalo [ ] vicinity

state New York code NY county Erie code 029 zip code 14212

3. State/Federal Agency Certification

As the designated authority under the National Historic Preservation Act, as amended, I hereby certify that this [X] nomination [ ] request for determination of eligibility meets the documentation standards for registering properties in the National Register of Historic Places and meets the procedural and professional requirements as set forth in 36 CFR Part 60. In my opinion, the property [X] meets [ ] does not meet the National Register criteria. I recommend that this property be considered significant [ ] nationally [ ] statewide [X] locally. ([ ] see continuation sheet for additional comments.)

Nicholas F. Lynch Deputy SHPO 14 JULY 2017

Signature of certifying official/Title Date

State or Federal agency and bureau

In my opinion, the property [ ] meets [ ] does not meet the National Register criteria. ([ ] see continuation sheet for additional comments.)

Signature of certifying official/Title Date

State or Federal agency and bureau

4. National Park Service Certification

I hereby certify that the property is:

[X] entered in the National Register
[ ] see continuation sheet
[ ] determined eligible for the National Register
[ ] see continuation sheet
[ ] determined not eligible for the National Register
[ ] removed from the National Register
[ ] other (explain) _____

for Alexis Abernathy 9/11/17

Signature of the Keeper date of action

5. Classification

Ownership of Property
(check as many boxes as apply)

[X] private
[ ] public-local
[ ] public-State
[ ] public-Federal

Category of Property
(Check only one box)

[X] building(s)
[ ] district
[ ] site
[ ] structure
[ ] object

Number of Resources within Property
(Do not include previously listed resources in the count)

Contributing	Noncontributing	
1	0	buildings
-	-	sites
-	-	structures
-	-	objects
1	**0**	**TOTAL**

Name of related multiple property listing
(Enter "N/A" if property is not part of a multiple property listing)

Historic Resources of the Black Rock Planning Neighborhood

Number of contributing resources previously listed in the National Register

N/A

6. Function or Use

Historic Functions
(enter categories from instructions)

INDUSTRY/manufacturing facility

Current Functions
(Enter categories from instructions)

VACANT

7. Description

Architectural Classification
(Enter categories from instructions)

No Style

Materials
(Enter categories from instructions)

foundation Concrete
walls Brick, Cinder Block
roof Asphalt
other

Narrative Description
(Describe the historic and current condition of the property on one or more continuation sheets)

Linde Air Products Factory
Name of Property

Erie County, New York
County and State

8. Statement of Significance

Applicable National Register Criteria
(Mark "x" in one or more boxes for the criteria qualifying the property for National Register listing.)

[**X**] **A** Property associated with events that have made a significant contribution to the broad patterns of our history.

[ ] **B** Property is associated with the lives of persons significant in our past.

[ ] **C** Property embodies the distinctive characteristics of a type, period, or method of construction or that represents the work of a master, or possesses high artistic values, or represents a significant and distinguishable entity whose components lack individual distinction.

[ ] **D** Property has yielded, or is likely to yield, information important in prehistory or history.

Criteria Considerations
(Mark "x" in all boxes that apply.)

[ ] **A** owned by a religious institution or used for religious purposes.

[ ] **B** removed from its original location

[ ] **C** a birthplace or grave

[ ] **D** a cemetery

[ ] **E** a reconstructed building, object, or structure

[ ] **F** a commemorative property

[ ] **G** less than 50 years of age or achieved significance within the past 50 years

Areas of Significance:
(Enter categories from instructions)

Industry

Period of Significance:

1907-1948

Significant Dates:

1907, 1911, 1916, 1934, 1948

Significant Person:

N/A

Cultural Affiliation:

N/A

Architect/Builder:

James B. McCreary (1907 Factory)

Esenwein & Johnson (1910, 1911 Additions)

Narrative Statement of Significance
(Explain the significance of the property on one or more continuation sheets.)

9. Major Bibliographical References

Bibliography
(Cite the books, articles, and other sources used in preparing this form on one or more continuation sheets.)

Previous documentation on file (NPS):

[**X**] preliminary determination of individual listing (36 CFR 67) has been requested. **NPS # 35,595**
[ ] previously listed in the National Register
[ ] previously determined eligible by the National Register
[ ] designated a National Historic Landmark
[ ] recorded by historic American Building Survey
_____
[ ] recorded by Historic American Engineering Record
_____

Primary location of additional data:

[ ] State Historic Preservation Office
[ ] Other State agency
[ ] Federal Agency
[ ] Local Government
[ ] University
[ ] Other repository: _____

10. Geographical Data

Acreage of Property 1.98 acres

UTM References
(Place additional UTM references on a continuation sheet.)

	Zone	Easting	Northing		Zone	Easting	Northing
1	17	673861	4753039	3	17		
2	17			4	17		

Verbal Boundary Description
(Describe the boundaries of the property on a continuation sheet.)

Boundary Justification
(Explain why the boundaries were selected on a continuation sheet.)

11. Form Prepared By

name/title M. Shoen, D. King, K. Hoke, M. Arch, C. Moriarty PhD/Architectural Historians [Edited by Jennifer Walkowski, NYSHPO]

organization Preservation Studios, LLC date April 2017

street & number 60 Hedley Place telephone 716-725-6410

city or town Buffalo state NY zip code 14208

Additional Documentation

Submit the following items with the completed form:

Continuation Sheets

Maps

A **USGS map** (7.5 or 15 minute series) indicating the property's location
A **Sketch map** for historic districts and properties having large acreage or numerous resources.

Photographs

Representative **black and white photographs** of the property.

Additional items
(Check with SHPO or FPO for any additional items)

Property Owner (Complete this item at the request of the SHPO or FPO)

name

street & number telephone

city or town state zip code

Narrative Description of Property

The Linde Air Products Factory is located at the northeast corner of Chandler Street and Manton Place in the North Buffalo area of Buffalo, Erie County, New York, within the defined boundary of the *Historic Resources of the Black Rock Planning Neighborhood* MPDF. It sits along a small industrial corridor just south of the existing New York Central Railroad Belt Line, one-half mile north of Buffalo State College and five miles north of downtown Buffalo. The surrounding area consists of a few early twentieth century industrial buildings together with a number of empty lots. The area north of the train tracks is residential with a mix of early twentieth century, single-family residences and mid-century, multi-family residences. The area south of the factory is also residential and made up of late nineteenth and early twentieth century residences. The factory itself faces due north onto Chandler Street and sits on a parcel that occupies half of the width of the block and the full depth of the block to Grote Street behind. It is built to the lot line on each side and is edged with a small amount of grass on the south and west sides.

The Linde Air Products Factory was built in phases from 1907 to 1959, with a majority of the building constructed by the Linde Air Products Company between 1907 and 1948. The building has a C-shaped plan that is nearly fully enclosed, forming a center courtyard. The footprint of the red brick factory is approximately 300 feet wide by 275 feet deep in size. The earliest portions of the building are two-story solid masonry construction with double-hung wood windows, brick piers, and pitched roofs along the northern half of the existing building. Later portions of the building range from one to two stories in height and have a steel frame clad in red brick, incorporate large steel factory windows and, in some places, are lit by long rooftop monitors. The single-story areas of the south and east portions of the factory are as tall—and at some places, taller—than the two-story areas in the north portion of the factory.

As the Linde Air Products Company, America's largest liquid oxygen manufacturing company, grew, it both built new facilities and expanded the Chandler Street factory to the south, east, and west. Its periods of growth coincide with the company's takeover by the Union Carbide Company and the changing focus of the factory from oxygen production to machinery repair and research development. During World War II, the plant was utilized as part of the Manhattan Project and it remained in the hands of the Linde Air Products Company until 1948. In 1951, Bell Aircraft occupied the building, constructing several one-story cinder-block additions in 1952 that projected into the courtyard, as well as introducing cinderblock partitions throughout several of the wings.

Diagram showing the different wings of the facility.

The earliest portion of the building, constructed in 1907, was built at the northwest corner of the site. It consists of a two-story office at the corner with a recessed, two-story addition extending to the east, and a single-story factory extending approximately seven bays to the south. Before long, the company began expanding with additions built almost every year until 1913. In 1909, a second floor was added to the single-story factory. The year 1910 saw significant expansion with a single-story, brick-and-steel addition to the West Wing and the single-story, L-shaped, brick-and-steel South Wing. A small addition was made at the eastern end of the 1907

block in 1911 followed by an adjacent 1912 single-story, brick and steel machine shop, both by local architectural firm Esenwein and Johnson. For three years, construction largely ceased at the site until another large expansion occurred in 1916-17. During 1916-17 part of the East Wing was constructed, and the 1912 machine shop received a second story and was expanded to the east. Also at this time, a small, single-story, brick-and-steel storage shed was added in the southeast corner between the South and East Wings. In 1934, the East Wing was expanded to the west and extended northward to the lot line along Chandler Street. The factory was vacant from 1948 until 1951, when Bell Aircraft acquired the building. Bell made several alterations, enclosing the recessed space east of the 1907 corner volume and adding cinderblock enclosures and small additions along the east and west sides of the courtyard in 1952, but the bulk of the building dates to the Linde era.

Diagram showing the dates of construction for each addition to the facility.

Exterior

Although continually expanded over the course of five decades as the company grew and the site shifted from production to repair and research functions, the Linde Air Products Factory is (apart from the later CMU additions) fairly consistent in appearance with window types and slightly varied brick colors as the chief indicators of the different building campaigns. The building sits on a consistent, twelve-inch, rough-hewn granite base with the brick above laid in common bond. On each elevation, the building is capped by a brick beltcourse and a brick parapet with a simple corbelled cornice and a glazed clay tile coping. Each of the window openings has a concrete sill. While many original windows remain, most of the openings are currently boarded up on the exterior.

Primary (north) Facade

The primary façade of the factory is the north elevation, which fronts onto Chandler Street and is two stories in height and twenty-four bays in width. It is composed of the five-bay, two-story face of the East Wing at the east end, the three-bay, two-story face of the West Wing at the west end, and the thirteen-bay face of the North Wing at the center. Between the West and North wings is an opening driveway of approximately twenty-four feet in width which leads into the courtyard at the center of the building. The East Wing, though two stories in height, contains a double-height space on the interior and features nearly full-height multi-light windows. In the second and third eastern bays are large garage doors with original, ten-light, steel transom windows above. The easternmost bay has paired twelve-over-twelve, steel windows with a twelve-light transom; the two western bays have similar tripled windows; however, the lower half of each opening is filled in with CMU. On the north façade of the East Wing, a towering second story projects up from the second bay with a pair of tall, multi-light, original windows on its northern face.

The fifteen bays that make up the North Wing are narrow and have a large, roughly square window opening at both the first and second floors. On the second floor, all openings are filled with painted sheathing, though some contain glass or cement blocks. Nearly all the windows on the first floor are gone as well, with the exception of the fourth through eighth bays, which contain paired twelve-light center-pivot casement windows. The ninth bay at the center of the North wing originally contained a window but was extended to the sidewalk and contains a non-original door with glass block sidelights possibly dating to Bell Aircraft's occupation of the building in the 1950s.

The northwest corner of the North Wing contains the two-bay original façade of the Linde Air Products Factory. This corner features an entry with transom in the first bay, and the opening is currently filled in with plywood. A large window opening centered in the remaining two bays contains original, tripled, four-over-four, double-hung, wood windows. A single opening is present in each of the second-floor bays with similar windows. Each of the openings on this portion of the building has a deep, jack-arched, brick lintel with a decorative brick keystone at the center. Instead of a parapet, the west wing is capped with a shallow, simple, brick pediment.

West Elevation
The west elevation of the factory consists of the eleven-bay, two-story side of the North and West Wings at the north end, and the six-bay, single-story South Wing at the south end. The four northernmost bays of the West Wing date to 1907 and have openings matching those of the primary façade. The remaining bays have wide openings at the first and second floors with deep jack-arched lintels and originally contained tripled windows. The South Wing is similar and also has jack-arched lintels; however, its openings are wider and originally contained groups of four windows. All of the window openings on this elevation are covered with corrugated metal or have been infilled with plywood and CMU.

East Elevation
The east elevation is composed of the side elevation of the double-height East Wing. It has regular, tall openings with pairs of twelve-over-twelve steel windows with a twelve-light transom. The third-story tower element is visible beyond at the northern end of the elevation. It is three bays long and has tall, paired, multi-light, steel widows similar to those below.

Rear (south) Elevation
The rear elevation is a consistent single story in height and is fifteen bays wide. The window openings have deep jack-arched lintels and originally contained groups of four windows. Each of the openings is covered with corrugated metal. In the sixth western bay, the opening has been extended to the sidewalk and is filled in with CMU. The last two eastern bays each have tall, single openings with multi-light steel windows.

Courtyard
The courtyard at the center of the Linde Air Products Factory is approximately 110 feet wide by 160 feet deep and consists of an open gravel space surrounded by the plant on each side. A number of shrubs and small trees are present at the perimeter, but there is otherwise no landscaping aside from some brick pavers that cross certain sections. The east elevation is formed by the 1934 addition to the East Wing and is composed of a simple, two-story, brick volume with large, double-height, multi-pane daylight factory windows. A 1952 CMU addition is present at the southern end but is almost fully obscured by the existing shrubbery. The rear of the two-story North Wing along the northern edge of the courtyard shows several shades of red brick dating to the various building campaigns, but it is otherwise consistent and has regular, paired, six-over-six, double-hung windows at the first and second floors. Single-story CMU construction dating to 1952 is present along the west side of the courtyard, with the red brick second-story of the West Wing visible beyond. The southern elevation of the courtyard consists of the single-story red brick elevation of the South Wing with regular six-over-six, double-hung windows at both the first floor and in the monitor above. The most significant feature of the courtyard is the approximately 100-foot tall chimney located at the center of the courtyard elevation of the North Wing. “Linde” is spelled out vertically in yellow-painted brick on the east and west sides of the chimney.

Interior

The interior of the Linde Air Products Factory is divided into four distinct wings, with each wing different in materials and design. The North Wing contains administrative, laboratory, and office spaces and includes the only finished rooms in the building. The West Wing consists of one of the original manufacturing spaces, as well as a tall center-dormer production shed. The South Wing consists of one large open floor dominated by a full-length central frame monitor. The East Wing contains the newest additions added by Linde, constructed between 1917 and 1934, and it consists of tall single-story gantry-crane sheds between twenty-seven and thirty-eight feet tall.

North Wing
The North Wing consists of the original 1907 administrative offices at the northwesternmost corner of the building, a 1912 machine shop with 1916 addition, and a 1916 office and laboratory build out at the eastern end. It also includes a c. 1940 cinderblock and brick office and storage area.

The wing is oriented east-west, and there is no general plan for the layout, as the first floor is divided by walls for each of the additions without any central circulation or organization. Original lighted wooden doors still lead to empty rooms at the western end of the first floor that were likely offices when the building opened in 1907. The first floor of the c.1940 addition has concrete floors and exposed columns, with doors leading into the East Wing and courtyard. The rest of the first floor of the North Wing is built out with 1960s faux paneling.

The second floor is oriented along a full-width central corridor that runs from the original 1907 office all the way to the laboratories at the eastern end of the wing. The 1907 offices have plaster walls and wooden floors, and though the c. 1940 addition retains a wooden partition that divides the north and south halves of the room, the only other features of the space are the tall ceilings (with dropped-ceilings in places) and tile and wood floors throughout.

The eastern end of the North Wing is occupied by laboratories for Linde, although some of the spaces were altered by the introduction of fireproof bricks by Bell Aircraft. The original space, however, is still articulated, with a central shower and locker room, surrounded by four specialized labs separated by either thick brick walls or wooden office partitions. Historic stenciling denoting the lab purposes (e.g. metallography) and their occupants still are written on the doors. This portion also contains several historic skylights that illuminate central hallways between the offices.

West Wing
The West Wing is the smallest of the Linde Air Products Factory wings, consisting of the original 1907 manufacturing space and a tall production shed from 1910. The 1907 space has two stories with long narrow

open floorplate and concrete flooring on the first and wood floors above, with exposed wooden ceiling joists in both. All of the windows to the space are boarded up, though the original openings are still present. The 1910 production shed is a tall single-story space with an open floor plate and a long open hallway that connects the North Wing, West Wing, and South Wing.

The production space contains a wide Warren Truss-supported wooden roof with a center wooden monitor, with wide openings with steel lintels cut into the brick wall of the 1907 room and taller openings with steel lintels cut into the wall leading to the hallway to the east. The openings may have contained doors at one point, but at the very least, they connected the tall production areas with circulation along the sides. The area was originally lit by windows along the center monitor, but the roof is deteriorated and there are none remaining. A wide doorway on the north wall leads into the 1940s portion of the north wing, which seems to have contained a garage.

The hallway along the eastern edge of the production shed contains a door and ramp to the courtyard on the eastern wall, a doorway to the central staircase of the Northern Wing on the north end, and doorways to the 1952 cinder block addition along the east wall. The wooden ceiling is supported by steel joists.

South Wing

The South Wing is the longest portion of the Linde Air Product Factory, with a nearly continuous open volume that runs east-to-west and is divided at several points by concrete block partitions from circa 1952. The building has a similar form as the West Wing's production shed, but it has a frame roof and monitor supported by steel columns. Nearly all of the original sixteen-light single-sash wood windows in the South Wing's monitor are intact.

Similarly, nearly all of the windows along the first floor are intact as well, featuring wide eight-over-eight wooden double-hung windows in groups of four along the west and south walls. Interestingly, all of the windows in the monitors and the first floor have opaque glass, suggesting this space was utilized for gas separation or some other process where direct sunlight might affect molecular structures. The space is open with the exception of steel columns supporting the monitor and the aforementioned cinderblock partitions, with concrete flooring and wooden ceilings supported by steel joists throughout. At the eastern end of the South Wing, 1952 partitions create small manufacturing spaces that project into the open-volume space, but otherwise there are no interruptions of the open floor plate.

East Wing

The East Wing contains the tallest portions of the facility, with two large additions from 1934 at the northernmost part of the wing in front of a similarly scaled addition from 1916-1917. The spaces in this wing have ceilings twenty-seven to thirty-eight feet high, with large full-height multi-light windows, some inoperable

sash as large as twenty-eight lights, and several center pivot sixteen-light awning windows throughout as well. Just like the South Wing, the windows contain the same opaque glass that would limit the impact of direct sunlight. The floors are concrete, and the space is largely open with the exception of original brick partitions that have had large openings cut into them, supported by steel I-beams, in order to create even more open space. At the northern end is a small foreman's office, elevated about fifteen feet in the air.

1952 Courtyard Additions

The 1952 additions date to Bell Aircraft's use of the factory and consist of one-story cinderblock additions with few window openings or features. Two of these additions project into the courtyard, one off the West Wing and one off the South and East Wings. Both are one-story and occupy most of the southeast and southwest corners of the courtyard, respectively. The addition on the West Wing appears to contain small offices and storage areas, with concrete floors and painted cinderblock walls. Some of the rooms lead to the courtyard via paired wooden doors with inset eight-light windows. The addition in the southeast corner is similar in that the walls are painted cinderblock, but this addition was likely used for some sort of small-scale manufacturing, as it is adjacent to the boiler and the rooms are divided from the remainder of the South and East wings by heavy fire doors. Both additions contain short metal skylight features.

Summary

The Linde Air Products Factory retains historic design, construction, form, materials, and detailing that convey its historic use as an industrial gas manufacturing and research facility. The utilitarian nature of the floorplate, including concrete floors throughout, large windows and center monitors for natural light, and exposed steel columns and joists are common to many manufacturing spaces of the era. Other details communicate the Linde Air Products Company's use of the factory over a period of forty years for production, repair, and research functions. The North Wing retains administrative office space, laboratories that still contain original leaded glass windows in the heavy wooden doors, and a shower and locker room for removing chemicals. The West and South Wings contain large manufacturing spaces with light-dampening techniques on the windows suited to working with sensitive gasses. The East Wing features the same light-dampening glass windows and contains tall spaces ideal for moving large gas storage tanks onto trucks.

Statement of Significance:

The Linde Air Products Factory (also referred to as the Chandler Street Plant) is a locally significant oxygen extraction plant located at 155 Chandler Street in Buffalo, Erie County, New York. Opened in 1907 by the German-based Linde Air Products Company, the Linde Air Products Factory in Buffalo was the first oxygen extraction facility in America and was later dubbed "the birthplace of the oxygen industry in the United States."[1] The laboratory in the Chandler Street Plant served as the primary research facility for the company from 1923 until 1942. On site, the company produced pressurized oxygen for acetylene torches used in industrial welding and developed new methods of transporting liquid oxygen. In addition, scientists involved in the Manhattan Project used laboratories in the Linde Air Products Factory between 1942 and 1946.

The Linde Air Products Factory is locally significant under criterion A in the area of Industry for its associations with the nationally prominent Linde Air Products Company. The Linde Air Products Company was the nation's first provider of purified oxygen, which, when used with acetylene, powered welding torches that were critical to efficiently cut and join steel. In 1927, scientists at the Linde Air Products Factory on Chandler Street developed the Driox system, which provided unprecedented efficiency in liquid oxygen production, storage, and distribution. While the Linde Air Products Company opened other Buffalo area facilities and factories in New Jersey, Pennsylvania, and Illinois, the Linde Air Products Factory on Chandler Street was the first oxygen extraction plant in the United States and it remained an important research facility for decades.

The building has additional industrial significance, as it was one of two Linde Air Products Company sites in Western New York involved in the Manhattan Project, the federal nuclear weapons research program during World War II. The Linde Air Products Factory was used to produce barrier material, an important component in the construction of the atomic bomb.

The period of significance for the Linde Air Products Factory stretches between 1907 and 1948, beginning with the initial construction of the building and ending with the last year that the Linde Air Products Company utilized the factory. This span also includes the most expansive building phases of the facility. After Linde Air Products Company vacated the facility in 1948, the building was vacant for three years. Bell Aircraft Company leased the factory from 1951 to 1957 and used the space to manufacture parts for its larger airplane assembly plant on Kenmore Avenue. Despite later use by this nationally renowned aircraft company, the building is most strongly identified with the Linde Air Products Company and is significant for that association.

In 2010, an extensive survey of the Black Rock Neighborhood was completed with the support of the City of Buffalo's Office of Strategic Planning, the Baird Foundation, the John R. Oishei Foundation, the Preservation League of New York State, and the Buffalo Urban Renewal Agency. This survey resulted in the National

[1] "Linde Magazine Tells of Growth," *Buffalo Courier-Express,* April 26, 1957, 26.

Register Multiple Property Documentation Form (MPDF), *Historic Resources of the Black Rock Planning Neighborhood*. The purpose of the document is to streamline designation of the neighborhood's eligible National Register properties. The MPDF discusses the role of the Black Rock neighborhood within the historical development of the city of Buffalo and states that eligible industrial buildings within the survey boundaries must "be directly associated with a significant historical context; must have been constructed during the period of significance; and must display the distinctive features characteristic to the period of construction."

Based on these criteria in the Black Rock Planning Neighborhood MPDF, the Linde Air Products Factory clearly meets the requirements for National Register nomination. The building is located within the defined geographic boundaries of the Black Rock Planning Neighborhood and was built within the MPDF's period of significance. Further, the Linde Air Products Factory was the first oxygen production facility built in the United States. The German-based Linde Air Products Company, a world leader in the industrial gas extraction industry, opened the Chandler Street Plant in 1907 and occupied the site until 1948 (as a subsidiary Union Carbide after 1917). Over this time, the facility expanded according to its changing function as an oxygen extraction plant, a machinery repair center, and a research laboratory. The factory maintains a high degree of integrity from each of these roles, including office, manufacturing and laboratory spaces.

Black Rock and the New York Central Railroad Belt Line

The Linde Air Products Factory is located in a historic neighborhood known as Lower Black Rock, which is generally defined as the area along the Niagara River just north of the Scajaquada Creek. The Lower Black Rock neighborhood was part of the Village of Black Rock, a community that grew alongside Buffalo and was annexed by the City of Buffalo in 1854. Prior to the opening of the Erie Canal in 1825, Lower Black Rock was heavily wooded and sparsely settled by farmers.[2] After the Erie Canal opened, people began building mills along the Niagara River and Scajaquada Creek. By the 1830s, these mills produced tons of flour and were joined by cooperages, lumberyards, and other factories along Hertel Avenue and Amherst Street.[3] These industrial sites attracted German and Irish immigrants to Lower Black Rock and the area's population grew from 1,400 in 1855 to 2,200 in 1875.[4]

The rapid expansion of railroads following the American Civil War helped stimulate growth in Black Rock. Starting in 1871, the New York Central Railroad began laying tracks in a loop around Buffalo. The new rail network, which became known as the Belt Line, was completed in 1883 and opened up opportunities for

[2] Jennifer Walkowski, "Historic Resources of the Black Rock Planning Neighborhood, Buffalo, Erie County, NY," National Register of Historic Places Multiple Property Documentation Form, Clinton Brown Company Architecture, 2010, Section E, Page 2.
[3] Ibid., Section E, Page 9.
[4] Ibid.

industrial development around the city.[5] The rail line had nineteen stations spaced one mile apart and connected portions of the former Buffalo and Niagara Railroad, the New York Central and Hudson River Railroad, and the Lake Shore and Michigan Southern Railway.[6]

The Belt Line attracted industry to Lower Black Rock and North Buffalo where the availability of land, combined with the efficient transportation network, transformed rural neighborhoods into thriving industrial centers. Pratt & Letchworth was one of the earliest and most successful firms to develop around this time, with a thirty-five-acre saddle-making factory located at the junction of the Belt Line and Niagara and Tonawanda Streets. The continued growth of this company in the years following the Belt Line's construction lead to an influx of workers using the Belt Line to travel to work daily and encouraged their settlement in the Black Rock area.[7] By the 1880s, Polish residents from Buffalo's East Side began migrating into Black Rock, establishing a solid community base and workforce in the area around Amherst Street. Many of the workers were Polish immigrants and buildings such as the Church of Assumption at 435 Amherst Street (extant) reflect the influence these Polish workers had on Black Rock.[8]

Between 1890 and 1920, industrial activity flourished along the Niagara Street stretch of the Belt Line, southwest of Chandler Street. Companies like the Mentholatum Company (1360 Niagara Street), Great Lakes Pressed Steel Corp., George J. Meyer Malt and Grain Corp., John, Fischer & Co. Inc. Lumber Yard, and the Behr-Manning Corp created industrial character along the Niagara Street Corridor.[9]

Similarly, the Elmwood Avenue-Belt Line crossing in North Buffalo and much of the surrounding area was unbuilt until the 1890s. The 1872 Hopkins Atlas shows only two buildings on the Elmwood lots abutting the future Belt Line route and no buildings at the future Elmwood-Belt Line intersection. By 1895, however, all four corners around the intersection were bustling with industry. Freed from the necessity of locating near the waterfront or Erie Canal, companies erected facilities like the Pierce Arrow Factory (1906, NR 1974), American Radiator Complex (1891, NR 2015), Houk Manufacturing Company Factory (1910-1930, NR 2014), and Taylor Signal Company Factory (1902-1906, NR 2014).[10]

[5] Derek King, "The American Radiator Company Factory Complex," National Register of Historic Places Nomination/Inventory Form, Preservation Studios, Buffalo, April 7, 2015, Section 8, Page 2.
[6] Aaron T. Heverin, "Past Tracks: A Queen City Built by Rail," The Buffalo History Works, last updated October 1, 2010, Buffalohistoryworks.com/ptracks/.
[7] Walkowski, "Historic Resources of Black Rock," Section E, Page 10.
[8] Ibid., Section E, Page 12.
[9] Sanborn Map Company, *Buffalo, Erie County, New York*, 1950, Sheet 345.
[10] Walkowski, "Historic Resources of Black Rock," Section E, Page 11.

The History of the Gas Extraction Industry

The Linde Air Products Company, a German company that specialized in the extraction of pure oxygen from the atmosphere, contributed to the wave of industrial growth in Black Rock. Looking to expand into America, company executives took note of Buffalo's favorable transportation network and industrial density and decided to build an oxygen extraction factory in the city. Because early oxygen had to be transported in heavy metal cylinders, it was important for the Linde Air Products Company to locate its factory along a prominent rail line and near major industry. The site on Chandler Street, near the Belt Line, satisfied those transportation requirements.

While the Linde Air Products Company did not start the oxygen extraction industry, it became one of the most successful gas extraction companies of the early twentieth century due to its innovative extraction methods. Carl Von Linde, the company's founder, was born in 1842 in Berndorf, Bavaria. A renowned German scientist and engineer, Linde made several scientific breakthroughs between the 1870s and 1890s related to gas liquefaction, air separation, and refrigeration. His prior experience prepared him to contribute specifically to the oxygen extraction industry, and in 1899 his biggest achievement—extracting oxygen from liquid air—helped transform the burgeoning industry into a successful field of specialty.

While scientists experimented with separating the components of air as early as the fifteenth century, it was not until the 1850s that gas extraction companies formed specifically to pursue oxygen extraction for industrial applications. During the Second Industrial Revolution, in particular, advances in electrical generation and chemistry propelled refined practices of gas extraction and transportation. Initially, gas extraction companies captured oxygen from the atmosphere by allowing potassium chlorate ($KCLO_3$) to elementally decay, and then distributed the captured oxygen in large gasbags resembling smiths' bellows.[11] Most commonly, the oxygen extracted from potassium chlorate was mixed with hydrogen to form oxyhydrogen (HHO) and used to fuel limelights, an early theater lighting apparatus. Limelights used the combustion of oxyhydrogen against a stick of quicklime to create a bright light capable of illuminating a theater. The reaction of oxyhydrogen and quicklime was also utilized in projection lanterns and lighthouses. While effective for this limited market, the method of extracting oxygen from decaying potassium chlorate produced oxygen with many impurities, limiting its application outside general lighting.

In 1886, the Brin Process introduced a method of extracting pure oxygen on an industrial scale. Developed by brothers Leon and Arthur Brin, the Brin Process involved heating barium oxide (BaO) until it reacted to the air,

[11] Raymond G. Stokes and Ralf Banken, *Building on Air: The International Industrial Gases Industry, 1886-2006* (New York: Cambridge University Press, 2016), 19.

forming barium dioxide (BaO_2). Continued heating caused the barium dioxide to decompose, producing barium oxide and oxygen with a purity of ninety-five percent.[12]

While the higher quality oxygen facilitated new applications for the product, transportation and longevity issues still hampered its widespread use. For example, oxygen extracted through the Brin Process was mixed with nitrous oxide to form an early and effective anesthetic, however, limelights remained the primary commercial application of purified oxygen.[13] Additionally, while the Brin Process produced oxygen with a purity of 95 percent, the decomposition of barium oxide was inefficient and the elements became inert after only two or three extractions. Finally, problematic transportation methods stymied market potential until seamless steel cylinders emerged in the 1890s.[14]

Carl Von Linde developed the next major advancement in oxygen extraction in 1899, when he engineered a method for extracting oxygen from liquid air. The innovative method built upon the work of Linde's Ice Machine Company, founded in in 1879, for which he was well known in Germany. In 1895, Linde invented a cooling system that used liquefying air to cool the environment. The process, known as the Hampson-Linde Cycle, utilized compression to create the necessary conditions for successfully liquefying fixed gasses and cooling the environment. This process allowed European brewers to work year round and freed them from the limitations of using unsanitary blocks of lake or river ice to chill beer as it brewed.[15] Encouraged by the success of his early refrigeration efforts, Linde experimented further with liquefied air.

Linde recognized broader potential for his process, including the possibility of extracting pure oxygen from the liquefied air. He created an independent branch of his refrigeration company dedicated to perfecting the oxygen extraction process.[16] Initially, he thought that extracting oxygen from liquid air would be a simple process. Liquefying air had only taken Linde and his assistants a few months, and they predicted that extracting oxygen would be easy once they separated the two primary components of air: oxygen and nitrogen.[17] Linde attempted to utilize fractioned vaporizations to remove the nitrogen from the oxygen but found doing so created an oxygen concentration of only 50 percent per volume, well below the 95 percent purity achieved by the Brin Process.[18]

[12] Ibid.
[13] Ibid., 23.
[14] Ibid.
[15] John Fiehn, "Beer Museum Delights Devotees," *Long Island City Star Journal,* 1963, 3.
[16] Dienel, *Linde: History of a Technology Corporation,* 64.
[17] Ibid., 66.
[18] Ibid., 67.

Finally, in 1899, Linde solved the problem by using rectification columns that separated oxygen and nitrogen. The rectification columns yielded a purity of roughly 95 percent oxygen per volume and produced about one-hundred cubic meters of oxygen each hour and at a competitive price.[19]

Linde's success immediately catapulted him into the top three producers of pure oxygen in the world, alongside Air Liquide, a French company, and Brin's Oxygen Company (BOC) from England.[20] Each of these companies was led by a scientist or inventor who developed an efficient way to extract oxygen from the air, and each company marketed its technological processes to both national and international markets.[21]

New applications for extracted oxygen developed alongside improvements in oxygen quality and transportation methods. After 1900, metalworking industries overshadowed limelights as a primary market for extracted oxygen. In 1895 a French chemist named Henri le Chatelier found that acetylene (C_2H_2) when mixed with pure oxygen produced a flame that burned at temperatures of up to 3200C, the highest temperature ever obtained by human means at that time.[22] The powerful flame produced by this chemical mixture was capable of efficiently cutting steel and the acetylene torch became a crucial metalworking tool.

While acetylene was first used in lighting, its most successful application came in the fields of metal cutting and welding.[23] The chemical reaction of acetylene and oxygen made it possible to efficiently cut steel and had far reaching effects on building trades, repairs, ship and automobile building, scrap reclamation, and general construction.[24] Acetylene torches, also referred to as oxyacetylene torches, became key to the construction of ever-larger bridges, ships, and buildings in the early twentieth century.

Demand for acetylene torches touched off a period of growth in the oxygen extraction industry and Air Liquide, the BOC, and Linde Air Products all successfully consolidated national markets in France, Britain, and Germany around the turn of the century. In 1906, Carl Von Linde decided to expand his oxygen extraction company oversees, targeting America, where no other companies had attempted industrial scale oxygen extraction.

The Linde Air Products Company and the Linde Air Products Factory on Chandler Street

The Linde Air Products Factory on Chandler Street reflects changes in company leadership and shifts in the primary function of the plant between 1907 and 1948. Carl Von Linde continued his pursuit of oxygen

[19] Stokes and Banken, *Building on Air,* 46.
[20] Dienel, *Linde: History of a Technology Corporation,* 80.
[21] Stokes and Banken, *Building on Air,* 49.
[22] Ibid., 36
[23] Dienel, *Linde: History of a Technology Corporation,* 32.
[24] "40 Per Cent Gain in Brooklyn Building," *The Brooklyn Daily Eagle,* October 31, 1915, 22.

extraction at the site from 1907-1918. Union Carbide acquired the Linde Air Company in 1917 and transformed the facility into a machinery repair center and research hub. Various additions and modifications to the building reflect Linde Air Products' different specialties as it advanced the oxygen extraction business.

As Carl Von Linde's share of the air liquefaction and oxygen extraction market grew at the turn of the twentieth century, he decided to expand into America, which he saw as a vast untapped market. Linde contacted Charles Brush, a wealthy inventor who made his fortune in electricity and in his invention of the arc lamp. Linde convinced Brush to put up $500,000 to help found a branch of Linde Air Products in America. In 1906, Linde sent his friend Cecil Lightfoot to scout a location for the new plant.[25]

In 1907, a man named John J. Henry deeded two parcels of land on Chandler Street in Buffalo to Carl Von Linde.[26] Construction of the original section of the Linde Air Products Factory began that year and lasted six months, and on Thanksgiving Day 1907, it opened as the first American oxygen extraction plant.[27] The two-story solid masonry building featured office and manufacturing space. Specialty equipment in the factory came from Linde's plants in Germany. The company shipped air liquefiers, rectification columns, welding devices, and 5,000 pressurized tanks for storing oxygen prior to opening the Chandler Street Plant.[28]

Between 1907 and 1909 the Linde Air Products Factory in Buffalo was the only commercial source of oxygen in America, and the dramatic expansion of the facility between 1907 and 1912 demonstrates its early success.[29] First, in 1909, the company added a second floor to the original single-story factory. The following year, two single-story, brick-and-steel additions expanded the facility footprint on the West Wing and the South Wing. The tall single-story areas served as manufacturing areas, with open floorplates and opaque glass windows. In 1911 and 1912, the prominent local architectural firm Esenwein and Johnson further enlarged the factory with two small brick-and-steel additions to the eastern side of the 1907 block.

While enjoying early success from its Buffalo location, the Linde Air Products Company found that expensive transportation costs limited its reach into the broad American market. Since refined gas had to be transported in 130 pound cylinders, freight costs were excessive. To ease the high cost of transportation, Linde Air Products opened new oxygen extraction factories in Chicago, Illinois (1910), Trafford, Pennsylvania (1911), and

[25] Dienel, *Linde: History of a Technology Corporation,* 81.
[26] "City-Deeds," *The Buffalo Courier,* June 15, 1907, 9.
[27] Dienel, *Linde: History of a Technology Corporation,* 82.
[28] Ibid.
[29] Harry L. Barnitz, "Growth of the Oxygen Industry in the United States and its Relation to Oxy-Acetylene Welding and Cutting Processes," *American Gas Journal* 109, no. 19 (1918): 435.

Elizabeth, New Jersey (1911).[30] Along with their factory in Buffalo, these sites gave the Linde Air Products Company the capacity to produce 3,000,000 cubic feet of oxygen per month.[31]

With its growing capacity and market dominance, the American branch of Linde Air Products quickly outgrew its parent company, and the increasingly strained relations between Germany and America leading into the First World War only exacerbated issues between the branches. By 1912 Carl Von Linde was no longer on the board of Linde Air Products and in 1914 Cecil Lightfoot was fired from his position as manager of the Buffalo plant.[32]

Amidst this organizational upheaval, the Chandler Street Plant expanded again with additions to the North Wing and the southwest corner of the facility c.1916-1917. On the North Wing, expansion included a second story on the 1912 machine shop and new building with offices, breakrooms, showers, and lab space. At the southwest corner, abutting the 1910 South Wing and extending north towards Chandler Street, a one-story warehouse and larger manufacturing building were constructed.

In 1917, the Union Carbide Company took over Linde Air Products in America, cutting Linde and his German company out completely. A year later, in 1918, Linde's shares in the American branch of Linde Air Products were completely worthless and Linde Air Products in America became a subsidiary company of Union Carbide.[33] After its takeover by Union Carbide, Linde Air Products (in America) grew to be one of the most powerful oxygen extraction firms in the world. In 1920, the company had a share capital of fifteen million dollars and produced oxygen in twenty-eight plants.[34]

Not long after the merger with Union Carbide, the Linde Air Products Factory was converted from an oxygen production facility to machine shops for repairing acetylene torches and other oxygen extraction equipment.[35] This shift in function did not require a new building campaign, as the same open floor plates required for production were easily reconfigured for new purposes.

Later, and still under the control of Union Carbide, the Chandler Street Plant became a significant research laboratory for Linde Air Products. In 1923, the company hired its first researcher, the Harvard educated physicist Leo Isadore Dana, and by 1934 the research department at Chandler Street had twenty employees.[36] In 1938, the company converted the Chandler Street Plant to office and research space.[37] The company built the

[30] Ibid., 436.
[31] Ibid.
[32] Ibid.
[33] Ibid., 83.
[34] Ibid.
[35] "Building Once Occupied by Bell Aircraft Sold," *Buffalo Courier-Express,* December 17, 1958, 5.
[36] Dienel, *Linde: History of a Technology Corporation,* 83.
[37] "Building Once Occupied by Bell Aircraft Sold," *Buffalo Courier-Express.*

tall single-story gantry-crane areas of the East Wing 1934, perhaps as auxiliary space for research and testing of liquid gas transportation systems.

The Linde Air Products Company had a major presence in Buffalo beyond the Chandler Street Plant. By 1936, the company maintained an oxweld apparatus warehouse and sales office at 956 Main Street, an acetylene order department at 90 Hopkins Street, a warehouse at 1345 Genesee Street, and an oxygen plant and order department at 1811 Broadway.[38] The plant at 1811 Broadway is the only other remaining Linde Air Products facility extant in the city of Buffalo. Further, in 1936, Linde Air Products broke ground on a million dollar research facility in Tonawanda.[39] This facility was the site of uranium and nickel processing during the Manhattan Project and later a dumping ground for radioactive sludge and wastewater, byproducts of the development of America's first nuclear weapon.

Research and Invention at the Linde Air Products Factory

In addition to being the first oxygen extraction factory in the United States, the Chandler Street Plant was also the site of significant research that changed the way purified oxygen was shipped and used by industrial manufacturers. Under the leadership of Leo Dana, the research team at the Linde Air Products Factory overcame some of the fundamental challenges that plagued the oxygen extraction industry since its inception.

Between 1923, when Leo Dana began researching for Linde Air Products, and 1948, when the research department was moved to the Tonawanda Plant, Linde Air Products filed numerous patents for inventions related to transporting oxygen in a liquid form. While transportation of purified oxygen was improved from the 1880s, it remained inefficient and costly, and in 1927, Linde Air Products initiated an experimental research program aiming to produce, store, and distribute oxygen in a liquid form.[40] Leo Dana ran the program, which became known as the 'Driox' system. As early as 1932, Linde Air Products was able to deliver liquid oxygen to America's big steel corporations, which used the liquid oxygen to convert iron to high quality steel. Though creating liquid oxygen was an easy process, the transportation and storage of the liquefied gas was problematic in the early 1930s. Because of its low boiling point (90K), any situation resulting in heat transfer between the storage container and liquid oxygen resulted in a measure of the oxygen returning to an unusable gaseous state. The researchers at the Chandler Street Plant worked to resolve this issue and create an efficient method of delivering liquid oxygen to the company's clients.

Some of the researchers' most important developments pertained to storage containers for liquid oxygen. In 1934, Dana and fellow researcher George Zenner patented a container for liquefied gases that consisted of an

[38] "Officials to Break Ground Today for $1,000,000 Plant," *Buffalo Courier-Express,* December 29, 1936, 15.
[39] Ibid.
[40] Ebbe Almqvist, *History of Industrial Gases* (New York: Springer Science + Business Media, 2003), 226.

inner core for storing the liquid gasses and an outer layer of thermal insulation to prevent the rapid expansion or evaporation of said gasses.[41] Dana and Arnold Hansen worked to improve the container, filing a patent in 1935 to improve the retention of stored gasses in a liquid form. To ensure environmental heat did not infiltrate the stored gasses, converting some of the liquid gasses back to their natural gaseous state, the patent argues that a refrigeration medium between the inner and outer layer of the storage container was necessary to impede heat flow.[42] In 1943, Dana filed another patent for a storage container for liquid gasses that built from the first two patents. It argued in specific and technical language how best to store liquid gasses based on the temperature of their vaporization (less that 100K vs. greater than 100K) and identified the best solids to serve as insulation.[43]

Research at the Chandler Street Plant was critical to the growth of the Linde Air Products Company and helped American steel companies produce higher quality metal. The patents filed by Dana and Linde Air Products were crucial to the development of the Driox System, and as the company's oxygen storage tanks improved, their shipping capacity grew immensely. The introduction of Dana's storage containers allowed Linde Air Products to ship up to twenty-five tons of liquid oxygen in a train car.[44] This increased the amount of compressed oxygen the company was able to ship by ten times the previous amount. The ability to ship huge volumes of liquid oxygen made Linde Air Products the leader in industrial oxygen production in America. Additionally, steel manufacturers could more aggressively utilize liquid oxygen in their production process, creating higher quality steel than had previously been possible given earlier delivery methods for purified oxygen.[45]

The work of Leo Dana and Linde Air Products was recognized in 1947, when Dana received the Jacob F. Schoellkopf Medal, a prestigious award given by the Western New York Section of the American Chemical Society. This award recognized Dana's contributions to the field of chemistry in Western New York and the importance of his discovery of an effective method for shipping large amounts of liquid oxygen and nitrogen.[46]

Advances in the storage and transportation of liquid oxygen were the primary focus of Linde's research team at the Chandler Street Plant until 1942, when the plant shifted towards research and production related to the Manhattan Project. Scientists used laboratories in the Chandler Street Plant between 1942 and 1946 to produce barrier material necessary for the gaseous diffusion process then being used to enrich uranium. After the Second

[41] Leo Dana, and George Zenner, Container for Liquefied Gases, US Patent 1976688A, filed April 19, 1932, and issued October 9, 1934.
[42] Leo Dana, and Arnold Hansen, Method and Apparatus for Handling Gas Materials, US Patent 2148109A, filed May 16, 1935, issued February 21, 1939.
[43] Leo Dana, Insulated Container for Liquid Gasses and the Like, US Patent 2396459A, filed August 28, 1943, issued March 12, 1946.
[44] Robert D. Stief, *A History of Union Carbide Corporation From the 1890s to the 1990s* (Danbury: Carbide Retiree Corps, Inc., 1998), 34.
[45] "Union Carbide Earnings Down," *Buffalo Courier-Express,* March 27, 1939, 17.
[46] "The Jacob F. Schoellkopf Medal 1931-2015," The Western New York American Chemical Society, http://wny.sites.acs.org/SchoellkHist.pdf.

World War, the Chandler Street Plant continued as a research site for Linde Air Products until 1948, when all research functions were moved to the company's Tonawanda Plant.

Linde Air Products and the Manhattan Project[47]

Between 1942 and 1946 several companies in Tonawanda/Buffalo, including Linde Air Products, were involved in the 'Feed Materials Program' for the Manhattan Project.[48] The program's directives involved taking raw ores containing uranium and thorium, converting these raw materials into concentrated uranium or thorium, then refining them into various compounds such as uranium dioxide, uranium tetrafluoride, uranium hexafluoride, or uranium metal.[49] In Tonawanda, the military contracted four companies to serve as feeder sites, including: Linde Air Products, the Electro Metallurgical Company, the Hooker Electrochemical Company, and the Harshaw Chemical Company.[50] Each company was responsible for a different element of uranium production and chemical processing. An investigative report from the 1980s detailed the roll of Linde Air Products as follows:

> Linde had experience in the ceramics business, working with uranium ore which was used to make the salts that were used in the production of ceramic glaze. Linde's role in the Manhattan Project was to take tons of uranium bearing ore, both American and African, refine it down, then move it on to the next processing plant. Refinement was done in three steps. Step one produced a black oxide, which was sent to Hooker (in nearby Niagara Falls) for an acid bath, and was then sent back to Linde. Step two produced a brown oxide, or uranium dioxide, and step three produced uranium tetrafluoride, a green salt, which was sent to Electromet (Electro Metallurgical Company in Tonawanda).[51]

During the three years Linde Air Products processed materials for the Manhattan Project, the company refined 300 tons of brown oxide and 2,060 tons of green salts.[52] Linde primarily refined its uranium ore at the Tonawanda Ceramics Plant; however, researchers from the Chandler Street facility were also involved in the Manhattan Project.[53] While the Tonawanda Ceramics Plant has a well-documented history, the operations of the Linde Air Products Factory remained classified.[54] However, workers operating out of the plant were clearly

---

[47] While the Manhattan Project is a theme of national significance, the Linde Air Products factory's significance and role in the project is here only considered as significant at the local level. Based on the background research for this nomination, this plant played an important role in supporting the Manhattan Project, but did not play a major, critical role in the development or production of nuclear material. Additional, more thorough research analyzing the plant's production and scientific role in the larger, nation-wide project would need to be developed in order to augment a national level of significance.

[48] Vincent C. Jones, *Manhattan: The Army and The Atomic Bomb* (Washington D.C.: Center of Military History, 1985), 307.

[49] Ibid.

[50] Ibid., 309.

[51] Fred Isseks, "Love Canal and the Manhattan Project," *Garbage Gangsters and Greed,* http://www.garbagegangstersandgreed.com/.

[52] Jones, *Manhattan: The Army and The Atomic Bomb,* 315-6.

[53] "Linde Ceramics Plant Pulling Out of A-Bomb Work," *Buffalo Courier-Express,* June 22, 1946, 15.

[54] Ralph Blumenthal, "Big Atom Waste Site Reported Found Near Buffalo," *New York Times,* February 1, 1981, 31.

involved in the Manhattan Project. On October 4, 1945 General Leslie Groves, military commander of the Manhattan Project, came to Buffalo for an awards ceremony to honor the men and women from Western New York who had worked on the Manhattan Project. As part of his visit Groves handed out metals to representatives of each of the Linde plants involved in the creation of the nuclear bomb; among the recipients was Louis Ayres of the Chandler Street Plant.[55] Additionally, Leo Dana was listed as another scientist involved in the Manhattan Project.[56]

An evaluation by the Department of Energy from 1987 details the role of the Linde Air Products Factory. The report states that the facility developed and produced non-radioactive materials for the Oak Ridge Gaseous Diffusion Plant.[57] Specifically, the document lists the production of sintered nickel used for barrier fabrication as the plant's primary function with research as a secondary focus of the plant.[58] Barrier material was critical to the creation of uranium-235, the fission material inside the atomic bomb. Uranium-235 is the only naturally occurring fissionable nucleus of uranium but only makes up 0.72 percent of natural uranium.[59] Scientists utilized a process known as gaseous diffusion to produce uranium-235. In gaseous diffusion, uranium hexafluoride was passed through porous membranes made of nickel or aluminum. The uranium hexafluoride was 'cascaded' up to 3,000 times through the membranes, which had pores no larger than twenty-five nanometers and separated the uranium nuclei from the fluoride.[60] Once completed, the process of gaseous diffusion resulted in uranium that had been enriched up to 90 percent uranium-235.[61] The barrier material produced at the Linde Air Products Factory was a crucial component to the gaseous diffusion process. The factory produced sintered nickel that was used as the porous membranes through which the uranium hexafluoride passed.

After the Second World War ended there was debate about keeping the Linde Air Products Factory as an active site. Those in favor of maintaining the factory believed it would be ultimately cheaper and allow the scientists who'd been working to perfect the creation of barrier material to continue their work undisturbed.[62] Further, in the event of an emergency, production at the Linde Air Products Factory could be ramped up with less difficulty than at Oak Ridge.[63] Ultimately however, the decision was made to centralize nuclear research at Oak Ridge and the Linde Air Products Factory was closed by the Manhattan Project.

---

[55] "Realism about A-Bomb Asked by General Groves," *Buffalo Courier-Express,* October 4, 1945, 26.
[56] "Leo Dana Dies at 94; Aide at Union Carbide," *The New York Times,* August 23, 1990, 6.
[57] U.S. Department of Energy, *NY: 65-2 Linde Air Products Division Union Carbide Corporation* (Washington, DC: GPO, 1991), 3.
[58] Ibid.
[59] Simon Cotton, *Lanthanide and Actinide Chemistry* (Uppingham: John Wiley & Sons, Ltd., 2006), 163.
[60] Ibid.
[61] Ibid.
[62] U.S. Department of Energy, *Memorandum to Dr. G. T. Felbeck* (Washington DC: GPO. 1946), 3.
[63] Ibid., 4.

Subsequent Tenants

In 1948, the General Services Administration purchased the Linde Air Products Factory, and in 1951, the Bell Aircraft Corporation began leasing the building.[64] Founded in 1935, the Bell Aircraft Corporation designed and built planes. The company was well known for the line of fighters and bombers it developed during World War II, including the P-39 Airacobra and the P-63 Kingcobra.

The Bell Aircraft Corporation also produced parts for jet engines used by other aircraft companies. After leasing the Linde Air Products Factory in 1952, the Bell Aircraft Corporation used the building to manufacture parts for the B-47 Stratojet and B-52 Stratofortress.[65] The jet engine components manufactured in the Chandler Street Plant were sent to the Bell Aircraft Corporation's main plant on Kenmore Avenue, where they were incorporated into the planes as they were assembled.[66] In addition to the Kenmore plant, Bell Aircraft had major facilities on Elmwood Avenue and in Wheatfield, New York. The Wheatfield facility was the primary manufacturing site of Bell Aircraft's two popular warplanes. In total, the Bell Aircraft Company had 1,800,000 square feet of manufacturing space in Western New York, of which only 67,000 square feet was contained in the Chandler Street Plant.[67] The Bell Aircraft Company left the Linde Air Products Factory in 1957, and a year later the General Services Administration sold the factory to the G&R Machinery Equipment Company for $93,000.[68] Upon purchasing the factory, Donald L. Rosen, owner of G&R Machinery Equipment, subdivided the building and rented it out as an industrial center.[69] Over half of the building remained vacant, however, with small office and storage build outs in the North Wing and shipping operations out of the East Wing.

Architects of the Linde Air Products Factory/Chandler Street Plant

James B. McCreary

The oldest portion of the Linde Air Products Factory was designed by James B. McCreary of the architectural firm of McCreary, Wood, & Bradney. McCreary designed the original two-story factory and office that was constructed for $30,000. In addition to the work McCreary completed at the Linde Air Products Factory, he also designed the Medina City Hall in 1908 (NR District 1995). Together with Wood and Bradney, McCreary also designed several notable buildings in Buffalo including the Sidway (1906) and Spaulding Buildings (1906)

[64] "Five Buildings Sold by Bell to Benderson," *Buffalo Courier-Express,* November 22, 1957, 11.
[65] "150 Walk Out at Bell Plant; Output Halts," *Buffalo Courier-Express,* March 22, 1957, 7.
[66] "Bell Aircraft to Use Chandler St. Plant," *Buffalo Courier-Express,* December 15, 1951, 20.
[67] Ibid.
[68] "Building Once Occupied by Bell Aircraft Sold," *Buffalo Courier-Express*, December 17, 1958, 1.
[69] "Buffalo Firm Buys Industrial Building," *Niagara Falls Gazette,* December 17, 1958, 12.

in downtown Buffalo. The firm also designed five distinguished Colonial Revival homes adjacent to Delaware Park for John D. Larkin that would be collectively known as 'Larkland.'[70]

Esenwein & Johnson

The 1911 and a 1912 additions to the Linde Air Products Factory were designed by locally prominent architecture firm Esenwein & Johnson. Consisting of German-born August C. Esenwein (1856-1926) and American James A. Johnson (1865-1939), the firm secured over one thousand commissions during its existence, showcasing proficiency in a diverse range of building types, including factories.[71] Esenwein attended the Stuttgart Polytechnic University and worked in a Parisian architect's office before immigrating to Buffalo in 1880. After a brief stint working as a civil engineer for the Delaware, Lackawanna and Western Railroad, he left to pursue an architectural career. During his years of independent practice, Esenwein designed the Italian Renaissance style Buffalo Music Hall (1882-1883), the Romanesque German-American Brewery & Hall (1893 and 1895), and the Queen Anne style Alfred Schoellkopf Residence (1895-1896).[72] He also won a competition to design the Temple of Music for Buffalo's 1901 Pan American Exposition.[73]

Prior to joining Esenwein, Johnson worked with several notable New York architectural firms, including McKim, Mead and White, and Richard Morris Hunt, where he gained a strong background in neoclassical styles. In Buffalo, he worked briefly with James H. Marling (1892-1895) and William H. Boughton (1895-1897), designing Colonial Revival residential buildings before partnering with Esenwein in 1897.[74] Over the course of their career together, Esenwein and Johnson became the premier architectural firm in Western New York. As of 2016, the firm has over a dozen buildings listed on the National Register of Historic Places, a testament to their outstanding skill and the impact that they had on the built environment of the region. Esenwein & Johnson designed a variety of building types—including public buildings, commercial structures, and residences—and drew from a diverse range of stylistic references, creating such notable projects as the Mayer & Well commercial building (1898-1899), the Hotel Touraine (1901-1902), Lafayette High School (1901, NR 1980), the Providence Retreat asylum (1905-1908), the original Hotel Statler (1905-1906), the Calumet Building (1906, NR 2010), the Automobile Club of Buffalo (1910-1911, NR 2012), and the M. Wile & Company Factory Building (1924, NR 2000). The firm's 1911 addition to the Linde Air Products Factory and

[70] Chris Bush, "Medina's Historic City Hall: An Enduring Piece of WNY's Architectural Heritage," *2 Your Town,* WGRZ Orleans County, http://orleanscounty.wgrz.com/news/70959-medinas-historic-city-hall-enduring-piece-wnys-architectural-heritage.
[71] Kerry Traynor, "The Calumet," National Register of Historic Places Nomination/Inventory Form, kta preservation specialists, Buffalo, August 30, 2010, Section 8, Page 2.
[72] Martin Wachadlo, "Work Completed Prior to Partnership," Art Nouveau and Other Expressions: Rediscovering the Architecture of Esenwein & Johnson, Buffalo & Erie County Historical Society, 2007, http://www.buffalohistory.org/Explore/Exhibits/virtual_exhibits/esenwein_johnson/esenwein_before.htm.
[73] "The Temple of Music," Pan-American Exposition of 1901, University at Buffalo Libraries, http://library.buffalo.edu/pan-am/exposition/music/templetext.html.
[74] Wachadlo, "Work Completed Prior to Partnership," *Art Nouveau and Other Expressions*.

1912 machine shop are representative examples of the duo's ability to build utilitarian factory spaces in addition to architecturally stylish buildings.

Summary

The Linde Air Products Factory at 155 Chandler Street is a locally significant building for its role as the first purified oxygen factory in the United States of America. The factory complex is also significant for its role in the Manhattan Project, one of the most significant military projects ever undertaken. Built in 1907 and operated until 1948 by Linde Air Products, the plant was initially used to produce pure oxygen for use in acetylene torches, an important early twentieth century metal cutting tool. Following the purchase of Linde Air Products by the Union Carbide Company, the Chandler Street Plant was converted to a repair shop for oxygen extraction equipment and acetylene torches. Additionally, the facility became a research facility during this period, a role it would maintain until Linde Air Products left the space in 1948.

Bibliography:

Almqvist, Ebbe. *History of Industrial Gases*. New York: Springer Science + Business Media, 2003.

Barnitz, Harry L. "Growth of the Oxygen Industry in the United States and its Relation to Oxy-Acetylene Welding and Cutting Processes." *American Gas Journal* 109, no. 19 (1918): 434-436.

Blumenthal, Ralph. "Big Atom Waste Site Reported Found Near Buffalo." *New York Times,* February 1, 1981.

Brooklyn Daily Eagle. "40 Per Cent Gain in Brooklyn Building," October 31, 1915.

Buffalo Courier-Express. "150 Walk Out at Bell Plant; Output Halts," March 22, 1957.

Buffalo Courier-Express. "Bell Aircraft to Use Chandler St. Plant," December 15, 1951.

Buffalo Courier-Express. "Building Once Occupied by Bell Aircraft Sold." December 17, 1958.

Buffalo Courier-Express. "Five Buildings Sold by Bell to Benderson," November 22, 1957.

Buffalo Courier-Express. "Linde Ceramics Plant Pulling Out of A-Bomb Work," June 22, 1946.

Buffalo Courier-Express. "Linde Magazine Tells of Growth," April 26, 1957.

Buffalo Courier-Express. "Officials to Break Ground Today for $1,000,000 Plant," December 29, 1936.

Buffalo Courier-Express. "Realism about A-Bomb Asked by General Groves." October 4, 1945.

Buffalo Courier-Express. "Union Carbide Earnings Down," March 27, 1939.

Bush, Chris. "Medina's Historic City Hall: An Enduring Piece of WNY's Architectural Heritage." *2 Your Town WGRZ Orleans County.* http://orleanscounty.wgrz.com/news/70959-medinas-historic-city-hall-enduring-piece-wnys-architectural-heritage.

Cotton, Simon. *Lanthanide and Actinide Chemistry.* Uppingham: John Wiley & Sons, Ltd., 2006.

Dana, Leo. Insulated Container for Liquid Gasses and the Like. US Patent 2396459A, filed August 28, 1943, issued March 12, 1946.

Dana, Leo. and Arnold Hansen. Method and Apparatus for Handling Gas Materials. US Patent 2148109A, filed May 16, 1935, issued February 21, 1939.

Dana, Leo, and George Zenner. Container for Liquefied Gases. US Patent 1976688A, filed April 19, 1932, and issued October 9, 1934.

Dienel, Hans-Liudger. *Linde: History of a Technology Corporation.* New York: Palgrave Macmillan, 2004.

Fiehn, John. "Beer Museum Delights Devotees." *Long Island City Star Journal,* 1963.

Isseks, Fred. "Love Canal and the Manhattan Project." *Garbage Gangsters and Greed.* http://www.garbagegangstersandgreed.com/.

Jones, Vincent C. *Manhattan: The Army and The Atomic Bomb*. Washington D.C.: Center of Military History, 1985.

King, Derek. "The American Radiator Company Factory Complex." National Register of Historic Places Nomination/Inventory Form. Preservation Studios, Buffalo, April 7, 2015.

New York Times. "Leo Dana Dies at 94; Aide at Union Carbide," August 23, 1990.

Niagara Falls Gazette. "Buffalo Firm Buys Industrial Building," December 17, 1958.

Stief, Robert D. *A History of Union Carbide Corporation From the 1890s to the 1990s.* Danbury: Carbide Retiree Corps, Inc., 1998.

Stokes Raymond G., and Ralf Banken. *Building on Air: The International Industrial Gases Industry, 1886-2006*. New York: Cambridge University Press, 2016.

Traynor, Kerry. "The Calumet." National Register of Historic Places Nomination/Inventory Form. kta preservation specialists, Buffalo, August 30, 2010.

"The Temple of Music." Pan-American Exposition of 1901. University at Buffalo Libraries. http://library.buffalo.edu/pan-am/exposition/music/templetext.html.

U.S. Department of Energy. *Memorandum to Dr. G. T. Felbeck.* Washington DC: GPO. 1946.

U.S. Department of Energy. *NY: 65-2 Linde Air Products Division Union Carbide Corporation.* Washington, DC: GPO, 1991.

Wachadlo, Martin. "Work Completed Prior to Partnership." Art Nouveau and Other Expressions: Rediscovering the Architecture of Esenwein & Johnson. Buffalo & Erie County Historical Society. 2007. http://www.buffalohistory.org/Explore/Exhibits/virtual_exhibits/esenwein_johnson/esenwein_before.htm.

Walkowski, Jennifer. "Historic Resources of the Black Rock Planning Neighborhood, Buffalo, Erie County, NY." National Register of Historic Places Multiple Property Documentation Form. Clinton Brown Company Architecture, Buffalo, 2010.

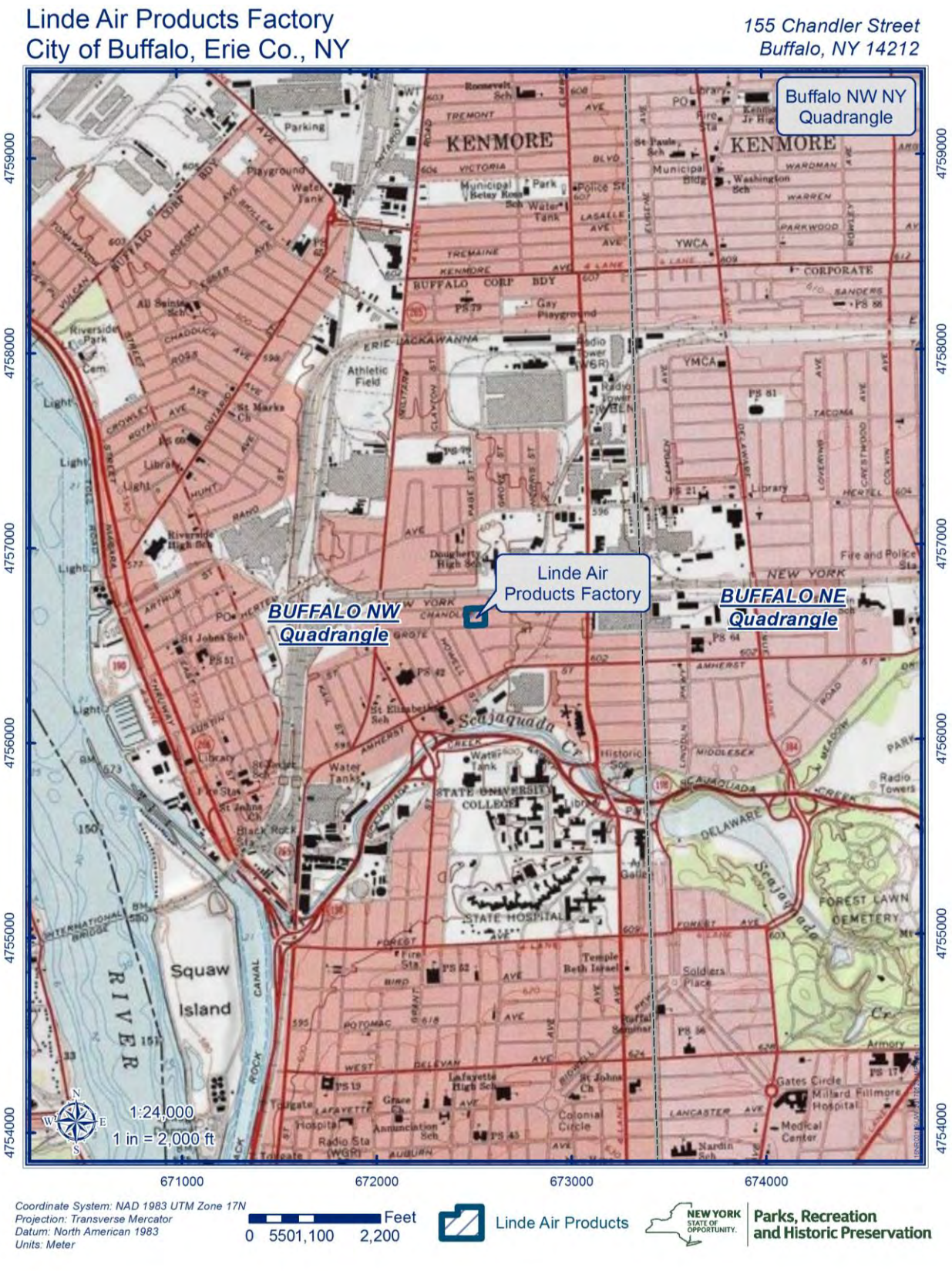
The Western New York American Chemical Society. "The Jacob F. Schoellkopf Medal 1931-2015." http://wny.sites.acs.org/SchoellkHist.pdf.

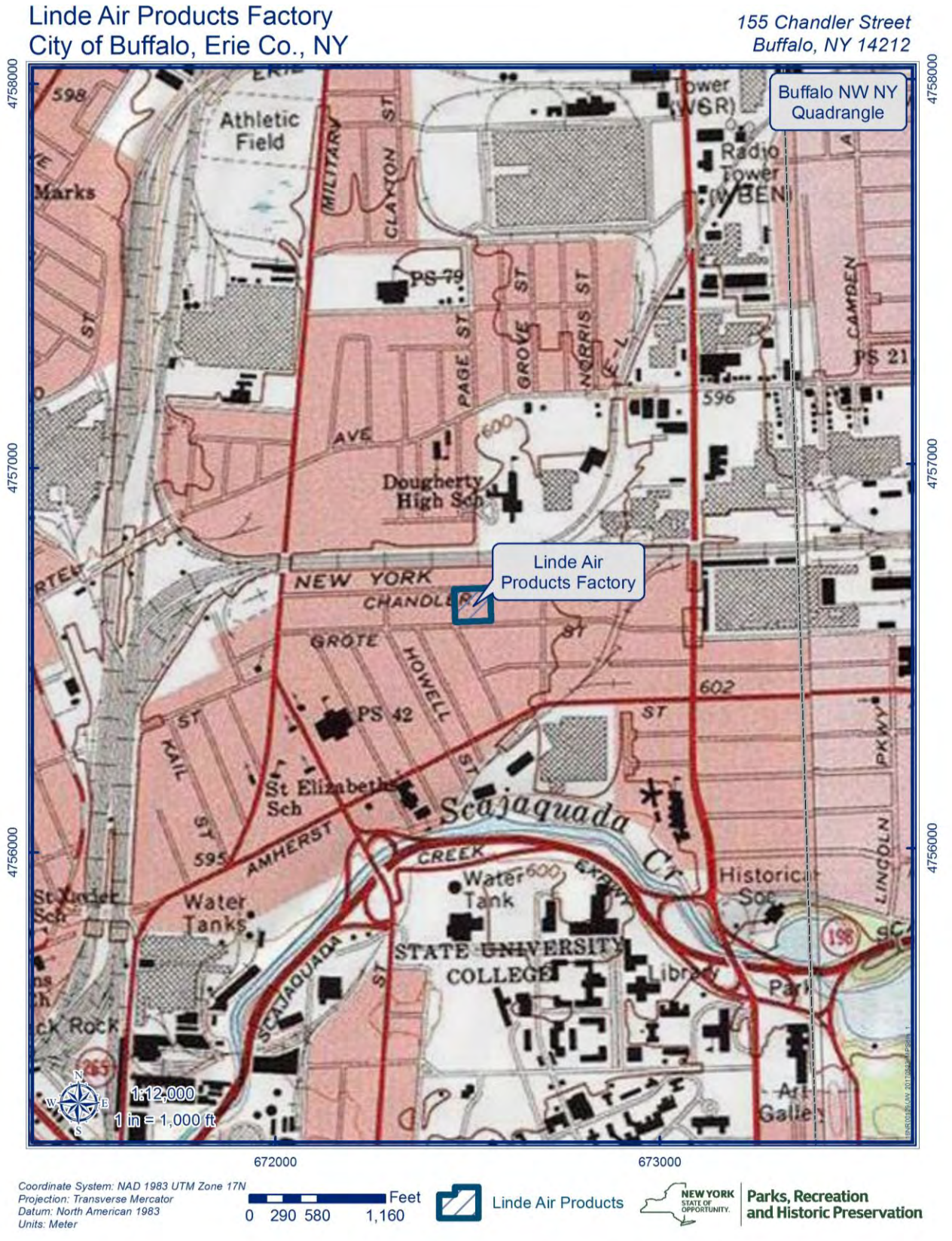
Verbal Boundary Description

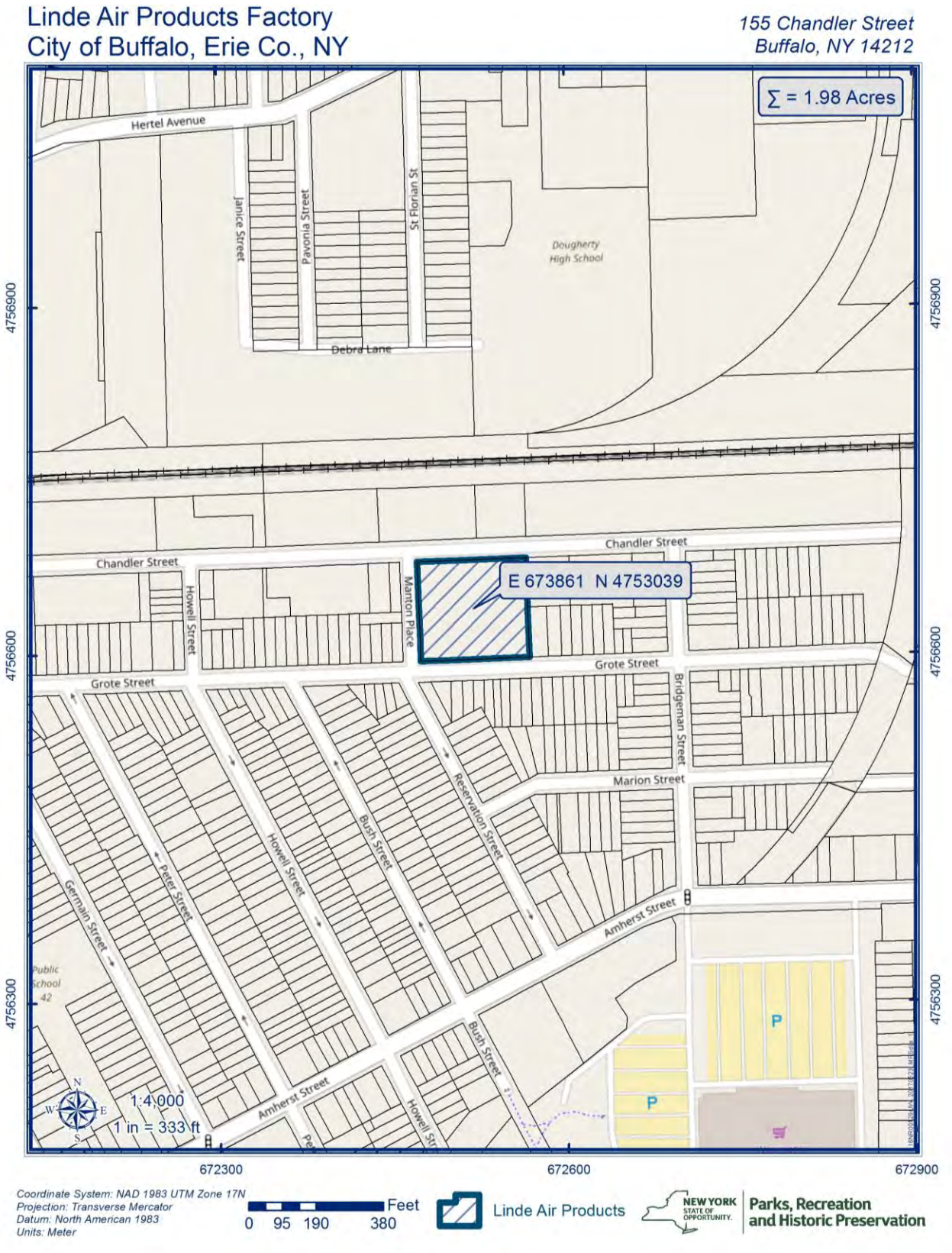
The boundary is indicated with a heavy line on the attached maps with scale.

Boundary Justification

The boundary encompasses all land historically and currently associated with the Linde Air Products Factory.


Linde Air Products Factory
City of Buffalo, Erie Co., NY
155 Chandler Street
Buffalo, NY 14212
Buffalo NW NY Quadrangle
Linde Air Products Factory
BUFFALO NW Quadrangle
BUFFALO NE Quadrangle
KENMORE
Squaw Island
RIVER
Scajaquada Cr
STATE UNIVERSITY COLLEGE
STATE HOSPITAL
FOREST LAWN CEMETERY
1:24,000
1 in = 2,000 ft
4759000
4758000
4757000
4756000
4755000
4754000
671000
672000
673000
674000
Coordinate System: NAD 1983 UTM Zone 17N
Projection: Transverse Mercator
Datum: North American 1983
Units: Meter
Feet
0 5501,100 2,200
Linde Air Products
NEW YORK STATE OF OPPORTUNITY.
Parks, Recreation and Historic Preservation


Linde Air Products Factory
City of Buffalo, Erie Co., NY
155 Chandler Street
Buffalo, NY 14212
Buffalo NW NY Quadrangle
Linde Air Products Factory
Athletic Field
Radio Tower (WSR)
Radio Tower (WBEN)
PS 79
PS 21
PS 42
Dougherty High Sch
St Elizabeths Sch
Water Tank
Water Tanks
STATE UNIVERSITY COLLEGE
Scajaquada Cr
Scajaquada Creek
NEW YORK
CHANDLER
GROTE
HOWELL
AMHERST
MILITARY
CLAYTON
PAGE
GROVE
NORRIS
CAMDEN
LINCOLN
PKWY
KAIL
AVE
4758000
4757000
4756000
672000
673000
1:12,000
1 in = 1,000 ft
Coordinate System: NAD 1983 UTM Zone 17N
Projection: Transverse Mercator
Datum: North American 1983
Units: Meter
Feet
0 290 580 1,160
Linde Air Products
NEW YORK STATE OF OPPORTUNITY.
Parks, Recreation and Historic Preservation


Linde Air Products Factory
City of Buffalo, Erie Co., NY
155 Chandler Street
Buffalo, NY 14212
∑ = 1.98 Acres
E 673861 N 4753039
Hertel Avenue
Janice Street
Pavonia Street
St Florian St
Dougherty High School
Debra Lane
Chandler Street
Howell Street
Manton Place
Grote Street
Bridgeman Street
Marion Street
Reservation Street
Bush Street
Amherst Street
Germain Street
Peter Street
Public School 42
P
1:4,000
1 in = 333 ft
4756900
4756600
4756300
672300
672600
672900
Coordinate System: NAD 1983 UTM Zone 17N
Projection: Transverse Mercator
Datum: North American 1983
Units: Meter
Feet
0 95 190 380
Linde Air Products
NEW YORK STATE OF OPPORTUNITY.
Parks, Recreation and Historic Preservation


Linde Air Products Factory
City of Buffalo, Erie Co., NY
155 Chandler Street
Buffalo, NY 14212
∑ = 1.98 Acres
Hertel Ave
Janice St
Pavonia St
Saint Florian St
Debra Ln
Chandler St
Manton Pl
E 673861 N 4753039
Grote St
Bridgeman St
Marion St
Reservation St
Howell St
Peter St
Germain St
Amherst St
Bush St
4756900
4756600
4756300
672300
672600
672900
1:4,000
1 in = 333 ft
Coordinate System: NAD 1983 UTM Zone 17N
Projection: Transverse Mercator
Datum: North American 1983
Units: Meter
Feet
0 95 190 380
Linde Air Products
NEW YORK STATE OF OPPORTUNITY.
Parks, Recreation and Historic Preservation

Additional Information

List of Photographs

Name of Property: Linde Air Products Factory
City or Vicinity: Buffalo
County: Erie
State: New York
Name of Photographer: Derek King; Benjamin Siegel
Date of Photographs: October 2016; April 2017
Number of Photographs: 10

NY_Erie County_ Linde Air Products Factory _0001
North elevation, northeast corner, camera facing southwest

NY_Erie County_ Linde Air Products Factory _0002
North elevation, northwest corner, camera facing southeast.

NY_Erie County_ Linde Air Products Factory _0003
West elevation, camera facing southeast.

NY_Erie County_ Linde Air Products Factory _0004
South Elevation, camera facing east

NY_Erie County_ Linde Air Products Factory _0005
West elevation of east wing, from courtyard, showing tall windows, camera facing east.

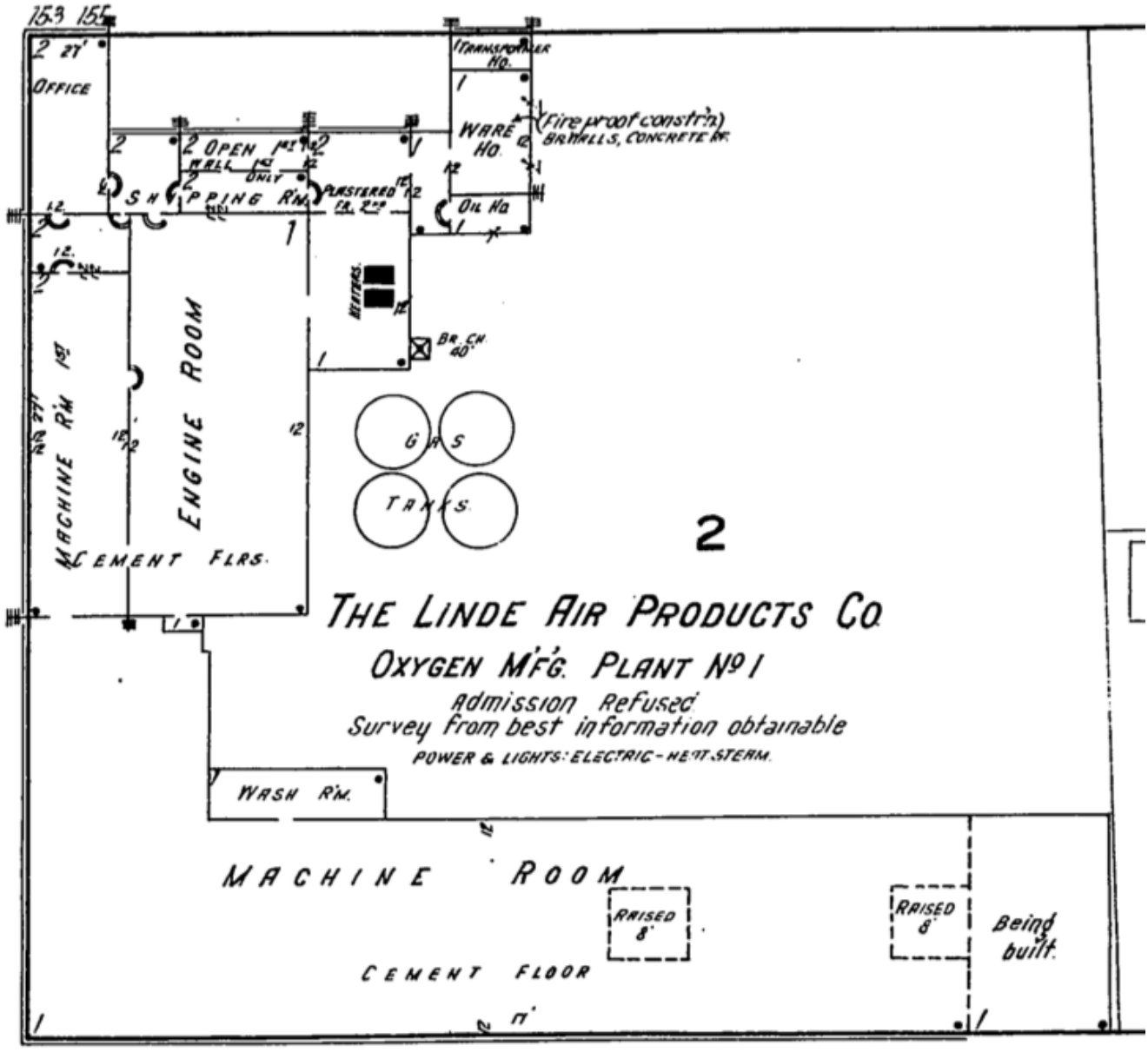
NY_Erie County_ Linde Air Products Factory _0006
Linde smokestack, camera facing east.

NY_Erie County_ Linde Air Products Factory _0007
Interior of 1910 portion of West Wing, camera facing south.

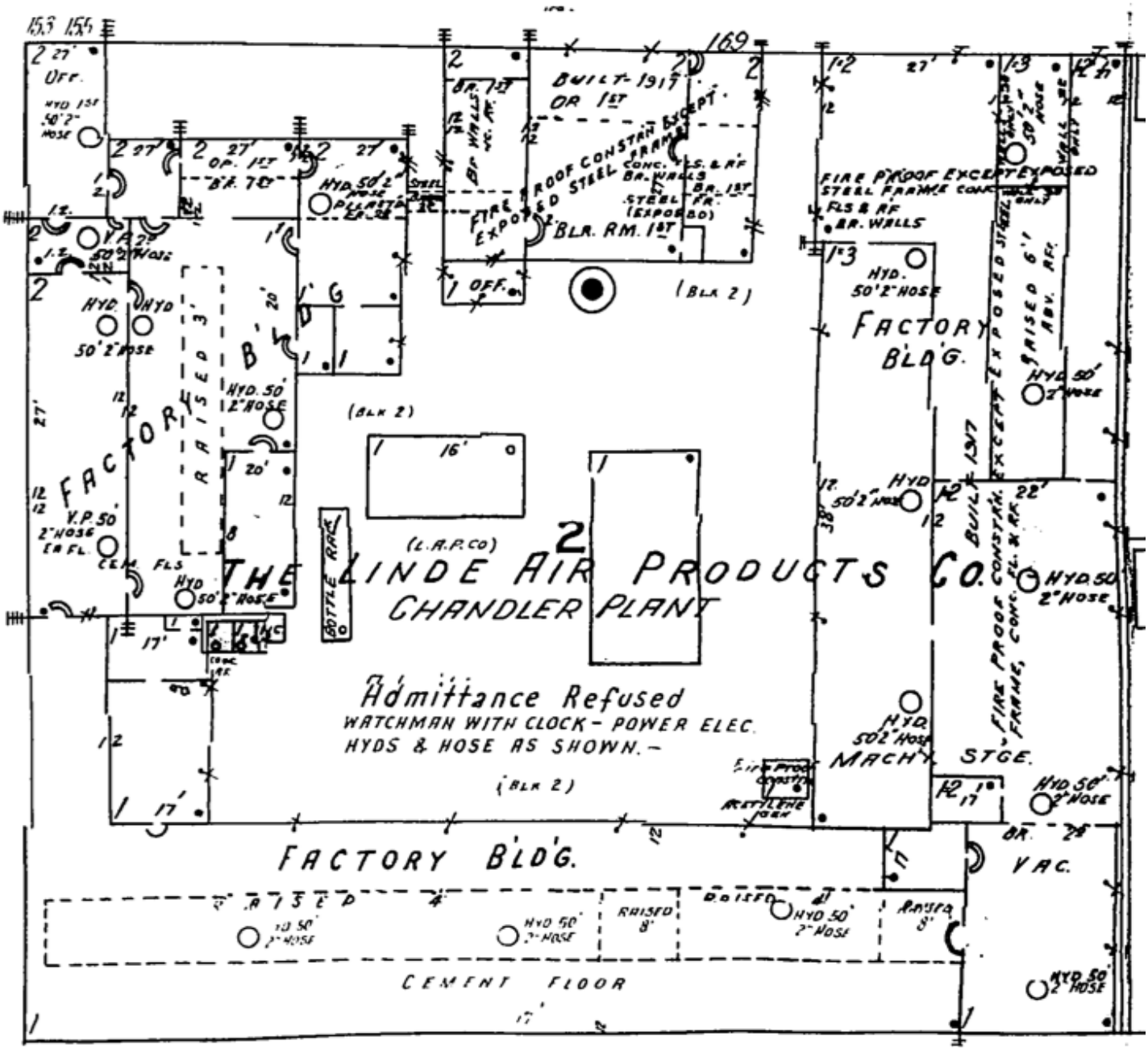
NY_Erie County_ Linde Air Products Factory _0008
Interior of 1910 South Wing, camera facing east.

NY_Erie County_ Linde Air Products Factory _0009
Interior of 1934 East Wing, camera facing north.

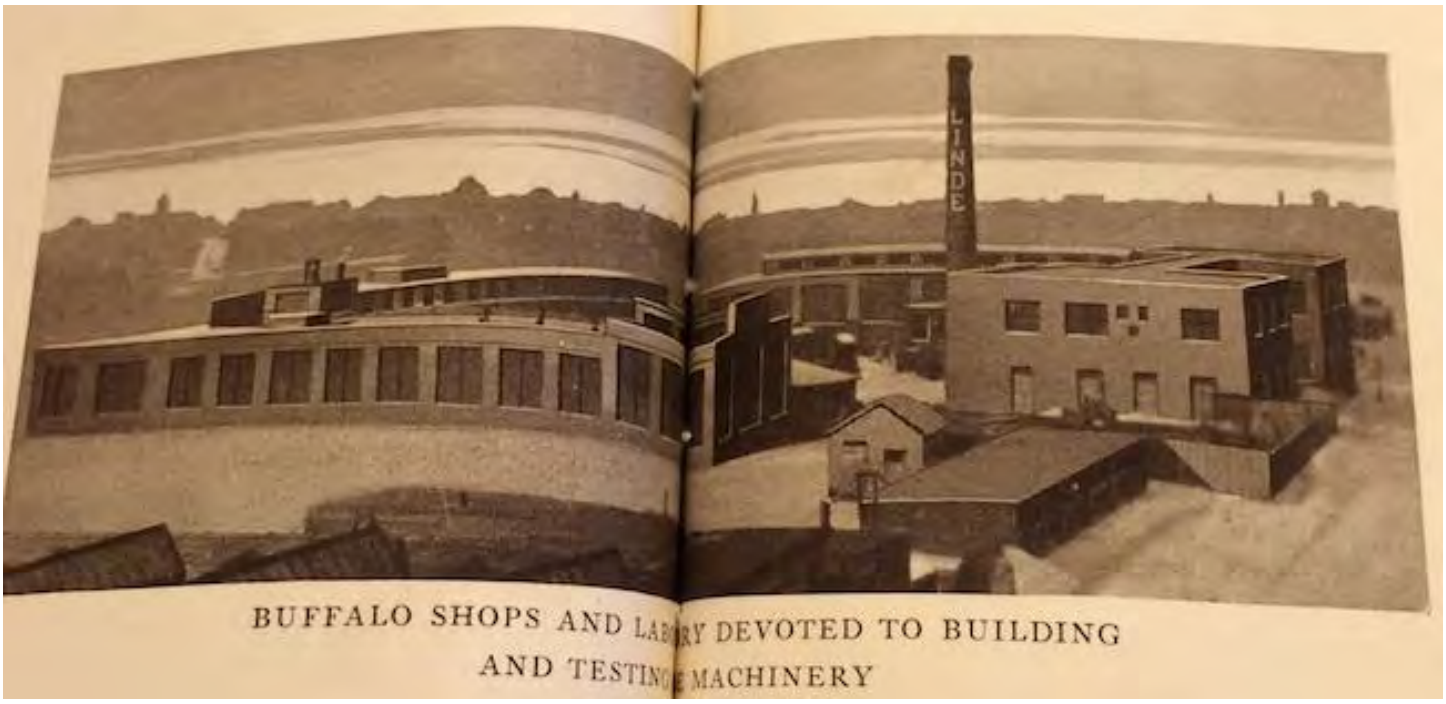
NY_Erie County_ Linde Air Products Factory _0010
Second floor office of North Wing, camera facing north.



Sanborn Fire Insurance Map (1916)
Map shows the early development of the Chandler Street Plant.



Fire Insurance Sanborn Map (1928)
Sanborn Map depicting the growth of the Linde Air Products factory by 1928.

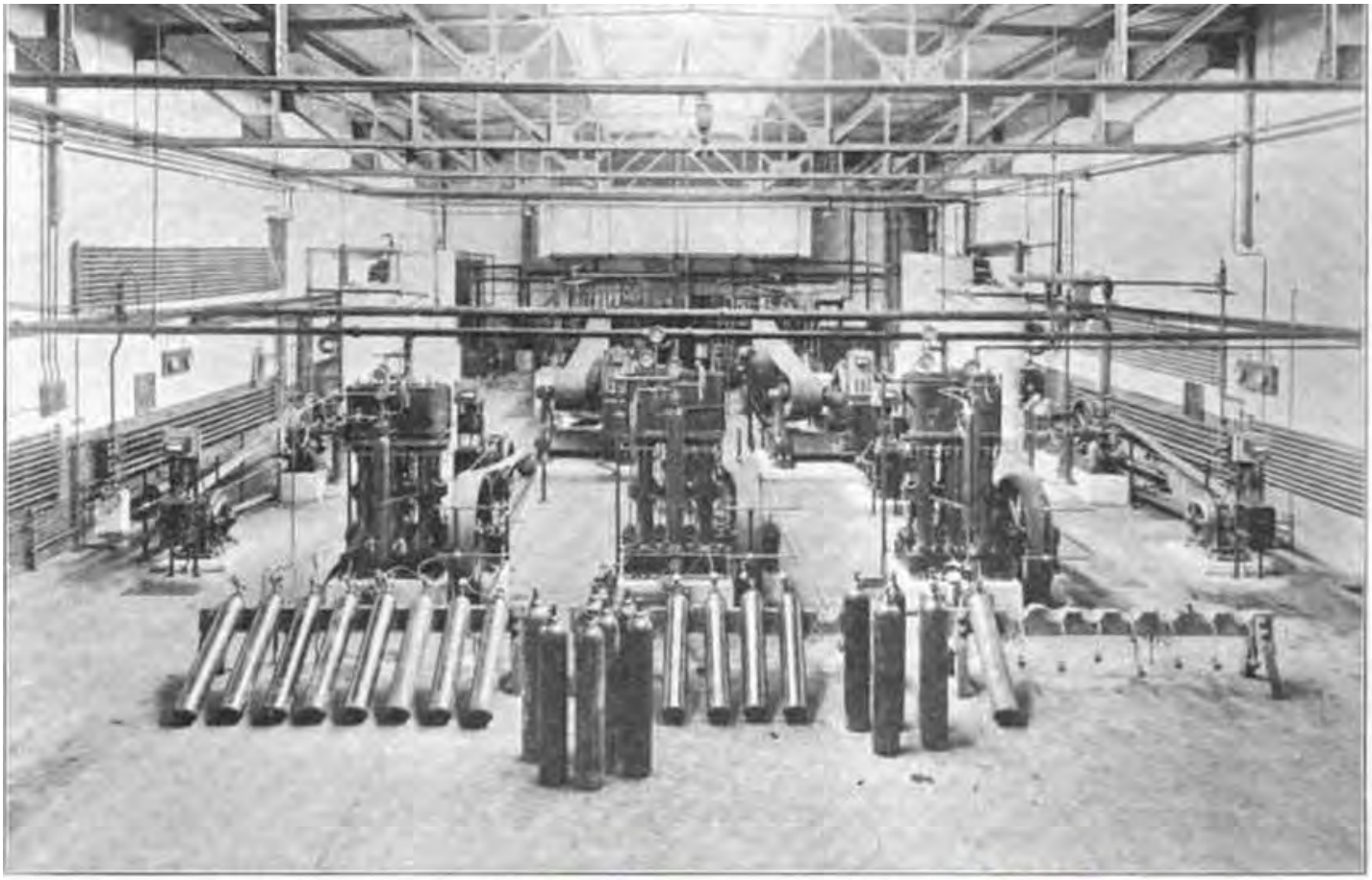


Drawing of the Linde Air Products Factory (1924)

Drawing depicts the Linde Air Products Factory after its purchase by the Union Carbide Corporation. *The Union Carbide and Carbon Corporation: Activities and Products of the Important Subsidiaries* (New York City: Union Carbide and Carbon Corporation, 1924), 28-29.

Drawing of the Machine Shop's Interior that shows the equipment and materials utilized by the factory while it operated as a research facility (1924)

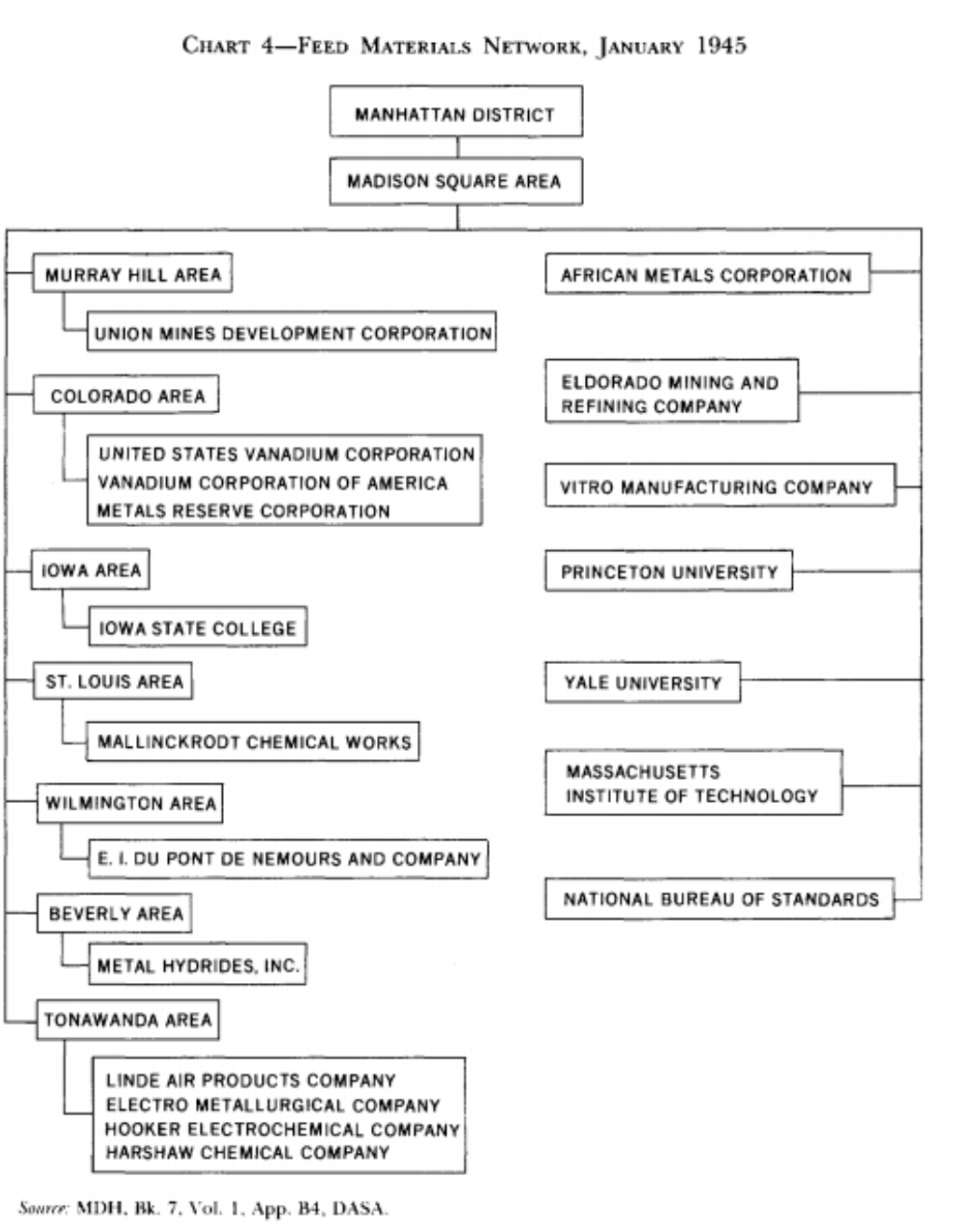
The Union Carbide and Carbon Corporation: Activities and Products of the Important Subsidiaries (New York City: Union Carbide and Carbon Corporation, 1924), 29.



INTERIOR OF PLANT OF LINDE AIR PRODUCTS CO. AT BUFFALO, N. Y.

Photograph of the interior of the 1910 Addition to the West Wing that shows oxygen tanks and extraction equipment at work (1910)

E.C. Cook ed., "Welding by Oxy-acetylene," *Railway Journal* 16. No. 12 (1910): 26.



Depiction of the Feed Program in 1945 showing Linde Air Products and the other Chemical Companies in Tonawanda involved in The Manhattan Project

Vincent C. Jones, *Manhattan: The Army and The Atomic Bomb* (Washington D.C.: Center of Military History, 1985), 309.

Aerial view of Linde Air Products Factory, looking southeast (2017)
Note how, from the street, it looks like two separate buildings, however it really forms a donut around an internal work yard. From Google Imagery.


NO DUMPING
LITTERING


inkwell Printers
CHANDLER ST
MANTON PL

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

NATIONAL REGISTER OF HISTORIC PLACES
EVALUATION/RETURN SHEET

Requested Action:	Nomination
Property Name:	Linde Air Products Factory
Multiple Name:	Black Rock Planning Neighborhood MPS
State & County:	NEW YORK, Erie

Date Received:	Date of Pending List:	Date of 16th Day:	Date of 45th Day:	Date of Weekly List:
7/28/2017	9/1/2017	9/18/2017	9/11/2017	9/14/2017

Reference number:	MP100001584
Nominator:	State

Reason For Review:

__ Appeal	**X** PDIL	__ Text/Data Issue
__ SHPO Request	__ Landscape	__ Photo
__ Waiver	__ National	__ Map/Boundary
__ Resubmission	__ Mobile Resource	__ Period
__ Other	__ TCP	__ Less than 50 years
	__ CLG	

__**X**__ Accept _____ Return _____ Reject __**9/11/2017**__ Date

Abstract/Summary Comments:	A PDIL, a well written nomination.
Recommendation/ Criteria	

Reviewer Alexis Abernathy Discipline Historian

Telephone (202)354-2236 Date

DOCUMENTATION: see attached comments : No see attached SLR : No

If a nomination is returned to the nomination authority, the nomination is no longer under consideration by the National Park Service.

NEW YORK STATE OF OPPORTUNITY. | Parks, Recreation and Historic Preservation

ANDREW M. CUOMO
Governor

ROSE HARVEY
Commissioner

24 July 2017

Alexis Abernathy
National Park Service
National Register of Historic Places

Mail Stop 7228

1849 C Street NW
Washington DC 20240

Re: National Register Nominations

Dear Ms. Abernathy:

I am pleased to submit the following four nominations, all on disc, to be considered for listing by the Keeper of the National Register:

Oak Hill Historic District, Greene County
Newberry Building, Genesee County
Linde Air Products Factory, Erie County
First Baptist Church of Springville (Expansion), Erie County

Please feel free to call me at 518.268.2165 if you any questions.

Sincerely:

Kathleen LaFrank
National Register Coordinator
New York State Historic Preservation Office