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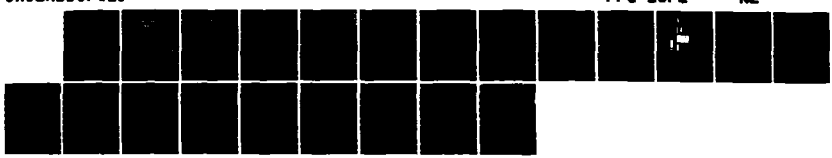

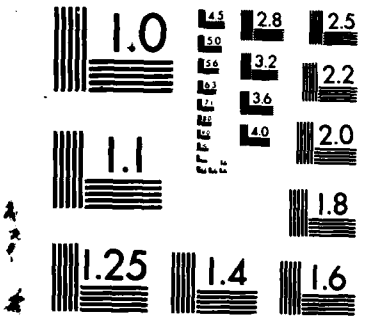

PENNSYLVANIA SITE PRELIMINARY SURVEY

FOR

COAL GAS / FUEL CELL / COGENERATION PROJECT

REPORT CLIN 000202

PREPARED FOR

DEPARTMENT OF THE ARMY
AND
GEORGETOWN UNIVERSITY

MARCH, 1985

EBASCO

EBASCO SERVICES INCORPORATED

Two World Trade Center
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17. DISTRIBUTION STATEMENT *(of the abstract entered in Block 20, if different from Report)*

18. SUPPLEMENTARY NOTES Prepared in cooperation with Georgetown University. The views, opinions and/or findings contained in this report are those of the author(s) and should not be construed as an official Department of the Army position, policy or decision, unless so designated by other documentation.

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

Preliminary Survey of the Scranton, Pennsylvania site for Coal Gasification/ Fuel Cell/Cogeneration system.

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

Report describes site characteristics that could affect the feasibility of a Coal Gas/Fuel Cell/Cogeneration project and describes existing sources of thermal and electric energy.

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PRELIMINARY SITE SURVEY REPORT

1.0 Introduction

The purpose of this report is to present the results of the preliminary survey of the Scranton, Pennsylvania site proposed for a Coal Gasification/Fuel Cell/Cogeneration (GFC) system.

The site characteristics that could affect the feasibility of a GFC installation are discussed as well as existing methods for generating and distributing thermal and electric energy.

2.0 Summary

The high density of use of the Army Ammunition Plant (AAP) site probihits location of the Fuel Cell System within its property lines.

Consequently, the installation of a GFC system depends upon the successful acquisition of property close to the AAP. Among the sites external to the AAP that have been considered, is a 3.96 acre parcel of land owned by the University of Scranton that is now used for parking and as an athletic field. Though attractive because of its close proximity to AAP, an overhead electric transmission line serving the AAP has an easement that makes the north portion of this property unavailable for permanent construction. This has the effect of narrowing the available land to approximately 2.5 acres which would be adequate for one GFC system.

However, use of this site would require replacement of the athletic field taken up by the fuel cell system and is subject to further architectural study.

Thermal output of the GFC would be supplied to the AAP through a 6 in. steam main and 4 in. condensate return routed west from the GFC and under Cedar Avenue. Alternately, all or part of this output could be routed to the University of Scranton for use in their heating system or in absorption type water chillers. The third possibility of supplying thermal output to the privately owned district heating system serving Scranton University will be reviewed pending receipt of required information. Fuel cell net output of 7000 kW is well in excess of the AAP annual average load of 2740 kW and also approximates the AAP demand peaks. Subject to confirmation by economic analysis, it is expected that all electric output of the GFC will be supplied to the PP&L grid at avoided cost rates.

Potential emission sources are controllable by system design and operating practices to within federal and local environmental limits. For example, fugitive dust emissions will be controlled by enclosures for

material handling equipment, and by dust suppression sprays and dust collectors; sulfur pit emissions will be controlled by recycling vapor to the oxidizer tanks; the occassional excess gasifier output due to fuel cell demand reduction will be handled by flaring; noise emissions of coal delivery and coal handling and of rotating equipment can be reduced by enclosures and/or direct acoustic treatment.

When received, geotechnical information will be reviewed in terms of impact on excavation and foundation costs. However, judging from existing adjacent structures, this aspect is not believed to present either technical risks or affect site suitability.

The Scranton University property has no peculiarities that would affect technical risks identified in the Basic System Description (CLIN 0001) and, subject to its availability and to a satisfactory architectural solution for replacement of their athletic field, none that would eliminate this site from consideration to accommodate a GFC system.

3.0 Site Description

The Scranton Army Ammunition Plant (AAP) is one of four sites proposed for the Gasification/Fuel Cell/Cogeneration (GFC) system and is located within the city of Scranton, Lackawanna County in northeastern Pennsylvania. The AAP is in a valley area between the Lackawanna River and Roaring Brook which is at an elevation of approximately 700 ft above mean sea level.

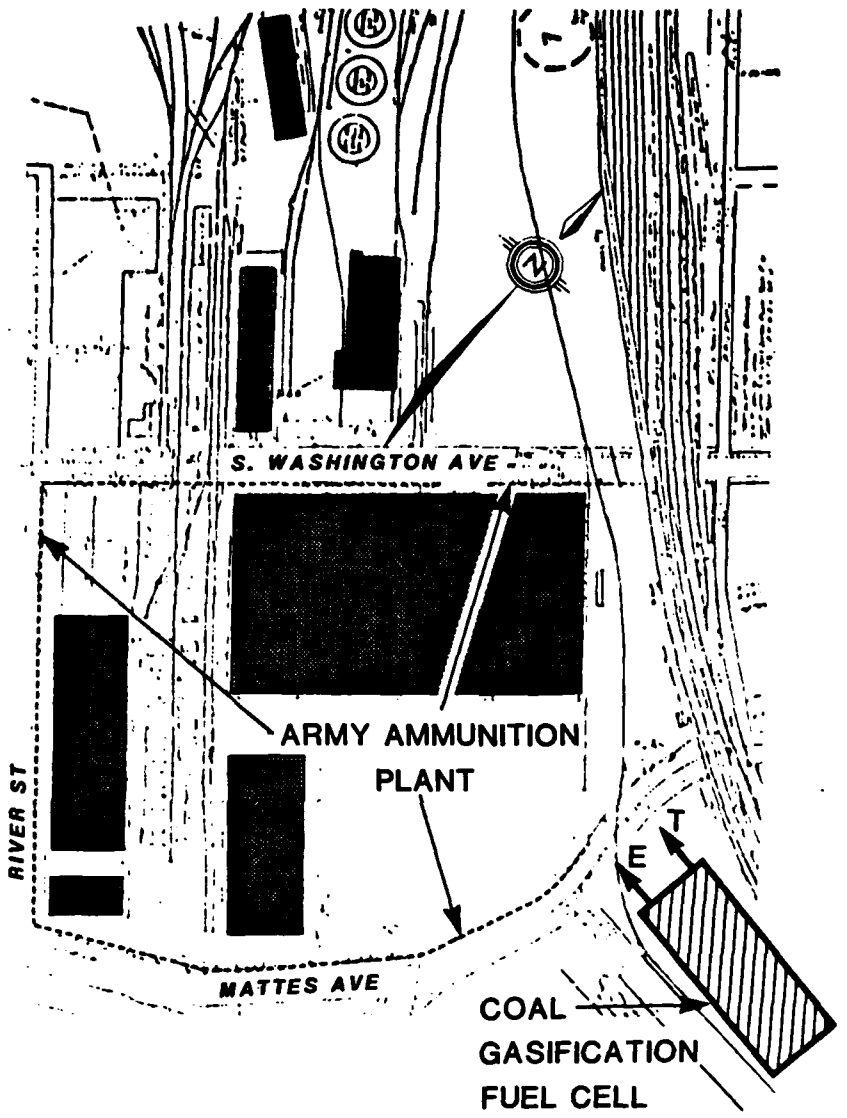
The 15.3 acre site has approximate overall dimensions of 900 ft x 800 ft and is bordered on the northwest and northeast by Conrail property (See Figure 3 PA-1). The AAP site together with the Conrail property formerly constituted the locomotive repair and maintenance yard of the Delaware, Lackawanna and Western Railroad.

Truck access to the area of the AAP is provided by interstate I-81 with the Central City xxit to Cedar Avenue less than a mile from the site.

Originating in the Elmhurst reservoir, adequate water supply for process and makeup (approximately 35 gpm) are available from 10 inch mains located on Lackawanna and South Washington Avenues. Depending upon state and City of Scranton requirements, wastewater consisting of approximately 7 gpm of treated process condensate will be discharged either to the city combined storm and sanitary system which ultimately empties into the Lackawanna River or to the Roaring Brook located on Mattes Avenues.

The property that is now the AAP was acquired in 1951 and includes five major buildings:

Production Shop	344' x 582'	overall
Joiner Building	110' x 125'	overall
Heat Treat Shop	125' x 300'	overall
Forge Shop	120' x 400'	overall
Office Building	60' x 130'	overall



PROPOSED DISTRIBUTION OF GFC ENERGY

ELECTRIC (E):

TO ELECTRIC UTILITY : 7000KW

THERMAL (T) :

TO ARMY AMMUNITION PLANT AND OTHERS

DOA / GEORGETOWN UNIVERSITY
COAL GAS / FUEL CELL / COGENERATION
SCRANTON, PENNSYLVANIA SITE PLOT PLAN
FIGURE PA 3-1
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Because the AAP property is totally dedicated to production facilities and employee parking, it is necessary to acquire property external to the plant as the site for the fuel cell system.

Among the fuel cell sites considered for acquisition, is the University of Scranton's 3.96 acre property east of and adjacent to the AAP. The western and narrower portion of this property (90 to 120 ft wide) serves as a parking area while the eastern portion (255 ft wide) serves as an athletic field. The west portion of this site is essentially level, but midway for a distance of 75 ft, ramps up 6.5 ft to the wider eastern portion of the site.

This property is bordered on the north by a 27 ft high concrete retaining wall at the top of which and beyond, are the Conrail railroad tracks. On the south is the Laurel Line Drive, on the east, Route I-81 and on west, Cedar Avenue and the AAP.

The following utilities shown on a site plan dated 5/16/83(1) traverse the length of this property in an east-west direction:

- o sanitary sewer line, 30"
- o water line, 2"
- o Underground PP&L electric line (size not indicated)
- o Overhead PP&L cables (size not indicated) with transmission towers.

4.0 Site Peculiarities

1. Due to the density of use of the Army Ammunition Plant, a fuel cell system installation for the AAP requires acquisition of additional property.

2. A PP&L power line serving the AAP passes east-west about 48 ft above grade at the north end of the University of Scranton property. The PP&L easement prohibits permanent structures located below for a horizontal distance of approximately 60 ft from the retaining wall.(2) This restricts construction on this site to approximately 2.5 acres.

3. The configuration of the University of Scranton site will require encroachment by the GFC system on the area occupied by the Athletic Field.

4. Because of the location of the Scranton University property in a downtown area, as well as its proximity to a university athletic area, it is essential to control dust, emissions, odors and noise to within state and local pollution control laws, including those enforced by the Pennsylvania Department of Environmental Resources.

   The coal gasification and gas processing plant has several emission points including the:

   - Gasifier
   - Cyclone dust and gasifier ash removal system
   - Ammonia Stripper
   - Stretford oxidizer vent
   - Sulfur pit

Gasifier emissions may occur as gas leaks around pokeholes during the poking operation and through the lock hopper disk valves during coal charging. The emissions can be minimized by decreasing the air flow of the gasifier during the poking operation, placing the gasifier under a slight negative pressure. Correct maintenance of the pokehole covers and disk valves in the lock hopper will hold emissions to a negligible level.

Another source of gasifier emissions is the off specification gas produced during start-up or unexpected upsets. The gases will be flared resulting in small intermittent emissions on NO_x and SO_2.

Fugitive emissions from the intermittent removal of cyclone dust are negligible.

Ammonia released during stripping of the process condensate will be flared continuously, producing minor amounts of NO_x.

The Stretford oxidizer vent which is released to the atmosphere consists mainly of air, water vapor evaporated from the solution, and minute quantitites of ammonia and hydrocarbons. Due to the extremely low concentration of ammonia in the anode feed gas (0.5 ppm) and the low solubility of hydrocarbons in water, concentrations of these products in the Stretford oxidizer vent would be negligible.

To prevent escape of vapors, a ventilation system will exhaust the sulfur pit and recycle the vapors back to the Stretford oxidizer tanks.

It is expected that the emissions discussed in this section will cause no operational problems and can be controlled well within the environmental limits.

Noise from rotating apparatus or coal handling equipment will be contained by suitable enclosures.

5. Existing Thermal Energy Sources and Distribution

The primary source of thermal energy for the AAP is natural gas which is supplied at 20 psi from a 6 in. main located along South Washington Avenue. Referring to Figure PA 5-1, gas is distributed to three water tube boilers in the southwest corner of the AAP, to 27 gas fired industrial space heaters located throughout the plant and to processes located in the Production Shop, Forge Shop and Heat Treat Shop. Boilers No. 1 and 2 each have ratings of 400 boiler horsepower (bhp) or 14000 lb/hr. Boiler No. 3 has a rating of 800 bhp or 28000 lb/hr.

Boilers No. 1 and 2 are 25 to 30 years old and Boiler No. 3, 18 years old.

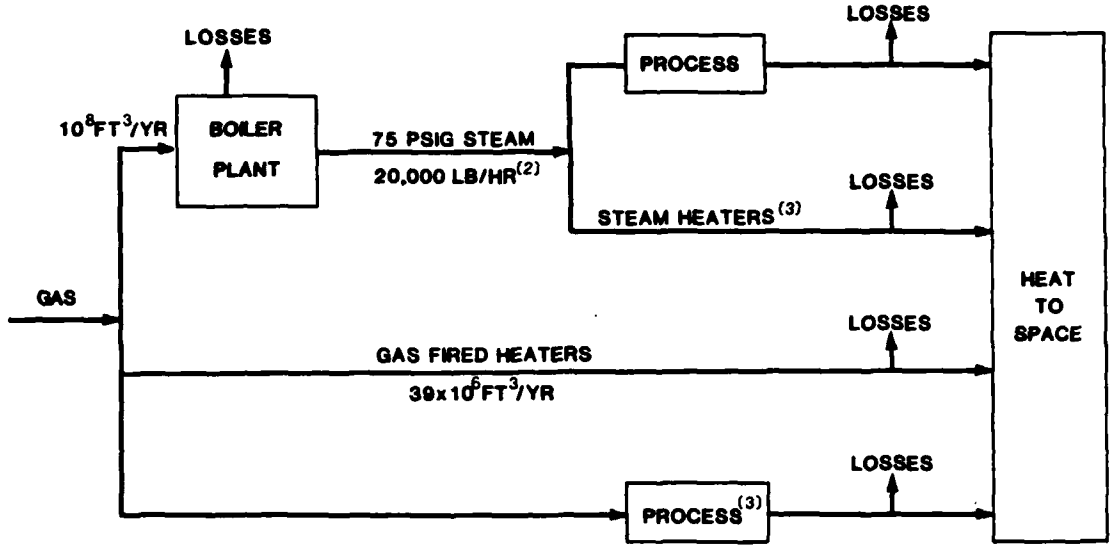
The annual gas consumption of the boiler plant is approximately 100×10^6 ft^3.

Starting with an 8 in. main at the Boiler Room, steam is distributed to all buildings through connecting tunnels at pressures varying from 75 psig to 5 psig for use in production and space heating. The developed length of the longest run is approximately 1000 ft.

Steam flow meters at the package boilers indicated the following usage in calender year 1983:

Consumption	Total Steam (lb)	Average Usage (lb/hr)
Annual	80,735,000	9216
Maximum Monthly (January)	10,787,000	14500
Minimum Monthly (August)	2,268,000	3048
Single Day Maximum (February)	467,000	19458

From the above, it is apparent that most of the steam generated is used directly for space heating. The balance of steam generated is used for process, but ultimately contributes to space heating.



NOTES:

1. FLOWS ARE APPROXIMATIONS BASED ON INFORMATION RECEIVED FROM REPRESENTATIVES OF CHAMBERLAIN MANUFACTURING CORP.
2. SINGLE DAY MAXIMUM, 1983
3. FLOWS NOT AVAILABLE

DOA / GEORGETOWN UNIVERSITY

COAL GAS / FUEL CELL / COGENERATION

SCRANTON, PENNSYLVANIA SITE
DIAGRAM OF THERMAL FLOW

FIGURE PA 5-1

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The peak day average steam load is approximately 20,000 lb/hr of which more than half could be supplied by the thermal output of the proposed fuel cell system. The fuel cell system thermal capacity however, is expected to amply exceed the annual average AAP usage of 9216 lb/hr.

6.0 Existing Electrical Energy Sources and Distribution

The electrical requirements for the Scranton Army Ammunition Plant is supplied by Pennsylvania Power and Light Company. Electric power is transmitted to the munitions plant via two 66 Kilovolt (kV), 600 ampere, 3 phase lines. The AAP substation is fed from two sources: One is a line from the Minoolca substation. The second is a line from an adjacent substation served by the power company's Suburban Plant.

The Scranton Army Ammunition Plant uses this electrical power from the substation for lighting, air conditioning and process power. There is no provision for emergency electric power at the site.

Operation and maintenance of the AAP electrical system is the responsibility of plant personnel and is reported to be in generally good condition.

Monthly billings for 1984 reviewed during a site visit, show the average monthly consumption for that year to be approximately 2,400,000 kWh. Maximum demand of approximately 8400 kW occurred in January 1984; and the minimum of approximately 6600 kW occurred during the months of March and April 1984.

The maximum capability of each of the utility's transmission lines entering the munition plant's Substation Transformer Yard was approximately 58,000 kW at a power factor of 85 percent. This allows the utility to supply approximately 116,000 kW of the power which would cover the requirements of full mobilization production. However, expansion of the plant electrical capacity would be required to distribute and fully utilize this power within the plant during this full production period. The current prediction for full mobilization peak hour electricity is 61,000 kW with an average hourly use of 41,000 kW.

7.0 Fuel Supply

Anthracite coal from the Northern Anthracite Field of Pennsylvania was selected as the gasifier fuel for this study because of its proximity to the Scranton site and because anthracite is non-agglomerating.

Two companies which supply coal from the Northern Anthracite Field are Beltrami Enterprises, Inc. and Lehigh Valley Coal Sales Company.

Beltrami Enterprises offers a pea-size anthracite (13/16" x 9/16") which would be transported by 20 to 22 ton capacity trucks from the Eckley Breaker to the Scranton site.

Similarly, the Lehigh Valley Coal Sales Co. would transport pea-size anthracite coal by truck from Hazleton, Pennsylvania to the Scranton site.

In both instances, the trucking distance would be approximately 35 miles.

8.0 References:

8-1 CECO Associates, Inc. Sheet No. L-1, Site Plan, University of Scranton Athletic Field, 5-16-83.

8-2 Personal Communication with Pennsylvania Power & Light Co.

END

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