

AESD TME-3031

**Advanced Energy Systems Division**



**ENVIRONMENTAL IMPACT ASSESSMENT  
for  
METHANE UTILIZATION FROM COALBEDS  
FOR POWER GENERATION  
at  
BETHLEHEM MINES CORPORATION  
MARIANNA MINE NO. 58—MARIANNA, PENNSYLVANIA**

**JULY 1980**

**UGR FILE**

# 407

Prepared for

**THE UNITED STATES DEPARTMENT OF ENERGY  
Under Contract No. DE-AC21-77ET13133**

**Westinghouse Electric Corporation  
Advanced Energy Systems Division  
P.O. Box 10864  
Pittsburgh, Pennsylvania 15236**

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## EXECUTIVE SUMMARY

This project will be conducted at the Sabol Shaft which is located outside Marianna, Pennsylvania, in Washington County. The United States Department of Energy proposes to provide financial support to this project with additional funding provided by Bethlehem Mines Corporation and the Commonwealth of Pennsylvania. The Advanced Energy Systems Division of Westinghouse Electric Corporation is the prime contractor.

This project has its objective, the successful demonstration of an existing gas turbine/generator assembly adapted to a methane ( $\text{CH}_4$ ) fuel source. The gas normally vented to the atmosphere prior to a mining operation can be used as a fuel source to drive the gas turbine/generator assembly to produce electrical power. This power can then be fed back to the mining operation which reduces the dependence of the mine on electrical power supplied by the utilities company. The fuel source in this project is the Waychoff Borehole, Marianna No. 58 Mine, of Bethlehem Mines Corporation.

The gas turbine/generator assembly is portable and mounted on a trailer van. Thus when the fuel source has been depleted, the installation can be moved to another site location for subsequent use.

The relatively small size of the system and rural location combine to minimize the environmental impact. The installation will not have any impact on any threatened or endangered species of wildlife or vegetation. Discharges to the atmosphere will be gaseous since the fuel is a gas. The system does not utilize water or solid fuel; therefore, there will be no liquid or solid discharge. The turbine/generator assembly is enclosed within a trailer and thereby minimizes the increase in ambient noise.

No large labor force is anticipated for this project. Laborers will be Bethlehem Mines Corporation personnel living in the area. Installation and checkout

is expected to be completed within a two week period. During operation, two personnel provided by Westinghouse will be assigned for around-the-clock continuous operation.

## 1.0 INTRODUCTION

### 1.1 OBJECTIVES

The Advanced Energy Systems Division of Westinghouse Electric Corporation has been engaged for several years in the development of new energy systems either through the use of new technology or the application of existing technology to previously available but untapped energy sources. The release to the atmosphere of entrapped methane is inherent in coal mining operations. For years this methane has been a product which had to be disposed of for safe mining operations. Studies by Westinghouse and others have concluded that this gas can be used in a variety of ways rather than being wasted. In September of 1977, Westinghouse was awarded a contract from DOE to recover this gas and convert it into a more useful form of energy by driving a gas turbine/generator assembly to produce electric power. This power will be fed back into the mine's power grid and augment the mine power supply. This will reduce the dependence of the mine on the local power company, offset the cost of electric power to the mine, and utilize a viable energy source now being wasted.

This document has the following objectives:

- To describe the system for collecting the methane gas and converting it to electric power.
- To describe the environmental conditions at the site prior to development of the program.
- To define the environmental impacts associated with the program.

The analysis is made in accordance with the National Environmental Policy Act of 1969 (NEPA) and ERDA's guidelines for Environmental Impact Assessments Preparation (EIA) as set forth in 10CFR711.

It is expected that this project will demonstrate the feasibility of converting a waste product into a useful energy source.

## 1.2 NEED FOR THE PROJECT

This project will combine technically proven components with a waste product inherent in coal mining operations to produce useful power. The successful demonstration could lead to many such installations in coal mining operations. The net results will be to decrease the cost of electrical power to the mine and reduce the mine's dependence on the local utility for electric power. DOE recognizes that significant quantities of methane are available but are not being used. The successful application of this gas as an energy source could alleviate the energy shortage,

## 1.3 SITE LOCATION

The site is situated on the east side of Pennsylvania Interstate Highway Route 79 about three miles from Marianna, Pennsylvania. The plot of ground is 90 feet by 50 feet, owned by Bethlehem Mines Corporation, and is adjacent to the existing Sabol Shaft site. Access to the site is by dirt road since it is a relatively remote site, i.e., not visible from the road. This site was selected because the existing electrical substation facilitates interfacing with the mine power grid. Figures 1 and 2 show the location of the site relative to surrounding property.

An interface agreement between Bethlehem Mines Corporation and Westinghouse Electric Corporation was negotiated and executed covering responsibilities for this project. Appendix A is a copy of this agreement.

## 1.4 SITE DESCRIPTION

The location is called the Bethlehem Mines Sabol Shaft site. The Bethlehem Mines Sabol Shaft site is a fenced area consisting of a West Pennsylvania Electric Power Company substation, mine ventilation fan and fan housing with shroud, compressor building, electrical switchgear, electric poles, telephone poles, emergency escape crane and a ventilation shaft. The fenced area is leveled and is covered with slag. The elevation of the site is about 1150 feet above sealevel. Terrain surrounding the site consists of slopes of up to 25 percent which contain several varieties of trees, including pine, fir, oak, elm and maple. These trees are not in any order or sequential pattern, but instead are randomly

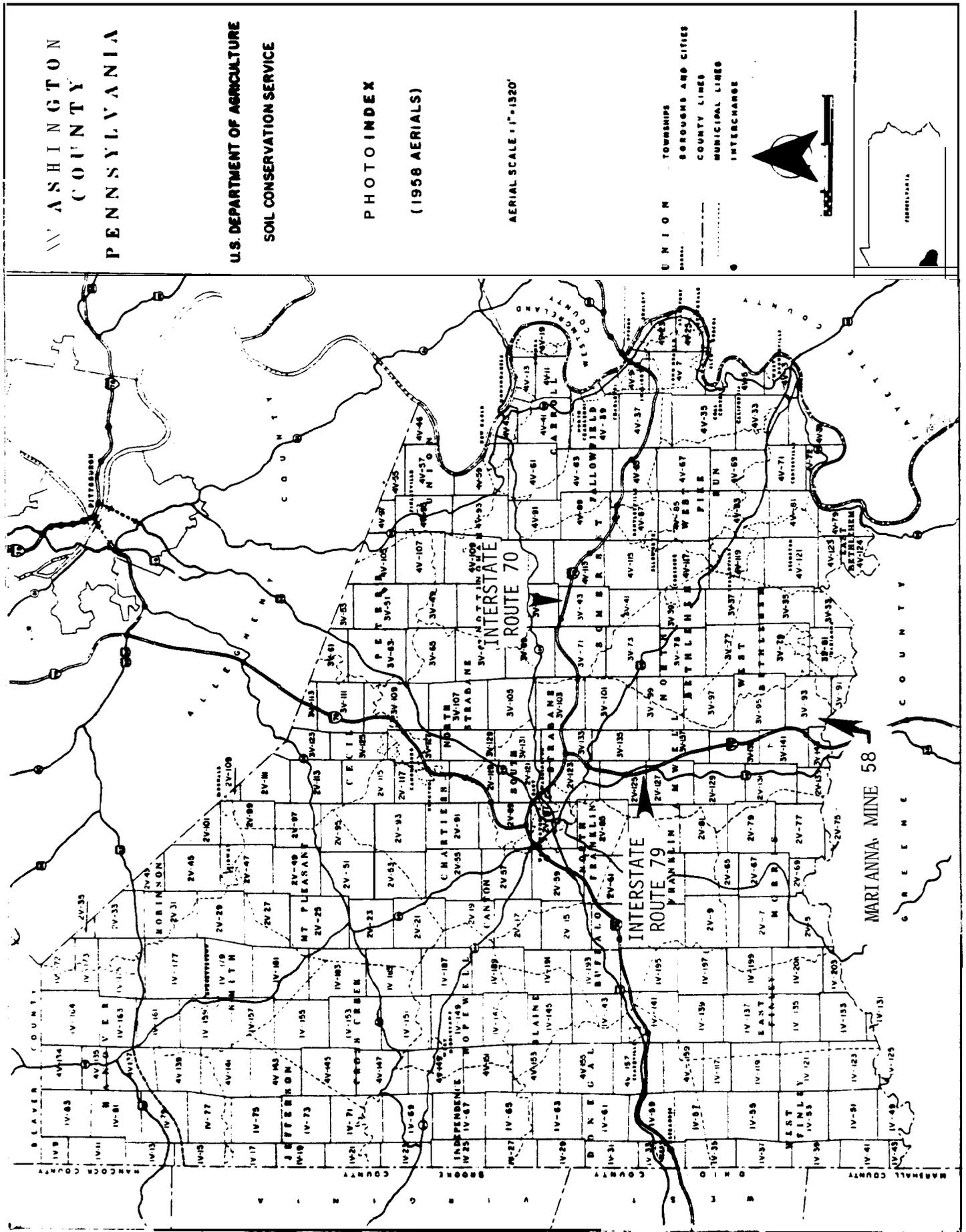
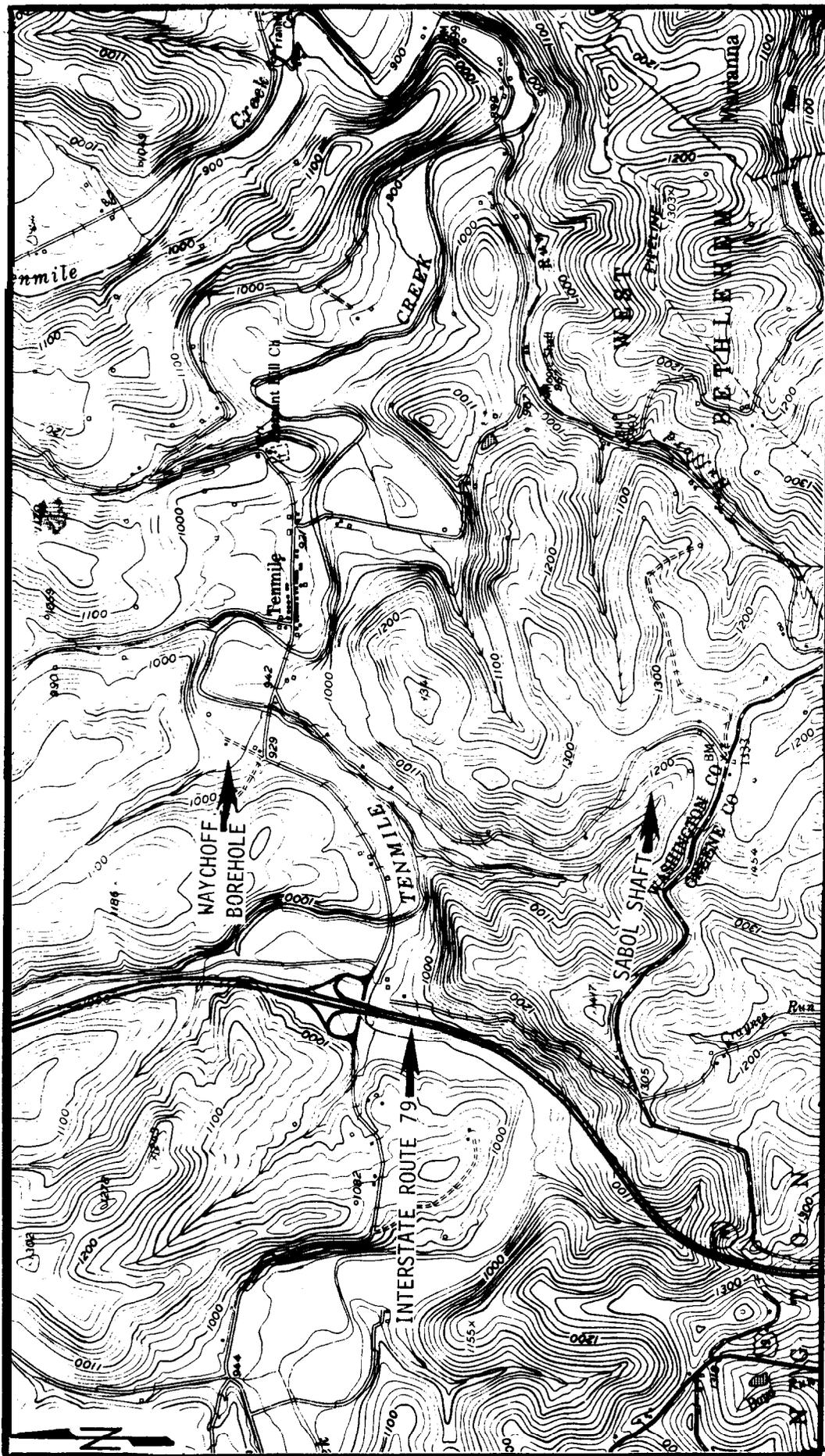
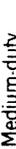
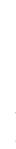
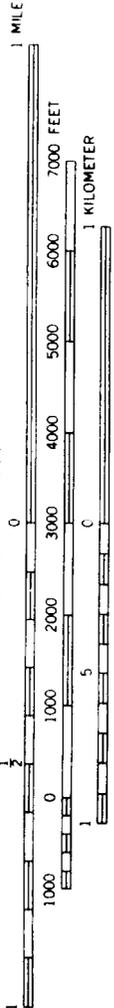


Figure 1. Location of Site Relative to Surrounding Property



**ROAD CLASSIFICATION**

- Heavy-duty 
- Medium-duty 
- Light-duty 
- Unimproved dirt 
- Interstate Route 
- U. S. Route 
- State Route 



CONTOUR INTERVAL 20 FEET  
DATUM IS MEAN SEA LEVEL



**AMITY, PA.**  
SW/4 AMITY 15' QUADRANGLE  
N4000—W8007.5/7.5

1954

PHOTOREVISED 1969  
AMS 4964 II SW—SERIES V831

Figure 2. Location of the Site Relative to Surrounding Property

'located and spaced. Moss is present on the wooded slopes. Vegetation on these slopes also includes natural grasses, clover, chickweed, dandelions, daisies, etc. At the base of the slope which includes the site is a creek called Ten Mile Creek. Dormont-Culleoka, Dormont, Newark and **Glenford** soils are prevalent in this area. Appendices B, C, D and E\* describe the composition and makeup of these soils. Appendix F\* identifies the various soils in the proximity of the site. Arrows have been added to the map to show the approximate locations of the Waychoff **Borehole** and the Sabol Shaft site. Area wildlife includes rabbits, squirrels, groundhogs, deer, birds, field mice, etc.

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\*Information presented in Appendices B, C, D, E, and F was obtained from the U.S. Department of Agriculture, Soil Conservation Service.

## 2.0 DESCRIPTION OF THE SYSTEM

### 2.1 INTRODUCTION

This section includes a description of the system utilized to collect the methane gas and convert it into electrical energy. The selected components and plans have been designed to effect the completion of a technically, economically, and environmentally acceptable plant.

### 2.2 GENERAL DESCRIPTION

The system consists of a fuel source, borehole, compressor assembly mounted on a skid, a gas turbine/generator assembly enclosed in a trailer van, and transformers. The control room for the compressor assembly, and the gas turbine/generator assembly is located in the aft end of the trailer van. All components are installed on a 90 foot by 50 foot area, adjacent to the Sabol Shaft site, enclosed by a 7 foot chain link fence having a 10 foot gate. Figure 3 is a block diagram of the system.

#### 2.2.1 FUEL SOURCE

The fuel source originates at the Waychoff borehole located about 7500 feet from the Sabol Shaft site. The borehole is vertical, cased and terminates in a mined-out area near a nonworked coal seam face. Four horizontal wells of various lengths were drilled into the coal seams at their face. An underground collection and dewatering system routes the methane from each well to the vertical borehole via steel pipe. The use of this fuel source system introduces an environmental threat in one area:

- A gas pipeline will be needed to transport the fuel from the Waychoff borehole to the Sabol Shaft site. To accomplish this a trench for the gas pipeline will be dug approximately 7500 feet in length. The underground pipeline will transverse private property, cross over Ten Mile Creek with the bridge, continue adjacent to a public light-duty road, and then to the Sabol Shaft. Vegetation will be free to grow back in, once the trench is covered and surface contour restored.

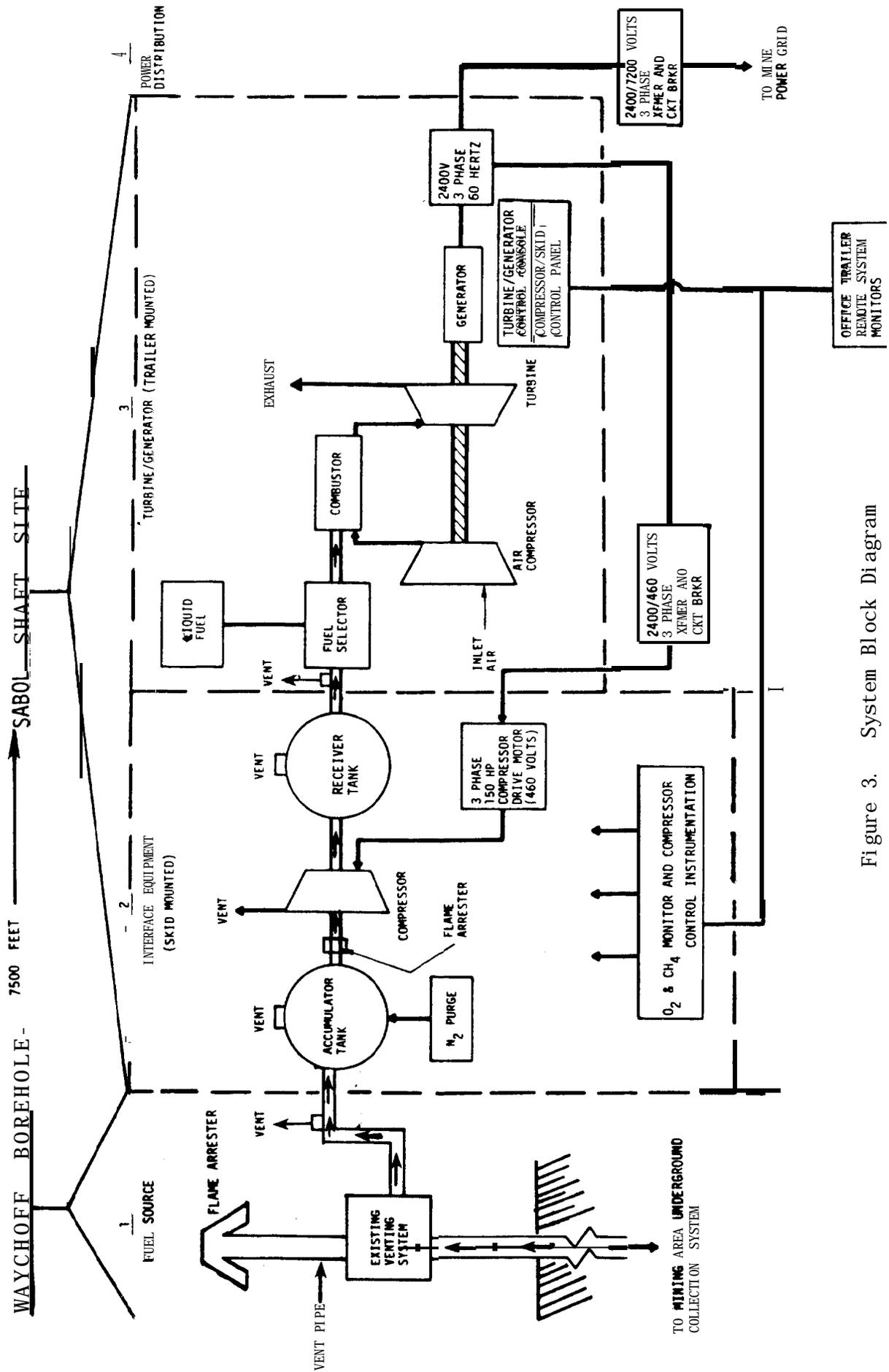


Figure 3. System Block Diagram

### 2.2.2 VENT PIPE

The vent pipe extends 30 feet above the ground level and includes a flame arrester, exhaust fan, lightning protection, piping and valves within a security fence. The vent fan is not in service and can be valved in when and if desired. An interfacing piping system is required at the borehole to divert gas flow from the vent pipe to an underground pipeline for transmission to the Sabol Shaft site.

### 2.2.3 COMPRESSOR/SKID ASSEMBLY

The compressor/skid assembly, consisting of an accumulator, compressor, receiver and associated piping, valves, flame arrester, and other miscellaneous hardware, is mounted on a pallet and connected on its inlet side to the fuel source and on its outlet side to the gas turbine. The assembly pulls the gas from the fuel source, smooths out the flow in the accumulator, compresses the gas to 160 psig and stores it in the receiver tank for use in the gas turbine. The accumulator and receiver tanks are ASME code constructed and stamped. A flame arrester is in line between the compressor intake and accumulator discharge. This precludes the possibility of a flame propagating to the fuel source and creating a fire hazard to the mine.

The accumulator and receiver tanks are equipped with pressure sensors, vent valves, relief valves and pressure gages. Isolation valves are located between the accumulator and compressor, the compressor and receiver, and the receiver and turbine. With the exception of valves within the compressor itself, all valves are actuated electrically from the control panel in the gas turbine van.

Both the accumulator and the receiver tanks individually provide for condensate removal. This apparatus consists of a mist extractor, liquid level gauge, high liquid level shutdown switch and an automatic liquid drainer. Any condensate will be expelled to the environment.

The assembly has a built in purge system consisting of piping, valves, a pressure regulator and two nitrogen bottles. The system will be purged with gaseous nitrogen prior to startup of the compressor and turbine, and after

breaking any lines that may introduce air into the system. All components and piping on the downstream side of the accumulator compressor inlet valve will be purged.

Gas sample lines are provided to sample the methane and oxygen content of the gaseous fuel. The methane sample line is located at the accumulator tank intake and the oxygen sample line is located at the compressor intake. The routing of these small lines is such that condensate will not collect in them. Sampling and analysis is a continuous operation and sampled gases are exhausted to the atmosphere.

#### 2.2.4 GAS TURBINE/GENERATOR ASSEMBLY

The prime mover for this project is a Solar International Saturn Model gas turbine. This engine is of the axial flow type and features an 8 stage compressor, annular type combustor, 3 stage turbine and a single common shaft of rotation.

The generator is driven by the engine and is a 2 bearing, 750 kW, 3 phase, 6 wire 50/60 Hertz brushless unit. It is mounted aft of the engine and is connected to the engine through a reduction gear drive unit which is spline coupled to the aft end of the turbine rotor. The gas turbine/generator assembly includes the engine mounted accessories, fuel system accessories, oil tank, oil filters, oil cooler, control and relay panels, gage panel and voltage adjusting rheostat.

This entire assembly is installed in the center compartment of a three compartment trailer. The forward compartment of the van serves as the air intake for the engine and also houses a 500 gallon fuel tank and the aft compartment or control room, houses the control panels for operation. The entire assembly is completely portable and can be moved from site to site as need is dictated.

The control console for the gas turbine/generator assembly is located in the control room of the trailer. It contains control, monitoring, and switching devices and is divided into four panels. The first panel contains the malfunction alarm system and shore power connection points. In addition, lightning arresters are located in the bottom of this panel. In the event of a malfunction, system interlocks are redesigned such that the corresponding annunciator begins flashing and the alarm rings. This system will automatically effect

an emergency shutdown of the engine if the malfunction is of a major nature. The second panel contains devices for engine operation and monitoring as well as shore and control power circuit breakers. In addition, the main high voltage fuse bank for the system is located in the bottom of this panel. Operating and monitoring devices for the generator are located in the third panel. Load switching and paralleling are accomplished from this panel. The main load breaker, surge capacitors and a kilowatt-hour meter are located in the fourth panel.

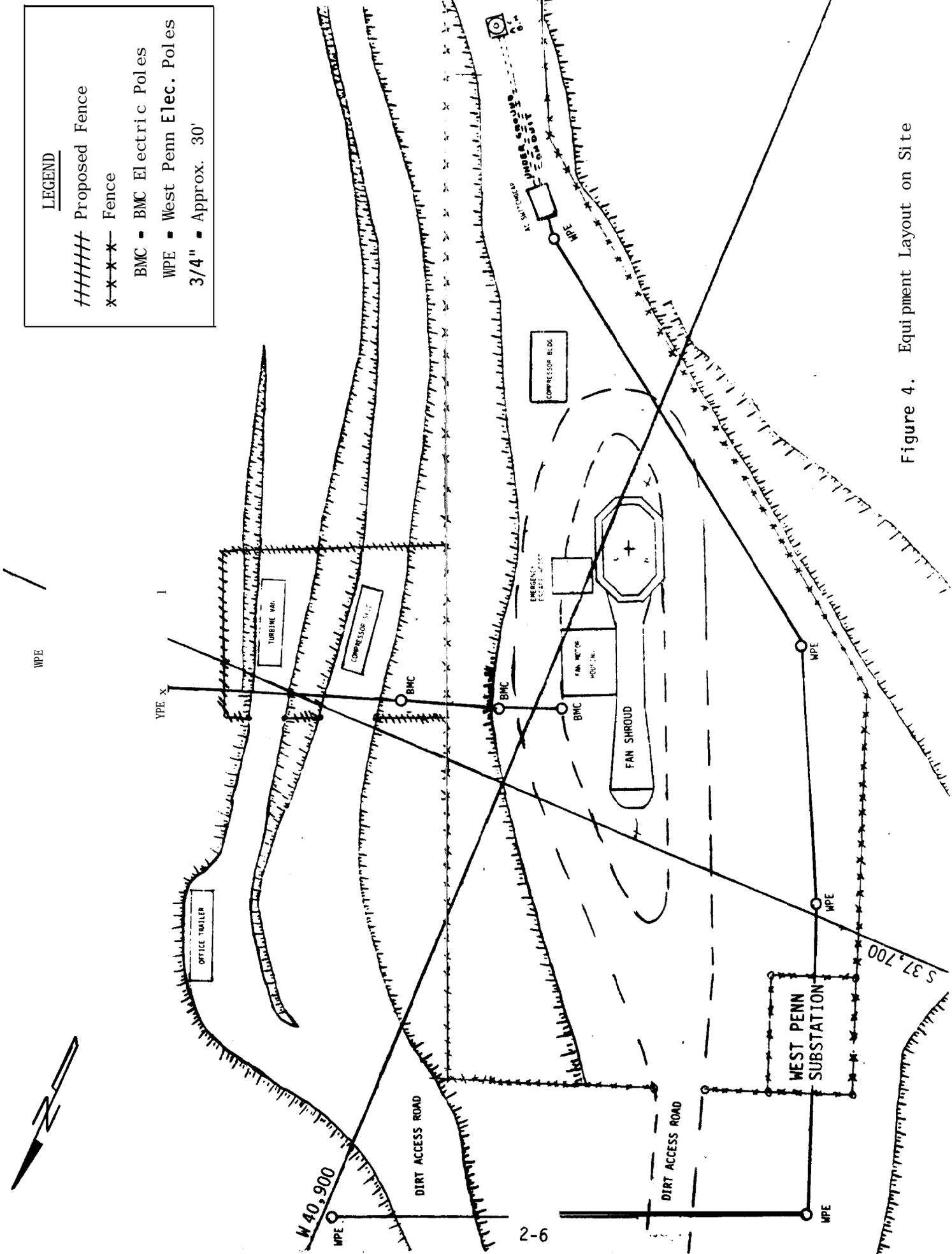
A separate control panel for the skid mounted compressor assembly will be installed in the control room of the trailer. This panel will provide for monitoring of the critical functions of the skid mounted equipment.

The gas turbine engine is normally operated on liquid fuel. However, this specific gas turbine has been modified to include a fuel injection system capable of handling gaseous fuel. For this fuel a gas analyzer system will be installed in the control room of the trailer. It will continuously sample and analyze the methane and oxygen content of the gaseous fuel, alarming if a warning condition occurs. Liquid fuel injection capability has been maintained for stand-by use in the event normal gas flow from the compressor/skid assembly is interrupted.

#### 2.2.5. SYSTEM ARRANGEMENT

Figure 4 is a layout of the Sabol Shaft site showing an expected arrangement of operating equipment. The entire area will be enclosed by a 7 foot high chain link fence with a 10 foot wide gate where the access road enters the area. Distances spacing equipment with respect to one another and actual equipment sizes are approximate and may vary slightly.

The location of the incoming gas pipeline to the turbine/generator assembly permits the site to extend in the direction of the closest mine power lines. This arrangement allows for the shortest length of mine power cables from the mine power system to the turbine/generator assembly and associated transformers.



LEGEND

- Proposed Fence
- \*\*\*\*\* Fence
- BMC • BMC Electric Poles
- WPE ■ West Penn Elec. Poles
- 3/4" ■ Approx. 30'

Figure 4. Equipment Layout on Site

From a functional standpoint equipment locations on the site and their relative positions to each other are not significant. The arrangement of equipment will be determined after the location of gas pipeline is established. Considerations affecting arrangement include ease of installation and hookup, piping and cable runs, and adequate space for maintenance.

### 3.0 DESCRIPTION OF THE EXISTING ENVIRONMENT

The two areas required for this project are connected by 7500 feet of pipeline. The first area is located at the Waychoff **borehole** where the methane originates; whereas the second is the Sabol Shaft where the methane is converted into electrical power. The existing environment is described by starting at the Waychoff **borehole** as shown on Figure 2 and then proceeding to the Sabol Shaft along dirt and hard surfaced secondary roads that connect the two locations. For the most part, the pipeline will parallel these roads although a more direct path will be utilized where practical.

At the Waychoff **borehole** are existing piping components as described in Section 2.2.2. This arrangement is enclosed by a 7 foot fence and the area is almost flat. This fenced area is surrounded by a fenced pasture that is presently used for grazing cattle. The significant vegetations in this region are grazing grasses. Some rocks, small trees and bushes are scattered throughout the pasture.

The Waychoff **borehole** and three domestic dwellings are accessed by a narrow red dog (dead-end) road leading from the hard surfaced secondary road. Three domestic dwellings are situated along the red dog road i.e. two frame structures and one home trailer.

At the red dog and hard surfaced road intersection, which is also the location of one of the frame structures, the route continues in an easterly direction **across** a steel grate bridge with guard rails. Adjacent to this hardsurface road are cleared fields, small trees, and a grazing pasture. The bridge crosses Ten Mile Creek which is estimated to be about fifteen feet wide at the bridge.

About 100 yards beyond the grate bridge a gravel type secondary road veers sharply to the right. This road provides access to the Sabol Shaft about one and one-quarter (1 1/4) miles distance. In the vicinity of this intersection are a one room dwelling, a frame house and a house trailer with yard, etc.

The house trailer is slightly beyond the other two structures and at this point the gravel road changes to dirt and begins to wind, dip and rise. The dirt road parallels Ten Mile Creek for a short distance. This road to Sabol Shaft is terraced from varying sloped terrain and no guard rails or fences line the road. Power utility poles, a tree cleared apron of varying width, and a shallow natural earth drainage trench accompany the dirt road for almost the entire distance to the Sabol Shaft. The apron area is totally overgrown with thick brush. Along this road are the foundation remains of a dwelling and two unauthorized rubbish dumps. Except for the dwelling plots and rubbish, the terrain adjacent to the road beyond the apron consists of slopes up to 25%. These slopes contain several varieties of trees, including pine, fir, oak, elm and maple. The trees are not in any order or sequential pattern, but instead are randomly located and spaced. Vegetation on these slopes also include moss, natural grasses, clover, chickweed, dandelions, wild flowers and berries.

Direct access to the Sabol Shaft is via a red dog road that branches off the dirt road. A locked gate across the entrance of the red dog road keeps unauthorized personnel from access to the Sabol Shaft area.

Vegetation on the slopes adjacent to the red dog road, which also surrounds the area cleared and leveled to accommodate the Sabol Shaft activity, include moss natural grasses, clover, chickweed, dandelions, wild flowers and berries. A detailed description of the equipment at Sabol Shaft is shown within the existing fence on Figure 4.

Two dead-end dirt roads are terraced from the sloped terrain above and outside the fenced area of the Sabol Shaft as shown on Figure 4. These roads were constructed for access routes to the utility poles and pole mounted electrical equipment required for Sabol Shaft operations. The West Penn poles are in a tree cleared path with thick brush over the entire tree cleared area.

#### 4.0 POTENTIAL ENVIRONMENTAL IMPACTS

The potential impacts and threat to the environment of implementing the proposal demonstration project are minimal. This contention is based on the relatively small size of the system combined with the rural setting. This proposed project will not have any impact on any threatened or endangered species of wildlife or vegetation. This contention is further supported by the following statements that address potential impacts in the areas of construction, operation and site restoration.

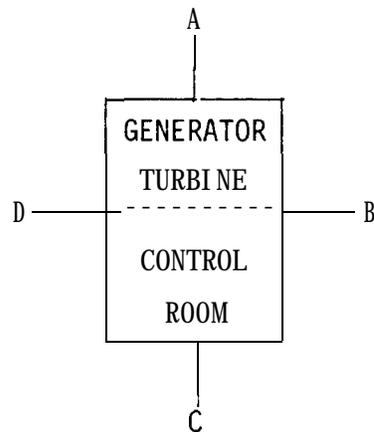
- Construction at the Waychoff borehole is limited to installation of piping and valves to an existing piping network.
- The Pipeline route will transverse open fields and be adjacent to roadways in areas where impact on vegetation and terrain contour is minimal.
- Construction at the Sabol Shaft area will consist of slightly increasing the width and leveling a section the existing two roads. This surface will be gravel covered and the equipment enclosed by a fence connected to the existing fence.
- No large labor force is anticipated for this project. Laborers will be Bethlehem Mines Corporation personnel living in the area or local contractors.
- This turbine is currently exempt from EPA standards for a five year period.
- Operation of the system at the Marianna No. 58 Mine, of the Ellsworth Division, is in a remote area outside of Marianna, Pennsylvania.
- This turbine has been manufactured in large quantities (2,500 - 3000 units) and is in use all over the world. Some typical installations are as follows:
  - Federal Court Building, Philadelphia, Pennsylvania (three turbine/generator units on the 10th floor)
  - Washington, D.C. (one unit each at the Pentagon and the new FBI Building)
  - Annapolis, Maryland (one unit in operation at the U.S. Navy complex)

- Operation of this turbine with gas fuel is known to be one of the cleanest types of combustion processes. Using commercial grade natural gas (which is primarily CH<sub>4</sub>) for example, stack emissions are typically 2%- 4% carbon dioxide and water, 76% - 78% nitrogen and 18% - 20% oxygen.
- All design and system operation activities have been, and will continue to be completely coordinated with the Mining Safety and Health Administration (MSHA), the U.S. Army, Bethlehem Mines Corporation, and the turbine/generator manufacturer (SOLAR Turbines International).
- Period of Operation - Operation of the system at the Marianna No. 58 Mine is part of an overall program of work scheduled to be completed within twelve months. Actual system operating time for the turbine/generator is less than six months. Subsequent to this, the turbine/generator is to be returned to the U.S. Army at Fort Belvoir, Virginia.
- Waste Generation -The only waste generated by the system is the stack exhaust (hot air) and this is dumped to the atmosphere.
- Acoustic noise levels generated by the gas turbine/generator assembly at idle conditions ranges from 89 dbA to 63 dbA at distances of 50 feet and 200 feet, respectively. Table 1 provides some recent noise measurements on a gas turbine/generator recorded by the U.S. Army. The total noise level for the complete system will be measured during operations and recorded. This will include noise emanating from the compressor/skid, gas turbine/generator and the existing compressor and mine ventilation buildings. Figure 4 illustrates the layout of this operating equipment.
- Restoration consists of removal of all portable equipment and to restore the ground to the condition existing before equipment installation.

TABLE 1: SOUND MEASUREMENTS

GAS TURBINE/GENERATOR ASSEMBLY SOUND MEASUREMENTS, dbA (IDLE CONDITION)				
RADIAL DI STANCE	LOCATI ON			
	A	B	C	D
50 feet	73 (50)*	77 (50)	74 (51)	89 (50)
100 feet	71 (49)	72 (50)	68 (48)	78 (50)
150 feet	70 (49)	69 (48)	65 (54)	74 (56)
200 feet	67 (49)	68 (48)	63 (51)	NA (NA)

\*Measurement in ( ) is background noise, dbA



## 5.0 RELATIONSHIP BETWEEN LOCAL SHORT TERM USES OF THE ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENTS OF LONG TERM PRODUCTIVITY

The entire project to demonstrate the feasibility of using methane as a fuel to produce electric power will involve short term use of the environment because the operational portion of the demonstration plant is less than a one year period. At the end of this time frame, the equipment, being portable, will be dismantled and removed.

The long term productivity involves the development of an additional source of gaseous fuel in significant quantity. This has the effect of increasing the supply of gaseous fuel available to the United States, decreasing the nation's dependence on foreign fuel sources and converting a produce now being wasted into a relatively cheap source of energy.

Maintenance and operating personnel will be drawn from existing personnel in the mine work force. Use of personnel in this manner will not have any appreciable effect on the long term productivity of the regional socioeconomic sector.

Bethlehem Mines Corporation owns the plot of land used for the demonstration project. At the conclusion of the project and after all of the equipment has been removed, a minimal effort will be required to restore the ground to the condition existing before equipment installation.

Water is not consumed by the equipment for this demonstration project.

## 6.0 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

The design, construction, assembly and operation of the demonstration project are based on the assumption that the equipment will be disassembled and removed at the conclusion of the project. The term of this program is 12 months. This period was selected as being of sufficient length to successfully demonstrate the objectives of the project. It is conceivable that the project could be extended if other work is included by contract amendment or if Bethlehem Mines Corporation elects to continue operation until the gas source becomes depleted. In any event, it is not likely that more than two years of additional operation could occur due to depletion of the gas source.

Regardless of the length of the project, the compressor/skid assembly and the trailer van housing the gas turbine/generator assembly will be removed when the project has been completed. These are portable items which can be used in other applications. The original preparation of the site for these items consisted of clearing and leveling the areas where the turbine and compressor assemblies are located. At the conclusion of the Methane Utilization Program, the Waychoff borehole and Sabol Shaft site will be restored to their original configuration.

The gas from the vent was being irretrievably discharged to the atmosphere before the project was initiated. During project operation, this gas will be irreversibly burned in the gas turbine and the exhaust gas irretrievably discharged to the atmospheric environment.

Since the demonstration equipment does not use water, no water will be irretrievably or irreversibly committed to the site.

The construction, assembly, operation and disassembly of the demonstration equipment will not destroy or degrade any historical or archaeological sites. No habitats or populations of threatened or endangered species will be affected by this project.

## 7.0 ALTERNATIVES TO THE PROPOSED ACTION

### 7.1 ALTERNATE SITE

The intent of the project is to demonstrate the feasibility of burning methane or gob gas in a gas turbine to drive a generator and produce electric power. The gas is obtained from boreholes located and drilled in a mining complex at strategic locations to promote mine ventilation. In a mining complex, there will be several boreholes exhibiting various flow rates and methane content. The site selected for the demonstration plant was selected on the basis that the particular borehole presented an available fuel source with acceptable characteristics. In the interest of minimizing costs, a turbine/generator assembly was obtained on loan from the U.S. Army for the term of the project after being modified to be compatible with the fuel source.

It is conceivable the powerplant could be located at the Waychoff Borehole rather than at the Sabol Shaft site. However to accomplish this arrangement, it would be necessary to install transmission lines from the Sabol Shaft to the Waychoff Borehole which would be a distance of approximately one and a half miles. There is also a problem of noise made by the equipment while being located near a family residence. A pipeline was concluded to be the easier to build than the transmission lines and present significantly less legal problems. The choice of the site at the Waychoff Borehole was dismissed.

Other factors regarding boreholes were considered with regard to their influence on selection of a borehole. These factors include relative location to the mine power grid system, accessibility to the borehole, and availability of a labor pool. These factors turn out to be relatively equal regardless of the borehole location. There must be access to all boreholes so that gas flow measurements can be made, and the labor pool is the same for any mining complex. Thus, it was determined that these factors do not have an important role in the selection of a site.

## 7.2 ALTERNATE SYSTEM DESIGN

One alternate to the proposed system design considered larger equipment which would generate more power, but would require a larger energy source. Since an objective of the project is to use methane gas, it would have been necessary to tie several vents or wells together to get sufficient gas to run the larger equipment. Combining the output of several vents requires a large surface collection system with possibly some legal problems concerning pipeline right-of-ways. The resulting design of the system was much more complex, time consuming to assemble and disassemble and, therefore, more costly while not affording significant advantages. While the output of the system would be greater than that proposed, the additional complexity and cost involved were deemed unnecessary to establish feasibility of the basic concept and the idea was not pursued further.

Another alternative considered the use of a reciprocating engine as the prime mover. This consideration was dismissed because an engine size compatible with the output of the mine vent could not be located as standard hardware. Development of an engine suitable for use with this mine vent would not add anything of substantial technical value to the project and the idea was dismissed.

## 7.3 NO ACTION

Methane gas is a by-product of underground coal mining operations. This gas must be disposed of to enhance the safety of mining. Typically, disposal consists of venting the gas to the atmosphere. Since this gas has a considerable Btu content, this practice represents an enormous and irretrievable waste of one of our country's resources. This is an available energy source which only needs a successful demonstration of utilization feasibility to effect a considerable increase in the amount of gaseous fuel available for national use.

Continued waste of this energy source by inaction on this program will increase our dependence on a finite supply of natural gas and imports of LNG and oil.

APPENDIX A

BETHLEHEM/WESTINGHOUSE AGREEMENT UNDER CONTRACT DE-AC21-77ET13133

(Formerly Contract DE- AC05-77ET13133)

AGREEMENT dated this *15<sup>th</sup>* day of *February*, 1980, between WESTINGHOUSE ELECTRIC CORPORATION, acting through Its Advanced Energy Systems Division (hereinafter sometimes called "Westinghouse"), a corporation organized and existing under the laws of the Commonwealth of Pennsylvania, party of the first part, and BETHLEHEM MINES CORPORATION (hereinafter sometimes called "Bethlehem") a corporation organized and existing under the laws of the State of West Virginia, party of the second part.

WHEREAS, Westinghouse has heretofore entered into a contract with the United States Department of Energy, marked and known as Contract DE-AC05-77ET13133 (formerly known as contract EY-77-C-21-8098 and DE-AC21-77MO8098) and an agreement with the Commonwealth of Pennsylvania, each relating to a Pilot Demonstration Methane Utilization **Program** (hereinafter referred to as the "Demonstration Program"); and

WHEREAS, the methane supply at the present demonstration site, Bethlehem's **Revloc #32** Mine of its Cambria Division located near **Ebensburg**, Pennsylvania is inadequate for the **purpose of completion** of the Pilot **Demonstration Methane Utilization Program set forth in** the previous Agreement dated June 20, 1978 between Westinghouse and Bethlehem; and

WHEREAS, it is proposed that the Demonstration Program be

relocated at a new site, Bethlehem's Marianna #58 Mine of Its Ellsworth Division located near Marianna, Pennsylvania; and

WHEREAS, Westinghouse will continue to require the assistance of Bethlehem, in the Demonstration Program and in particular has requested that Bethlehem make available the gas emitted from the mine of Bethlehem known as its Marianna No. 58 Mine of its Ellsworth Division located near Marianna, Pennsylvania and the right to use the power distribution network of Bethlehem for its mines in the Ellsworth Division of Bethlehem Mines Corporation; and

WHEREAS, specific requests will be submitted to Bethlehem by Westinghouse concerning various types of assistance to be provided by Bethlehem incident to this agreement; and

WHEREAS, Bethlehem is willing to cooperate with Westinghouse in the Demonstration Program and is willing to furnish to it a site, said gas and the use of said power distribution system, provided, however, that the power if any, introduced to such system shall be delivered to Bethlehem without any cost to Bethlehem; and

WHEREAS, Bethlehem by its agreement to cooperate does not intend to yield up to Westinghouse any control of its operations in its Ellsworth Division arising out of its cooperation in the Demonstration Program and in particular will retain complete control of its ventilation systems for its mines, including its Marianna Mine No. 58.

NOW, THEREFORE, Westinghouse and Bethlehem, intending to be legally bound hereby, and in consideration of the covenants and agreements to be kept and performed as hereinafter set forth, agree as

follows:

(1) Bethlehem grants to Westinghouse such rights as it now has or may obtain by the exercise of efforts deemed reasonable solely by it which will **permit** the installation of facilities used or useful in the Demonstration Program and for such purpose grants to Westinghouse the right of ingress and egress to and over any lands controlled by Bethlehem insofar as necessary for the construction, erection, repair, maintenance or removal of the facilities of Westinghouse and others to be used in the Demonstration Program, provided, nevertheless, that the activities of Westinghouse and others involved in the Demonstration Program shall be conducted in such a manner as to not interfere with the mining operations of Bethlehem and Bethlehem shall not be required to modify its mining operations for the purposes of the Demonstration Program other than as herein set forth.

(2) The work to be carried out by Westinghouse under said United States Department of Energy Contract contemplates the furnishing, operating, and maintaining by Westinghouse of a gas turbine generating complex which will be located on lands controlled by Bethlehem under this Agreement and the furnishing to Bethlehem of the power generated, if any, during the Demonstration Program.

(3) The bringing upon said land controlled by **Bethlehem** of the turbine generating complex and all materials, maintenance, and operating personnel required for the turbine generating complex shall be the sole responsibility of Westinghouse and during the term hereof Westinghouse shall be responsible for compliance, with respect to such turbine generating complex, with all **applicable** local, state and

Federal laws and regulations, including but not limited to the Coal Mine Health and Safety Act of 1969, Public Law 91-173 as amended and Part 191 and 192, Title 49 CFR. Bethlehem will render assistance to Westinghouse with respect to identifying the requirements of such local and state laws and regulations.

(4) Westinghouse has been advised of the following by the U. S. Army and Solar Turbine International based on their experience with the Saturn Engine:

(a) Turbine Exhaust and Noise Levels -- (1) the turbine exhaust rate is approximately 28,000 cfm, (ii) the exhaust from the turbine generating complex will be clean and dry and will have as a part of its composition 17% to 19% oxygen by volume and (iii) the noise levels, at two feet and fifty feet from the turbine generating complex machine, will be 85 dbA and 76 dbA, respectively.

(b) Electrical Connection to the Power System of Bethlehem -- 'The turbine generating complex will deliver, through a three or four-wire cable of approximately fifty (50) feet in length, power to Bethlehem's power distribution system at 2400 or 4160 volts, respectively, 3-phase, 60 Hertz. The point of connection to the power system of Bethlehem shall be at the end of such cable. The turbine generating complex includes protection devices which, responding to signals received from either the turbine generating complex or Bethlehem's power distribution system, will automatically sever the connection to Bethlehem's power distribution system through a Circuit breaker in the turbine generating complex in the event that the voltage frequency or phase characteristics exceed preset limits. All

materials and workmanship used in the connection of the turbine generating complex to the distribution system of Bethlehem shall be in full compliance with applicable local, state and Federal laws and regulations, including mining laws and regulations.

(5) The turbine generating complex is intended to operate on methane gas which is being emitted from an existing bore hole drilled by Bethlehem and known as its Waychoff bore hole. Westinghouse **will** supply to Bethlehem operating specifications for the turbine generating complex. In the event that the quality or quantity of the methane emitted from the bore hole shall not suffice to operate the turbine generating complex, Westinghouse at its discretion **may**, but shall not be obligated to, continue operation of the turbine generating complex with a supplemental fuel source. Such **supplemental** fuel source shall be the sole responsibility of Westinghouse including, without limiting the generality of the foregoing, any permits **that** may be required in connection therewith.

(6) Westinghouse will supply a detailed electrical **schematic** drawing of the power to be supplied to the distribution system of Bethlehem, including wiring types, voltage levels, wire sizes, connectors and circuit protection devices included in the turbine generating complex and will include the proposals for the protection of the power distribution system of Bethlehem from damage by lightning striking the turbine generating complex.

(7) The turbine generating complex will be made secure by the installation of a seven foot high fence with a ten foot wide gate, which, for security purposes, will be kept locked.

(8) Bethlehem will supply a connection from- said last mentioned bore hole of Bethlehem, and make available to Westinghouse for its Demonstration Program the methane emitted from such bore hole. Nothing herein contained shall require Bethlehem to modify its mine ventilation system or operate its Mine No. 58 in any manner other than normally used by Bethlehem in its sole discretion. A failure of such bore hole to supply a suitable methane shall not be treated as a failure of cooperation on the part of Bethlehem in the Demonstration Program. The supply by Westinghouse to Bethlehem of specifications on minimum flow rates of methane required for satisfactory turbine generator operation shall not be construed by the parties as erecting any obligation on the part of Bethlehem to supply methane as set forth in such specifications. Westinghouse will, upon notice by Bethlehem or its representatives, halt or curtail the taking of methane from the bore hole of Bethlehem and the supply of power to the power distribution system of Bethlehem.

(9) Bethlehem will supply an electrical schematic drawing of the distribution system of Bethlehem from the point of its connection to the turbine generating complex to its nearest terminal control point, including thereon wire types and sizes, circuit protection devices, relay panels, switching elements and load characteristics. Bethlehem **will** make such reasonable measurements of the use by it of power to be supplied from the turbine generating complex as Westinghouse may from time to time request.

(10) Anything contained in this Agreement to the contrary

notwithstanding, the rights of the parties hereunder shall terminate thirty (30) days after the completion of performance under this Agreement or the termination of said United States Department of Energy Contract whichever shall first occur and the parties shall take such actions during said thirty-day period to restore the surface of the land on which the turbine generating complex is located. The expense of such surface restoration, other than removal of facilities furnished by Bethlehem, shall be for the account of Westinghouse and any subsurface restoration deemed necessary or desirable by Bethlehem shall be for the account of Bethlehem; provided, however, that if removal of the underground portion of the pipeline of approximately 7,500 feet in length proposed to be constructed is required by any law or regulation or by the terms of any right-of-way or other agreement, pursuant to which rights were granted for the installation of such pipeline, then and in either such event, the expense of such removal shall be for the account of Westinghouse.

(11) All work under this Agreement including restoration actions by Westinghouse under Section 10 hereof shall be completed not later than December 31, 1980 unless this date is extended by mutual agreement of the parties, or unless one party delays the completion of the work by the other party.

(12) The parties hereto recognize that Bethlehem shall be and remain at all times an independent contractor with respect to any work done by it or its employees or agents in connection with the Demonstration Program. Westinghouse shall not have any power of direction or control over Bethlehem or its employees and agents

other than as set forth in this Agreement. In the work provided to **be** done in said United States Department of Energy Contract to which Westinghouse is a party, Westinghouse shall conduct, supervise, direct and be responsible for all work performed thereunder and Bethlehem shall be at all times governed solely by this Agreement; except for such work and assistance by Bethlehem as may be authorized pursuant to paragraph **19** herein.

Employees of Westinghouse or agents utilized by Westinghouse shall be deemed to be and remain at all times employees or agents of Westinghouse and shall not be deemed in any respects to be the employees or agents of Bethlehem, and Westinghouse shall assume full responsibility and liability for compliance with all provisions of applicable **Workmen's** Compensation laws and other Federal and State laws relating to or affecting labor.

(13) Each party agrees that it will be responsible for its own acts and the results thereof and shall not be responsible for the acts of the other party and the results thereof. Each party therefore agrees that it will assume all risk and liability to itself, its agents or employees for any injury to persons **or** real property resulting in any manner from the conduct of its own operations and the operations of its agents or employees, under this Agreement. In no event, however, shall Bethlehem **or** Westinghouse be liable to the other whether based on contract, negligence, strict liability, tort, or otherwise for loss of use of the methane gas, equipment or power system; for cost of capital; for loss of profits or revenues or the loss of use thereof; for cost of purchased or replacement power; for claims of

any customers; or for any special, indirect, incidental **or** consequential loss or damage whatsoever.

If the turbine generating complex fails to meet any of the criteria set forth in this agreement, the sole remedy of Bethlehem is to require Westinghouse to remove the equipment and Westinghouse shall not be liable for any damage whatsoever arising out of such failure of the complex whether the claim is in contract, tort, negligence, warranty or otherwise.

Anything in this Agreement to the contrary notwithstanding, Bethlehem does not make any representation as to the adequacy of said gas supply, the suitability of said site and said power distribution system, the condition of said coal mine or the property of Bethlehem involved in the Demonstration Program, it being the obligation of Westinghouse to determine at all times in its sole discretion and at its own risk such adequacy, suitability and condition.

(14) Westinghouse and Bethlehem will comply with all provisions of Executive Order No. 11246 of September 24, 1965, as amended from time to time and subsequent Executive Orders of a similar import and the rules, regulations and relevant orders issued pursuant thereto.

(15) Each of the parties hereto agrees to keep the other **party** currently informed as to technical data and analysis, developed under the Demonstration Program. To the extent that Westinghouse shall have the right to do so under the terms of said United States Department of Energy Contract and said agreement with the Commonwealth

of Pennsylvania and not otherwise restricted, It shall-make available to Bethlehem copies of technical data developed by it on behalf of the signatories to the aforesaid contract and agreement which are kept or arise out of work done by it under said contract and agreement.

(16) Neither party hereto shall announce, publish, or otherwise make public information or conclusions resulting from the work performed hereunder, until after review for technical accuracy by both parties. This is not to be construed as a prohibition to publication, and such review shall not be unreasonably delayed. Any announcement or publication of work hereunder by either party shall recognize and give credit in the text and on the title page to the cooperation of the other party, unless either party requests otherwise. Nothing in this Section is intended to interfere with fulfillment Of **the** reporting responsibilities of Westinghouse under law or under said United States Department of Energy Contract or prejudice the rights of the Government **with** respect to data generated **or** reported under that contract.

(17) The parties hereto agree that other than **personnel** employed by Bethlehem **or** visitors brought onto the site by Bethlehem, visitors to the site shall be considered for the purposes of this agreement invitees of Westinghouse. Any exception to the foregoing may be had only with the consent of Bethlehem first had and obtained In writing.

The unique nature of this program will result in the need to accommodate outside agency visitors for brief periods through the program. Such visitors will be requested to provide 48-hour notice

for such visits. This requirement does not include representatives Of Bethlehem, United States Department of Energy and Westinghouse who may elect to monitor program progress directly. Program briefings **for** visitors to the site are to be prepared and given by Westinghouse. Outside agency contacts for site visitations are as follows:

(a) Bethlehem Ellsworth

**Mr.** Sam Sprague

(412) 228-5500, Ext. 217

(b) Westinghouse

Mr. Carl L. **Sturgill**

(412) 892-5600, Ext. 5437

(18) The parties recognize, that before this Agreement can be implemented, it will be necessary for Bethlehem to obtain:

(1) necessary rights permitting it to route and install a pipeline system from the Waychoff Bore Hole to Bethlehem's Sabol Shaft;

(ii) a bridge load limit variance or extension of any existing variances to permit movement of the compressor and the gas turbine van trailer (60 tons) to and from the Sabol Shaft site; (iii) the agreement of parties who may own Interests in the methane to be used by the turbine generating complex; (iv) the concurrence or agreement of the supplier to Bethlehem of power for its operation in the Ellsworth Division and any applicable government authority, permitting it to use power generated by the turbine generating complex in conjunction with power supplied by such supplier. Anything herein contained to the contrary notwithstanding, there shall not be any

obligation on Bethlehem to act to secure such **rights, variances,** agreements or concurrence other than at its sole discretion. Bethlehem will provide to **Westinghouse** written notice whether Bethlehem has secured such rights, variances, agreements and concurrences, and if such rights, variances, agreements and concurrences are not secured, Westinghouse and Bethlehem will take such steps as are necessary to restore the parties to their respective positions occupied prior to the date hereof in accordance with the provisions of section (10) hereof.

(19) Subject to Department of Energy approval, Westinghouse will issue purchase orders, in form and substance satisfactory to Westinghouse and Bethlehem, covering the work and assistance to be provided by Bethlehem such as site preparation, transportation, materials and services including installation of pipeline as **necessary;** to implement, this Agreement.

(20) This Agreement expresses the entire agreement between Westinghouse and Bethlehem relating to the subject matter hereof, and there are not and have not been inducements for the execution of this Agreement not stated herein and no modification of the terms hereof shall be valid unless in writing signed by the parties hereto.

(21) Except as herein otherwise specifically provided, and subject to the provisions hereof, this Agreement shall be binding upon and inure to the benefit of the parties hereto and their respective successors and assigns.

IN WITNESS WHEREOF, said Westinghouse Electric Corporation

and said Bethlehem Mines Corporation has each caused this Agreement to be executed as of the day and year first above written.

WESTINGHOUSE ELECTRIC CORPORATION,  
by



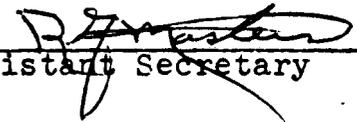
\_\_\_\_\_  
E. S. Larkin, Jr.  
Manager of Purchases  
Advanced Energy Systems Division

BETHLEHEM MINES CORPORATION,  
by



\_\_\_\_\_  
Vice President

ATTEST:



\_\_\_\_\_  
Assistant Secretary

## APPENDIX B - NEWARK SOILS

Newark Soils: Newark soils are deep somewhat poorly drained soils formed from alluvium. They are on nearly level floodplains and are subject to flooding. They have moderate permeability, a high available water capacity and a seasonal high water table at 10 to 15 inches of the surface during wet periods of the year.

### Soil Horizon Characteristics of a Typical Soil

0 to 10 inches, dark yellowish brown silt loam surface soil.

10 to 39 inches, yellowish brown and light brownish grey silty clay loam subsoil.

39 to 60 inches, light brownish grey and brown loam substratum.

### Mapping Units

06A1 - Newark Silt Loam

## APPENDIX C - GLENFORD SOILS

**Glenford Soils:** Glenford soils are deep moderately well drained soils formed from stratified stream deposited material. They are on stream terrace positions above the floodplains. They have moderately slow permeability, a high water capacity and a seasonal high water table at 24 to 28 inches of the surface during wet periods of the year.

### Soil Horizon Characteristics of a Typical Soil

0 to 9 inches, brown silt loam surface soil.

9 to 47 inches, yellowish brown silty clay loam subsoil.

47 to 60 inches, yellowish brown gravelly silt loam substratum.

### Mapping Units

42A Glenford silt loam. 0 to 3 percent slopes.

43B Glenford silt loam. 3 to 8 percent slopes.

42C-2 Glenford silt loam. 8 to 15 percent slopes.

## APPENDIX D - DORMONT SOILS

Dormont Soils: Dormont soils are deep moderately well drained soils formed from shale, siltstone and limestone. They are on upland slopes. They have moderately slow permeability, a high available water capacity and a seasonal water at 24 to 30 inches of the surface during wet periods of the year.

### Soil Horizon Characteristics of a Typical Soil

0 to 8 inches, dark brown silt loam surface soil.

8 to 54 inches, yellowish brown silty clay loam subsoil.

54 to 78 inches, brown silty clay substratum.

### Mapping Units

26B Dormont silt loam. 3 to 8 percent slopes.

26C Dormont silt loam. 8 to 15 percent slopes.

27D-3 Dormont silt loam. 15 to 25 percent slopes.

## APPENDIX E - DORMONT- CULLEOKA SOILS

Dormont- Culleoka: Dormont- Culleoka soils are moderately deep to deep, moderately well to well drained soils, formed from shale, interbedded shale, siltstone, sandstone and limestone. They are on upland slopes. The Dormont soils have moderatley slow permeability, a high available water capacity and a seasonal water at 24 to 30 inches of the surface during wet periods of the year. The Culleoka soils have moderate to moderately rapid permeability, a moderate available water capacity and normally have no seasonal high water table.

### Soil Horizon Characteristics of a Typical Soil

0 to 11 inches, dark brown silt loam surface soil.

8 to 54 inches, yellowish brown silt loam or silty clay loam subsoil.

54 to 78 inches, brown silty clay substratum.

### Mapping Units

26D-2 Dormont- Culleoka silt loams 15 to 25 percent slopes

26D-6

26EF-6 Dormont- Culleoka silt loams 25 to 50 percent slopes.

APPENDIX F  
SOIL TYPES IN VICINITY OF SITE

