Industrial Fuel Gas Demonstration Plant Program

DOE/ET/13046--T64

DEMONSTRATION PLANT

CONSTRUCTION PLAN

DELIVERABLE NO. 37

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The Department of Energy
Under Contract ET-77-C-01-2582

MEMPHIS LIGHT, GAS AND WATER DIVISION
P.O. BOX 430, MEMPHIS, TENNESSEE 38145

In Association with
FOSTER WHEELER ENERGY CORPORATION
INSTITUTE OF GAS TECHNOLOGY
DELTA REFINING COMPANY

MASTER

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MEMPHIS INDUSTRIAL FUEL GAS

DEMONSTRATION PLANT PROJECT

DEMONSTRATION PLANT CONSTRUCTION PLAN
(Deliverable #37)

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PREPARED FOR THE
U. S. DEPARTMENT OF ENERGY
ASSISTANT SECRETARY OF FOSSIL ENERGY

UNDER CONTRACT DE-AC02-77ET13406
(FORMERLY CONTRACT ET-77-C-01-2582)

MEMPHIS LIGHT, GAS AND WATER DIVISION

December 15, 1979
Letter No. ME-103F

U. S. Department of Energy
Projects Management Division, Dr. R. W. Laza
9800 South Cass Avenue
Argonne, Illinois 60439

Attention: Dr. Peter Lui

Subject: MLGW Reference No. 8802
DOE Reference No. 2582
DEMONSTRATION PLANT CONSTRUCTION PLAN
DELIVERABLE NO. 37

Gentlemen:

Enclosed is Deliverable No. 37, "Demonstration Plant Construction Plan", which has been prepared as part of our Phase I work.

We request your approval.

Very truly yours,

R. W. Gray
Program Manager

RWG:RJS:au
Enclosure.

cc: J. Gannon (6)

MLGW/DOE INDUSTRIAL FUEL GAS DEMONSTRATION PLANT PROGRAM

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CONSTRUCTION PLAN
DELIVERABLE NO. 37

Section 1.0

INTRODUCTION

The United States Department of Energy (DOE) awarded a contract to Memphis Light, Gas and Water Division (MLGW) which requires MLGW to perform process analysis, design, procurement, construction, testing, operation, and evaluation of a plant which will demonstrate the feasibility of converting high sulfur bituminous coal to industrial fuel gas with a heating value of 300 ± 30 Btu per standard cubic foot (SCF). The demonstration plant is to be based on the U-Gas process, with its product gas to be used in commercial applications in Memphis, Tennessee.

In order to perform this work, MLGW has established an industrial team, which includes:

MLGW - Memphis Light, Gas and Water Division, Memphis, Tenn.
The prime contractor and distributor of the industrial fuel gas.

FWEC - Foster Wheeler Energy Corporation, Livingston, N.J.
The engineer-construction manager,

IGT - Institute of Gas Technology, Chicago, Illinois.
The process developer.

DRC - Delta Refining Company, Memphis, Tenn.
To provide operating experience.

The contract specifies that the work is to be conducted in three phases. The phases are:

- Phase I - Program Development and Conceptual Design
- Phase II - Demonstration Plant Final Design, Procurement
and Construction
- Phase III - Demonstration Plant Operation

Included within Task VII (Planning for Final Design, Construction and Operation), Phase I activities is the preparation of a Construction Plan.

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DEMONSTRATION PLANT
CONSTRUCTION PLAN
DELIVERABLE NO. 37

Section 2.0

CONSTRUCTION PLAN

2.1 General

Major activities during construction of the IFGDP will consist of site preparation, followed by the construction of foundations, barge unloading facilities, warehouses, and shops, on-site facilities and the IFG distribution system. Site preparation includes the construction of the access road, site clearing, site build up, site grading and construction facilities. All major construction activities are described below.

A network logic diagram of the IFGDP construction program is shown on the attached charts, together with a more detailed network for the gasification and cooling/scrubbing sections (Section 330 and 340), which comprise the most intricate construction work.

2.2 Organization

Attached is an organization chart for the Construction Manager of the IFGDP. This organization is based upon subcontracting all work. Major subcontracts anticipated are

. Site Preparation-Clearing	. Mechanical	. Landscaping
. Grubbing, Dredging & Backfill	. Electrical	
. Foundations & Underground Piping	. Buildings	
. Dock Facilities	. Insulation	
. Coal/Coke & Ash Handling	. Painting	

Should direct line construction be approved for FWEC during Phase I, this organization will be altered.

2.3 Description of Construction Activities

This section describes the major activities necessary to construct the IFGDP. Table 2-1 provides a construction activity schedule corresponding to descriptions.

2.3.1 Access Road

Access to the construction site will be made along an existing road which extends along the top of the levee west of the Allen Generating Plant to the T. E. Maxson Wastewater Treatment Facility discharge canal, then north to the site (Figure 2-1). The road will require temporary modification in order to transport heavy earthmoving equipment onto the site. These modifications will include widening and leveling. During site filling, the access road will be elevated to 233 feet. All permanent modifications to the road will be made at that time. This access road will provide the right of way for all utilities entering and leaving the site from the south.

OVERALL SUMMARY CPM
NETWORK DIAGRAM FOR
INDUSTRIAL FUEL GAS
DEMONSTRATION PLANT
FWEC 15-2200

NOTE: CPM LOGIC IS NOT ON TIME SCALE

INDUSTRIAL FUEL GAS DEMONSTRATION PLANT
MEMPHIS, TENN.
CONTRACT No. ET 77C-01-2582

MEMPHIS LIGHT, GAS AND WATER DIVISION MEMPHIS, TENN.	DEPARTMENT OF ENERGY COAL CONVERSION DIVISION WASHINGTON, D.C.
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DELIVERABLE NO. 37

CONSTRUCTION ACTIVITY SCHEDULE

Table 2-1

<u>Construction Activity</u>	<u>Months After Go-Ahead</u>
Site Preparation	
A. Access Roads	1
B. Construction Facilities	1
C. Site Filling	1 to 10
D. Site Grading & Compaction	11 to 15
Construction Facilities	10 to 13
Foundations	12 to 21
Warehouse and Shops	12 to 21
Underground Piping and Electrical	12 to 25
Barge Unloading Facilities	10 to 24
Waste Water Treatment	12 to 27
Structural Steel Erection	15 to 24
Gasification Structure Erection	15 to 24
Equipment Setting	15 to 40
Air Plant Erection	22 to 33
Above Ground Piping and Electrical	22 to 42
Instrumentation	31 to 45
Insulation, Fireproofing, Painting	36 to 45
Preparational Test	42 to 45
IFG Distribution System	34 to 45

Figure 2-1 Location of Access Road

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CONSTRUCTION PLAN
DELIVERABLE NO. 37

2.3.2 Construction Facilities

Construction facilities required during site preparation will be set up on existing built up areas, including the access road and areas near the Allen Generating Plant and the T. E. Maxson Wastewater Treatment Facility.

A temporary electric transmission line will deliver electricity to the construction facilities. The location of this line is identical to that of the permanent line along the access road. This line will have a capacity of 3000 kilovolt-amperes.

2.3.3 Site Clearing

The plant site will be cleared of all vegetation. Slash will be chipped and sold to the maximum extent possible rather than burned.

2.3.4 Site Buildup

Site buildup will involve raising the elevation of the site to the project design elevation using dredged material obtained from the Mississippi River.

Dredging Operations

Fill will be obtained from the Mississippi River. The most probable dredging location is the western side of the barge channel in the vicinity of river mile 725. It may also be possible to dredge the eastern side of the river near the same river mile. The number of dredge barges and the amount of river traffic will be used to determine exact locations. On the western side of the channel, possible dredge locations extend south from the vicinity of river mile 725. Use of the eastern side of the river south of that mile may be restricted because of the proximity to the existing revetment and the barge channel.

The dredged material will be pumped to the site through 24 to 30 inch flexible pipe. Up to three dredgers will operate approximately 22 hours per day during dredging operations, which are estimated to last for 250 calendar days. The exact number and size of dredgers is dependent on the contractor involved. Three 24-inch, one to two 27-inch or one 30-inch dredger may be used, each resulting in the same schedule.

Site Filling

Following are two possible methods of site filling:

Dredge material will first be pumped onto the east end of the site. This material will be used to build a temporary dike around a small area, most probably in the location of the ash disposal area. Additional dredge material will then be deposited and allowed to drain through a weir into Lake McKellar. Subsequently, more dredge material will be placed on the central and western portion of the site to accomplish the site build up.

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CONSTRUCTION PLAN
DELIVERABLE NO. 37

The fill to be used for the process and Steam Generation units and the live coal pile will be compacted to 95 percent of Modified Proctor Density (ASTM D 1557). The vibratory compaction method will be used. All other fill will be placed by the dredge discharge pipe and spread by bulldozers. Adequate compaction will be achieved by water drainage during the filling operation.

An alternate method of site filling would be to clear the site and provide temporary diking around the entire site to presently undetermined elevation no greater than 71 meters (233 feet) above sea level. This dike would probably be constructed of a combination of materials from the site and some dredge fill. A weir will be located on the north side leading to Lake McKellar. The dredger would then fill the site generally from south to north. Water would rise inside the dike and overflow the weir to the lake.

The specific method of filling and vibratory compaction will be dependent on the contractor selected, equipment available, contractual terms and other considerations. The end result, however, will be the same.

The site will be filled to an elevation of 233 feet above mean sea level for the process and support facilities and the live coal pile. The remainder of the site will be built to the required elevations.

Grading and ditching will be provided during construction to convey rainfall runoff to a holding pond in the northeastern end of the site. The runoff diversion will serve as a method of erosion control. The water will then be allowed to flow into Lake McKellar. If the alternate scheme is used, rainfall would flow through the weir to the lake.

2.3.5 Site Grading

Site grading will begin as site build up nears completion or as soon as possible thereafter. The site will be graded to above project flood level to an elevation of 233 feet above mean sea level for the process and Steam Generation units and for the live coal pile. Other process and storage areas will be graded to an elevation of 225 feet and will be surrounded by a levee at 233 feet mean sea level elevation.

Rip-rap will be placed on the outside slopes of the plant site and access road where required to reduce any erosion caused by wave action along the shore. All open areas where no construction will occur (such as the inside of the dike and the long-term ash disposal area) will be seeded with grass to prevent erosion due to rainfall runoff.

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CONSTRUCTION PLAN
DELIVERABLE NO. 37

2.3.6 Foundations

The construction of foundations will occur simultaneously with bathtubbing and site grading. All structures will be supported on spread flooring with an allowable net soil bearing value of 3000 pounds per square foot. To compensate for the fact that the site is located in Zone 3 of the U.S. Seismic Risk Map, a factor of safety will be incorporated so that the net soil bearing value will increase to a maximum of 4000 pounds per square foot.

The minimum foundation depth will be about 1 meter (3 feet) below final grade to ensure frost protection and to provide for adequate confinement of the bearing soils. The minimum foundation width will be about 0.5 meter (18 inches) for continuous footings and 24 inches for individual footings. The bottom of the footings will be compacted to densities equivalent to 95 percent of the Modified Proctor density (ASTM Specification D-1557). The footing excavation will not extend below the groundwater table. The construction of foundations will begin approximately 2 to 6 months following completion of the filling or as soon as possible.

The foundation design criteria mentioned above are considered preliminary and are subject to change pending further soils investigations during Phase II design period of this project. It may be necessary to use piles for the gasifier structure and live coal pile structure. All changes, as well as the above specifications, will be in accordance with the ACI 318 "Building Code Requirements for Reinforced Concrete."

2.3.7 Warehouses and Shops

Various temporary construction shops, warehouses and auxiliary buildings will be constructed in the locations shown on the attached Figure (location of on-site Construction Facilities). A concrete batch plant and materials testing laboratory may also be located in this area. These temporary facilities will be prefabricated corrugated metal structures or trailers. Approximately 9 acres are available for these facilities.

The permanent warehouse and maintenance building, laboratory/first aid building and firehouse construction will start at this time and will be in use during the remainder of the construction program. The security fence will also be constructed along the 233 feet elevation.

2.3.8 Underground Piping and Electrical System

Following site grading, and concurrent with the construction of warehouses and shops, the electric transmission line, main substation, water supply pipelines, sanitary sewage line and wastewater discharge pipeline will be constructed.

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CONSTRUCTION PLAN
DELIVERABLE NO. 37

2.3.9 Barge Unloading Facilities

Much of the equipment to be used during permanent facilities construction will be transported to the site by barge. Maximizing barge delivery will reduce the amount of construction traffic on city streets. As a result, the barge unloading facilities will be constructed concurrently with site grading and installation of warehouses, shops, underground piping and the electrical transmission system.

Dredging and filling may occur along the north bank of the channel in order to provide a uniform bank. The maximum anticipated dredging is approximately 3800 feet in length, 50 feet in width and 6 feet in depth. All dredged material from the unloading channel will be disposed of in the existing dredge spoil area at the eastern end of the peninsula, and all fill material will be obtained from dredging operations.

Mooring stations will be located south of the site. Each station will be made up of one to four separately driven piles. Barge mounted pile driving equipment will be used for this activity. The main support deck for the barge unloader will be pile supported.

2.3.10 On Site Facilities

The equipment for all control facilities will be built or set on their respective foundations at grade and on structural steel as it is being erected. This is best illustrated by the network designated as typical for the Coal Gasification/Cooling and Scrubbing Units (330 & 340) regarding erection of vessels, tanks, pumps, etc. Wastewater Treatment Unit (440) will be concurrently worked with the Dock facilities (490), Coal Gasification (330 & 340) Units and field erection of T-3601, H₂S Absorber, of Gas Treating Unit (360). Air Separation Unit (310) Gas Compression & Treating Units (350/360) will be worked at the same time with Sour Water Stripper Unit (370) and Cooling Tower Area (450). Sulphur Recovery Unit (380) and Tail Gas Treatment Unit (390) will be worked in conjunction with the Utility Area (430) and Facilities Area (470). The Credit Generation Unit (220) will be concurrently worked with the Flare Unit (460), Coal/Coke Receiving and Handling Unit (410), Coal/Coke Treating and Feed Unit (320) and Ash Treatment Area (420). All above ground piping, electricals and instrumentation will be installed. The facilities will be painted, insulated, fireproofed and prepared for pre-operational testing.

During construction, wastewater and rainfall runoff will be stored in the long-term ash disposal area. Suspended particulates will be allowed to settle out before being allowed to flow to Lake McKellar.

All construction equipment will meet OSHA-specified noise standards.

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DEMONSTRATION PLANT
CONSTRUCTION PLAN
DELIVERABLE NO. 37

2.3.11 IFG Distribution System

The section of the IFG distribution system under Lake McKellar will be installed by dredging in a right-of-way across the lake. The pipeline will be anchored with concrete weights at specified intervals to counteract buoyancy. The top of the pipe will be at a maximum elevation of about 155 feet above mean sea level, which conforms to U.S. Army Corps of Engineers requirements. 30 foot wide right-of-way will be obtained both across Lake McKellar and on President Island where the pipeline is not located in street right-of-way. Crossing Lake McKellar will require dredging a length of approximately 270 meters (885 feet) to a depth of approximately 1.5 meters (5 feet) below the lake bed. The maximum width of dredging for both the IFG and city-water pipelines is 10 feet. The water pipeline has a diameter of 16 inches and the IFG pipeline has a diameter of 30 inches or less.

Coated welded steel gas pipe will be used in the construction of the distribution system. For quality assurance, each weld will be inspected and/or x-rayed. The top of the pipe will be located at a minimum of about 1.1 meters (3.5 feet) below the ground surface. The existing storage area at the MLGW service center will be used as a staging and warehouse area for construction.

2.3.12 Construction Termination

Upon commencement of operation, the construction program will be terminated. This will include landscaping and the removal of all temporary facilities. The temporary facilities will be demolished or relocated by owners.

2.4 Construction Labor Force

The construction labor force, divided into labor categories, is summarized on a quarterly basis in Table 2-2. The maximum number of workers for any quarter is expected to be 950. These workers are expected to be available from the Memphis area. This will minimize the need for temporary housing due to the construction program.