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June 30, 1989

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RE: ENVIRONMENTAL MONITORING PLAN ANNUAL REPORT

In accordance with Article 7.4(b) of the Price Guarantee Commitment, enclosed herewith is the Environmental Monitoring Plan Annual Report covering the time period between April 1, 1988 to March 31, 1989 for the Dow Syngas Project.

Sincerely,

G. C. LeBlanc

G. C. LeBlanc
Environmental Coordinator

Enclosure

jdg

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Louisiana Gasification Technology, Inc.

**ENVIRONMENTAL
MONITORING PLAN
ANNUAL REPORT**

APRIL 1, 1988 TO MARCH 31, 1989

JUNE 30, 1989

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**ENVIRONMENTAL MONITORING PLAN
FOR THE
DOW SYNGAS PROJECT
ANNUAL REPORT**

APRIL 1, 1988 - MARCH 31, 1989

Submitted to:

Office of Synthetic Fuels Projects
U.S. DEPARTMENT OF TREASURY
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2.0 PROJECT STATUS

2.1 Plant Production Summary

The Dow Syngas Project achieved Commencement of Commercial Production on December 18, 1988. This major project milestone and contract commitment involved production equating to 60 % of capacity in a consecutive 90 day period. The plant has operated at daily production rates as high as 91.9 %, limited primarily by operational problems associated with the wastewater treatment system, char recycle handling system, and shutdowns for routine equipment inspection and maintenance.

The plant operated a total of 5307 hours on coal (1348 hours during first quarter 1989), producing a total of 5435 BBtu of on spec product (1446 BBtu during first quarter 1989). During the reporting period, the plant was on line and in service to the Power Plant over 59 % of the time (58 % during first quarter 1988). Production during this reporting period was more than double that of the previous annual reporting period. A number of production records were set during the period, including daily, monthly, quarterly and annual records. In addition, on March 29, 1989, the plant began a test run on bituminous coal. (See Table 2.1-0 for a listing of significant events during the reporting period.)

2.2 Plant Description

Design changes completed during this reporting period are described in Section 2.2.3 and are reflected in modifications of the plant description in Section 2.2.2.3. The remainder of Sections 2.2.1 through 2.2.2.8 are unchanged from the Quarterly Report for fourth quarter 1988.

2.2.1 Project Overview and Location

The Dow Syngas Project produces medium BTU synthetic gas (syngas) for consumption by the existing gas turbine power generation units at Dow's Louisiana Division chemical complex in Plaquemine, Louisiana. Figure 2.1-1 shows the location of the Louisiana Division. Figure 2.1-2 shows the location of the Dow Syngas Project facilities at the Louisiana Division site.

At capacity, the Dow Syngas Project will produce 30,000MM BTU of synthetic gas per day from approximately 2,200 tons per day of western sub-bituminous coal from the Powder River Basin in Wyoming. The design-basis coal, used for purposes of sizing equipment, is a lignite coal. The Project will use sub-bituminous coal initially and intends to switch to lignite or other types of coal later on in the project life. All ranges of coal, including anthracite, bituminous, sub-bituminous, and lignite, may be used if the specific plant design is adapted to that coal type and as long as the feedstock does not exceed 1.2 % sulfur as allowed in the air permit for the project.

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TABLE 2.1-0

LIST OF SIGNIFICANT EVENTS
APRIL 1, 1988 - MARCH 31, 1989

DATE	EVENT	COMMENTS
4-1-88	Gasifier on coal	Continuation of operation from previous quarter
4-7-88	Gasifier on coal	Tail Gas Incinerator opacity exceeds 20 %
4-29-88	Daily Production Record	91.9 %
April 1988	Monthly Production Record	37.8 %
5-3-88	Gasifier on coal	SO ₂ emission from Gas Turbine Stack exceeds permit by 9.2 lbs
5-18-88	Manual trip of gasifier	Trip to avoid release of H ₂ S in excess of reportable quantity for H ₂ S from Tail Gas Incinerator
5-18-88	Gasifier on coal	
6-1-88	Manual trip of gasifier	Trip to eliminate incinerator stack emissions in excess of 20 % opacity
6-6-88	Gasifier on coal	Tail Gas Incinerator opacity exceeds 20 %
6-14-88	Annual Production of 1987 exceeded	
6-19-88	Trip of Gasifier	Trip to install secondary soot scrubber
Second Quarter 1988	Quarterly Production Record	33.2 %
7-6-88	Gasifier on coal	
7-19-88	Gasifier on coal	Tail Gas Incinerator opacity exceeds 20 %
July	Monthly Production Record	53.9 %

TABLE 2.1-0
(continued)

LIST OF SIGNIFICANT EVENTS
APRIL 1, 1988 - MARCH 31, 1989

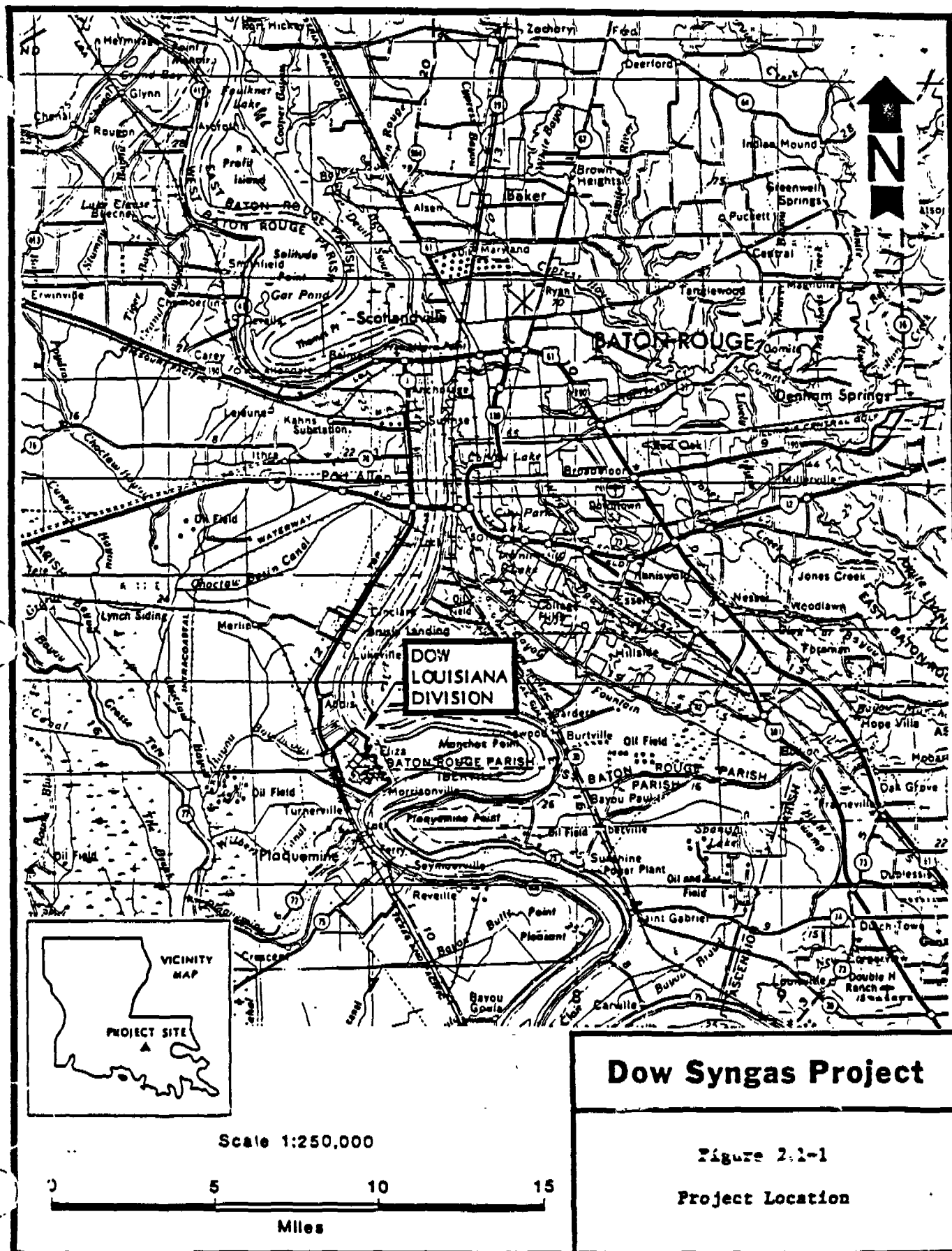
DATE	EVENT	COMMENTS
8-29-88	Gasifier on coal	Tail Gas Incinerator opacity exceeds 20 %
8-30-88	Gasifier on coal	Tail Gas Incinerator opacity exceeds 20 %
8-31-88	Gasifier on coal	Tail Gas Incinerator opacity exceeds 20 %
9-1-88	Gasifier on coal	Tail Gas Incinerator opacity exceeds 20 %
Third Quarter 1988	Quarterly Production Record	44.4 %
October	Continuous "On-Coal" Record	
11-10-88	Gasifier on coal	Tail Gas Incinerator opacity exceeds 20 %
11-23-88	Gasifier on coal	Tail Gas Incinerator opacity exceeds 20 %
11-30-88	Manual trip of gasifier	Major maintenance performed included planned modifications to the wastewater treatment system
November 1988	Continuous "On-Coal" Record Monthly Production Record	79.3 %
12-7-88	Gasifier on coal	
12-18-88	Established Commercial Production Status	
Fourth Quarter 1988	Quarterly Production Record	64.0 %
1988	Annual Production Record	41.6 %

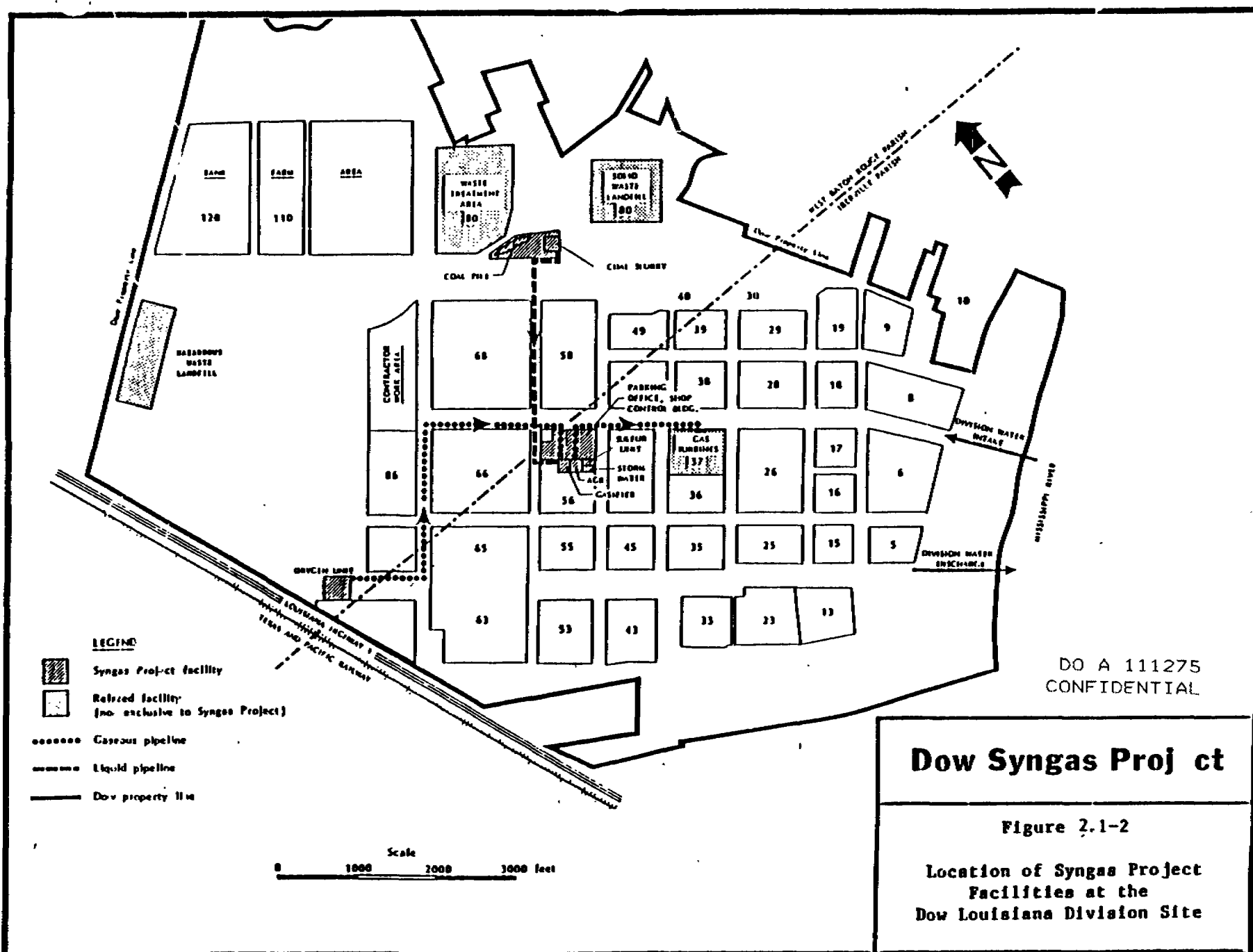
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TABLE 2.1-0
(continued)

LIST OF SIGNIFICANT EVENTS
APRIL 1, 1988 - MARCH 31, 1989

DATE	EVENT	COMMENTS
1-1-89	Gasifier on coal	
1-28-89	Manual trip of gasifier	Shutdown to coincide with Power Plant outage for Gas Turbine work
3-10-89	Continuous "On-Coal" Record	
3-30-89	Gasifier on coal	Test run on bituminous coal begun





2.2.2 Process Description

The block diagram in Figure 2.1-3 illustrates the process used by the Dow Syngas Project. The environmental monitoring locations designated for the process are listed in Table 2.1-1. The following subsections describe various portions of the project.

2.2.2.1 Coal Slurry Facility

The existing coal slurry facility, which was designed to support the Prototype II coal gasification plant, was expanded to provide the coal slurry feed for the commercial facilities. Coal is delivered in bottom dump hopper cars and discharged from the railcars into unload pit hoppers. Conveyors move the coal from the hoppers to a radial area and keeps dust emission to a minimum. Reclaiming of stacker which distributes coal over the entire stockpile the coal from the stockpile is accomplished by using a bulldozer to feed the coal in to reclaim pit hoppers where it is then ground and slurried with recycled process water and transferred to storage tanks. Coal slurry is transferred to the process site via pipeline into a storage tank located at the process site.

2.2.2.2 Gasification, Primary Particulate Recycle, and Heat Recovery

The Dow Syngas Project gasifier design is proprietary, but can be generally classified as a high-temperature, entrained-flow, slagging design.

The coal slurry is fed to the reactor, where it is mixed with oxygen and the reactor temperature is carefully controlled to maintain a specific narrow range. The coal is almost totally gasified by partial combustion to produce synthetic gas consisting principally of hydrogen, carbon monoxide, carbon dioxide, and water. The sulfur in the coal is converted almost totally to hydrogen sulfide with small amounts of carbonyl sulfide. The nitrogen from the coal is converted primarily to elemental nitrogen with some ammonia (NH₃) found and to a lesser degree to hydrogen cyanide and thiocyanate.

The ash is fused in the flame and is drained as molten slag from the bottom of the reactor by an enclosed system. The slag will be used for commercial purposes, rather than being disposed of as a solid waste.

The gas is passed through a cyclone separator to remove most of the entrained char. The removed char particles are slurried with recycled water and the slurry recycled back to the gasifier. The raw synthetic gas containing some entrained particulates (char) is then cooled in a heat recovery train, generating steam.

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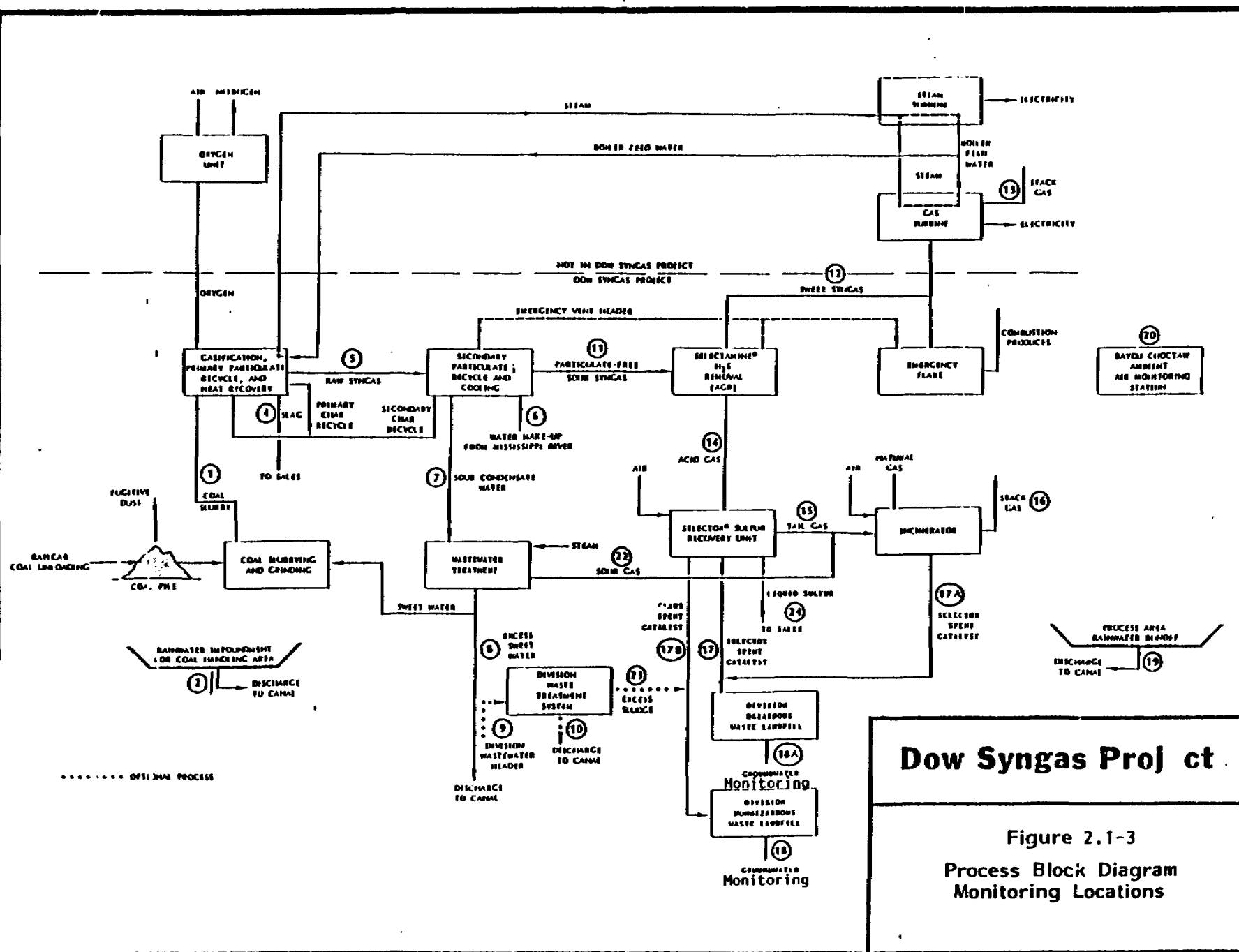


TABLE 2.1-1
KEY TO MONITORING LOCATION DESIGNATORS

Location Designator	Proprietary Status of Monitoring Data ^a	Description
1	NP	Coal feedstock
2	NP	Rainwater runoff from coal pile
3	-	Reserved designator (Location 3 was formerly groundwater monitoring wells associated with rainwater impoundment for coal handling area. However, impoundment has been closed.)
4	NP	Slag from gasifier
5	P	Raw syngas from gasifier
6	NP	Make-up water from Mississippi River
7	P	Sour condensate water from syngas particulate recycle and cooling
8	NP	Excess sweet water after waste water treatment
9	P	Wastewater header from other Louisiana Division process facilities
10	NP	Wastewater discharge from Louisiana Division treatment system (optional process)
11	P	Particulate-free sour syngas at inlet to Selectamine [®] acid gas removal system
12	NP	Sweet syngas from Selectamine [®] acid gas removal system
13	NP	Gas turbine stack gas
14	P	Acid gas from Selectamine [®] acid gas removal system
15	P	Tail gas from Selectox [®] sulfur recovery unit
16	NP	Incinerator stack gas
17	NP	Spent Selectox [®] catalyst from sulfur recovery unit
17A	NP	Spent Selectox [®] catalyst from incinerator
17B	NP	Spent claus catalyst from sulfur recovery unit
18	NP	Groundwater monitoring wells for new Louisiana Division solid waste landfill
18A	NP	Groundwater water monitoring wells for Louisiana Division hazardous waste landfill
19	NP	Effluent from rainwater impoundment for process facilities areas
20	NP	Bayou Choctaw ambient air monitoring station
21	-	Reserved designator (Location 21 was formerly char from syngas particulate recycle system which is considered an internal stream and will not be monitored)
22	P	Sour gas from distillation columns
23	NP	Excess sludge from Louisiana Division waste treatment system (optional process)
24	NP	Liquid sulfur from Selectox [®] sulfur recovery unit
F	NP	Fugitive area monitoring (gaseous) near Dow Syngas Project process facilities
L	NP	Leak detection monitoring (gaseous) near Dow Syngas Project process facilities
P	P	Health and safety monitoring for personnel, during routine operation and during maintenance of process units
Sp	NP	Slag from oxygen-blown protoplant gasifier
Wp	NP	Sweet condensate water from oxygen-blown protoplant

^aNP = nonproprietary
P = proprietary

2.2.2.3 Secondary Particulate Recycle and Cooling

The syngas passes from the heat recovery train to a wet particulate scrubbing system and the resulting slurry produced is pumped back to the gasifier. Thus, none of the particulate matter or scrubber water is discharged as waste streams.

The final scrubber product gas is then cooled through a series of heat exchangers before entering the hydrogen sulfide (H₂S) removal process. Water condensed from the product gas as it is cooled (sour condensate water) is stripped of the sour gases and much of the water recycled back to the process. Any excess water that has been stripped (sweet condensate water) will be discharged to the Division canal.

2.2.2.4 Selectamine® H₂S Removal, Selectox® Sulfur Recovery, and Tail Gas Incineration

The sulfur in the sour syngas is removed by the Selectamine® or GAS/SPEC ST-1® acid gas removal (AGR) process, which is a process licensed from the Dow Chemical Company. The sweetened product gas is suitable as fuel for the gas turbine power generation system, and the extracted acid gas is suitable as feed to the sulfur recovery unit.

Selectox® sulfur recovery process is licensed through the Ralph M. Parsons Company, and the liquid sulfur produced by the Selectox® process will be sold as a by-product.

The tail gas from the Selectox® unit is fed to an incinerator which oxidizes the remaining H₂S to SO₂ and vents it to the atmosphere. Small amounts of acid gas collected from various other points in the process are also disposed through the incinerator.

2.2.2.5 Existing Gas Turbines

The clean syngas stream from the AGR is used to fire the equivalent of one existing gas turbine in the Power II facility at Dow's Louisiana Division. Two gas turbines are expected to be able to switch from natural gas to syngas as well as operate on blends of syngas and natural gas.

2.2.2.6 Emergency Flare System

The location of the flare stack is in an area dedicated for that purpose. Adequate area has been left unoccupied to avoid any hazards when flaring.

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2.2.2.7 Process Wastewater Treatment

The water condensed from the product gas as it is cooled is passed through a water treatment system for removal of dissolved gases, primarily H₂S and NH₃. Much of the condensate from the water treatment system will be recycled to the coal slurry process. Any excess water (90 - 225 gpm; 175-225 gpm for lignite and 90-140 gpm for western sub-bituminous coal) that is not recycled to the process will be discharged to the Louisiana Division canal through a permitted outfall.

The sweet condensate water will be characterized for contaminants that it may contain. If the level of contaminants are above the permitted level for discharge, the excess sweet condensate water will undergo secondary treatment for the removal of the impurities before being discharged. The secondary treatment will consist of treatment by activated sludge in the existing Louisiana Division wastewater treatment facilities.

2.2.2.8 Industrial Solid Waste Landfills

The spent catalysts which are periodically removed from the Selectox® sulfur recovery unit will be landfilled. These are the primary solid wastes from the Dow Syngas Project that will be disposed of in landfills. The gasifier slag and liquid sulfur from the Selectox® unit will be sold.

The spent Claus catalyst will be landfilled in the solid waste landfill permitted for the Louisiana Division of the Dow Chemical Company.

Spent Selectox® catalyst is considered hazardous since it contains vanadium pentoxide, an acutely toxic chemical. It will be disposed in the hazardous waste landfill located within the Louisiana Division.

2.2.3 Process Design Changes

Operational difficulties in the secondary particulate scrubbing area of the process were essentially resolved with the addition of a secondary particulate scrubber during late June 1988. The modification significantly reduced the levels of solids in downstream equipment. Concentration of the char removed in the particulate scrubbers has been found to be lower than expected via Protoplant experience. Plans are to install a test centrifuge during second quarter 1989 to improve char concentration prior to recycle to the gasifier.

Planned modifications to the wastewater treatment system were completed during December 1988. Major equipment added included a new overheads heat exchanger and vent scrubber for the ammonia system. In addition, a spare reboiler was installed on the ammonia stripper column. Preliminary data from stack and aqueous sampling

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performed after these process modifications indicate that the ammonia present in the tank vent system has been significantly reduced.

Some modifications to the reactor slurry feed system were performed to allow demonstration of bituminous coal as alternative feedstock to the gasifier. Initial indications from the coal test are that the system will operate successfully on bituminous coal.

2.3 Environmental Monitoring Plan Status

Implementation of the EMP remained on schedule with completion of the Commissioning Phase monitoring of the commercial facilities. The Commissioning Phase Preliminary Report issued on September 29, 1988, and was reviewed at the Annual Monitoring Review Committee (MRC) Meeting on October 12, 1988. At the recommendation of the MRC, an Executive Summary to the Preliminary Report issued on January 27, 1989. The Summary further detailed the activities and findings during the Commissioning Phase, thereby finalizing the report.

Monitoring was performed at each of the monitoring locations designated in the EMP during the reporting period. With few exceptions, monitoring followed the schedule specified in the EMP. Gaseous, aqueous, solid, leak detection, health and safety, ambient and compliance monitoring have been conducted with excellent results. Monitoring through the second quarter of 1988 was reviewed and discussed at the Annual MRC Meeting. This data were used in the preparation of the first set of Comprehensive Phase Tests which occurred during fourth quarter 1988. Data from this testing phase will be presented in a future Phase Report. Current plans are to issue the Phase Report prior to the 1989 Annual MRC Meeting tentatively scheduled for mid-September 1989.

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5.0 HEALTH AND SAFETY MONITORING

5.1 Annual Report

Since the Annual EMP Health and Safety Report on the Dow Syngas Project for calendar year 1988 will issue, under separate cover, during early third quarter 1989, this report will include only brief summaries of these areas, in addition to any activities associated with first quarter 1989.

The 1988 LGTI Plant Health Team Review was held on May 26, 1988. Representatives from the Safety, Industrial Hygiene and Medical Departments audited the plant with respect to health and safety performance during 1987 and reviewed plans for 1988. The main topics discussed included the plant chemistry/process, a plant tour, 1987 exposure monitoring data, 1988 monitoring plans, the education/training programs and the health surveillance program.

5.2 Safety Program

The Safety Program of the Dow Syngas Project incorporates the guidelines of the Louisiana Division with the specific needs of the LGTI facility. The program focuses on proactive identification and correction of potentially hazardous situations and practices. Progress in the areas of housekeeping, participation in the plant safety program and safe completion of maintenance tasks are used as indicators of the safety performance at LGTI. During first quarter 1989, four potentially serious incidents were proactively investigated at LGTI, with follow up action implemented to prevent actual occurrence.

5.3 Industrial Hygiene Monitoring

In addition to routine industrial hygiene monitoring of both contractor and Dow personnel for hydrogen sulfide, carbon monoxide, dust and noise, monitoring for ammonia and benzene soluble organics was begun. Monitoring was performed using area, personal and portable monitors, as well as surface wipes and Draeger® tubes. Monitoring results indicate that exposure to these chemicals are typically well within established exposure limits.

Data from precautionary area sampling for benzene levels were received during first quarter 1989. The samples were taken in areas with the highest potential for benzene vapor based on a review of the process. The results show all levels were less than 10 % of the Permissible Exposure Level for benzene. This confirms that LGTI is not covered under the OSHA Benzene Standard, and therefore, no health surveillance activities relating to potential benzene exposure are required.

5.4 Medical Monitoring

The existing Dow Louisiana Division medical monitoring program is being utilized for monitoring the health of the employees of the commercial Syngas Project. Core examinations

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were performed on 63 Dow and 35 contractor employees during 1988. No adverse job-related medical conditions were found. Annual medical monitoring was performed for three years to allow the development of baseline health information. Hereafter, medical monitoring will be performed every two years.

Nineteen industrial injuries occurred during the reporting period; nine involving Dow employees, and ten involving contractor employees. Eight of the injuries were classified as recordables. Recordable injuries are those injuries, which due to their severity, somewhat restrict an employee's activities, but do not result in any lost time from work. Each of these injuries has been detailed in previous quarterly reports. The remainder of the injuries were minor in nature.

Two minor injuries occurred at the facility during first quarter 1989; both involving Dow employees. The first of the injuries was classified an OSHA recordable, and occurred while an employee was performing housekeeping duties in the process area. While rolling up a utility hose in the plant for proper storage, the employee bumped his elbow on a pressure gauge located in a run of process piping. As follow-up action to prevent recurrence, the need to assess body position and review potential hazards in the work area was recommunicated to operations personnel.

The other injury resulted while a Dow employee was performing a routine shutdown of a process pump. The employee started disconnecting tubing that was still under pressure and suffered a minor thermal burn on the hand when process liquid leaked from the tubing. All personnel were retrained in the importance of utilizing line opening procedures.

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8.0 MONITORING PROBLEMS/RECOMMENDATIONS FOR CHANGES

8.1 Problems Encountered

Minor problems encountered with monitoring during the reporting period were usually addressed with re-emphasis of established procedures or method modification. Off-line time resulted in some backward shift of the monitoring schedule. Nevertheless, the shift did not adversely affect the overall Commissioning Phase schedule nor the first Phase of Comprehensive Tests.

8.2 Solutions

Nothing to report.

8.3 Recommended Changes to the Environmental Monitoring Plan

A number of changes to the Environmental Monitoring Plan occurred during the reporting period. The first set of the changes was recommended at the Annual MRC meeting held in October. These modifications primarily focused on changing monitoring schedules described as twice in eight months or four times in eight months to once per quarter. In addition, monitoring schedules associated with compliance sampling were modified to match the frequencies dictated in the permits. Other changes involved the elimination of testing for oxygen and sulfur in pure sulfur, and an update of methods used for testing for metals in aqueous and solid streams. These proposed modifications were officially approved.

Another set of changes to the EMP were submitted to the MRC for comment in a letter dated November 4, 1988. In particular, the changes involved trace element analyses and organic characterizations associated a number of aqueous and gaseous streams. Although these modifications have not been formally approved, MRC members recommend acceptance of the changes.

Also recommended by the MRC, is a proposed change in the EMP to allow substitution of routine supplemental monitoring with similar monitoring during demonstration runs on varying feedstocks. This modification could result in two sets of monitoring during a given quarter, with monitoring omitted during another quarter. No change in compliance or health and safety monitoring would result. This change has not been formally accepted by Treasury.

The final set of proposed changes awaiting formal acceptance were included in the Fourth Quarterly Report for 1988. These changes involve modification of EMP testing schedules to reflect testing for all parameters described in the existing water permit.

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