DOE/EV-0014 ~~DR. 218~~

Report to Congress

Requirements for Environmental Monitoring, Assessment, and Controls for Nonnuclear Energy Demonstration Projects

May 1978

Prepared in Fulfillment of
Public Law 95-39, Section 113

U.S. Department of Energy
Assistant Secretary for Environment

DISCLAIMER

DOE/EV-0014
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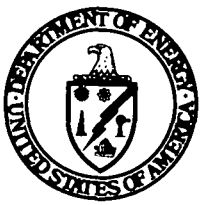

U.S. Department of Energy
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Washington D.C. 20545

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Department of Energy
Washington, D.C. 20585

JUN 8 1978

Honorable Walter F. Mondale
President of the Senate
Washington, D.C. 20510

Dear Mr. President:

Section 113 of Public Law 95-39 (The Energy Research and Development Administration Appropriation Authorization Act for FY 1977) includes the requirement that ERDA (now the Department of Energy) submit a report to the Congress on the environmental monitoring, assessment, and control efforts relating to environment, safety, and health, which are required to successfully demonstrate any project subject to Sections 8(e) and (f) of the Federal Nonnuclear Energy Research and Development Act of 1974. The report is required to contain the extent to which monitoring and control is required and the estimated cost thereof.

The enclosed report has been prepared pursuant to this requirement and is transmitted for the use of the Congress.

Sincerely,

John F. O'Leary
Deputy Secretary

Enclosure:
As stated

Department of Energy
Washington, D.C. 20585

JUN 8 1978

Honorable Thomas P. O'Neill, Jr.
Speaker of the House of
Representatives
Washington, D.C. 20515

Dear Mr. Speaker:

Section 113 of Public Law 95-39 (The Energy Research and Development Administration Appropriation Authorization Act for FY 1977) includes the requirement that ERDA (now the Department of Energy) submit a report to the Congress on the environmental monitoring, assessment, and control efforts relating to environment, safety, and health, which are required to successfully demonstrate any project subject to Sections 8(e) and (f) of the Federal Nonnuclear Energy Research and Development Act of 1974. The report is required to contain the extent to which monitoring and control is required and the estimated cost thereof.

The enclosed report has been prepared pursuant to this requirement and is transmitted for the use of the Congress.

Sincerely,

John F. O'Leary
Deputy Secretary

Enclosure:
As stated

EXECUTIVE SUMMARY

This report is submitted by the Department of Energy, in consultation with the Environmental Protection Agency, in fulfillment of Section 113 of the Energy Research and Development Administration Appropriation Authorization Act for FY 1977 (P.L. 95-39), which mandates the submission of a report to the Congress on the environmental monitoring, assessment, and control efforts related to environment, safety, and health required to successfully demonstrate any project which is subject to Sections 8(e) and (f) of the Federal Nonnuclear Energy Research and Development Act of 1974 (P.L. 93-577) and is authorized by P.L. 95-39 or any prior Act. The report shall contain the extent to which monitoring and control are required and shall provide the associated cost estimates.

The Department of Energy (DOE) has received Congressional authorization to proceed with seven energy demonstration projects that comply with Sections 8(e) and (f) of P.L. 93-577 (the Federal share of construction costs in excess $25,000,000). Of these, one was authorized subsequent to the enactment of P.L. 95-39, one was cancelled, two have not yet been funded, and one is still in the precontractual planning stages. Excluded are projects that are developmental in nature (e.g., pilot plants, test facilities). Two demonstration projects remain for which a report under Section 113 of P.L. 95-39 is required: the High Btu Synthetic Pipeline Gas Demonstration Plant and the Low Btu Industrial Fuel Gas Demonstration Plant.

The high Btu synthetic pipeline gas demonstration plant will validate the commercial viability and demonstrate the technical performance and feasibility of a full-scale demonstration module of a plant for converting coal to pipeline quality gas. The construction and operating costs will be shared equally by the Federal Government and industrial partner. The low Btu fuel gas industrial demonstration plant is specifically directed to the production of low Btu fuel gas for use by industrial consumers or for the production of synthesis gas as a chemical feedstock and entails similar participation by industry.

Contractors have been selected (two for each project) and contracts awarded for the development and conceptual design (Phase I) of the two demonstration projects. Phase I completion is expected in mid-1978 and mid-1979 for the high and low Btu projects, respectively. At the end of Phase I, one contractor will be selected as the IP for each project and will continue on with the Phase II (detailed design and plant construction) and Phase III (operations and final process evaluation) efforts.

To address the environment, health, and safety issues, it is necessary to identify, characterize, analyze, and assess the environmental impacts of the processes and incorporate and/or develop appropriate control and treatment systems so that future commercial applications will be environmentally acceptable. Socioeconomic, institutional, and aesthetic impacts and public concerns are considered with health and safety effects in determining environmental issues. Accomplishing these goals requires an environmental research and assessment

program which will ensure not only demonstration plant compliance with existing legislation, standards, and regulations but also the viability of the process to proceed from the demonstration to commercial phase in an environmentally acceptable manner.

Environment, health, and safety issues are important considerations of the demonstration projects from early planning through the operation of the plant. In the Phase I segment of these two projects, the contractors will be performing an environmental analysis to define the interrelationship of the demonstration plant with the surrounding physiographic, biologic, and atmospheric environs. This report to Congress is being prepared concurrently with the analysis activity to define environmental assessment, monitoring, and control efforts required for the plants. Therefore, the mandate of Section 113 (P.L. 95-39) cannot be fully answered at present.

The Phase I analysis will include assessments of the properties of the expected gaseous, liquid, and solid wastes; the land-use requirements; and the monitoring program requirements to establish the environmental baseline. Such assessments will be necessary to accurately characterize and measure the effluent streams and environmental impacts caused by plant operations and to accomplish environmental control system implementation and trade-off studies aimed at determining the most economic and efficient control for each pollutant or combination of pollutants. Additionally, DOE is coordinating with other Federal agencies in performance of supporting research, analyses, and laboratory studies to determine and evaluate the monitoring requirements and the environmental controls necessary to mitigate the environmental impacts. This support, which is primarily technical in nature, will be continued for numerous environmental concerns including new source performance standards as the demonstration projects move into the construction stage. The support will be coordinated jointly with the Environmental Protection Agency (EPA) and the National Institute for Occupational Safety and Health (NIOSH).

The estimated costs of the environmental analyses and studies conducted by the contractors during Phase I are $1,145,000 and $1,214,000 for the high and low Btu projects, respectively. An additional $7,000,000 has been budgeted or requested through FY 1979 for DOE-supported environmental studies and is divided approximately equally between the two projects. Environmental funding projections for Phases II and III will not be available until the environmental analysis, with its environmental monitoring plan, and the associated environmental control trade-off studies are complete. At such time, the costs associated with the monitoring program and the control efforts will be available for scrutiny.

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I. INTRODUCTION

A. PURPOSE

This report is submitted in fulfillment of Section 113 of the Energy Research and Development Administration Appropriation Authorization Act for FY 1977 (P.L. 95-39) which states that:

> . . . the Administrator, in consultation with the Administrator of the Environmental Protection Agency, shall submit a report to the Congress, six months after enactment of this Act, on the environmental monitoring, assessment, and control efforts, relating to environment, safety, and health, which are required to successfully demonstrate any project, which is subject to Section 8 (e) and (f) of the Federal Nonnuclear Energy Research Development Act of 1974 (42. U.S.C. 5907 (e) and (f)), and is authorized by this Act or any prior Act. The report shall contain the extent to which monitoring and control is required, and the estimated cost thereof.

The report was prepared by the Department of Energy in consultation with the Environmental Protection Agency.

B. BACKGROUND

The Department of Energy (DOE) has initiated major energy development programs in the areas of fossil energy, solar energy, and geothermal energy. Emphasis has been placed on the development of the coal-based fossil energy technologies including coal liquefaction, gasification, and direct combustion processes. Several coal gasification technologies have reached the highest state of maturity and are expected to enter the demonstration phase in the near future.

A fundamental strategy of the DOE programs is to develop technologies that will permit a smooth transition from the use of scarce and expensive foreign fuel resources to the widespread use of plentiful domestic fuels. The objective is to develop and demonstrate, in cooperation with industry, the energy technologies necessary to allow the substitution of plentiful fuels for oil and gas in ways that are economically, environmentally, and socially acceptable. This objective first requires identification of those technologies having significant potential to permit substantial increase in the use of plentiful fuels within the appropriate economic, social, and environmental limits.

C. ORGANIZATION OF REPORT

An overview of the energy demonstration projects currently authorized by the Congress and being actively pursued by the Department of Energy is contained in Section II of this report. The two projects -- each demonstrating coal gasification technologies -- which are reportable under Section 113 of P.L. 95-39 are identified and described therein.

Those environmental effects which are pertinent to the general area of coal gasification are delineated in Section III. A comprehensive overview is given of the potential environmental concerns.

Section IV presents the spectrum of environmental activities which are directed toward resolving the environmental concerns related to coal gasification. Actions to comply with existing laws and regulations, to define environmental concerns, and to develop mitigation strategies are delineated. Section V gives the funding currently identified for environmental activities related to the reported demonstration plants.

II. ENERGY DEMONSTRATION PROJECTS

A. PROCESS DEVELOPMENT SEQUENCE

To implement the DOE strategy, a process development sequence approach is being utilized and is shown in Figure 1. This sequence provides for the orderly development of a particular energy technology and culminates in the transfer of the technology to the private sector. Each phase in the sequence involves scaling up to larger units until the scale of the demonstration plants is large enough to provide firm data for cost estimates and for the design of commercial-scale plants. Industry participation is desired at all stages of the process development sequence. The lengths of time for the phases of development (shown in the figure) depend upon the complexity of the process, the project, the scope, and the resources. Because the phases usually overlap, the total development time from laboratory to completion of the demonstration plant operation is typically 15 to 20 years.

Technical feasibility and economic, social, and environmental acceptability of the technology are evaluated in each phase. These evaluations are tentative in the early phases and improved through the demonstration plant phase. Environmental Impact Statements are developed as required when plants (typically pilot and demonstration plants) of sufficient size to have major environmental impact are constructed.

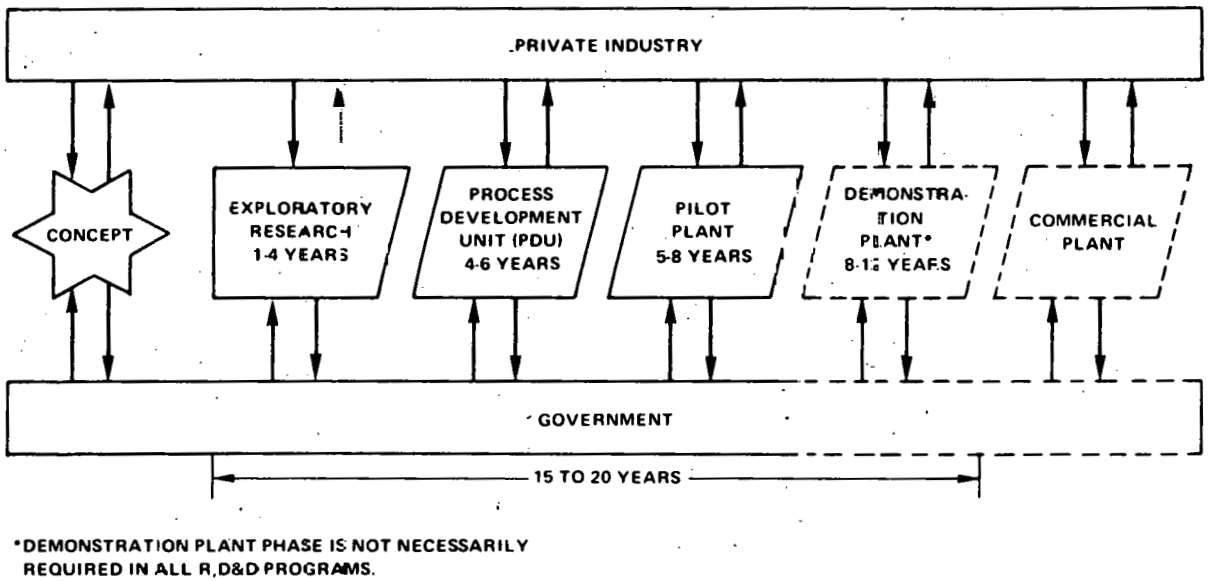
The usual elements of the process development sequence are: exploratory research, process development units (PDUs), pilot plants, demonstration plants, and commercial applications. The distinction between the various plants is not so much the size, as the purpose (the kind of information that the activity is designed to provide). In this context, the purposes of the development stages are described below.

- o Exploratory Research: To supply information on fundamental chemical processes and materials characteristics;

- o Process Development Unit (PDU): To establish the technical feasibility and viability of the process, to acquire data for process design and evaluation, and to identify the effect of operating procedures and conditions on pollutant emission levels;

- o Pilot Plant: To provide further evidence of the reproducibility and viability of the process on a scale large enough to conclude that the integrated process will be technologically and environmentally feasible and to generate design data for the construction of a fully integrated demonstration plant;

- o Demonstration Plant: To resolve investment uncertainty by demonstrating commercial-scale technical and economic viability and environmental feasibility, by determining capital and resource requirements,



*DEMONSTRATION PLANT PHASE IS NOT NECESSARILY REQUIRED IN ALL R,D&D PROGRAMS.

Figure 1. Typical Process Development Sequence

and by establishing product, by-product, pollutant characteristics and quantities, and feasible pollution control technology on a commercial scale; and

- o Commercial Plant: To assist commercial-scale demonstration facilities by developing financial, legal, and regulatory arrangements necessary to enlist the support of industry and state and local governments.

An individual process development program does not always adhere to this sequence. A large-scale pilot plant may provide sufficient data to proceed to a commercial-scale plant, or PDU and pilot plant phases may be combined.

B. CURRENT DEMONSTRATION PROJECTS

The Department of Energy currently has received Congressional authorization to proceed with a number of energy demonstration projects that potentially fall under the reporting requirements of Sections 8(e) and 8(f) of the Federal Nonnuclear Energy Research and Development Act of 1974 (P.L. 93-577) and Section 113 of the Energy Research and Development Administration Appropriation Authorization Act of 1977 (P.L. 95-39). Sections 8(e) and 8(f) of P.L. 93-577 provide that, inter alia, if the total estimated amount of the Federal contribution to the construction cost of a demonstration project exceeds $25,000,000, a full and comprehensive report on the proposed demonstration plant shall be provided to the appropriate committees of the Congress. With regard to the definition of the term "demonstration project," it is significant to note that the General Accounting Office (GAO), in its Report No. EMD-77-25, "Ways to Strengthen Congressional Control of Energy Construction Projects Other than Nuclear," February 25, 1977, found that:

> ". . .There is a need to clarify the specific types of projects subject to the reporting or specific authorization requirements of Section 8 of the Federal Nonnuclear Energy Research and Development Act of 1974. Although the term "demonstration project" is used, the Act does not provide a precise definition of what the term encompasses. Also, the various uses of the term "pilot" and "demonstration" in Section 8 are ambiguous. . ."

Even though the term "demonstration project" is open to interpretation, for the purposes of this report the reporting requirements of Section 113 of P.L. 95-39 were deemed to apply only to DOE demonstration plants. As such, pilot plants and test facilities were not included in this category.

In light of this interpretation, there are seven energy demonstration projects having a Federal share of construction costs in excess of $25,000,000 that have received Congressional authorization. These projects, identified in Table 1, demonstrate the coal-based technologies of gasification, liquefaction, and direct combustion as well as the geothermal energy production process. Of these projects, however, one was authorized subsequent to the enactment of P.L. 95-39,

Table 1. Summary of Department of Energy Nonnuclear Demonstration Projects

Project No.	Title	Applicability of Project to Legislative Criterion: Federal Share of Estimated Construction Costs (in $ million)	Applicability of Project to Legislative Criterion: Applicability of Project
76-1-a	Clean boiler fuel demonstration plant	$ 91	Applicable: not reported because of project cancellation
76-1-b	High Btu synthetic pipeline gas demonstration plant	246	Applicable: reported herein
76-1-c	Low Btu fuel gas demonstration plant	150	Applicable: reported herein
76-1-d	Fluidized bed direct combustion demonstration plant	162	Applicable: not reported because project is in pre-contract stage; may be operated as a Government facility requiring new legislation
77-1-b	High Btu pipeline gas demonstration plant	246	Applicable: not reported because no funds have been appropriated
77-1-c	Low Btu fuel gas demonstration plant	51	Applicable: not reported because no funds have been appropriated
—	50-megawatt geothermal demonstration plant	55	Not applicable: authorized subsequent to P.L. 95-39

one was cancelled, two have not yet been funded, and one is still in the precontractual planning stage. Thus, two demonstration projects remain for which a report under Section 113 of P.L. 95-39 is required: the High Btu Synthetic Pipeline Gas Demonstration Plant and the Low Btu Industrial Fuel Gas Demonstration Plant.

C. DESCRIPTION OF APPLICABLE DEMONSTRATION PROJECTS

1. High Btu Pipeline Gas Demonstration Plant

In mid-1977, DOE awarded contracts for the design, construction, and operation of demonstration plants incorporating two different approaches for high Btu pipeline gas production. The contractors selected for the two plant designs were CONOCO Coal Development Company (CCDC) and Illinois Coal Gasification Group (ICGG). The primary product of these plants will be direct substitutes for natural gas.

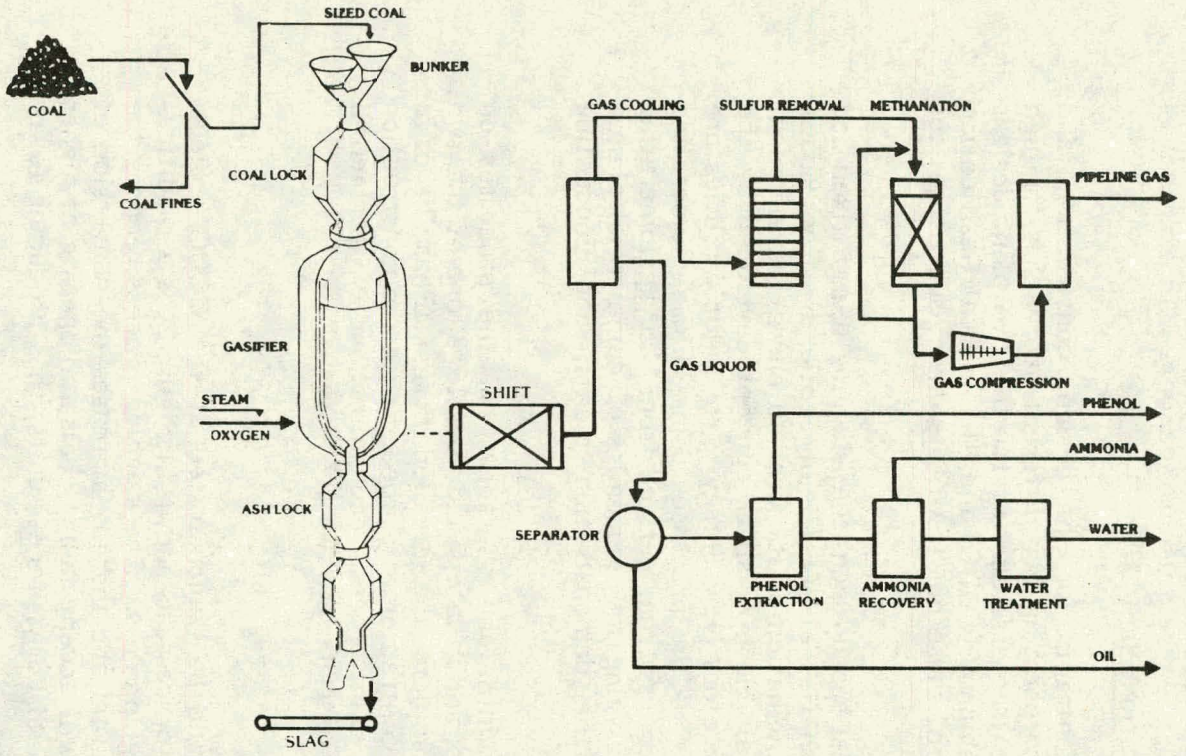
The CCDC-proposed process is based upon the slagging Lurgi fixed-bed gasifier concept developed by British Gas at Westfield, Scotland. The ICGG-proposed process is based upon a combination of the coal-oil energy development (COED) pyrolysis concept and char air-blown gasifier concept developed by the COGAS Development Company, Princeton, New Jersey. The pilot facilities are being used to confirm the operability of the processes using U.S. agglomerating (Eastern) coals or, for the COGAS process, char derived from U.S. agglomerating coal. Both CCDC and ICGG are analyzing the economics of commercial plants, developing conceptual designs of the demonstration plants, and conducting confirmatory tests in the pilot plant.

The conceptual designs, economics, and operability of the processes on agglomerating coals will be compared, and in late fiscal year 1978, one of the two contractors will be selected to complete the detailed design (Phase II) of a demonstration plant. The successful contractor will proceed with the construction and operation to verify the selected plant process, economics, and environmental acceptability. The following sections describe the two processes.

a. Slagging Lurgi Process

The slagging Lurgi process would be demonstrated at the CCDC project, located in Noble County, Ohio. This process, as shown in Figure 2, is a modification of the existing commercial Lurgi process. The slagging process reduces the carbon content of the molten ash stream and thereby increases the conversion of carbon in coal to gas. The process will accept caking coals and operate at higher temperatures than the older commercial Lurgi process units, thus producing fewer tars, phenols, and heavy hydrocarbons.

Gases leaving the gasifiers are cooled in a gas liquor (recycled water) spray. The H_2:CO ratio required for downstream methanation is adjusted by shift conversion. In the purification step, naphtha and water are separated by condensation,



SCHEDULE

ACTIVITY	FISCAL YEAR								
	77	78	79	80	81	82	83	84	85
PHASE I - COMMERCIAL & DEMO PLANTS CONCEPTUAL DESIGN	△——▽								
PHASE II - DEMO PLANT									
• DETAILED DESIGN		△——▽							
• LONG LEAD PROCUREMENT		△———	———	———	——▽				
• CONSTRUCTION			△———	———	———	——▽			
PHASE III - SHAKEDOWN & OPERATION						△———	———	———	——▽

Source: Fossil Energy Research and Development Program of the U.S. Department of Energy, March 1978 (DOE/ET-0013-78).

Figure 2. Slagging Lurgi Process and CONOCO Schedule

while hydrogen sulfide and carbon dioxide are removed by the Lurgi rectisol process. In the methanation step, methane is produced from carbon monoxide and hydrogen over a fixed-bed nickel catalyst.

In the gas liquor separator, coal fines, tar, and tar oil are removed from the water. The fines with tar and oil are recycled to extinction in the gasifiers. The Lurgi phenosolvan process extracts phenols from the water. Ammonia is removed from the gas by the CLL process to produce aqueous ammonia. An air separation plant is required to produce oxygen which is a necessary part of the process in making pipeline quality gas.

In addition to the tar precipitation, oil separation, and phenol extraction processes, the plant will include all the service sections required, such as steam production, water purification, air separation, incineration, and waste treatment, as well as product loading, tankage, and buildings.

Figure 2 also includes the schedule for design, fabrication, and operation of the proposed CONOCO gasification demonstration plant.

b. COGAS Process

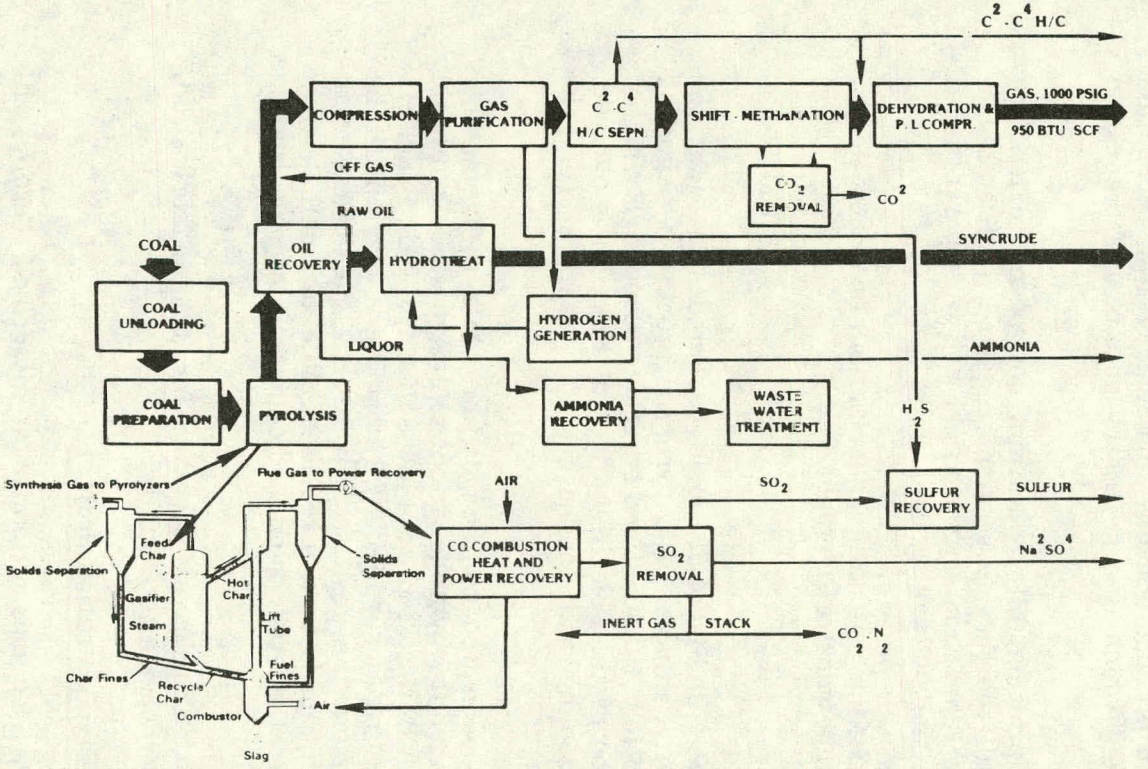
The COGAS process, depicted in Figure 3, would be demonstrated at the ICGG plant located in Perry County, Illinois. The pyrolysis process is begun by heating dried crushed coal in up to four fluidized-bed stages at successively higher temperatures until a major fraction of the volatile matter of the coal is evolved. Gas and oil are recovered by cooling and condensing the volatiles from the pyrolysis.

The char product of pyrolysis is fed to the gasifier while the remaining product, the raw oil, may be upgraded (by hydrogenation) to a high-grade synthetic crude oil or (by using less hydrogen in this step) to a low-sulfur No. 4 or 5 fuel oil. The hydrogen for this oil hydrotesting is supplied by reforming a portion of the product gas. The synthesis gas from the gasifier is pressurized and cleaned to reduce particulates and sulfur compounds to a level acceptable for methanation. The resultant product gas is then methanated, dried, and compressed for utilization as a pipeline gas.

Figure 3 also presents the ICGG proposed schedule for design, fabrication, and operation of the gasification demonstration facility.

2. Low Btu Industrial Fuel Gas Demonstration Project

The DOE low Btu fuel gas demonstration plant described herein will demonstrate coal-to-fuel gas conversion for industrial use (i.e., a large gasifier supplying an industrial community). Contracts for the design, construction, and operation of large industrial-user dedicated plants have been awarded to the City of Memphis (Memphis Light, Gas, and Water) and W. R. Grace and Co. A design competition will be conducted, and the successful contractor will proceed with the



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SCHEDULE

ACTIVITY	FISCAL YEAR									
	77	78	79	80	81	82	83	84	85	86
PHASE I - CONCEPTUAL DESIGN	△	▽								
PHASE II										
• DETAILED DESIGN		△				▽				
• LONG LEAD PROCUREMENT		△					▽			
• CONSTRUCTION			△					▽		
PHASE III - SHAKEDOWN & OPERATION					△					▽

Source: Fossil Energy Research and Development Program of the U.S. Department of Energy, March 1978 (DOE/ET-0013-78).

Figure 3. COGAS Process and ICGG Schedule

construction and operation of a demonstration plant. The two competing projects, Fuel Gas Industrial "A" (Memphis Light, Gas, and Water) and "B" (W. R. Grace and Co.) are described below.

a. Fuel Gas Industrial "A"

The Memphis Light, Gas, and Water Division (a department of the City of Memphis, Tennessee), in association with the Institute of Gas Technology (IGT) and the Delta Refining Company (a division of the Foster Wheeler Energy Corporation) is conducting a fuel gas demonstration program based upon the U-GAS Process (see Figure 4). Through this program, 175 million ft^3/day of industrial fuel gas having a nominal gross heating value of 285 Btu/scf will be produced from 2800 tons/day of Kentucky No. 9 coal and delivered to Memphis industrial consumers through a pipeline distribution system. This is equivalent to 50 million ft^3/day of natural gas.

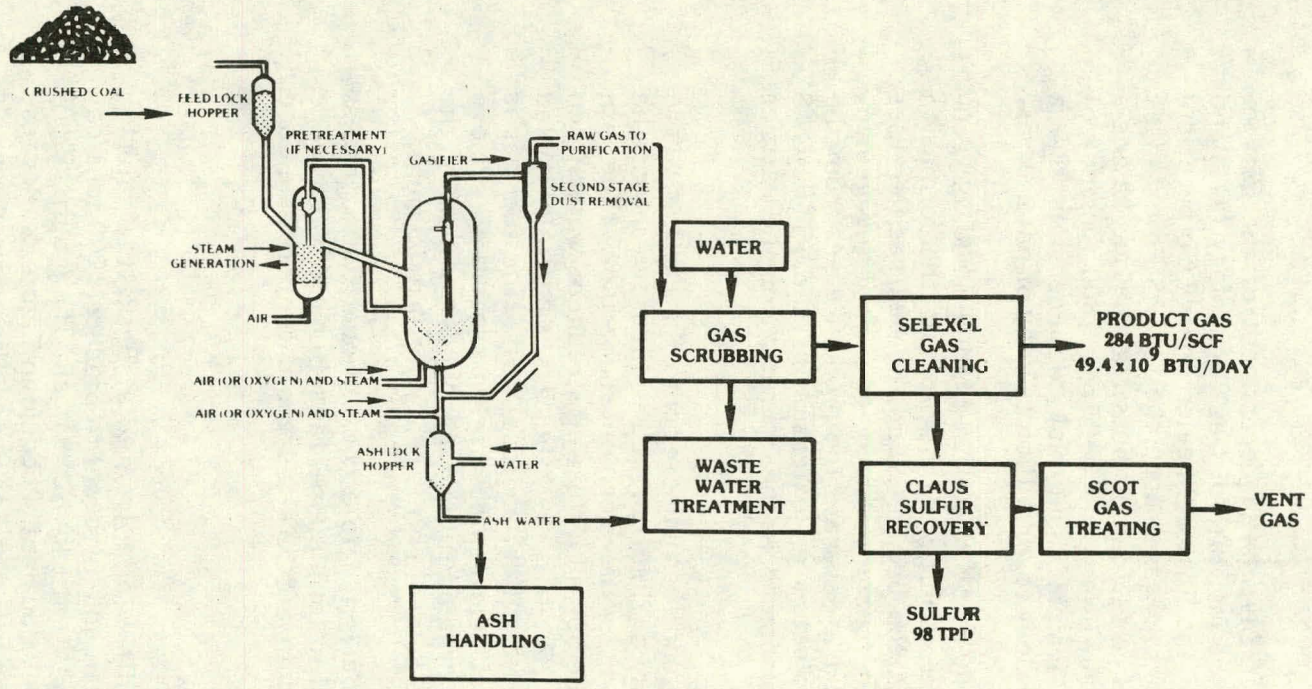
The U-GAS Process, under development by IGT, is a fluidized-bed, oxygen-steam gasification process operating under conditions that promote the formation of ash agglomerates in the lower part of the bed. A fluidized-bed gasifier uses steam and oxygen to keep the coal bed in constant suspension. A disengagement zone is maintained above the fluidized bed to separate the product gases from the solid particles. The gasifier for the project is an extension of the IGT/U-GAS reactor concept; the principal new development is the operation of the gasifier under pressure (90 psig).

Crushed coal is fed to a pretreator and then injected into the gasifier where it contacts the oxygen-steam mixture in a fluidized bed. Figure 4 shows the schematic diagram of the process and its development schedule. The ash agglomerates from the gasifier are quenched by a circulating stream of water, then withdrawn in the form of a water slurry. The hot, raw, fuel gas is partially cooled and scrubbed to remove ammonia, hydrogen sulfide, and coal dust. The fuel gas is then compressed and treated in a Selexol acid-gas absorption process to remove essentially all of the hydrogen sulfide and organic sulfur compounds and part of the carbon dioxide. The purified gas from the Selexol unit is ready for distribution.

Acid gas containing hydrogen sulfide is fed to a conventional Claus process during which the H_2S is partially oxidized to form elemental sulfur and water. The off-gas from the Claus unit is processed to a SCOT tail-gas unit to recover and recycle the remaining H_2S.

b. Fuel Gas Industrial "B"

The W. R. Grace and Company facility, to be located at Baskett, Kentucky, would synthesize gas (a mixture of hydrogen and nitrogen) to produce 1200 tons/day of ammonia from 1700 to 1800 tons/day of Kentucky No. 9 coal. The industrial "B" process is shown schematically, with its development schedule in Figure 5. Because ammonia formation is favored at high pressure, the Texaco gasifier chosen for this project is being tested to operate in the range of 1200 to 2500 psig. The gasifier is an entrained flow ash agglomerating type with a continuous cocurrent downward

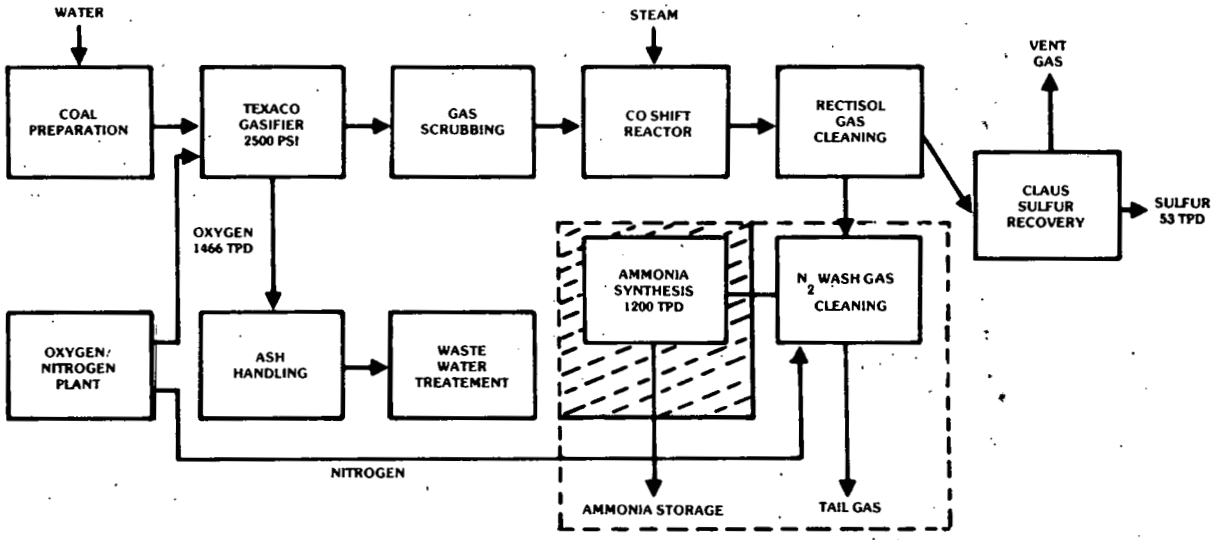


SCHEDULE

ACTIVITY	FISCAL YEAR						
	77	78	79	80	81	82	83
PHASE I -							
• CONCEPTUAL DESIGN	△	▽					
PHASE II -							
• DETAILED DESIGN			△		▽		
• LONG LEAD PROCUREMENT		△	▽				
• CONSTRUCTION				△		▽	
PHASE III -							
• SHAKEDOWN & OPERATION						△	▽

Source: Fossil Energy Research and Development Program of the U.S. Department of Energy, March 1978 (DOE/ET-0013-78).

Figure 4. Fuel Gas Industrial "A" Process and Memphis Light, Gas, and Water Division Schedule



NOTE: AREA INDICATED BY HATCHED LINES NOT COST-SHARED WITH DOE

SCHEDULE

ACTIVITY	FISCAL YEAR						
	77	78	79	80	81	82	83
PHASE I - CONCEPTUAL DESIGN	△		▽				
PHASE II -							
• DETAILED DESIGN			△		▽		
• LONG LEAD PROCUREMENT		△				▽	
• CONSTRUCTION				△		▽	
PHASE III - SHAKEDOWN & OPERATION						△	

Source: Fossil Energy Research and Development Program of the U.S. Department of Energy, March 1978 (DOE/ET-0013-78).

Figure 5. Fuel Gas Industrial "B" Process and W.R. Grace and Co. Schedule

gas flow and a lateral gas outlet near the middle of the gasifier (at the top of the slag quench chamber).

Coal feedstock in the form of a water/coal slurry is blended with oxygen for high-pressure injection into the gasifier. The resultant gas, containing carbon and fly ash, is scrubbed to recover the carbon and recycled to the gas generator. The remaining synthesis gas in the gas generator, rich in carbon monoxide, is converted to hydrogen by the water/gas shift reaction. Hydrogen sulfide and carbon dioxide removal is accomplished by physical absorption in refrigerated methanol. A liquid nitrogen scrubbing process is utilized for final removal of residual unconverted carbon monoxide, methane, and argon gases. The product gas is blended with nitrogen and is the feedstock for the ammonia synthesis step. The ammonia, a second product, is produced in an adjacent facility.

III. COAL GASIFICATION ENVIRONMENTAL EFFECTS

Environmental disturbances and effects caused by commercial coal gasification facilities will depend on the size and the site of the individual plant and the particular gasification process utilized. This section describes in general terms the potential health and environmental impacts of coal gasification in order to provide a basis for the development of an environmental management and control program in concert with the development of the energy technology.

Coal gasification has environmental similarities to present industrial activities such as conventional direct combustion, coal-fired power plants, and petroleum and chemical refineries and is therefore a relatively familiar technology in terms of air and water emissions of presently regulated pollutants and quantities of solid wastes generated. However, currently unregulated pollutant species could be produced in coal gasification processes, the environmental and health effects of which are generally unknown. Other environmental unknowns could result from plant construction, siting, and operation. For these reasons, the full spectrum of environmental concerns must be addressed in the environmental management and control program to ensure development of environmentally acceptable gasification processes.

The potential environmental impacts of these gasification plants result from three factors and their interactions: (1) pollutant releases, (2) physical disturbances, and (3) commitment of nonrenewable resources. These factors impact on ecological, occupational health and safety, public health, and socioeconomic elements of the environment. The impact of air and water pollution on man and the ecosystem is aggravated or ameliorated depending upon the exposed plant, animal, or human population, the proximity of source and pathway of pollution to that population; and the control technology in place.

Gas and vapor emissions and liquid effluent streams are capable of affecting air and water quality; solid wastes generated also can perturb air and water quality along with land resources. Physical disturbances and the utilization of nonrenewable resources may include the use of large quantities of water for various process purposes, thermal effects on water and air, the appropriation of land area both for the facility itself and for the disposal of solid wastes, the generation of noise and odors, and the potential disruption of indigenous ecosystems.

The following paragraphs identify the significant areas of environmental concern.

A. AIR QUALITY

The off-gases potentially emitted from a coal gasification facility are principally stack and fugitive emissions containing constituents such as hydrogen sulfide, ammonia, particulate matter (e.g., coal dust, product fines), hydrocarbons,

sulfur dioxide, hydrogen cyanide, carbon monoxide, and nitrogen dioxide. Potentially hazardous trace materials such as polycyclic organic matter and heavy metals may also be released to the atmosphere. The levels of these pollutants must be monitored to ensure that they fall within regulatory standards and that they are at levels deemed to be safe for workers and the public.

High Btu gasification will require H_2S cleanup prior to methanation as a process requirement. This is not true of the low Btu gasification process which may produce a very dirty product which will require additional tail-end clean-up.

B. WATER QUALITY

Coal gasification processes may produce waste effluents that have broad temperature and pH ranges and contain a variety of materials which may include suspended particulates, ammonia, hydrogen sulfide, toxic trace metals, phenols, aromatic hydrocarbons, thiophenes, aromatic amines, and other organic compounds. Discharges for each gasification process must be characterized and their effects on indigenous aquatic organisms and communities assessed and monitored for compliance with regulatory standards. Potential pathways to man via drinking water supplies or the food chain must be examined.

C. SOLID WASTE

Solid wastes generated by coal gasification processes consist primarily of ash, slag, and refuse removed from the coal and solids recovered from waste treatment processes. The major solid waste streams as well as minor ones (e.g., spent catalyst) must be characterized. Developed disposal techniques will be required to meet standards to be developed under the Resource Conservation and Recovery Act of 1976.

Conventional disposal of solid wastes in offsite landfills will require transport and handling equipment as well as large areas of land. The handling and transportation of wastes may generate fugitive dust emissions, the severity of which must be assessed.

Groundwater leaching is a concern that must be evaluated if landfills are used as disposal areas for coal gasification solid wastes. The physical and chemical reactions involved and the effects of various methods of disposal upon leachability must be determined.

D. WATER USE

In the area of water use, the Federal Nonnuclear Energy Research and Development Act requires that water usage impacts of new energy technologies be assessed. The impact on water quality of reduced stream flow and of modified flow waters returned to streams at higher temperatures or deoxygenated is an essential aspect of these studies. These assessments will be carried out by the Water Resources Council, with the water-use data on the developing technologies furnished by DOE. The geographic location of the plant has an important bearing on the severity of the water-use impact. The demonstration plants, which are designed to utilize Eastern coals, are located in areas where water is relatively plentiful.

E. NOISE AESTHETICS

Noise and odor generated from coal gasification facilities may threaten individual and community aesthetic values, especially in pristine areas. The noise in coal gasification facilities must be compatible with Federal standards set for work place noise levels, and the applicability of conventional noise control technologies to these facilities must be determined.

F. ECOLOGICAL EFFECTS

Construction and operation of demonstration and commercial coal gasifiers can affect both terrestrial and aquatic indigenous plant and animal species at all levels of community organization. Effects upon these populations must be within limits set by Federal, state, and local legislation. Air and water emissions, product spills during transport, and solid waste disposal all can have short- and long-term effects on ecosystems, both within the immediate vicinity of an operating facility and for some distance as determined by atmospheric, hydraulic, and food-chain transfer.

G. LAND-USE IMPACTS AND DISTURBANCES

The land-use impacts and land disturbances resulting from a commercial-scale coal gasification facility will vary with siting requirements such as topography, access to coal, and land area needed for the gasifier, support facilities, and secondary growth. Because low Btu facilities will be sited generally in industrialized areas, potentially important alternative land uses might have to be foregone for facility construction and solid waste disposal. High Btu gasification facilities will be built in semi-remote areas with less competition for land, but recreational uses may be disrupted. The construction of pipelines to transport high Btu gas also may impact land use.

H. SOCIOECONOMIC IMPACTS

The socioeconomic impacts of coal gasification can result from the shifts of population associated with the construction and operation of a gasification facility. These shifts can impact the economic, social, and recreational needs of a community. The extent of these impacts will vary with the location, size, and type of each facility. In remote Western areas, public services, transportation facilities, and government infrastructure may be less developed than in the East where a trained labor force and support services may already exist. The shutdown and decommissioning of coal gasification facilities also can be expected to have socioeconomic impacts.

I. GENERAL POPULATION HEALTH EFFECTS

The gaseous, liquid, and solid effluents generated by gasification processes may be different from those of a conventional coal use facility; therefore, potential effects on the health of area residents may differ significantly. Chronic effects of low-level pollutant release and pollutant-derived atmospheric/aquatic food chain transformation products will be the principal public concern, although a single high exposure from an accidental discharge also could occur and have adverse health effects. Gasifier process emissions will have to be compatible with Federal health standards.

J. OCCUPATIONAL HEALTH AND SAFETY

The gasification of coal can produce hazardous substances such as polynuclear aromatic hydrocarbons, phenols, thiophenol/aromatic amines, etc. Quenching and cooling operations, tar separation and lean oil washing operations are designed to selectively remove those materials presently considered the most toxic. This will produce high concentrations of toxic materials which will pose an occupational hazard requiring specialized procedures. Some occupational hazards that may be associated with coal gasification are: physical contact with or inhalation of potentially carcinogenic or toxic products and potential for explosions or fires due to malfunction of high pressure or high temperature equipment.

The occupational health and safety impacts of a facility depend upon the nature and level of exposure. Procedures for monitoring workers' health, long-term compilation of workers' health data, and determination of compatibility with the Occupational Health and Safety Administration standards will be necessary.

IV. SCOPE AND STATUS OF DEMONSTRATION PLANT ENVIRONMENTAL R&D PROGRAMS

DOE provides program management direction and control for environmental activities to both of the demonstration projects for the purpose of addressing the probable effects of any technological developments on the environment. Project-specific support is provided by environmental programs within DOE's Office of Energy Technology as well as by Federal entitites that are not a part of DOE. Principal support is derived from the DOE Office of Environment and the Environmental Protection Agency (EPA).

This section contains descriptions of the scope and status of projects to date. The scope of the management and control activities is contained under heading A; the status of each of the two demonstration projects is presented under heading B; and related research and assessment activities are listed under heading C.

A. SCOPE OF ENVIRONMENTAL REQUIREMENT EFFORTS

The environmental programs have, as their primary objective, the assurance of the environmental acceptability of developing energy technologies. The scope of this objective and any supportive research activities is two fold:

- o to ensure that new energy facilities will comply with existing environmental laws and regulations, and
- o to define environmental concerns which go beyond those covered by the existing laws and regulations.

Although both aspects of the scope are regulation-related, oriented toward the same general objectives, and not truly separable from an environmental impact viewpoint, they are mentioned separately because of the research required to support them. The existing laws and regulations place specific requirements on the development, fabrication, and operation of energy facilities. Consequently, project-specific environmental research and development efforts are principally directed toward establishing compliance with these regulations.

The environmental R&D efforts involved with identifying new concerns will be utilized to establish the need for new or revised regulations or project modifications which might result from the identification of additional environmental concerns. The DOE Environmental Development Plan for Coal Gasification provides the general scope of the environmental R&D program necessary to identify and resolve the environmental concerns. There are definitive needs for a comprehensive effort to characterize plant effluents, to assay biological and ecological effects of these effluents, and to conduct environmental assessments, not only for demonstration plant sites, but for potential commercial sites. These research efforts would provide the basis for the development of any additional regulations and for modification to DOE program plans and operations.

1. Laws and Regulations

Congress has passed laws designed to protect aspects of the environment potentially affected by energy development. These laws must be considered in any assessment of energy-related environmental impacts, because widespread commercialization will be predicated on the ability of evolving energy technologies to meet these laws. Federal environmental legislation and its applicability to coal gasification assessment requirements are listed in Table 2. DOE's assessment responsibilities derive basically from the National Environmental Policy Act (NEPA) and relate to the development of an environmental assessment as a step leading to an environmental impact statement. State and local legislation must be considered on a site-by-site basis.

Environmental concerns exist with respect to the use of new technologies that extend beyond the limits of current laws, regulations, standards, and guidelines. Unique characteristics of the process, product, and residuals must be assessed, and the associated environmental concerns defined. In assessing these processes, steps to be considered include: (1) developing plans for ensuring that environmental factors are adequately taken into account, (2) performing studies and assessments to determine the environmental effects of these processes, (3) conducting research activities to evaluate the effects of effluents and/or energy processes on the health and environment, and (4) developing standards and requirements to describe the realm within which the technology may be demonstrated and utilized. Most of the activities conducted under these four considerations apply to the development and demonstration of coal gasification as a viable energy source, rather than to the demonstration plants themselves.

For emerging energy technologies (e.g., coal gasification, coal liquefaction, geothermal), new regulations may be required to provide for the protection of the public and the environment in concert with the development and utilization of these energy systems. Both the Department of Energy and the Environmental Protection Agency have recognized the need for cooperative efforts to establish the eventual regulations. Interagency agreements are being developed to define the procedural responsibilities of both organizations for the development of adequate and timely guidance and regulations by the Environmental Protection Agency.

2. Requirements

The types of environmental activities associated with the DOE high Btu pipeline gas demonstration plant are depicted in Figure 6. The figure covers all of the contractual phases which are:

- Phase I — Conceptual Design,
- Phase II — Detailed Design and Construction, and
- Phase III — Operation.

Table 2. Federal Environmental Legislation Applicable to Coal Gasification

Legislation	Applicability to Coal Gasification Assessment Requirements
National Environmental Policy Act of 1969 (NEPA)	Environmental Impact Statements (EIS) must be prepared for all major Federal actions significantly affecting the quality of the human environment.
Nonnuclear Energy Research and Development Act of 1974	Water availability assessments are required for demonstration and commercial plants; responsibilities are shared with the Water Resources Council (WRC).
Clean Air Act as amended, 1977	Ambient air quality standards have been set for SO_2, TSP, NO_2, CO, HC, and O_x; more are being considered. New Source Performance Standards (NSPS) have been prepared for first-generation Lurgi high Btu gasification processes (not a part of DOE's program); NSPS for low Btu and second generation high Btu gasification processes will be developed during FY 1978. Standards for hazardous air pollutants limit mercury emissions, which may affect wastewater treatment plant sludge. NSPS and regulations for the prevention of significant deterioration may affect plant siting; siting in nonattainment areas may require air emissions tradeoffs and lowered achievable emission rates. Best Available Control Technology (BACT) is required of gasification demonstration facilities that will be located in clean air regions.

Table 2. Continued

Legislation	Applicability to Coal Gasification Assessment Requirements
Federal Water Pollution Control Act Amendments of 1972 (FWPCA)	National Pollutant Discharge Elimination System (NPDES) permits are required to control wastewater discharges. Because effluent guidelines have not been developed for most fossil energy technologies permit requirements are determined on a case-by-case basis to meet State plans. A "No Discharge" goal has been set for 1985.
Resource Conservation and Recovery Act of 1976	Solid waste disposal must comply with most stringent air and water standards; monitoring is required. New regulations will be developed in 1 to 2 years for a Federal hazardous waste handling permit system and state programs for nonhazardous solid wastes.
Toxic Substances Control Act (TOSCA)	Disposal of specific materials (e.g., nickel catalyst) used in gasification processes may be regulated.
Safe Drinking Water Act	Wastewater discharges may require additional treatment for heavy metals or organic waste if they impact drinking water supplies.
Noise Control Act of 1972	To protect health and welfare, ambient noise levels are recommended; they may become standards for facilities regulated by State and local governments.

Table 2. Continued

Legislation	Applicability to Coal Gasification Assessment Requirements
Occupational Safety and Health Act of 1970	Health and safety regulations must be met for workers in gasification facilities.
Coastal Zone Management Act of 1972	State coastal zone management plans developed with Federal financial assistance may affect plant siting and design.
Marine Protection, Research and Sanctuaries Act of 1972	Permits are required for activities in wetland areas, which may restrict gasification facility siting.
The River and Harbor Act of 1899	Permits are required for dredge and fill activities in navigable waters, which may affect gasification facilities siting. Projects must be integrated with flood control, river, and dam projects.
National Historic Preservation Act of 1966	Federally financed, assisted, or permitted projects cannot impact important historic or cultural sites unless no alternatives exist.
Endangered Species Act of 1973	Identification of endangered aquatic and terrestrial species at a potential construction site is required, which may affect gasification facility siting.
The Fish and Wildlife Coordination Act of 1934	Any project requiring modification of bodies of water must be reviewed to prevent loss or damage to fish and wildlife.

Table 2. Continued

Legislation	Applicability to Coal Gasification Assessment Requirements
Wild and Scenic Rivers Act of 1968	Projects must not degrade the quality of wild and scenic rivers.
Clean Water Act of 1977	Amends FWPCA of 1972. Establishes more stringent control of toxic pollutants and encourages innovative control technologies.
Wilderness Act of 1964	Sets aside designated land areas to be excluded from development.

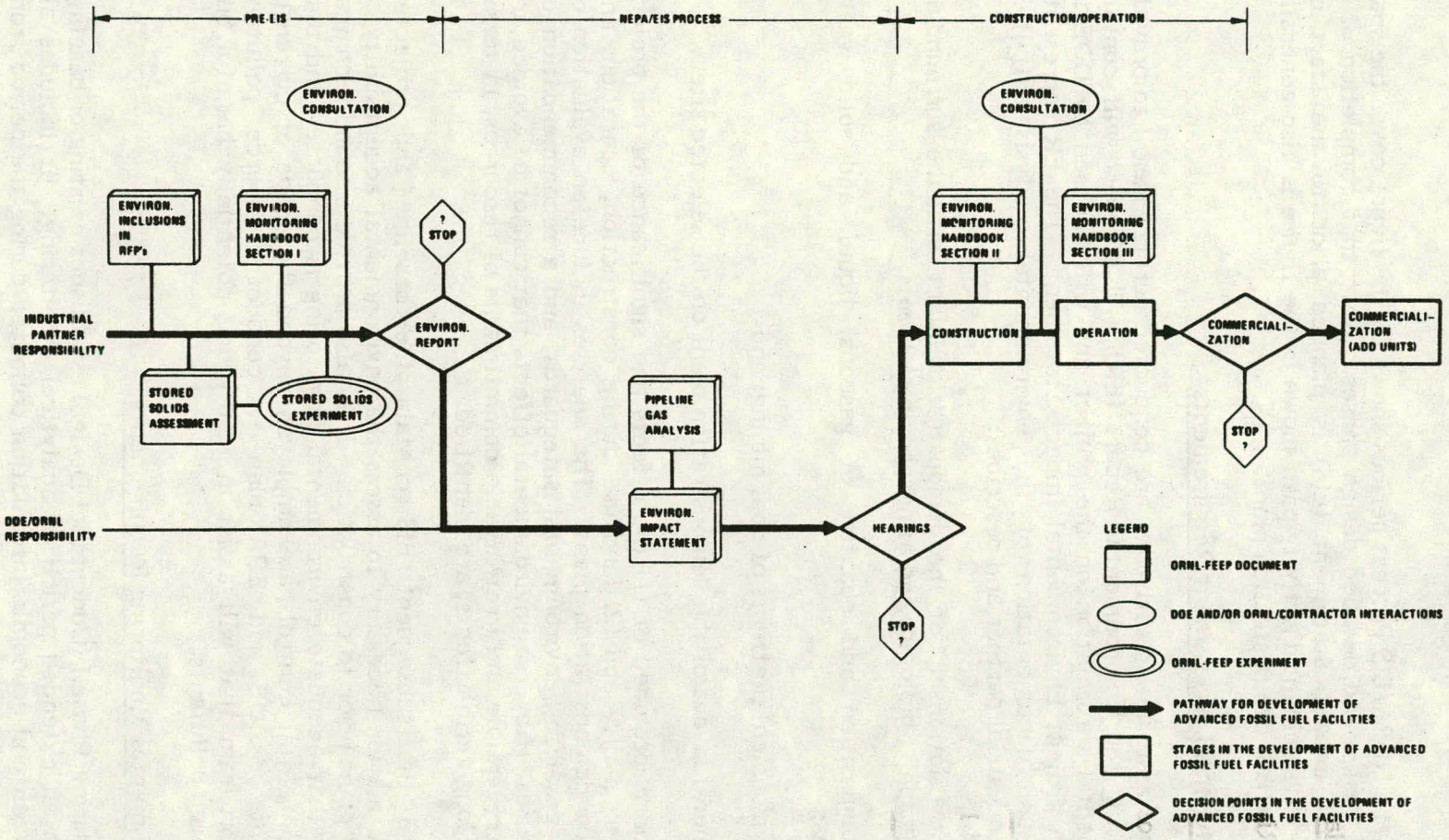


Figure 6. Environmental Path to Commercialization - Coal to Pipeline Gas Demonstration Plants

The pre-EIS and NEPA/EIS Process periods shown on the figure cover the span of the conceptual design and detailed design phases. Note that completion of a final Environmental Impact Statement (EIS) is planned prior to the start of construction. The environmental activity path shown in the figure is also generally applicable to the low Btu demonstration plant.

a. Environmental Assessment Requirements

Environmental assessment activities are conducted during Phase I to provide a basis for preparing the Environmental Report (ER). This report will contain specific environmental information on the project and will be used by DOE in preparation of the project Environmental Impact Statement. The ER represents the culmination and documentation of the environmental analysis activities conducted by the industrial partner and describes:

- the interrelationship of the demonstration plant with the surrounding physiographic, biologic, and atmospheric elements;
- the composition and quantity of gaseous, liquid, and solid waste streams;
- the environmental effects of coal mining; and
- the general layout of the demonstration plant on the selected site.

An evaluation is provided of (1) the effects and significance of the project upon air and water quality and (2) land use during construction, operation, and maintenance of the demonstration plant. The analyses include an evaluation of alternatives, a proposal for environmental safeguards, and a recommendation of monitoring procedures. Adverse environmental effects that cannot be avoided are delineated. The irreversible and irretrievable commitments of resources, in terms of both short- and long-term effects, are identified.

The ER and the subsequent EIS contain the baseline and projected environmental information necessary to assess the environmental acceptability of the demonstration plant prior to construction. They also provide a sound technical basis for ensuring that adequate environmental monitoring is conducted and that appropriate environmental controls are employed beyond the scope of currently regulated pollutants. DOE and EPA plan to conduct a source pollutant characterization program that will assist in identifying potentially harmful but currently unregulated pollutants.

b. Environmental Monitoring Requirements

Monitoring during Phase I (Conceptual Design) establishes existing or baseline conditions through an extended period of analytical monitoring. It includes all environmental, social, and economic information collected during the period from the initial site survey to the beginning of construction.

Monitoring in Phase II (Detailed Design and Construction) occurs during site preparation as well as during plant construction. For the data to be meaningful the preconstruction monitoring program must be continuously maintained. The scopes of the two programs must be nearly identical so that quantitative, statistically valid data comparisons can be made. These data enable an assessment of expected and unexpected construction impacts and provide additional baseline data for comparison with future operational-phase monitoring data.

Monitoring during Phase III (Plant Operation) provides sufficient data to assess and document, by comparison with preconstruction and construction data, the environmental impacts of routine and accidental releases of plant effluents. Operational monitoring at the demonstration plant stage should provide useful information for adapting these technologies to a commercial scale in a timely and cost-effective manner.

c. Environmental Control Requirements

The effectiveness and the need for adequate environmental control technology must be evaluated as each process design matures to ensure that the impact of the process on the environment is directly or indirectly eliminated or mitigated. Environmental controls are expected to be required in the areas of tar and particulate removal, SO_x and NO_x control, hydrocarbon emission control, sulfur removal, solid waste management, and wastewater treatment needs. Additionally, control of emissions and effluents from coal storage and cleaning is required. Consideration will extend to the control of toxic or other potentially damaging compounds should they be determined to be present in the effluent streams.

To ensure and ascertain that the planned environmental control equipment satisfies the environmental impact mitigation needs, sufficient data will be collected through the operational monitoring program to evaluate the following concerns:

- Environmental control efficiency -- to determine the degree of pollutant removal;
- Environmental control reliability -- to determine control effectiveness over extended periods including the response to upsets and varied operational conditions;
- Environmental control maintenance -- to determine time, personnel, and cost to maintain control equipment;
- Environmental control trade-off studies -- to determine the most efficient, existing control for each pollutant or for pollutant combinations; and
- Process improvements -- to minimize pollutant output levels, i.e., fine tuning of gasifier/reactor to obtain maximum combustion efficiencies with respect to effluent stream outputs.

Finally, to ensure the timely availability of environmental controls and to facilitate trade-off studies, an assessment of available controls will be required. This will include a comparison of controls used in refinery waste streams for application to coal gasification, a characterization of controls used in similar coal gasification pilot plants, and a projection of the state-of-the-art in environmental control technology at the time the demonstration plants go on-line.

B. STATUS OF ENVIRONMENTAL REQUIREMENTS AND EFFORTS

As previously noted, two contractors have been selected to prepare conceptual designs for the high Btu pipeline gas demonstration plant: the CONOCO Coal Development Company (CCDC) and the Illinois Coal Gasification Group (ICGG). Two other contractors are similarly competing on the low Btu industrial fuel gas project -- the Memphis Light, Gas, and Water Division in association with the Institute of Gas Technology (IGT) is competing with W. R. Grace and Company. Thus, four conceptual designs are in preparation for the two demonstration projects. Each pair of competitors is on the same schedule and status information presented below is applicable to each pair of the competing contractors. The environmental activities are divided into the categories of assessment, monitoring, and control in the following status description.

1. Assessment

Environmental assessment activities occur mostly during conceptual design of each project. The focal point for this activity is the Environmental Report (ER) to be prepared by the industrial partner under the direction of the Federal Government.

Both the high and low Btu projects are currently in the Phase I stage with completion of the two designs expected in mid-1978 for the high Btu project and mid-1979 for the two designs of the low Btu project. Consequently, data collection and analysis activities to support preparation of each ER are in process. The four ERs are scheduled for publication at the end of Phase I.

2. Monitoring

As previously mentioned, the environmental monitoring program conducted by the four contractors during Phase 1 is limited to two activities -- the establishment of an environmental baseline for the prospective demonstration plant sites and the development of an environmental monitoring plan.

The current (Phase I) monitoring activities are being conducted to establish environmental backgrounds of the four potential sites for the two coal gasification demonstration plants. This baseline program comprises the following areas: air quality and meteorology, surface water quality and hydrology, groundwater quality and hydrology, terrestrial ecology, aquatic ecology, and socioeconomics. The current efforts are involved in establishing a record of the chemical balances in each of these areas, so that changes from either the construction or operation phases can be measured and evaluated.

Monitoring for air quality is primarily involved with measuring six critical items: carbon monoxide, hydrocarbons, ozone, SO_x, NO_x, and suspended particulates. The program is also designed to establish baseline measurements for any probable pollutants that could be present in the residuals from each specific plant. A subprogram to evaluate the presence of trace metals in the atmosphere is also underway.

The water quality baseline monitoring program is concentrated on the EPA's list of 129 priority pollutants. Trace metals, polyaromatic hydrocarbons, phenols, etc., are also being evaluated as part of the ambient water environment. The program is based on anticipated discharges from the specific plants even though the lack of plant design quite probably results in monitoring a larger number of pollutants than will actually occur.

The specific monitoring plans for Phases II and III are being developed at this time by the four contractors; they have not yet been presented to the Department of Energy. When available, these monitoring plans will be reviewed by DOE and EPA.

3. Control

During Phase I, available environmental controls including data on their cost, efficiency, and reliability, will be evaluated in trade-off studies to determine the most economic and efficient control for each pollutant or combination of pollutants. In many cases, the environmental controls are integral to the process design (i.e., not separate "add-on" controls) and must be evaluated integrally with the process design of the plant. The results of the Phase I effort will define the extent of the environmental controls to be used in the detailed design and construction activities of Phase II.

C. DEMONSTRATION PLANT SUPPORTING ENVIRONMENTAL ACTIVITIES

A number of projects are being funded by DOE in the areas of environmental assessment, monitoring, and control in direct support of the subject demonstration plants. In addition, DOE and EPA are supporting a number of studies through government-research laboratories and contractors that relate to the biological and environmental impacts of coal conversion and gasification processes and facilities. These projects and studies are listed in Table 3 according to the appropriate category of applicability. As the demonstration programs proceed, some of the general support projects may be concluded and project-specific activities of a similar nature begun; other support work (i.e. additionally identified general needs) will continue to support coal gasification in the more general nature.

Table 3. Characterization of Environmental Projects According to Area of Applicability

Characterization, Monitoring, and Measurement Techniques

Demonstration-Project Specific

- Design and Implementation of an Occupational Health and Safety Monitoring Program for Demonstration Plants (DOE)
- Standardizing Methods for Environmental Data Collection, Formatting, and Use of Demonstration Plant Data (DOE)
- Development and Implementation of Detailed Ambient Baseline Monitoring Programs (DOE)
- Implementation of Ambient Monitoring Programs During the Construction and Operation of Demonstration Plants (DOE)
- Design and Implementation of Emissions and Product/By-Product Monitoring Programs for All Demonstration Plants (DOE)

General Support to Coal Gasification Program

- Low Btu Gasifier - Biological Characteristics (DOE)
- Coal Conversion Pollutant Chemistry (DOE)
- Environmental Assessment Sampling and Analytical Strategy Program (EPA)
- Environmental Assessment Data Base for Low/Medium Btu Gasification Technology (EPA)
- Procedures Manual for Environmental Assessment of Fluidized-Bed Combustion Processes (EPA)
- Initial Environmental Test Plan for Source Assessment of Coal Gasification (EPA)
- LBG--Biological Characterization of Field Collected Effluents (DOE)
- University of Minnesota, Duluth--Project, Gasifiers-in-Industry (DOE)
- Environmental Assessment and Regulation for Coal Conversion (EPA)

Table 3. Continued

Control/Mitigation

Demonstration-Project Specific

- Evaluation of Environmental Control Technologies for Demonstration Plants (DOE)

General Support to Coal Gasification Program

- Environmental Assessment of High Btu Gasification: Annual Report (EPA)
- Environmental Assessment Data Base for Low/Medium Btu Gasification Technology (EPA)
- Control Technology Development for Fuel Conversion System Wastes (EPA)
- Development of Multimedia Environmental Goals (MEG's) for Pollutants from Fuel Conversion Processes (EPA)
- Environmental Program for Solid Wastes from Synthetic Fuels from Coal Technologies (EPA)
- Control Technology Development for Products/By-Products of Coal Conversion Systems (EPA)

Ecological Effects

General Support to Coal Gasification Program

- Initial Environmental Test Plan for Source Assessment of Coal Gasification (EPA)
- Water Conservation and Pollution Control in Coal Conversion Processes (EPA)

Health and Safety

General Support to Coal Gasification Program

- Low Btu Gasification Early-Damage Indicators for Inhaled Effects (DOE)
- Toxicology of Coal Gasification (DOE)

Table 3. Continued

- o Synfuel Carcinogenesis Assay (DOE)
- o Genetic Effects -- Molecular and Radiation Genetics (DOE)

Socioeconomic Effects

Demonstration-Plant Specific

- o Analyses of Socioeconomic Impacts of Demonstration Projects (DOE)
- o Water Availability Assessments for Demonstration Projects (DOE)

NEPA Compliance

Demonstration-Plant Specific

- o Preparation of EIAs and EISs for Demonstration Projects (DOE)

Resource Requirements

Demonstration-Plant Specific

- o Water Availability Assessments for Demonstration Projects (DOE)

V. ENVIRONMENTAL ACTIVITY FUNDING

The estimated costs associated with the assessment, monitoring, and control efforts to successfully demonstrate the High Btu Synthetic Pipeline Gas and the Low Btu Fuel Gas demonstration plants are to be reported as stated in Section 113 of P.L. 95-39. Firm requirements for environmental activities are presently being evaluated for these plants in the environmental analysis being performed as a part of the conceptual design (Phase I). Therefore, the extent of environmental assessment, monitoring, and control and the associated costs cannot be defined at present.

Table 4 presents the identified environmental activity funding that can be identified at this time. The funding data shown in the table are limited because the plants are in the early stages of design, and these stages include trade-offs in the interaction of environmental controls and process functions and the development of a monitoring plan.

The funding for environmental analyses includes the total cost associated with the efforts and is not broken down into discrete subelements for assessments, monitoring or control activities. Additionally, environment-related costs for Phases II and III will be estimated upon completion of the environmental analyses. At that time, a firm monitoring plan will be available, and the types of environmental controls established.

The DOE supporting costs through FY 1979 are shown in the table and include the technical support in the form of research, analyses, and laboratory studies to evaluate and determine the monitoring requirements and the environmental controls necessary to characterize the pollutants and mitigate the environmental impact. The DOE-supported efforts will be continued for numerous environmental concerns, (e.g., new source performance standards) and will be coordinated jointly with EPA and NIOSH. Environment-related activities to be funded in the future will evolve from these studies as well as from the contractor's environmental analyses and will be supported as the projects proceed into Phases II and III.

Table 4. Identified Environmental Activity Funding For the Two Demonstration Plants

Category	Costs* ($000)
High Btu synthetic pipeline gas demonstration plant	
Preparation of environmental analysis by contractors	1,145+
DOE-supported environmental studies	3,600@
Total	4,745
Low Btu industrial fuel gas demonstration plant	
Preparation of environmental analysis by contractors	1,214+
DOE-supported environmental studies	3,400@
Total	4,614

* Operating expenses authorized
\+ Total Phase I cost for the two contractors involved
@ Budget Authorization funding through FY 1979 (DOE Congressional Budget Submission)

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