DOE/EA-1029

The Department of Energy

Final Environmental Assessment for the *Liquid Phase Methanol (LPMEOH™) Project*

CLEAN COAL TECHNOLOGY

June, 1995

Cover Sheet

Proposed Action: To decide whether the Department of Energy (DOE) should fund the demonstration of the Liquid Phase Methanol (LPMEOH™) process. If approved, the DOE would provide, through a cooperative agreement with Air Products Liquid Phase Conversion Co., L.P., partial funding for the design, construction, and operation of a 260 ton per day methanol facility at the Eastman Chemical site in Kingsport, Tennessee.

Type of Statement: Environmental Assessment

Lead Agency: Department of Energy
Pittsburgh Energy Technology Center

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Abstract: The proposed project is to demonstrate on a commercial scale the production of methanol from coal-derived synthesis gas using the LPMEOH™ process. The methanol produced during this demonstration will be used as a chemical feedstock (on-site) and/or as an alternative fuel in stationary and transportation applications (off-site). In addition, the production of dimethyl ether (DME) as a mixed co-product with methanol may be demonstrated for a six month period under the proposed project pending the results of laboratory/pilot-scale research on scale-up. The DME would be used as fuel in on-site boilers.

The proposed LPMEOH™ facility would occupy approximately 0.6-acres of the 3890-acre Eastman Chemical facility.

The effects of the proposed project include changes in air emissions, wastewater discharge, cooling water discharge, liquid waste quantities, transportation activities, socioeconomic effects, and quantity of solids for disposal. No substantive negative impacts or environmental concerns were identified.

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ACRONYMS

BOD	*Biological Oxygen Demand*
CCT	Clean Coal Technology
dBA	decibels
DME	dimethyl ether
DOE	Department of Energy
EA	Environmental Assessment
EIV	Environmental Information Volume
gal	gallons
H_2	hydrogen
H_2S	hydrogen sulfide
lb	pounds
L.P.	Limited Partnership
LPMEOH™	Liquid Phase Methanol
M	millions
MeOH	methanol
NH_3	ammonia
PSD	*Prevention of Significant Deterioration*
SO_2	sulfur dioxide
TPD	tons per day
TPY	tons per year
TSP	total suspended particulate
VOC	Volatile Organic Compound
WWT	Wastewater Treatment
Yr	year

1.0 Purpose and Need

Department of Energy's (DOE) Purpose

The Clean Coal Technology program is a nearly $7 billion technology demonstration program that was legislated by Congress to be funded jointly by the federal government and industrial sector participants. The goal of the Clean Coal Technology demonstration program is to make available to the United States marketplace a number of advanced, more efficient, reliable, and environmentally responsive coal utilization and environmental control technologies.

The proposed Liquid Phase Methanol (LPMEOH™) demonstration project, to be conducted at the Eastman Chemical Facility in Kingsport, Tennessee, was selected under the third competitive solicitation of the Clean Coal Technology program. DOE's purpose for the demonstration of the proposed project is to help fulfill the goals and objectives of the Clean Coal Technology program by demonstrating the potential of a more efficient, liquid-phase reaction process as a preferred alternative to gas-phase reactions for methanol production.

Project Purpose

The purpose of the proposed project is to demonstrate on a commercial scale the production of methanol (MeOH) from coal-derived synthesis gas using the LPMEOH™ process. Current technology for MeOH production is based on reaction of carbon monoxide and hydrogen gases over a bed of catalyst particles. The proposed LPMEOH™ process would use an *alternative concept where the two gases are reacted over catalyst particles suspended in an inert* liquid (mineral oil). The potential advantages of this process are lower cost operations, higher processing efficiencies, smaller reaction vessels, and higher productivity.

The methanol produced during this demonstration would be used as a chemical feedstock (on-site) and/or as an alternative fuel in stationary (boilers) and transportation (busses and van pools) applications (off-site). In addition, the production of dimethyl ether (DME) as a mixed co-product with methanol may be demonstrated for a six month period under the proposed project pending the results of laboratory/pilot-scale research. The DME would be used as fuel in on-site boilers. The decision of whether to produce DME would be made by March 1, 1998. Table 1-1 presents the participants, their responsibilities for the proposed project, their cost-share contributions to the project, and their objectives for being involved with the proposed project.

DOE Need for Action

The methanol and DME would fill an important need in the development of alternative fuels. Both methanol and DME can be substituted for conventional fuels with the advantage of no sulfur compounds being emitted to the atmosphere. Blends of methanol and DME can be used a chemical feedstock for the synthesis of chemicals, or new, oxygenate fuel additives.

DOE Decision

The decision to be made by the DOE is whether to fund this project for the demonstration of the LPMEOH™ process. Several other federal and state agencies are also involved in this project. (See Table 1-2).

Table 1-1. LPMEOH™ Project:[a] Kingsport, Sullivan County, Tennessee

Participant	Responsibility	Cost	Objective
U.S. Department of Energy (DOE)	•Co-Funder •Federal Project Management	$92.7M	Meet Objectives of CCT Program (New Fuel Forms)
Air Products Liquid Phase Conversion Co., L.P.[b]	•Execute Private Sector Portion of Cooperative Agreement With DOE	$69.7M	Demonstration of Technology and Alternate Method of Producing MeOH
Air Products and Chemicals, Inc.	•Co-Funder •Technology Supplier •Design and Construct Project	$48.9M	Demonstration of Technology - Commercial Scale (260 TPD MeOH)
Eastman Chemical Company	•Host Site •Operator of Project •Synthesis Gas Provider	$0	Alternative Method of Producing MeOH
Acurex Environmental Corporation	•Co-Funder •Off-Site MeOH Testing (Mobile and Stationary)[c]	$2.2M	Test and Verify Acceptability of MeOH Product
Electric Power Research Institute	•Co-Funder •Off-Site MeOH Testing (Utility)	$0.2M	Test and Verify Acceptability of MeOH Product

a December 1996 - February 2001 (Operation)
b Joint Venture: Air Products and Chemicals, Inc. and Eastman Chemical Company
c January 1998 - August 1999 (Testing to Occur in California and West Virginia)

Table 1-2. Federal and State Agencies Involved With Project

Agency	Role in Project
U.S. Fish and Wildlife Service[a]	Consultation regarding impact of project on any threatened or endangered species
State Historic Preservation Office - Tennessee Historical Commission[a]	Consultation regarding impact of project on any cultural or historical properties
State of Tennessee - Dept. of Environment and Conservation[b]	Issuance of air contaminant source construction permit, air emissions, water effluent, and solids disposal permits[c]
Tennessee State Fire Marshal[b]	Issuance of building permit

a DOE responsible for action
b Eastman Chemical responsible for action
c Existing permit requirements, permits, and proposed permit modifications are discussed in the EIV (Eastman, 1994).

Scoping

Scoping activities included two site visits to the Eastman Chemical Facility; numerous meetings and telephone calls with Eastman Chemical and Air Products; and DOE review of the Environmental Information Volume (EIV) prepared by Eastman Chemical and Air Products to fulfill the requirements of the CCT program.

Scope of Environmental Assessment (EA)

The effects of the proposed project include changes in air emissions, wastewater discharge, cooling water discharge, liquid waste quantities, transportation activities, socioeconomic effects, and quantity of solids for disposal. No substantive negative impacts or environmental concerns were identified.

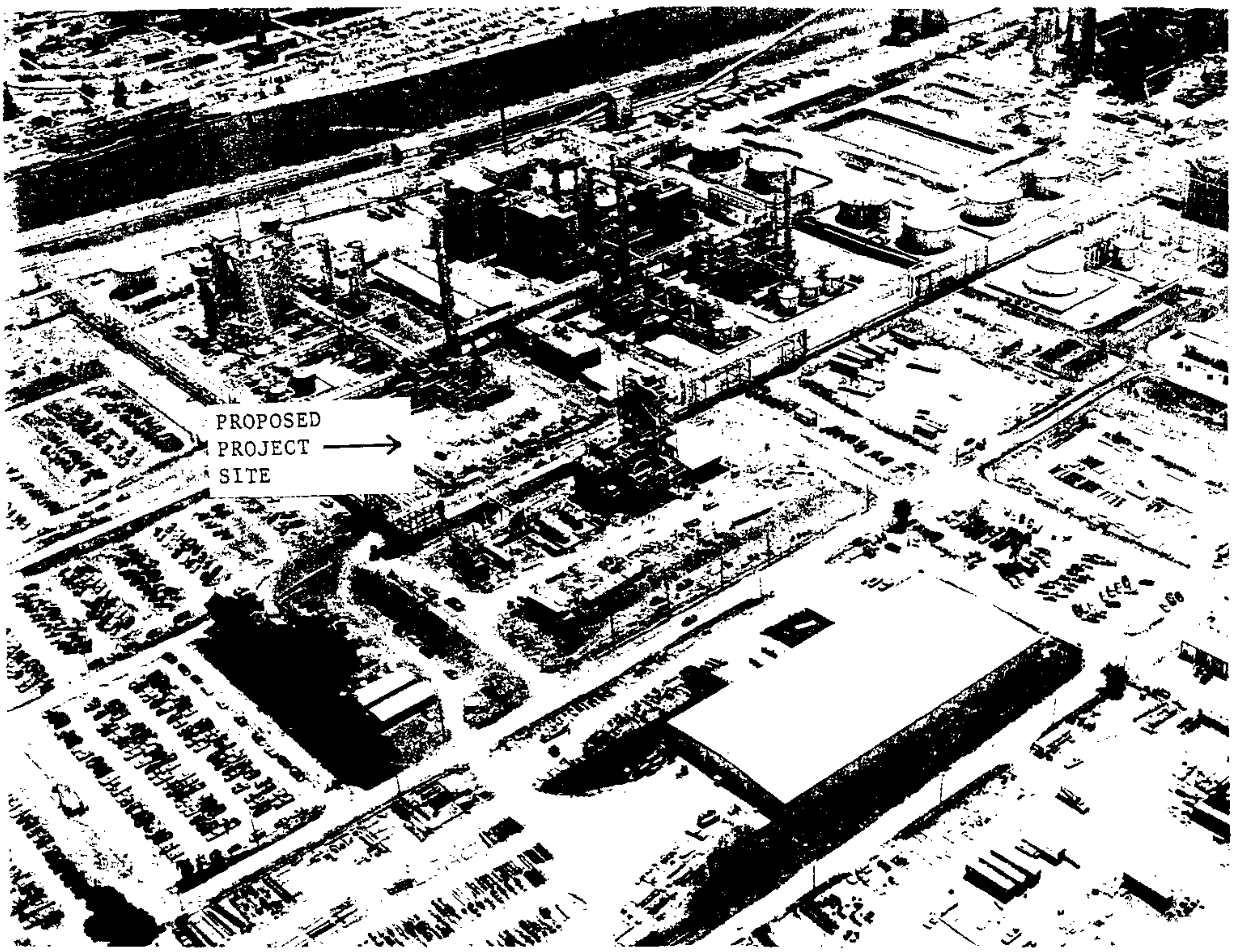
2.0 Proposed Project and Alternatives

This section describes the proposed project and the no-action alternative, focusing on how their environmental impacts differ.

Proposed Action

The *proposed action is for the DOE to provide, through a cooperative agreement with* Air Products Liquid Phase Conversion Co., L.P., partial funding for the design, construction, and operation of a 260 ton per day (TPD) methanol facility at the Eastman Chemical site in Kingsport, Tennessee. A complete technical description of the process is contained in Appendix A. The proposed project site is on the eastern half of South Long Island between the South Fork Holston River and Big Sluice River. Figure 2-1 illustrates the location of the proposed project site at the Eastman Chemical facility.

Figure 2-1. Proposed Project Site at Eastman Chemical Facility



Construction of the LPMEOH™ facility would begin in September 1995; operation would begin in December 1996 and continue until February 2001. The proposed project also includes the provision for off-site testing of 400,000 gallons (~1333 tons) of the methanol produced from the LPMEOH™ facility from January 1998 until August 1999. In addition, the proposed project also includes the provision for the production of DME for a six month period as a mixed co-product with methanol pending the results of laboratory/pilot-scale research. At the end of the demonstration period, Eastman Chemical would make a decision whether to continue operation or dismantle the LPMEOH™ facility.

The proposed LPMEOH™ facility would occupy approximately 0.6-acres of the 3890-acre Eastman Chemical facility. The major new structures and equipment for the LPMEOH™ facility would include the following: a reactor; two distillation columns; two methanol storage tanks; two tanks for mineral oil storage; a slurry holdup tank; a trailer loading/unloading area; an oil/water separator, and catalyst slurry preparation vessels.

Eastman Chemical's current methanol production of 500 TPD for use in the production of methyl acetate, an acetic anhydride production process, is met by the existing Lurgi methanol synthesis unit (gas phase reactor). With the proposed LPMEOH™ facility producing 260 TPD of methanol, Eastman Chemical would continue to produce methanol utilizing the Lurgi unit. However, the Lurgi unit would operate at a reduced output of 210 TPD. The total methanol requirement would be met with the purchase of an additional 30 TPD. If the option to produce DME as a part of this proposed project is implemented, the Lurgi unit would continue to produce 210 TPD of methanol, the LPMEOH™ facility would produce 192 TPD of methanol, and 98 TPD *of methanol would be purchased. This information is summarized in Table 2-1.*

Table 2-1. Comparison of Methanol and DME Production Between Alternatives

Method of Acquisition of Methanol and DME	Proposed Project	Proposed Project W/DME Co-Production	No-Action Alternative	Change Due to Proposed Project
MeOH Produced By Lurgi Reactor	210 TPD	210 TPD	500 TPD	-290 TPD
MeOH Produced by LPMEOH™	260 TPD	192 TPD	0	+260 TPD +192 TPD w/DME Co-Production
MeOH Purchased	30 TPD	98 TPD	0	+ 30 TPD + 98 TPD w/DME Co-Production
DME Produced	0	27 TPD	0	+ 27 TPD w/DME Co-Production
Total MeOH Produced/Bought Daily	500 TPD	500 TPD	500 TPD	0 + 68 TPD w/DME Co-Production

No-Action Alternative

Under the no-action alternative, DOE would not provide partial funding for the design, *construction, and operation of the proposed LPMEOH™ project. Under the no-action alternative,* Eastman Chemical would continue to produce its total daily methanol requirement utilizing the existing Lurgi unit. Under this alternative, no methanol would be used for off-site testing.

Summary of Impacts

Table 2-2 compares the changes at the Eastman Chemical facility in emissions, effluents, and solid wastes, for each of the alternatives (Eastman Chemical, 1994). For all comparisons between the proposed project and the no-action alternative, the data provided for the proposed project include the reductions expected to be realized from the turning down of the Lurgi unit.

Table 2-2. Comparison of Emissions, Effluents, and Solids for Disposal Between the Proposed Project and the No-Action Alternative

Parameter	Proposed Project	Proposed Project With DME Production	No-Action Alternative	Change Due to Proposed Project
Air Emissions[a]	128.3 TPY	140.6 TPY	117.5 TPY	+10.8 TPY +23.1 TPY with DME Co-Production
Catalyst Disposal	103,000 to 128,000 lb/yr (MeOH Catalyst) 10,000 lb[b] (Guard Bed Adsorbent)	103,000 to 128,000 lb/yr (MeOH Catalyst) 10,000 lb (Guard Bed Adsorbent) 1,700 lb alumina[b]	35,000 to 60,000 lb/yr (MeOH Catalyst)	+68,000 lb/yr[c] +10,000 lb one time disposal of guard bed adsorbent +1,700 lb one time disposal of alumina w/DME Co-Production
Incinerator Ash	4.941 M lb/yr	4.941 M lb/yr	~4.900 M lb/yr	+0.041 M lb/yr
Cooling Water	378,508,000 gal/day	378,508,000 gal/day	378,500,000 gal/day	+8,000 gal/day
WWT[d] Facility Effluent Flowrate	23,001,150 gal/day	23,001,726 gal/day	23,000,000 gal/day	+1,150 gal/day +1,726 gal/day with DME Co-Production
Biological Oxygen Demand Entering WWT Facility	~159,180 lb/day (avg.)	~161,280 lb/day (avg.)	~155,000 lb/day (avg.)	+4,180 lb/day (avg.) +6,280 lb/day (avg.) with DME Co-Production
Waste Oil	13,000 lb/yr	13,000 lb/yr	0	+13,000 lb/yr
Distillation Liquid Sent to Boilers or Incinerator	143.324 M lb/yr	143.240 M lb/yr	~143.000 M lb/yr	+0.324 lb/yr +0.240 M lb/yr with DME Co-Production

a Includes Equipment Leaks and Absorber Emissions of VOCs, CO, Particulates, and Hydrogen Gas. The individual parameters of the air emissions are quantified in Table 3-1.

b Guard Bed Catalyst and Alumina for DME Production Will Not be Changed Out During the Project Demonstration Period but is Included in Solid Waste Disposal as it is Project Specific and Someday Will be Changed Out

c Catalyst Composition Between Alternatives is Quite Similar and Would be Handled in an Identical Manner

d Wastewater Treatment

3.0 *Affected Environment and Environmental Impacts of Proposed Project and No-Action Alternative*

The proposed LPMEOH™ facility would be located within the existing Eastman Chemical facility where current land use is primarily heavy industrial and would be located adjacent to existing manufacturing facilities which include: an acetic anhydride process; a methyl acetate process; a Lurgi methanol synthesis process; an integrated coal gasification facility; and a cyclohexanedicarboxylic acid process area.

Failure to construct the proposed LPMEOH™ facility at Eastman's Kingsport site would leave that space available for construction of another process facility. It cannot be assumed that the no-action alternative would result in non-use of the land because the site is centrally located to plant utilities. Within the next decade, it is conceivable that an Eastman Chemical plant expansion would occur should the proposed LPMEOH™ facility not be constructed.

In each of the affected resource areas, those impacts related to the construction of the proposed project are considered as short-term impacts, and those impacts related to operation of the proposed project are considered as long-term impacts. The Sullivan County Industrial Commission knows of no plans for new manufacturing or industry in the Kingsport area, therefore, the proposed project would have no effect on long term cumulative impacts. Permits and permit requirements related to the proposed project are fully discussed in the EIV.

Air Resources

Existing air quality background data, as measured from an existing network of air quality monitoring sites in the general vicinity of the proposed project site, were evaluated and the concentrations of all regulated pollutants are in attainment with their respective federal and state air quality standards (Appendix B).

Construction-Related Impacts

The primary sources of air emissions during the construction phase of the project would be vehicular exhaust emissions, such as from construction equipment, as well as "fugitive" particulate emissions. The latter emissions would be generated primarily by wind erosion during site excavation. However, construction would not involve moving large quantities of earth because the site is less than one-acre in size and would not require recontouring. The site has a gravel cover and precautions, such as watering, would be taken to eliminate dust generation. Support caissons would be drilled and there would be shallow excavations for building foundations, but no other earthmoving activities would occur.

Operational-Related Impacts

Air emissions would increase at the site even though the Lurgi unit would be operating at a lower capacity (210 TPD vs. 500 TPD). The fugitive emission rate of the Lurgi unit is independent of plant production rate. The magnitude of the emission rate of the proposed LPMEOH™ unit would be relatively small (9 to 20% of South Long Island emissions). The largest single parameter that would increase due to the proposed project would be volatile organic compounds (VOCs). VOCs are linked with the formation of ozone. The VOC emissions for the entire Eastman Chemical facility were 14,600 TPY (1992) therefore, the projected increase in VOCs due to the LPMEOH™ unit would represent a negligible increase relative to the entire plant

(0.05 to 0.1%). In addition, through Eastman Chemical's Responsible Care program, Eastman has reduced the Toxic Release Inventory (TRI) of chemicals (which includes VOCs) each year since 1988. Although the LPMEOH™ unit would increase VOCs, the overall VOC emission rate from Eastman would continue to decrease thereby cancelling out the projected project related increase in VOCs. Table 3-1 presents current emissions from South Long Island and the potential emissions from operation of the LPMEOH™ plant.

Table 3-1. Summary of Potential Emissions From Proposed LPMEOH™ Facility

Parameter	Current Emissions from South Long Island	Predicted Emissions from the LPMEOH™ Plant Alone	Predicted Emissions with DME Production/ LPMEOH™ Plant*	Will increase exceed air quality standards?	PSD Threshold Value
VOC	73.1 TPY	+ 7.3 TPY	+ 17.8 TPY	No	40 TPY
CO	38.1 TPY	+ 2.1 TPY	+ 3.2 TPY	No	100 TPY
H_2S/SO_2	2.54 TPY	0 TPY	0 TPY	N/A	N/A
H_2	2.94 TPY	+ 0.42 TPY	+ 0.63 TPY	N/A	N/A
NH_3	0.22 TPY	0 TPY	0 TPY	N/A	N/A
TSP	0.605 TPY	+ 1 TPY	+ 1.5 TPY	No	25 TPY

* DME Production Would Only Occur During the Final Six Month Period at the End of the Proposed Project

Because the increased levels of carbon monoxide (CO), VOCs, and particulates would be well below the threshold values for a Prevention of Significant Deterioration (PSD) review, air quality dispersion modelling would not be required as a part of the permitting process. However, air quality modelling was performed for CO. Results indicated that the predicted concentrations would be less than one percent of the National Ambient Air Quality Standards (NAAQS) and when combined with existing background levels, CO concentrations represent 21 percent of the NAAQS.

If the option to produce DME as a part of this proposed project is implemented, the DME produced would be used as an alternate fuel on-site. The DME would displace 21 TPD of coal as fuel in two on-site boilers. The combustion of the DME, which like methanol, is a clean burning fuel, would have the net effect of reducing emissions from the Eastman facility.

A review of estimated emissions that would result from the planned offsite testing, including methanol vapor losses during transfer and diesel emissions as a result of transport, shows them to be inconsequential. For example, an additional 1227 pounds of nitrogen oxides are estimated to be released in the transport of methanol off-site and in the off-site combustion (in boilers, busses, and van pools) of the methanol. The annual release of nitrogen oxides from the United States in 1989 that was due to human activities was 19 million tons or 38 billion pounds. The estimated release from the proposed project would result in an increase of three millionths of one percent (three parts in one hundred million).

Under the no-action alternative, current air emissions on-site and off-site (since no off-site testing would occur) due to the continued operation of the Lurgi unit would not change.

Solids and Waste Disposal

There would be three solid waste streams generated during the construction and operation phases of the proposed project. These streams are identified as: 1) construction waste debris; 2) spent catalyst (methanol catalyst, methanol/DME catalyst, and alumina catalyst); and 3) activated carbon from the guard bed. (See Appendix C for a detailed solid waste discussion.)

A 63,000 cubic yard on-site hazardous waste landfill will become operational during 1995. The landfill has an expected life of 17 years and is an independent part of Eastman Chemical's plans, irrespective of the decision made regarding DOE's partial funding of the proposed project.

Construction-Related Impacts

The amount of construction-related waste debris is estimated to be 3,000 to 5,000 cubic yards. Disposal would be in the permitted 1.81M cubic yard on-site non-hazardous landfill.

Operational-Related Impacts

There would be two solid waste streams generated with the proposed project: spent catalyst (methanol catalyst, methanol/DME catalyst, and alumina catalyst) and guard bed adsorbent. The primary option for disposal would be to send the spent catalyst material to a metals reclaimer and regenerate the spent adsorbent. A second option would be to incinerate the spent catalyst and adsorbent on-site. Should the catalyst and adsorbent be incinerated, there would be no change in the composition of the stack gases from the incinerator and the solid waste would be included in the incinerator ash. Due to the current practice of combustion of hazardous materials in the incinerator, the combination of the proposed project solid wastes with hazardous and nonhazardous materials currently incinerated at Eastman Chemical warrant the residual incinerator ash to be sent to an on-site hazardous landfill. The composition of the solid waste that would be generated under the proposed project would be similar to that currently managed at Eastman Chemical. The quantity of solid wastes from the proposed project would represent less than one percent of the total solid wastes generated annually at Eastman Chemical that are sent to the on-site hazardous waste landfill (see Table 3-2). No changes would be required to the current state operating permit for the Eastman Chemical incineration facility.

Table 3-2. Existing and Proposed Solids for Disposal

Parameter	**Proposed Project**	**Proposed Project With DME Co-Production**	**No-Action Alternative**	**Change Due to Proposed Project**
Catalyst Disposal	103,000 to 128,000 lb/yr (MeOH Catalyst) 10,000 lb (Guard Bed Adsorbent)	103,000 to 128,000 lb/yr (MeOH Catalyst) 10,000 lb (Guard Bed Adsorbent) 1,700 lb alumina	35,000 to 60,000 lb/yr (MeOH Catalyst)	+68,000 lb/yr +10,000 lb one time disposal of guard bed adsorbent +1,700 lb one time disposal of alumina w/DME Co-Production
Incinerator Ash	4.941 M lb/yr	4.941 M lb/yr	~4.900 M lb/yr	+0.041 M lb/yr

Under the no-action alternative, the amount of solids generated and disposed of by Eastman Chemical would remain unchanged with the continued operation of the Lurgi unit.

Water Resources

The three affected parameters with regard to water use are: the flowrate of the WWT facility effluent, the flowrate of cooling water, and the amount of BOD entering the wastewater treatment facility. The intake for the cooling water is from the South Fork Holston River. The outfalls for the cooling water and the wastewater treatment facility effluent are into the South Fork Holston River which has an average flowrate of 2290 cubic feet per second (1,479.9 M gal/day) and a low flow rate of 750 cubic feet per second (484.7 M gal/day).

Downstream studies of water quality have shown that most parameters measured met the state's eighteen criteria except for dissolved oxygen, nitrate, and fecal coliform. The lower dissolved oxygen concentrations are due to the Fort Patrick Henry Dam upstream of Eastman Chemical. The nitrate concentration is exceeded both upstream and downstream and is probably caused by agricultural and urban development. The presence of fecal coliform correlates to the influence of urban development near the river (Academy, 1992).

Construction-Related Impacts

Construction of the proposed project is not expected to negatively impact existing surface water or groundwater resources.

Operational-Related Impacts

Operational wastewater from the proposed facility includes cooling water and process wastewater. The increases in wastewater discharge (0.005 percent or 0.007 percent with DME co-production) and in cooling water discharge (0.002 percent) represent negligible contributions to the flow in the South Fork Holston River even during low flow conditions. The composition of the wastewater effluent would be similar to that from the existing Lurgi unit. Operation of the proposed facility would also increase the BOD entering the wastewater treatment facility by a negligible amount (2.6 percent or 4.0 percent with DME co-production). The parameters tested for by Eastman Chemical under the wastewater permit are contained in the EIV. The thermal impact to the South Fork Holston River due to the cooling water discharge would be negligible. The heat rejected by the LPMEOH™ mainly goes to the atmosphere due to a cooling tower. The proposed and existing discharges are shown in Table 3-3.

Table 3-3. Existing and Proposed Water Discharges

Parameter	Proposed Project	Proposed Project With DME Co-Production	No-Action Alternative	Change Due to Proposed Project
Cooling Water	378,508,000 gal/day	378,508,000 gal/day	378,500,000 gal/day	+8,000 gal/day
WWT Facility Effluent Flowrate	23,001,150 gal/day	23,001,726 gal/day	23,000,000 gal/day	+1,150 gal/day +1,726 gal/day with DME Co-Production
BOD Entering WWT Facility	~159,180 lb/day (avg.)	~161,280 lb/day (avg.)	~155,000 lb/day (avg.)	+4,180 lb/day (avg.) +6,280 lb/day (avg.) with DME Co-Production

The proposed project would have no effect on floodplains or wetlands as the site is above the 500 year floodplain and are there no wetlands in the proposed project vicinity. The stormwater runoff would be collected prior to discharge into the wastewater inceptor sewer which feeds into the wastewater treatment facility. The proposed project would not affect groundwater resources.

Under the no-action alternative, the wastewater treatment discharge flowrate, the BOD entering the wastewater treatment facility, and the cooling water discharge would all remain the same.

Liquid Waste Streams

There would be one new liquid waste stream generated and one existing liquid waste stream increased under the proposed project.

Construction-Related Impacts

There would be no new liquid waste streams generated during construction.

Operational-Related Impacts

The new liquid waste stream would be 13,000 lb/yr of waste oil from the oil/water separator and various maintenance activities. A liquid waste stream from an existing distillation process would be increased by 324,000 lb/yr. Both of these waste streams would be burned in on-site boilers with no required changes to existing certification of compliance documents. Table 3-4 presents a comparison of these waste streams between the alternatives.

Table 3-4. Existing and Proposed Liquid Waste Streams

Parameter	Proposed Project	Proposed Project With DME Production	No-Action Alternative	Change Due to Proposed Project
Waste Oil	13,000 lb/yr	13,000 lb/yr	0	+13,000 lb/yr
Distillation Liquid Sent to Boilers or Incinerator	143.324 M lb/yr	143.240 M lb/yr	~143.000 M lb/yr	+0.324 lb/yr +0.240 M lb/yr with DME Co-Production

Under the no-action alternative, the existing distillation process would still generate the liquid waste stream.

Transportation

On an average operating day, there are approximately 10,100 employees/automobiles onsite at the Eastman Chemical facility. Between 12,775 and 18,250 tanker trucks per year (35 and 50 tanker trucks per day) enter and exit the Eastman Chemical facility.

Construction-Related Impacts

During construction of the LPMEOH™ facility, a maximum of 150 additional workers/automobiles would be required. This represents a less than two percent increase over existing traffic entering/exiting the Eastman Chemical facility on a daily basis.

Operational-Related Impacts

For the operation of the LPMEOH™ facility, no more than ten workers are expected to be hired. This additional traffic of ten automobiles per day represents a negligible increase in traffic entering/exiting the Eastman Chemical facility.

During the proposed project, 30 tons per day (9,090 gallons per day) of methanol would be purchased and delivered to the Eastman Chemical facility. Using a nominal 6000 gallon tanker truck, this represents an increase of tanker trucks of 1.5 trucks per day. Should DME be co-produced with methanol during the last six months of the proposed demonstration project, 98 tons per day (29,694 gallons per day) are anticipated to be delivered via tanker truck to the Eastman Chemical facility. This represents an increase of 5 tanker trucks per day. In either case, the additional tanker truck traffic would represent a negligible increase in the traffic entering/exiting the Eastman Chemical facility.

During a portion of the operations phase (January 1998 through August 1999), approximately 400,000 gallons (approximately 1333 tons) of methanol produced by the proposed LPMEOH™ facility would be transported by tanker truck out of the Eastman Chemical facility for off-site testing. Approximately 67 tanker trucks per year would be required for transport. This represents a negligible contribution of a less than one percent increase in tanker trucks per year.

Under the no-action alternative, there would be no change to the current transportation activities with the continued operation of the Lurgi unit.

Socioeconomics

Construction-Related Impacts

During the construction phase, between 50 and 150 jobs would be created in the Kingsport community. The construction positions would be filled by local laborers. These jobs would have a small positive impact on the local employment and local economy.

Operational-Related Impacts

It is expected that ten jobs (filled by local workers) would be created in the Kingsport community for the operation of the proposed LPMEOH™ facility, resulting in a small positive impact on the local employment and local economy. As an additional benefit of the project, there would be small positive local economy impacts in the communities where supplies (e.g., raw materials, catalysts, and solvents) are procured for use in the proposed LPMEOH™ facility.

There would be no impacts on the environmental equity or justice of the surrounding community.

Under the no-action alternative, there would be no impacts to socioeconomics with the continued operation of the Lurgi unit.

Noise

The proposed LPMEOH™ facility would generate noise during construction and operation. The nearest resident is located approximately 260 feet from the site of the proposed LPMEOH™ facility.

Construction-Related Impacts

Increased noise levels would result from the machinery, installation of process equipment, and vehicle operations. Increases in noise levels would be localized and sporadic.

Operational-Related Impacts

During operation, the primary noise source would be the synthesis gas recycle compressor. Operational noise levels attributed to the recycle compressor are presented in Table 3-5.

Table 3-5. Noise Levels Comparative to Distance From Compressor

Distance From Compressor (ft)	Noise Level (dBA)
100	67
250	61
500	57
1000	53

Most equipment in the proposed LPMEOH™ facility would be designed to operate at a noise level below 85 dBA within three feet of machinery. This exposure limit is consistent with the noise level threshold below which no worker protection is required by the Occupational Health and Safety Administration. In areas where equipment would exceed this noise level, sound enclosures would be installed or ear protection would be mandated for personnel working in these locations. Noise levels at the nearest residence are estimated to be approximately 50 dBA which is quieter than a television when it is viewed from 10 feet away (55 to 60 dBA) at a normal volume.

Under the no-action alternative, noise levels in the area of the existing Lurgi process would remain the same.

Visual Resources

The Eastman Chemical facility is comprised of manufacturing buildings, office buildings, process plant areas including tanks, distillation columns, stacks, and steel structures (see Appendix D). The proposed LPMEOH™ facility would be consistent in appearance and size to existing structures located throughout the Eastman Chemical facility. The largest structures that would make up the proposed LPMEOH™ facility include a 84-foot tall reactor and two distillation columns, one approximately 82-feet tall and one 97-feet tall.

Under the no-action alternative, the visual resources in the area of the existing Lurgi process would remain the same.

Threatened and Endangered Species

The proposed project site and its vicinity as well as the remainder of the Eastman Chemical facility are not inhabited by significant or unique terrestrial or aquatic communities. According to the State of Tennessee Department of Environment and Conservation, Ecological Services Division, and the U.S. Fish and Wildlife Service (Appendix E), there are no recorded threatened or endangered species in the vicinity of the proposed project site.

Historic and Cultural Resources

Long Island of the Holston River is included in the National Register of Historic Places due to its potential for productive archeological investigation. However, the National Register of Historic Places Inventory Nomination Form for Long Island states, "...industrial development on the eastern half of Long Island does not contribute to the national significance of the site;..." No historic or archaeological resources are found within the project area. The proposed project would have no negative effect on the characteristics of the Long Island of the Holston (see letter to DOE in Appendix F).

Biodiversity

Biodiversity places value on the diversity of genes, species, and ecosystems. The proposed LPMEOH™ project would have no negative impact on biodiversity in or around the project area. There would be no loss of ecological habitat as the site is already cleared and backfilled and is entirely industrial in character. No threatened, endangered, or special concern plant or animal species would be affected by the construction or operation of the proposed LPMEOH™ facility.

Pollution Prevention

The following measures would be taken to minimize the level of process-related emissions from the LPMEOH™: use of a mineral oil catalyst system that provides greater catalyst temperature control -- thereby yielding better process stability with less off-specification product and lower waste production; reclamation of spent catalyst and carbon adsorbent; utilization of unreacted process gas as fuel for existing boilers; use of low-leakage mechanical components in systems to reduce fugitive emissions; use of secondary containment in the methanol and oil storage areas; enforcement of a facility-wide preventive maintenance program; early detection of leaks through an environmental monitoring plan; and implementation and enforcement of a good housekeeping program.

List of Agencies Consulted

Tennessee Historical Commission

Mr. Joseph Garrison
701 Broadway
Nashville, Tennessee 37243-0442

U.S. Fish and Wildlife Service

Mr. James Widlak
446 Neal Street
Cookeville, TN 38501

Tennessee Department of Environmental Conservation

Mr. John Walton
Air Pollution Control Division
9th Floor
L&C Annex
401 Church Street
Nashville, Tennessee 37243-1531

Mr. Hamid Yavari
Air Pollution Control Division
New Source Permitting Program

REFERENCES

ANSP (Academy of Natural Sciences of Philadelphia) 1992. Aquatic field studies in the vicinity of Kingsport, Tennessee, 1990.

Eastman Chemical Company, Environmental Information Volume Liquid Phase Methanol Project, Kingsport, Tennessee, June, 1994.

APPENDIX A

PROPOSED PROCESS DESCRIPTION

PROPOSED PROCESS DESCRIPTION

In the liquid phase methanol (LPMEOH™) process, synthesis gas, a mixture of carbon monoxide and hydrogen, is converted to methanol or methanol/dimethyl ether using a novel reactor concept called a slurry phase reactor. The attached figure, Figure A-1, illustrates how the liquid phase methanol technology would be integrated into the existing Eastman Chemical Company facility.

At Eastman Chemical's Kingsport, TN facility, coal is partially burned at high temperatures under moderate pressures in the presence of oxygen and steam in one of two existing Texaco gasifiers. The partial combustion of coal results in the production of raw synthesis gas. This gas is subsequently cleaned of particulates and sulfur using existing conventional gas cleaning technologies, i.e., Rectisol.

At this point, the cleaned synthesis gas is normally sent to existing processes for conversion to methanol and other chemicals. In the proposed project, a portion of the cleaned synthesis gas would be processed in the liquid phase methanol unit's slurry phase reactor, the heart of this technology demonstration project. The process flow diagram is presented in Figure A-2. The synthesis gas from the existing gas cleaning facilities as well as recycle gas from the slurry reactor is further cleaned in a guard bed(s) to remove final traces of contaminants. The purified synthesis gas is fed to the bottom of the slurry reactor. In this reactor, a catalyst consisting of copper and zinc oxides supported on alumina is mixed with Drakeol-10, a food-grade mineral oil. The synthesis gas then dissolves in the liquid phase and diffuses to the catalyst surface where the hydrogen and carbon monoxide are catalytically converted to methanol. The methanol desorbs from the catalyst and enters the gas phase where it is removed from the reactor along with unconverted synthesis gas and other by-products.

During the conversion of synthesis gas to methanol, large quantities of heat are generated by the reactions and must be removed from the reactor. The slurry phase reactor with its internal heat exchanger efficiently removes the heat of reaction, thereby maintaining a uniform temperature throughout the reactor. The steam generated in the heat exchanger will be fed to Eastman Chemical's existing utility steam system.

The slurry phase reactor also easily accommodates the addition and withdrawal of catalyst to maintain catalyst activity, which declines with time. Fresh slurry is prepared by introducing the catalyst into a vessel containing mineral oil. The slurry is then activated (reduced from its oxide state) using a mixture of nitrogen and synthesis gas while the contents are heated and agitated. The activated catalyst is transferred either directly to the reactor at initial startup or to a storage vessel for later addition to the reactor as needed.

The spent catalyst slurry withdrawn from the reactor is transferred back to the catalyst reduction vessel where it is cooled to remove dissolved gases. The cooled slurry is subsequently processed in a centrifuge to separate the catalyst and mineral oil. The mineral oil is stored for later use, while the catalyst is either sent to a metals reclaimer or properly disposed.

The gases leaving the slurry reactor are first cooled against the synthesis gas feed to condense any entrained mineral oil that may be present in the gas phase. The condensed mineral oil is returned to the reactor to minimize makeup. The gas stream is further cooled to separate the methanol from the unreacted gases. This separation occurs stepwise, first in a high pressure separator followed by a low pressure separator. A portion of the unreacted synthesis gas from the high pressure separator is recycled to the slurry reactor while the remainder is used as boiler fuel. The gases from the low pressure separator are also used for fuel.

The raw methanol product is further processed in two distillation columns to remove water, methyl formate, and higher alcohol impurities. In the stabilizer column, light hydrocarbons and carbon dioxide are removed from the raw product. In the fuel methanol mode, the bottom product from the stabilizer column which contains methanol and higher alcohols is sent directly to storage. The fuel methanol is stored until required for fuel testing, at which time, the fuel methanol is transferred to the loading rack.

For the production of chemical grade methanol, the bottom product from the stabilizer column is fed to the rectifier for purification. The overhead methanol product is sent to storage. Approximately 25% of the methanol, however, leaves with the bottom product from the rectifier. This material is sent to an existing distillation unit at the Eastman facility for further purification. The chemical grade methanol product will be transferred to existing plant storage tanks for use in other process areas.

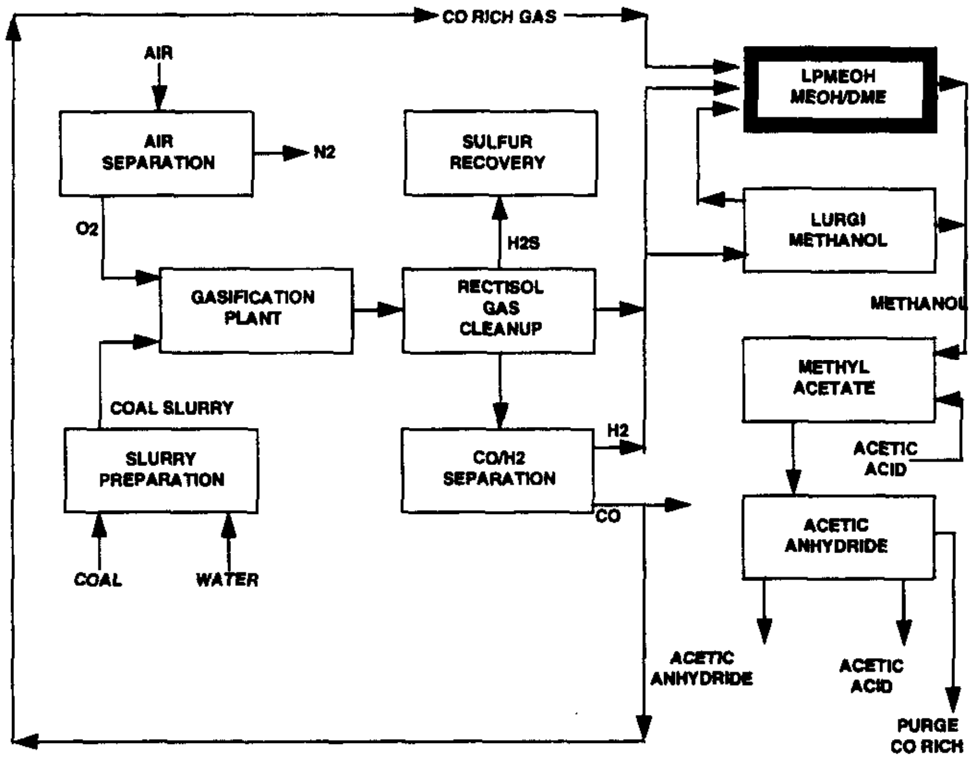


FIGURE A-1
INTEGRATION OF LPMEOH™ PLANT
INTO EASTMAN KINGSPORT PLANT

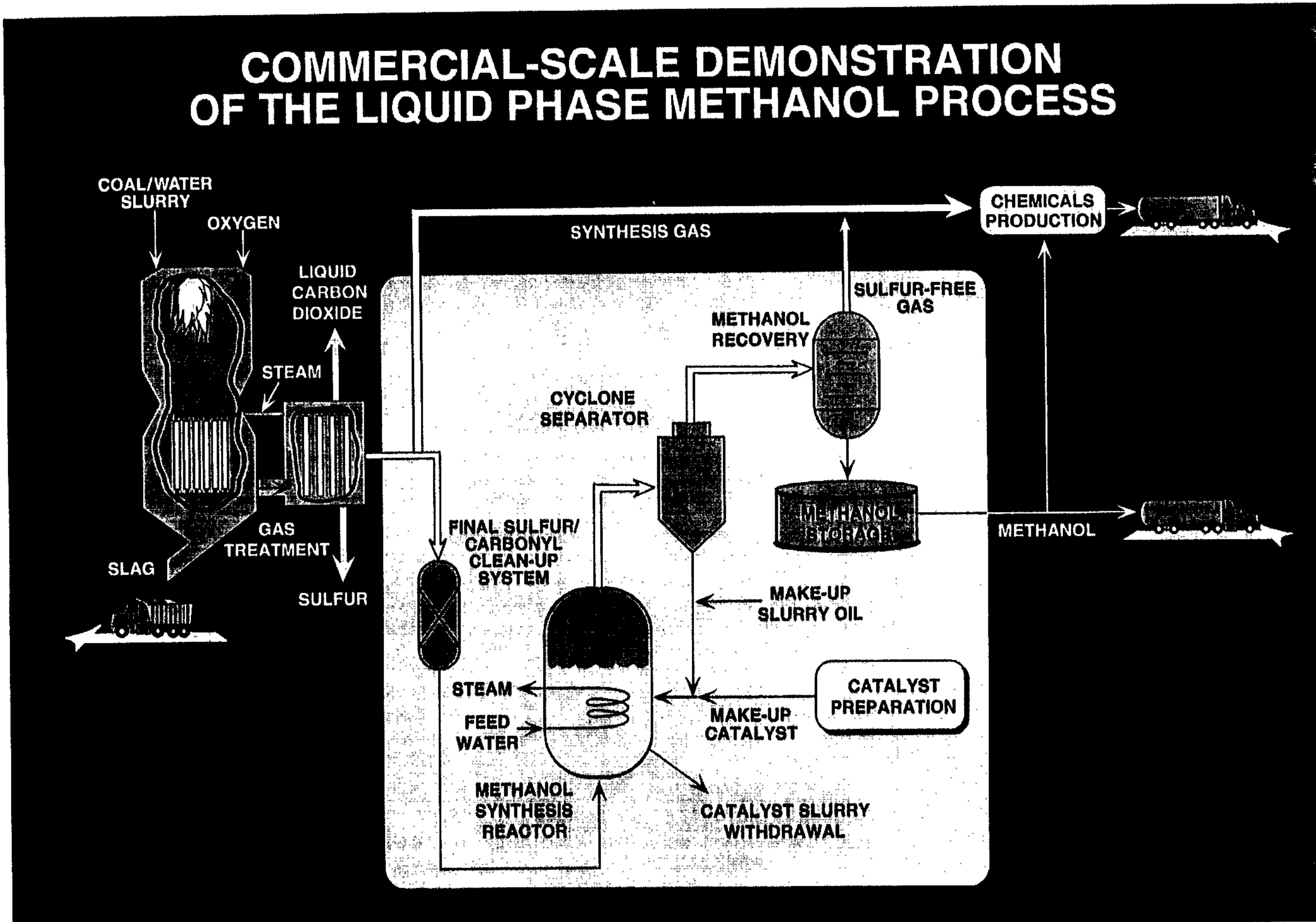

COMMERCIAL-SCALE DEMONSTRATION
OF THE LIQUID PHASE METHANOL PROCESS
COAL/WATER SLURRY
OXYGEN
LIQUID CARBON DIOXIDE
STEAM
GAS TREATMENT
SLAG
SULFUR
SYNTHESIS GAS
CHEMICALS PRODUCTION
SULFUR-FREE GAS
METHANOL RECOVERY
CYCLONE SEPARATOR
METHANOL STORAGE
METHANOL
FINAL SULFUR/ CARBONYL CLEAN-UP SYSTEM
MAKE-UP SLURRY OIL
STEAM
FEED WATER
CATALYST PREPARATION
MAKE-UP CATALYST
METHANOL SYNTHESIS REACTOR
CATALYST SLURRY WITHDRAWAL

Figure A-2

Appendix B

AIR QUALITY MONITORING STANDARDS AND MEASURED DATA

AIR QUALITY MONITORING STANDARDS AND MEASURED DATA

Parameter	Averaging Interval	NAAQS Primary	NAAQS Secondary	Tennessee Primary	Tennessee Secondary	Highest Concentration (μg/m³)[a]
TSP	Annual	---	---	75	60	40
	24 Hours	---	---	260	150	96
PM-10	Annual	50	50	50	50	32
	24 Hours	150	150	150	150	78
Sulfur Dioxide	Annual	80	---	80	---	29
	24 Hours	365	---	365	---	163
	3 Hours	---	1300	---	1300	441
Carbon Dioxide	8 Hours	10,000	10,000	10,000	10,000	5557
	1 Hour	40,000	40,000	40,000	40,000	8165
Ozone	1 Hour	235	235	235	235	227
Nitrogen Dioxide	Annual	100	100	100	100	37

a Annual Values are the Highest Site Annual Average in the Three Year Period. Short Term Values are the Highest of the Yearly Second High Values.

Appendix C

SOLID WASTE DISCUSSION

C.1. Construction Waste Debris

The miscellaneous construction waste debris would consist of wood, concrete, paper, and other garbage produced during the facility construction. The construction phase would last eighteen months. This waste debris is estimated to be 3,000 to 5,000 cubic yards of material. This material would be disposed of in the on-site non-hazardous waste landfill. This landfill currently handles a disposal rate of 530 cubic yards per day of waste. The impact of the proposed project on the average disposal rate into the non-hazardous landfill would be an average increase of 1.5 percent (based on 5,000 cubic yards of material) per day over the duration of the construction phase.

C.2. Methanol and Methanol/DME Catalyst

The methanol/DME catalyst is composed of copper/zinc oxide/alumina. Although the exact composition is proprietary, these consitutents compose 100 percent of the catalyst with no trace impurities. The amount of catalyst usage anticipated during the operation phase of the proposed project is 68,000 pounds per year. Disposal options that are to be explored include: 1) Recycle through a metals reclaimer and reuse the catalyst; or 2) Incineration and disposal of the spent catalyst in a permitted hazardous waste facility.

C.2.1. Recycle Through a Metals Reclaimer

The spent catalyst would be sent to a metals reclaimer so that the catalyst could be recycled and reused.

C.2.2. Incineration

The spent catalyst would be delivered to the permitted on-site incinerators licensed through the state of Tennessee. The 68,000 pounds/yr of spent catalyst would result in 41,000 pounds/yr of generated ash to undergo disposal in an on-site hazardous waste landfill. The average amount of ash generated at Eastman over the past six years has been 4.9 million pounds/yr. The 41,000 pounds/yr of ash from the spent catalyst represents less than one percent of the annually generated ash and represents no impact on the amount of material currently being disposed. It is noted that Eastman planned construction of the on-site hazardous waste landfill regardless of whether the proposed project was approved.

C.3. Activated Carbon

The guard bed material would be activated carbon. It is anticipated that 10,000 pounds of this material would be necessary during the operational phase and that changeout over the duration of operations of this project would not be required. The disposal scenarios proposed for this waste stream are: 1) Regeneration and reuse; 2) Incineration and disposal in a hazardous waste landfill; or 3) Disposal in a hazardous waste landfill without incineration.

C.3.1. Regeneration and reuse

Send to a reclaimer for recycle and reuse.

C.3.2. Incineration and Disposal

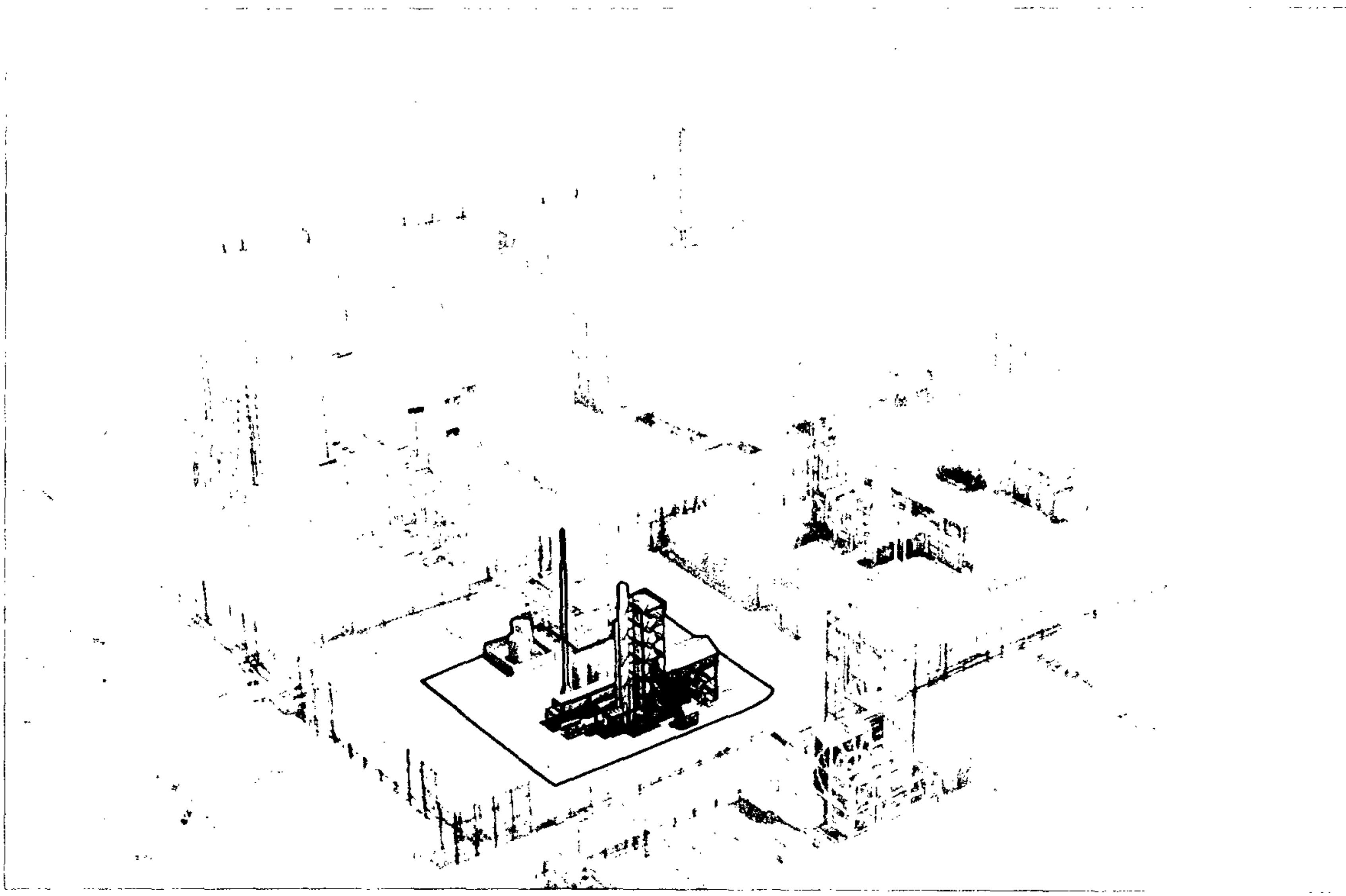
The spent activated carbon would be delivered to the permitted Eastman on-site incinerators licensed through the State of Tennessee. The 10,000 pounds of spent material would result in less than 1,000 pounds of generated ash (maximum ash percent is 8.0) to be disposed. This amount of material from the incinerated activated carbon represents less than one one-hundredth of a percent of the total ash that would be generated over the operational phase of the proposed project.

C.3.3. Disposal

Disposal of the activated carbon material without incineration would mean the disposal of 10,000 pounds of this material at the end of the project. This amount of material represents about five one-hundredths of a percent of the total hazardous material that would be disposed of during this time period.

Appendix D

VISUAL RENDERING



LPMEOH™

Liquid Phase Methanol Demonstration Project, Kingsport, Tennessee

Appendix E

U.S. FISH AND WILDLIFE CONSULTATION LETTER

United States Department of the Interior

FISH AND WILDLIFE SERVICE
446 Neal Street
Cookeville, TN 38501

December 12, 1994

Mr. Robert M. Kornosky
Office of Clean Coal Technology
Department of Energy
P.O. Box 10940
Pittsburgh, Pennsylvania 15236-0940

Re: FWS #95-0263

Dear Mr. Kornosky:

Thank you for your letter and enclosures of November 3, 1994, regarding a proposal by Air Products and Chemicals, Incorporated, to construct and operate a Liquid Phase Methanol Process Unit in Kingsport, Sullivan County, Tennessee. The Fish and Wildlife Service (Service) has reviewed the information submitted and offers the following comments.

The Service initially reviewed information regarding the proposed facility in April 1994. Our response, dated April 21, 1994, indicated that there were no wetland resources or federally endangered or threatened species in the project impact area. Review of our records indicates that no new species have been listed or proposed that might be affected by the proposed project. Therefore, our letter of April 21 remains in effect. However, you should reinitiate consultation with this office if: (1) new information reveals that the proposed project may affect listed species in a manner or to an extent not previously considered, (2) the proposed project is subsequently modified to include activities which were not considered during this consultation, or (3) new species are listed or critical habitat designated that might be affected.

The Holston River historically supported a diverse aquatic fauna. It appears that habitat in some reaches of the river below Cherokee Lake may once again be suitable for species of fish and mussels that once occurred there. We are therefore concerned about any activities that might have adverse impacts on aquatic habitats in the Holston River. We believe that the proposed facility could potentially have additional adverse impacts on the riverine habitat. Discharges from the facility may contain contaminants, such as polycyclic aromatic hydrocarbons, that could adversely affect aquatic organisms.

In your correspondence you indicated that the Department of Energy is preparing an environmental information volume. We would appreciate it if you would send a copy of that document to this office when it is available. In addition, we request that you provide information concerning the size and type of effluent discharge that will be used at the facility, and identify the components anticipated in the discharge.

Thank you for your cooperation. Your interest in the protection of endangered and threatened species is greatly appreciated. If you have questions, please contact Jim Widlak of my staff at 615/528-6481.

Sincerely,

Lee A. Barclay

Lee A. Barclay, Ph.D.
Field Supervisor

Appendix F

STATE HISTORIC PRESERVATION OFFICE CONSULTATION LETTER

TENNESSEE HISTORICAL COMMISSION
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
2941 LEBANON ROAD
NASHVILLE, TN 37243-0442
(615) 532-1550

November 15, 1994

Mr. Robert M. Kornowsky
Pittsburgh Energy Technology Center
Post Office Box 10940
Pittsburgh, Pennsylvania 15236-0940

RE: DOE, LPMEOH PROCESS UNIT, KINGSPORT, SULLIVAN COUNTY,

Dear Mr. Kornowsky:

The above-referenced undertaking has been reviewed pursuant to Section 106 of the National Historic Preservation Act for compliance by the participating federal agency or applicant for federal assistance. Procedures for implementing Section 106 of the Act are codified at 36 CFR 800 (51 FR 31115, September 2, 1986).

Based on the documentation submitted, it is our opinion that due to the location, scope and/or nature of the undertaking, and/or the size of the area of project impact, the undertaking will have no effect on National Register of Historic Places listed or eligible properties either because none exist in the area of project impact or because the undertaking will not alter any characteristics of an identified eligible or listed property which qualify the property for listing in the National Register, or alter such property's location, setting or use. Therefore, this office has no objections to proceeding with the project.

If you are applying for federal funds, license or permit, you should submit this letter as evidence of compliance with Section 106 to the appropriate federal agency, which, in turn, should contact this office as required by 36 CFR 800. If you represent a federal agency, you should submit a formal determination to this office for comment. Questions or comments should be directed to Joe Garrison (615)532-1559. Your cooperation is appreciated.

Sincerely,

Herbert L. Harper
Executive Director and
Deputy State Historic
Preservation Officer

HLH/jyg