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COMMERCIAL-SCALE DEMONSTRATION OF THE LIQUID PHASE METHANOL (LPMEOH™) PROCESS

TECHNICAL PROGRESS REPORT NO. 3

For The Period

October 1, 1994 to March 31, 1995

Prepared by

Air Products and Chemicals, Inc.
Allentown, Pennsylvania

and

Eastman Chemical Company
Kingsport, Tennessee

for the
Air Products Liquid Phase Conversion Company, L.P.

Prepared for the United States Department of Energy
Pittsburgh Energy Technology Center
Under Cooperative Agreement No. DE-FC22-92PC90543

Patents cleared by Chicago on _____.

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ACRONYMS AND DEFINITIONS

Acurex	-	Acurex Environmental Corporation
Air Products	-	Air Products and Chemicals, Inc.
AFDU	-	Alternative Fuels Development Unit
DME	-	dimethyl ether
DOE	-	United States Department of Energy
DVT	-	Design Verification Testing
Eastman	-	Eastman Chemical Company
EIV	-	Environmental Information Volume
EPRI	-	Electric Power Research Institute
HAPs	-	Hazardous Air Pollutants
IGCC	-	Integrated Gasification Combined Cycle
KSCFH	-	Thousand Standard Cubic Feet per Hour
LPMEOH™	-	Liquid Phase Methanol (the technology to be demonstrated)
MTBE	-	methyl tertiary butyl ether
NEPA	-	National Environmental Policy Act
Partnership	-	Air Products Liquid Phase Conversion Company, L.P.
Project	-	Production of Methanol/DME Using the LPMEOH™ Process at an Integrated Coal Gasification Facility
psia	-	Pounds per Square Inch (Absolute)
psig	-	Pounds per Square Inch (gauge)
P&ID	-	Piping and Instrumentation Diagram(s)
SCFH	-	Standard Cubic Feet per Hour
Sl/hr-kg	-	Standard Liter(s) per Hour per Kilogram of Catalyst
Tie-in(s)	-	the interconnection(s) between the LPMEOH™ Process Demonstration Facility and the Eastman Facility
TPD	-	Ton(s) per Day
WBS	-	Work Breakdown Structure
wt	-	weight

Executive Summary

The Liquid Phase Methanol (LPMEOH™) Demonstration Project at Kingsport, Tennessee is a $213.7 million cooperative agreement between the U.S. Department of Energy (DOE) and Air Products and Chemicals, Inc. (Air Products). The demonstration is sited at the Eastman Chemical Company (Eastman) complex in Kingsport. Air Products and Eastman executed a partnership agreement on 4 October 1994, forming the Air Products Liquid Phase Conversion Company, L.P (the Partnership). Air Products is the general partner of the Partnership. The DOE reviewed the partnership agreement and novated the cooperative agreement to the Partnership, pending final clarification and approval by DOE.

The project involves the construction of a 260 tons-per-day (TPD) methanol plant utilizing an existing coal-derived synthesis gas from Eastman's integrated coal gasification facility. The new equipment consists of synthesis gas feed preparation and compression, the liquid phase reactor and auxiliaries, product distillation, and utilities.

The technology to be demonstrated has been developed by Air Products in a DOE-sponsored program that started in 1981. Originally tested at a small, DOE-owned experimental facility in LaPorte, Texas, the LPMEOH™ process offers several advantages over current methods of making methanol. This liquid phase process suspends fine catalyst particles in an inert liquid, forming a slurry. The liquid slurry dissipates heat from the chemical reaction away from the catalyst surface, protecting it and allowing the methanol synthesis reaction to proceed at higher rates. The process is ideally suited for directly processing gases produced by modern coal gasifiers. At the Eastman Chemical complex, the technology will be integrated with existing coal gasifiers to demonstrate the commercially important aspects of the operation of the LPMEOH™ process to produce methanol.

A four-year demonstration will prove the commercial applicability of the process. An off-site product test program will prove the suitability of the product as a transportation fuel and as a

fuel for stationary applications in the power industry. In future commercial facilities, advanced coal-to-methanol processes may be a cost-enhancing option for coal gasification-based power plants. Future facilities using "integrated gasification-combined-cycle technology" will produce methanol as a co-product during times of low electricity demand, allowing the gasifiers to operate at steady, peak performance.

This project may also demonstrate the production of dimethyl ether (DME) as a mixed coproduct with methanol if laboratory and pilot-scale research and market verification studies show promising results. If implemented, the DME would be produced during the last six months of the four-year demonstration period. DME has several commercial uses. In a storable blend with methanol, the mixture can be used as a peaking fuel in coal gasification-based electric power generating facilities. DME can also be used to increase the vapor pressure of methanol, making it suitable for use as a diesel engine fuel. Blends of methanol and DME can be used as chemical feedstocks for synthesizing chemicals, including new oxygenated fuel additives.

The project was reinitiated in October of 1993, when DOE approved a site change to the Eastman Chemical complex located in Kingsport. Since then the program has been in the project definition phase, and during this last quarter, it transitioned to the design phase. The project requires review under the National Environmental Policy Act (NEPA) to move to the construction phase, which is scheduled to begin in August of 1995. DOE is moving forward with the preparation of an Environmental Assessment (EA) and Finding of No Significant Impact (FONSI), which are necessary to complete this review process. The facility is scheduled to be mechanically complete in November of 1996.

A. Introduction

The Liquid Phase Methanol (LPMEOH™) demonstration project at Kingsport, Tennessee is a $213.7 million cooperative agreement between the U.S. Department of Energy (DOE) and Air Products and Chemicals, Inc. (Air Products). A facility producing 260 TPD of methanol will be

located at the Eastman Chemical Company (Eastman) complex located in Kingsport, Tennessee. This project is sponsored under the DOE's Clean Coal Technology Program and its objective is to "demonstrate at a commercial scale the production of methanol from coal derived synthesis gas using the LPMEOH™ process. The project will also determine the suitability of the methanol produced for use as a chemical feedstock or as a low sulfur dioxide (SO_2), low nitrogen oxides (NO_x) alternative fuel in stationary and transportation application."

The project may also demonstate the production of dimethyl ether (DME) as a mixed coproduct with methanol, if laboratory- and pilot-scale research and market verification studies show promising results. If implemented, the DME would be produced during the last six months of the four-year demonstration period.

The LPMEOH™ process was developed by Air Products in a DOE-sponsored program that started in 1981. It was successfully piloted at a 10 TPD rate in the DOE-owned facility at Air Products' LaPorte, Texas, site. This demonstration project is the culmination of this extensive effort.

B. Project Description

Existing Site

The 0.6 acre demonstration facility will be integrated into the existing 4,000 acre Eastman complex located in Kingsport, Tennessee. The Eastman complex employs approximately 12,000 people. In 1983 Eastman constructed a coal gasification facility utilizing Texaco technology. The synthesis gas generated by this gasification facility is used to produce carbon monoxide and methanol. Both of these products are used to produce methyl acetate and ultimately cellulose acetate and acetic acid. The availability of this highly reliable coal gasification facility was the major factor in selecting this location for the LPMEOH™ Process Demonstration. Three different feed gas streams (hydrogen gas, carbon monoxide gas, and balanced gas) will be diverted from existing operations to the LPMEOH™ facility, thus providing the range of coal-

derived synthesis gas compositions needed to meet the technical objectives of the demonstration project.

For design and construction scheduling, and for descriptive purposes, the project has been divided into four major process areas with their associated equipment:

- *Reaction Area* - Synthesis gas preparation and methanol synthesis reaction equipment.
- *Purification Area* - Product separation and purification equipment.
- *Catalyst Preparation Area* - Catalyst and slurry preparation and disposal equipment.
- *Storage/Utility Area* - Methanol product, slurry and oil storage equipment.

The physical appearance of this facility will closely resemble the adjacent Eastman process plants, including process equipment in steel structures.

Reaction Area

The reaction area will include feed gas compression and catalyst guard beds, the reactor, a steam drum, separators, heat exchangers, and pumps. The equipment will be supported by a matrix of structural steel. The most salient feature will be the reactor, since with supports, it will be approximately 84 feet tall.

Purification Area

The purification area will feature two distillation columns with supports; one will be approximately 82 feet tall, and the other 97 feet tall. These vessels will resemble the columns of the surrounding process areas. In addition to the columns, this area will include the associated reboilers, condensers, air coolers, separators, and pumps.

Storage/Utility Area

The storage/utility area will include two diked lot-tanks for methanol, two tanks for oil storage, a slurry holdup tank, trailer loading/unloading area, and an underground oil/water separator.

Catalyst Preparation Area

The catalyst preparation area consists of a building with a roof and partial walls, in which the catalyst preparation vessels, slurry handling equipment, and spent slurry disposal equipment will be housed. In addition, a hot oil utility system is included in the area.

C. Process Description

The LPMEOH™ plant will be integrated with Eastman's coal gasification facility. A simplified process flow diagram is included in Appendix E. Synthesis gas will be introduced into the slurry reactor, which contains liquid mineral oil with suspended solid particles of catalyst (the slurry). The synthesis gas dissolves through the oil, contacts the catalyst, and reacts to form methanol. The heat of reaction is absorbed by the slurry and is removed from the slurry by steam coils. The methanol vapor leaves the reactor, is condensed to a liquid, sent to the distillation columns for removal of higher alcohols, water, and other impurities, and is then stored in the day tanks for sampling before being sent to Eastman's methanol storage. Most of the unreacted synthesis gas is recycled back to the reactor with the synthesis gas recycle compressor, improving cycle efficiency. The methanol will be used for downstream feedstocks and in off-site fuel testing to determine its suitability as a transportation fuel and as a fuel for stationary applications in the power industry.

D. Project Status

During the period 1 October 1994 to 31 March 1995, the project team completed essentially all of the activities necessary to start detailed design. Major accomplishments during this period are as follows:

1. Project Management Plan

Reviews

- A Design Hazards Review (DHR) is required by Air Products and Eastman safety procedures and is also part of OSHA PSM (Process Safety Management) requirements. Eastman's safety review methodology will be used for these meetings. DHR's were started with a 3-day session in March of 1995 at Kingsport. The reviews will continue in April and May.
- Operability reviews were held to identify potential risks and ensure all elements are included in the plant design for reliable plant operations. Air Products and Eastman team members included representatives from Process, Project, Machinery Engineering, the LaPorte Alternative Fuels Development Unit (AFDU), Process Controls, Engineering Technology, Systems Engineering, Maintenance and Plant Operations. A total of 12 days (approximately 100 person days) were spent on this effort.

Agreements

- The Continuation Application was submitted to the DOE on 7 October 1994.

The DOE conditionally approved the Continuation Application to proceed to Budget Period No. 2 (Design and Construction) on 3 February 1995.

- The Cooperative Agreement was modified on 15 March 1995 (Mod. A008). This modification acknowledged the Novation Agreement by which the project participant was transferred from Air Products to Air Products Liquid Phase Conversion Company, L. P.; extended the project completion date to 31 December 2001; and allowed the project to proceed into Budget Period No. 2. The modification also incorporated an updated Statement of Work, Statement of Joint Objectives, and the Eastman and Air Products Agreements as submitted with the Continuation Application. Final clarification and DOE approval of the Novation Agreement is expected in the next quarter.
- The Draft Project Evaluation Plan for Budget Period No. 2 was prepared and submitted to DOE for review on 15 March 1995.

Safety

- The Design Hazard Reviews were started at Kingsport on 21-23 March 1995. The distillation and product loading areas were covered. Eastman's safety team is directing the Hazard Review process using their methodology. Eastman provided training for the Air Products Hazard Review team in February at Air Products' Trexlertown offices.
- A Fire Protection Plan was written and approved by Eastman's insurer, Factory Mutual

2. *Technology Baseline*

Process Design

- Coordinated centrifuge tests for the spent catalyst oil recovery were held at the vendor's (Centrico) facility in Northvale, New Jersey on 25-26 January 1995. The need for two centrifuges in series to remove solids to below 1% in the recovered oil was confirmed. It was decided that the centrifuges would be eliminated from the Kingsport scope, since the value of the recovered oil did not justify the capital cost.
- The process design was revised to combine the duties and save one set of high pressure slurry pumps.
- An analytical study of Kingsport feed gas was completed. See attached report from C. M. Chen, dated 5 May 1995 in Appendix A. Based on this data Air Products determined that only one guard bed was needed to protect the catalyst. This guard bed will remove possible iron carbonyl and nickel carbonyl contaminants to below the 10 ppb level. Air Products is contemplating a more extensive testing program of the synthesis gas prior to startup. A laboratory-scale reactor would be utilized at the Kingsport site for 2 to 4 weeks to detect catalyst poisons over an extended period.
- Essentially all of the process equipment has been specified. The report in Appendix B (2 pages and summary page) on specification status shows that all but 4 of the 61 process equipment items have been specified.
- Extensive operability and hazards reviews were supported.
- Vendor quotes were evaluated and selections were made for 45 items to date.

Design Engineering

- Mechanical specifications have been released for 59 of the 65 items that are on the equipment list; see report on specification status in Appendix B.
- An Air Products lead piping designer has been providing preliminary layout drawings to support nozzle orientation requirements for the vendors. As of 31 March 1995, the reactor structure and distillation area details are about 80% complete, and work has started on the catalyst building, methanol storage, oil storage, and piperacks.
- The Piping and Instrument Diagrams (P&ID's) have gone through four revisions. When the Design Hazard Review is complete, the P&ID will be available to start detailed civil and piping design. This will be done in stages with design starting in the reactor and distillation areas.
- Air Products' Systems Engineering is providing piping and valving specifications to support the P&ID development.

Construction

No activity to report at this time. Eastman will make the process tie-ins during a shutdown scheduled for May of 1995. Work on extending these lines to the battery limitsof the LPMEOH™ Process Demonstration Facility will begin in April 1995.

3. Schedule Baseline

- The milestone schedule, dated 29 March 1995 (see Appendix C), has the following key dates:
    - Complete NEPA Review 15 May 1995
    - Start Construction 15 August 1995
    - Complete Design Engineering 28 February 1996
    - Complete Construction 15 November 1996
    - Start Plant Operation 16 December 1996
    - Complete Plant Operation 4 January 2001

4. Cost Baseline

The Cost Plan for the Project was submitted to the DOE with the Continuation Application on 7 October 1995, and is included in Appendix D for reference. The Cost Plan shows Phase 1 (Design)

costs of $11,711,000 and Phase 2 (Procurement and Construction) costs of $24,336,000 for a total of $36,047,000 for these two phases.

Procurement

- Procurement activity was high during the period from January to March 1995. By the end of March, 26 items were purchased with a total value of $2,600,000.

5. Financial Commitment

On 4 October 1994, Air Products and Eastman signed the agreements that would form the Partnership, secure the demonstration site, and provide the financial commitment and overall management for the Project. These Partnership agreements became effective on 15 March 1995, when DOE authorized the commencement of Budget Period No. 2 (Mod. A008 to the Cooperative Agreement). The Partnership has subcontracted with Air Products to provide the overall management of the Project, and to act as the primary interface with DOE. Air Products., as subcontractor to the Partnership, will also provide the engineering design, procurement, construction, and commissioning of the LPMEOH™ Process Demonstration Facility, and will provide the technical and engineering supervision needed to conduct the operational testing program required as part of the Project. As subcontractor to Air Products, Eastman will be responsible for operation of the LPMEOH™ Process Demonstration Facility, and for the interconnection and supply of synthesis gas, utilities, product storage, and other needed services.

6. National Environmental Policy Act

- Eastman applied for an Air Permit with the Tennessee Department of Environment and Conservation in December of 1994. Approval of the permit was granted in March of 1995.
- DOE's Pittsburgh Energy Technology Center (PETC) NEPA team met with Air Products and Eastman at Kingsport on 27 October 1994 for a site visit.
- The Environmental Information Volume (EIV) was reissued as Rev. 5 on 13 March 1995.
- PETC completed the draft Environmental Assessment (EA) in January/February of 1995.
- Answers to PETC NEPA team questions on the EIV were provided.
- Review of the draft EA by the States of Tennessee and Virginia was initiated in March 1995.

E. Planned Activities

- During the next quarter (April - June 1995):
    - Design Hazard Reviews will be completed.
    - Civil and piping design will begin.
    - Control valves and other instrumentation will begin to be specified.
    - All remaining equipment will be specified and purchased.
    - Tie-in to the Eastman facility will be nearly complete.
    - A Design Engineering schedule will be released.
    - DOE will issue the final EA and a Finding of No Significant Impact (FONSI).

F. Summary

- Process Engineering and Equipment Engineering activities have been at a high level this period, and essentially all of the equipment is out for bid or has been purchased.
- Vendor information is just starting to arrive.
- P&ID development has progressed rapidly and a civil/piping design start is imminent.
- A program to test synthesis gas for catalyst poisons is being considered.
- DOE conditionally approved the Continuation Application to Budget Period No. 2 (Design and Construction).

APPENDICES

APPENDIX A. **C. M. Chen memo dated 9 May 1995 (5 pages)**

Memorandum

AIR PRODUCTS

To: Distribution Dept./Loc.:

From: C. M. Chen Dept./Ext.: PSE Process Eng./1-3315

Date: 9 May 1995

Subject: Updated summary of Kingsport LPMEOH feed stream analysis results

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Distribution:

Air Products:
D. M. Brown *
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E. S. Schaub/V. E. Stein/B. L. Bhatt/M. S. Mazdai/S. P. DiMartino *
B. A. Toseland/X-D Peng *

Eastman Chemical:
M. S. Baggett
T. T. Golob
W. C. Jones
J. L. Phillips
K. M. Pittman
J. K. Sanders

* sent via MS Mail

The attached table is an *updated* summary of Kingsport gas feed stream analytical results. Results of gas scrubbing followed by ICP-AES (10 January 1995 report) and gas chromatographic analysis (23 February 1995 analysis report) have been incorporated into the table.

Please call me (610-481-3315) if you have any questions or comments.

Christopher M. Chen

Methanol Feed Contaminants: Summary of Analytical Results (rev. 4/28/95)

Component	Catalyst Limit (ppmv)	Analytical Method Used	Sampling Technique	Sample Date	ppmv in Syngas Feed, pre-G.Bed	ppmv in CO Makeup	ppmv in H_2 Makeup	Comments
Acetylene	5	GC-FID	Offline gas	8/5/94	< 0.5 (*Note 2*)	< 0.5 (*Note 2*)	< 0.5 (*Note 2*)	
		GC-FID	Offline gas	2/94	< 1 (*Note 2*)	< 1 (*Note 2*)	< 1 (*Note 2*)	
✓ Arsenic as AsH_3	0.01 ?	HGA-AAS	Charcoal tube	8/5/94	0.027	< 0.001	< 0.001	Eastman syngas guard bed
		ICP-AES	Acid scrub	4/94	< 0.04	N/A	< 0.04	
		TOF-SIMS	Spent catalyst	1993	Significant amount of AsO_2^- detected on spent catalyst surface vs. fresh catalyst.			
Halogens (Cl & F) ✓	0.01	TOF-SIMS	Spent catalyst	1993	No additional amount detected on spent catalyst surface vs. fresh catalyst. No further analysis performed.			
✓ HCl		FT-IR	Offline gas	2/94	< 1	< 1	< 1	
Iron as $Fe(CO)_5$	0.01	ICP-AES	Acid scrub	12/94	< 0.01	< 0.01	< 0.01	APCI guard bed for upset
		F-AAS	Offline gas	8/5/94	< 0.01	< 0.01	< 0.01	
		ICP-AES	Acid scrub	4/94	< 0.025	N/A	< 0.025	
		F-AAS	Charcoal tube	8/5/94	< 0.05	< 0.04	< 0.07	
		TOF-SIMS	Spent catalyst	1993	Slightly more Fe^+ detected on spent catalyst surface vs. fresh catalyst.			
✓ Nickel as $Ni(CO)_4$	0.01	ICP-AES	Charcoal tube	8/5/94	≤ 0.001	< 0.001	< 0.002	APCI guard bed for upset
		ICP-AES	Acid scrub	12/94	< 0.01	< 0.01	< 0.01	
		ICP-AES	Acid scrub	4/94	< 0.025	N/A	< 0.025	
		TOF-SIMS	Spent catalyst	1993	No additional amount of Ni^+ detected on spent catalyst surface vs. fresh catalyst.			
Nitrogen compounds								
Ammonia	10	ion chromatography	Acid scrub	3/94	< 0.23	N/A	< 0.23	
		FT-IR	Offline gas	2/94	< 1	< 1	< 1	
HCN	0.01	FT-IR	Offline gas	2/94	< 1	< 1	< 1	Need more sensitive analysis and/or portable test trailer.
		ion chromatography	Caustic scrub	3/94	< 5	< 2.5	< 7.5	
		TOF-SIMS	Spent catalyst	1993	No additional amount of CN^- detected on spent catalyst surface vs. fresh catalyst.			

Component	Catalyst Limit (ppmv)	Analytical Method Used	Sampling Technique	Sample Date	ppmv in Syngas Feed, pre-G.Bed	ppmv in CO Makeup	ppmv in H_2 Makeup	Comments
Amines		GC-NPD	Offline gas	8/5/94	< 0.5	< 0.5	< 0.5	
		GC-FID	Offline gas	2/94	< 0.5	< 0.5	< 0.5	
		TOF-SIMS	Spent catalyst	1993	Increased amount of amine-type species detected on spent catalyst surface vs. fresh catalyst.			
Acetonitrile	?	GC-FID	Offline gas	8/5/94	< 1	< 1	< 1	Technical risk. See HCN.
		GC-FID	Offline gas	2/94	< 0.5	< 0.5	< 0.5	
NO_x	0.1	FT-IR	Offline gas	2/94	< 1	< 1	< 1	
		TOF-SIMS	Spent catalyst	1993	No additional amount of NO_3^- detected on spent catalyst surface vs. fresh catalyst. (*Note 2*)			
Oxygen	1500	trace O2 analyzer	Online gas	1/95	100 to 200	N/A	N/A	
		GC-TCD	Offline gas	8/5/94	4000	800	71400	Levels in syngas & H2 makeup are unusually high & may be in error.
Sulfur, total	0.06	TOF-SIMS	Spent catalyst	1993	No additional amount of SO_3^- detected on spent catalyst surface vs. fresh catalyst.			
H_2S (pre-Guard Bed)		Tracor Atlas lead-acetate tape/reflectance	Online gas	3/2/94 to 8/10/94	0.061±0.031	*Note 2*	*Note 2*	
		ion chromatography	Caustic scrub	3/94	< 4	< 2	< 6	
H_2S (post-Guard Bed)	0.03	Tracor Atlas lead-acetate tape/reflectance	Offline gas	3/2/94 to 8/10/94	0.035±0.024	*Note 2*	*Note 2*	Eastman syngas guard bed.
COS	0.03	GC-FPD	Offline gas	8/5/94	< 0.5	< 0.5 (*Note 2*)	< 0.5 (*Note 2*)	EMN data shows that nearly all sulfur is in form of H2S. EMN guard bed will not remove COS at ambient temp.
Unsat. hydrocarbons (olefins, aromatics)	300	GC-FID	Offline gas	8/5/94	< 1	< 1	< 1	
		GC-FID	Offline gas	2/94	< 1	< 1	< 1.8	

Component	Catalyst Limit (ppmv)	Analytical Method Used	Sampling Technique	Sample Date	ppmv in Syngas Feed, pre-G.Bed	ppmv in CO Makeup	ppmv in H_2 Makeup	Comments
Antimony		ICP-AES	Acid scrub	12/94	< 0.025	< 0.025	< 0.025	
		ICP-AES	Acid scrub	4/94	< 0.025	N/A	< 0.025	
Barium		TOF-SIMS	Spent catalyst	1993	None detected on spent catalyst surface.			
Beryllium		ICP-AES	Acid scrub	12/94	< 0.025	< 0.025	< 0.025	
		ICP-AES	Acid scrub	4/94	< 0.025	N/A	< 0.025	
		TOF-SIMS	Spent catalyst	1993	None detected on spent catalyst surface.			
Boron		TOF-SIMS	Spent catalyst	1993	None detected on spent catalyst surface.			
Cadmium		N/A						
Calcium		TOF-SIMS	Spent catalyst	1993	Slightly more detected on spent catalyst surface vs. fresh catalyst.			
Chromium		ICP-AES	Acid scrub	4/94	< 0.025	N/A	N/A	
		TOF-SIMS	Spent catalyst	1993	None detected on spent catalyst surface.			
Cobalt		TOF-SIMS	Spent catalyst	1993	None detected on spent catalyst surface.			
Lead		N/A						
Manganese		N/A						
Mercury		Cold Vapor AAS	Acid scrub	12/94	< 0.01	< 0.01	< 0.01	
		Cold Vapor AAS	Acid scrub	4/94	< 0.025	N/A	< 0.025	
Phosphorus		N/A						
Potassium	absent	TOF-SIMS	Spent catalyst	1993	Slightly more detected on spent catalyst surface vs. fresh catalyst.			
Radionuclides		N/A						
Selenium		ICP-AES	Acid scrub	12/94	< 0.15	< 0.15	< 0.15	
		ICP-AES	Acid scrub	4/94	< 0.15	N/A	< 0.15	
		TOF-SIMS	Spent catalyst	1993	None detected on spent catalyst surface.			

Component	Catalyst Limit (ppmv)	Analytical Method Used	Sampling Technique	Sample Date	ppmv in Syngas Feed, pre-G.Bed	ppmv in CO Makeup	ppmv in H_2 Makeup	Comments
Silver		TOF-SIMS	Spent catalyst	1993	None detected on spent catalyst surface.			
Sodium	absent	TOF-SIMS	Spent catalyst	1993	Slightly more detected on spent catalyst surface vs. fresh catalyst.			
Thallium		TOF-SIMS	Spent catalyst	1993	None detected on spent catalyst surface.			
Vanadium	absent	ICP-AES	Acid scrub	12/94	< 0.025	< 0.025	< 0.025	

Notes:

1. In general, the lower detectable limit is dependent on the amount of gas sampled, the sampling procedure, the final analytical instrument, and the amount of interfering species. The notation "< X" is used to indicate that the analyte was not detected at the lower detectable limit of X.
2. Not expected to be present and no further analysis performed.

Abbreviations:

N/A: Not Analyzed
F-AAS: Flame Atomic Absorption Spectroscopy
FT-IR: Fourier Transform - Infrared Spectroscopy
GC-FID: Gas Chromatography - Flame Ionization Detector
GC-FPD: Gas Chromatography - Flame Photometric Detector
GC-NPD: Gas Chromatography - Nitrogen-Phosphorus Detector
GC-TCD: Gas Chromatography - Thermal Conductivity Detector
HGA-AAS: Heated Graphite Atomization Atomic Absorption Spectroscopy
ICP-AES: Inductively Coupled Plasma Atomic Emission Spectroscopy
TOF-SIMS: Time-of-Flight Secondary Ion Mass Spectrometry

APPENDIX B. Equipment Specification Status (3 pages)

Kingsport Liquid Phase Methanol Project 00-3-8215
Specification Status - Equipment

Tag #	Description	Process Engineer	Process Spec Released(Rev)	Equipment Specifier	Equipment Spec Released(Rev)	Eastman Comments	Vendor List*	Released to Purchasing	Bids Due	Bids Received	Order Placement	Vendor Prints Due/Received
C-01	LPMEOH Reactor	Schaub	6/10/94 (0)	Koeller	11/02/94 (1)	8/18/94	Y	8/29/94	9/29/94	10/3/94	11/8/94	Rec'd 1/3/95
C-02	Steam Drum	Schaub	10/19/94 (1)	Koeller	11/07/94 (1)	10/19/94	Y	11/8/94	12/6/94	12/7/94	3/16/95	Due 4/13/95
C-03	HP Methanol Separator	Schaub	11/18/94 (1)	Koeller	01/09/95 (2)	12/15/94	Y	1/5/95	2/2/95	2/10/95	3/15/95	Rec'd 4/04/95
C-05	Secondary Oil Knockout Vessel	Schaub	11/18/94 (2)	Koeller	1/09/95 (2)	12/15/94	Y	1/5/95	2/2/95	2/10/95	3/15/95	Rec'd 4/04/95
C-06	Reactor Cyclone	Schaub	11/21/94 (2)	Koeller	11/30/94 (1)	11/30/94	Y	12/2/94	12/28/94	12/16/94	3/21/95	Due 4/21/95
C-07	Syngas Compressor Knockout Separator	Mazdai	03/22/95 (0)	Koeller	3/23/95 (0)							
C-10	Methanol Stabilizer Column	Stein	11/11/94 (2)	Koeller	11/11/94 (2)	9/21/94	Y	10/4/94	11/1/94	11/1/94	12/20/94	Rec'd 1/25/95
C-10T	Methanol Stabilizer Column Trays	Stein	11/11/94 (2)	Koeller	11/11/94 (2)	10/11/94	Y	9/7/94	10/14/94	10/7/94	1/10/95	Rec'd 3/02/95
C-11	Methanol Stabilizer Reflux Drum	Stein	12/30/94 (2)	Koeller	01/09/95 (1)	12/15/94	Y	1/10/95	2/7/95	2/17/95	3/14/95	Due 4/11/95
C-12	Methanol Stabilizer Feed Vessel	Stein	11/18/94 (0)	Koeller	01/09/95 (1)	12/15/94	Y	1/10/95	2/7/95	2/17/95	3/14/95	Due 4/11/95
C-13	Methanol Stabilizer Condensate Pot	Stein	03/09/95 (0)	Koeller	3/27/95 (1)	3/27/95	Y	3/28/95	4/18/95			
C-20	Methanol Rectifier Column	Stein	11/11/94 (2)	Koeller	11/11/94 (2)	9/21/94	Y	10/4/94	11/1/94	11/1/94	12/20/94	Rec'd 1/25/95
C-20T	Methanol Rectifier Column Trays	Stein	11/11/94 (2)	Koeller	11/11/94 (2)	10/11/94	Y	9/7/94	10/14/94	10/7/94	1/10/95	Rec'd 3/9/95
C-21	Methanol Rectifier Reflux Drum	Stein	12/30/94 (2)	Koeller	01/09/95 (1)	12/15/94	Y	1/10/95	2/7/95	2/17/95	3/14/95	Due 4/11/95
C-23	Methanol Rectifier Condensate Pot	Stein	03/09/95 (0)	Koeller	3/27/95 (1)	3/27/95	Y	3/28/95	4/18/95			
C-30	Catalyst Reduction Vessel	Bhatt	8/23/94 (0)	Koeller	10/03/94 (1)	9/21/94	Y	10/4/94	11/1/94	11/1/94	12/16/94	Rec'd 1/12/95
C-31	Reduction Condensate Accumulator	Mazdai	3/07/95 (2)	Koeller	01/09/95 (1)	12/15/94	Y	1/10/95	2/7/95	2/17/95	3/14/95	Due 4/11/95
C-32	Utility Oil Surge Tank (V-01 Skid)	Bhatt	9/29/94 (0)	Koeller	12/02/94 (1)	11/23/94	Y	12/5/94	1/12/95	1/9/95	3/29/95	Due 4/26/95
C-40	Guard Bed	Chen	03/10/95 (0)	Koeller	3/27/95 (1)	3/27/95	Y	3/28/95	4/20/95			
C-50	Oil-Water Separator/Coalescer	N/A										
C-120	Vent Scrubber											
D-01	Safety Relief Knockout Drum						Y					
D-02	Slurry Tank	Mazdai	3/07/95 (2)	Koeller	3/08/95 (2)	3/3/95	Y	3/9/95	4/3/95			
D-20	Methanol Lot Tank	Stein	3/07/95 (1)	Koeller	3/09/95 (1)	3/8/95	Y	3/13/95	4/10/95			
D-21	Methanol Lot Tank	Stein	3/07/95 (1)	Koeller	2/20/95 (0)	3/8/95	Y		4/10/95			
D-25	Distillation Area Drain Tank	Frenduto										
D-30	Fresh Oil Storage Tank	Mazdai	3/30/95 (2)	Koeller	3/08/95 (2)	3/3/95	Y	3/9/95	4/3/95			
D-60	Caustic Mix Tank	Stein	2/03/95 (1)	Koeller	3/08/95 (2)	3/3/95	Y	3/9/95	4/3/95			
D-70	Compressor L.O. Sump (K-01 Skid)	Schaub	4/22/94 (1)	Fleischer	08/29/94 (1)	5/17/94	Y	5/17/94	6/12/94	6/12/94	8/12/94	Rec'd 10/14/94
E-01	Syngas Compressor Cooler	Chen	03/31/95 (5)	Koeller	11/07/94 (2)	10/11/94	Y	11/8/94	12/21/94	12/20/94	3/28/95	Due 5/09/95
E-02	Syngas Feed/Product Economizer	Schaub	8/29/94 (1)	Koeller	9/16/94 (1)	9/7/94	Y	9/19/94	10/14/94	10/24/94	12/2/94	Rec'd 1/27/95
E-03	Methanol Product Air-Cooled Condenser	Chen	10/14/94 (0)	Koeller	11/30/94 (1)	12/6/94	Y	12/1/94	1/5/95	1/9/95	3/24/95	Due 4/11/95
E-04	Methanol Product C.W. Condenser	Chen	10/21/94 (1)	Koeller	11/7/94 (2)	11/1/94	Y	11/8/94	12/21/94	12/20/94	3/28/95	Due 5/09/95
E-10	Methanol Stabilizer Reboiler	Stein	10/10/94 (2)	Koeller	11/07/94 (1)	10/19/94	Y	11/8/94	12/21/94	12/20/94	3/28/95	Due 5/23/95
E-11	Methanol Stabilizer Condenser	Stein	10/17/94 (3)	Koeller	11/7/94 (2)	10/11/94	Y	11/8/94	1/9/95	12/28/94	3/28/95	Due 5/09/95
E-20	Methanol Rectifier Reboiler	Stein	10/10/94 (1)	Koeller	11/07/94 (1)	10/19/94	Y	11/8/94	12/21/94	12/20/94	3/28/95	Due 5/23/95
E-21	Methanol Rectifier Air Cooler	Chen	03/31/95 (2)	Koeller	11/30/94 (1)	12/6/94	Y	12/1/94	1/5/95	1/9/95	3/24/95	Due 4/11/95
E-22	Methanol Rectifier C.W. Condenser	Stein	10/18/94 (2)	Koeller	11/7/94 (2)	11/1/94	Y	11/8/94	1/9/95	12/28/94	3/28/95	Due 5/09/95
E-23	Crude Methanol Cooler	Stein	10/09/94 (1)	Koeller	11/7/94 (2)	11/1/94	Y	11/8/94	1/9/95	12/28/94	3/28/95	Due 5/09/95
E-31	Reduction Vessel Overhead Condenser	Mazdai	10/14/94 (0)	Koeller	11/7/94 (2)	11/1/94	Y	11/8/94	1/9/95	12/28/94	3/28/95	Due 5/09/95
E-32	Utility Oil Heater (V-01 Skid)	Bhatt	9/29/94 (0)	Koeller	12/02/94 (1)	11/23/94	Y	12/6/94	1/12/95	1/9/95	3/29/95	Due 4/26/95

* preferred vendor list issued to Eastman

Kingsport Liquid Phase Methanol Project 00-3-8215
Specification Status - Equipment

Tag #	Description	Process Engineer	Process Spec Released(Rev)	Equipment Specifier	Equipment Spec Released(Rev)	Eastman Comments	Vendor List*	Released to Purchasing	Bids Due	Bids Received	Order Placement	Vendor Prints Due/Received
E-33	Utility Oil Cooler (V-01 Skid)	Bhatt	9/29/94 (0)	Koeller	12/02/94 (1)	11/23/94	Y	12/5/94	1/12/95	1/9/95	3/29/95	Due 4/26/95
E-70	Compressor L.O. Cooler (K-01 Skid)	Schaub	4/22/94 (1)	Fleischer	08/29/94 (1)	5/17/94	Y	5/17/94	6/12/94	6/12/94	8/12/94	Rec'd 10/14/94
E-71	Compressor L.O. Heater (K-01 Skid)	Schaub	4/22/94 (1)	Fleischer	08/29/94 (1)	5/17/94	Y	5/17/94	6/12/94	6/12/94	8/12/94	Rec'd 10/14/94
G-01 A/B	Condensed Oil Circulation Pumps	Schaub	10/20/94 (0)	Fleischer	03/15/95 (2)	11/30/94	Y	11/9/94	11/28/94	12/6/94	3/22/95	Due 5/08/95
G-02	Slurry Return Pump	Mazdai	03/14/95 (2)	Fleischer	03/15/95 (1)	12/15/94	Y	12/8/94	12/30/94	12/22/94	3/22/95	Due 5/08/95
G-03 A/B	Oil Makeup Pumps	Mazdai	03/14/95 (1)	Fleischer	03/15/95 (2)	11/30/94	Y	11/9/94	11/28/94	12/6/94	3/22/95	Due 5/08/95
G-04 A/B	BFW Pumps	Schaub	11/10/94 (1)	Fleischer	12/8/94 (2)	12/21/94	Y	12/8/94	12/30/94	12/22/94	*Bid Tab Appvd*	
G-10 A/B	Methanol Stabilizer Underflow Pumps	Stein	12/13/94 (1)	Fleischer	03/01/95 (4)	11/30/94	Y	12/19/94	1/6/95	1/9/95	*Ok to Purchase*	
G-11 A/B	Methanol Stablizer Reflux Pumps	Stein	12/13/94 (1)	Fleischer	03/01/95 (5)	11/30/94	Y	12/19/94	1/6/95	1/9/95	*Ok to Purchase*	
G-20 A/B	Methanol Rectifier Underflow Pumps	Stein	12/13/94 (1)	Fleischer	03/01/95 (4)	11/30/94	Y	12/19/94	1/6/95	1/9/95	*Ok to Purchase*	
G-21 A/B	Methanol Rectifier Reflux Pumps	Stein	12/15/94 (2)	Fleischer	03/01/95 (5)	11/30/94	Y	12/19/94	1/6/95	1/9/95	*Ok to Purchase*	
G-23 A/B	Methanol Transfer Pumps	Stein	02/28/95 (2)	Fleischer	03/01/95 (4)	12/12/94	Y	12/19/94	1/6/95	1/9/95	*Ok to Purchase*	
G-25	Distillation Area Drain Tank Lift Pump											
G-30	Slurry Transfer Pump	Mazdai	03/14/95 (2)	Fleischer	03/15/95 (1)	12/15/94	Y	12/8/94	12/30/94	12/22/94	3/22/95	Due 5/08/95
G-32	Utiility Oil Circulating Pump	Bhatt	9/29/94 (0)	Fleischer	2/23/95 (2)	11/30/94	Y	11/9/94	11/28/94	12/6/94	*Ok to Purchase*	
G-34	Oil Feed Pump	Mazdai	03/14/95 (1)	Fleischer	03/15/95 (2)	1/10/95	Y	12/19/94	1/6/95	1/9/95	*Ok to Purchase*	
G-60A/B	Caustic Metering Pumps	Stein	11/29/94 (0)	Fleischer	2/23/95 (1)	12/15/94	Y	12/8/94	12/30/94	12/22/94	*Bid Tab Appvd*	
G-70	Comp Main L.O. Pump (K-01 Skid)	Schaub	4/22/94 (1)	Fleischer	08/29/94 (1)	5/17/94	Y	5/17/94	6/12/94	6/12/94	8/12/94	Rec'd 10/14/94
G-71	Comp Aux L.O. Pump (K-01 Skid)	Schaub	4/22/94 (1)	Fleischer	08/29/94 (1)	5/17/94	Y	5/17/94	6/12/94	6/12/94	8/12/94	Rec'd 10/14/94
K-01	Syngas Compressor	Schaub	4/22/94 (1)	Fleischer	08/29/94 (1)	5/17/94	Y	5/17/94	6/12/94	6/12/94	8/12/94	Rec'd 10/14/94
K-70	Lube Oil Demister/Blower	N/A		Fleischer								
T-30	Fresh Catalyst Drum Loading Mechanisı	N/A										
V-01	Utility Oil Skid	Bhatt	9/29/94 (0)	Koeller	12/02/94 (1)	11/23/94	Y	12/5/94	1/12/95	1/9/95	3/29/95	Due 4/19/95
Y-01A/B	Fresh Feed Syngas Filter	Mazdai	03/22/95 (0)	Koeller	03/27/95 (0)		Y					
Y-02	Slurry Tank Agitator	Mazdai	11/29/94 (0)	Fleischer	2/23/95 (1)	12/15/94	Y	12/7/94	1/9/95	1/17/95	3/20/95	Due 4/17/95
Y-10	Methanol Product Filters	N/A		Koeller	03/27/95 (0)		Y					
Y-30	Catalyst Reduction Agitator	Bhatt	10/24/94 (1)	Fleischer	2/23/95 (2)	10/19/94	Y	11/11/94	12/9/94	12/14/94	3/20/95	Due 4/17/95
Y-35A/B	Seal Oil Filters	N/A	*data sheet issued*	Koeller	03/27/95 (0)		Y					
Y-40	GuardBed Electric Heater	Chen	03/10/95 (0)	Koeller	03/27/95 (0)		Y					
Y-60	Caustic Tank Agitator	Stein	11/29/94 (0)		2/23/95 (1)	12/15/94	Y	12/8/94	1/9/95	1/17/95	3/20/95	Due 4/17/95
Y-70A/B	Compressor L.O. Filters (K-01 Skid)	Schaub	4/22/94 (1)	Fleischer	08/29/94 (1)	5/17/94	Y	5/17/94	6/12/94	6/12/94	8/12/94	Rec'd 10/14/94
Y-71A/B	Compressor Seal Gas Filters (K-01 Skid)	Schaub	4/22/94 (1)	Fleischer	08/29/94 (1)	5/17/94	Y	5/17/94	6/12/94	6/12/94	8/12/94	Rec'd 10/14/94

* preferred vendor list issued to Eastman

Kingsport LPMEOH Project 00-3-8215
Specification Status

Process Specs

Process Area	Completed	To Do	% Completed
Compressor Area	7	0	100%
Reactor Area	8	0	100%
Distillation Area	23	2	92%
Catalyst Prep	10	0	100%
Storage/Misc	9	0	100%
Vents	0	2	0%
Total	***57***	***4***	***93%***

Equipment Specs

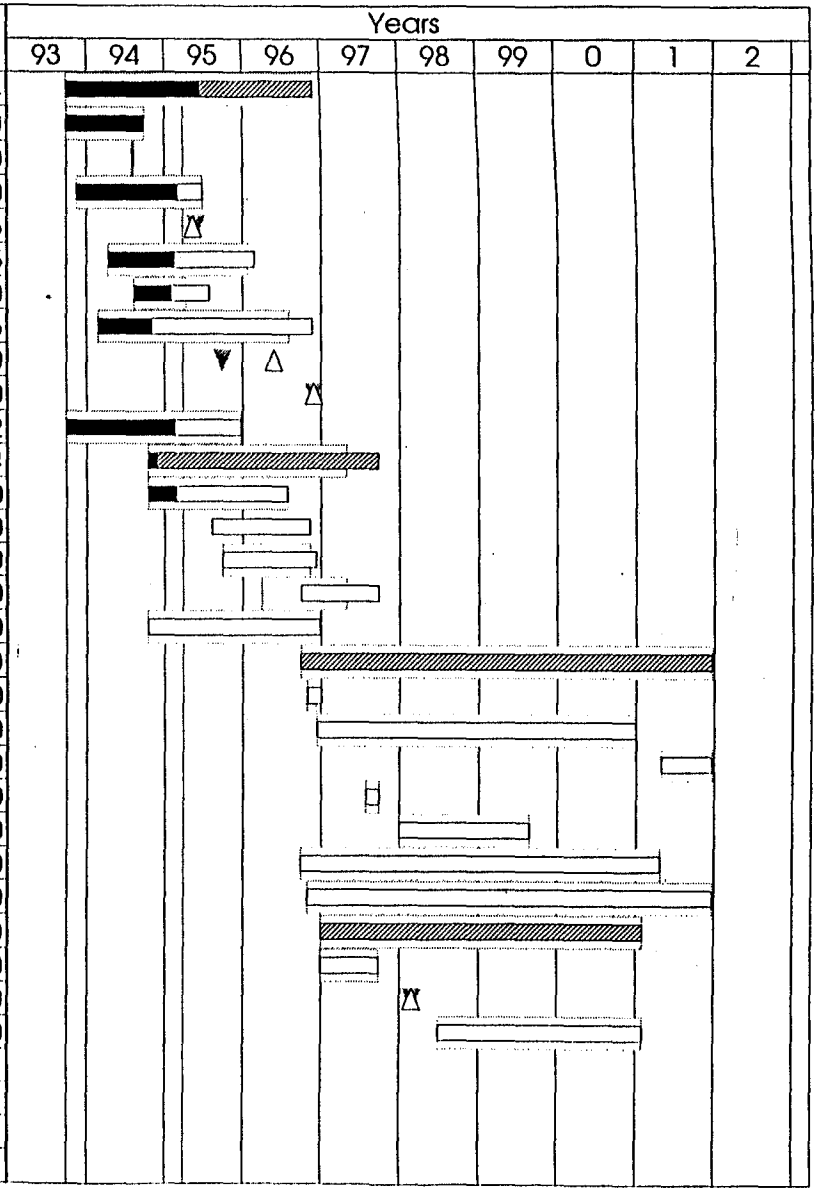
Process Area	Completed	To Do	% Completed
Compressor Area	7	0	100%
Reactor Area	8	0	100%
Distillation Area	24	2	92%
Catalyst Prep	10	1	91%
Storage/Misc	10	1	91%
Vents	0	2	0%
Total	***59***	***6***	***91%***

4/6/95

APPENDIX C. Milestone Schedule, 29 March 1995 (1 page)

MILESTONE SCHEDULE STATUS REPORT
LIQUID PHASE METHANOL DEMONSTRATION
DE-FC22-92PC90543

Task Name	Duration	Start	End	% Comp	% Sched
PHASE 1: DESIGN	**38.17 m**	**Oct/01/93**	**Dec/01/96**	**6**	**54**
PROJECT DEFINITION(TASK1)	12.04 m	Oct/01/93	Sep/30/94	100	100
CONTINUATION APPLICATION	9.00 d	Aug/02/94	Aug/10/94	100	100
PERMITTING(TASK 2)	19.50 m	Nov/17/93	Jun/30/95	80	80
NEPA FONSI APPROVAL	0.00 d	May/15/95	May/15/95	85	85
DESIGN ENGINEERING(TASK 3)	22.60 m	Apr/15/94	Feb/28/96	20	45
VENDOR ENGINEERING	11.78 m	Aug/10/94	Aug/01/95	10	50
OFF-SITE TESTING(TASK 4)	33.22 m	Feb/25/94	Nov/27/96	6	25
UPDATED FUEL TEST PLAN APPROVAL	0.00 d	May/30/96	May/30/96	0	0
DECISION TO CONTINUE DME TESTING	0.00 d	Dec/01/96	Dec/01/96	0	0
PLANNING, ADMIN & DME DVT(TASK 5)	27.05 m	Oct/01/93	Dec/29/95	55	62
PHASE 2: CONSTRUCTION	**35.63 m**	**Oct/17/94**	**Sep/30/97**	**0**	**4**
PROCUREMENT(TASK1)	21.61 m	Oct/17/94	Aug/01/96	20	20
CONSTRUCTION(TASK 2)	15.14 m	Aug/15/95	Nov/15/96	0	0
TRAINING & COMMISSIONING(TASK 3)	14.52 m	Oct/03/95	Dec/15/96	0	0
OFF-SITE TESTING(TASK 4)	12.00 m	Oct/02/96	Sep/30/97	0	0
PLANNING & ADMINISTRATION(TASK 5)	26.62 m	Oct/17/94	Dec/31/96	0	0
PHASE 3: OPERATION	**63.18 m**	**Oct/01/96**	**Dec/28/01**	**0**	**0**
START-UP(TASK 1)	2.24 m	Oct/31/96	Jan/06/97	0	0
METHANOL OPERATION(TASK 2.1)	48.86 m	Dec/16/96	Jan/04/01	0	0
DISMANTLE PLANT(TASK 2.3)	7.98 m	May/01/01	Dec/28/01	0	0
ON-SITE PRODUCT USE DEMO(TASK 3)	2.08 m	Aug/01/97	Oct/02/97	0	0
OFF-SITE PRODUCT USE DEMO(TASK 4)	20.02 m	Jan/02/98	Aug/31/99	0	0
DATA ANALYSIS/REPORTS(TASK 5)	55.09 m	Oct/01/96	Apr/27/01	0	0
PLANNING & ADMINISTRATIVE(TASK 6)	62.19 m	Oct/31/96	Dec/28/01	0	0
PROVISIONAL DME IMPLEMENTATION	**49.25 m**	**Jan/02/97**	**Feb/02/01**	**0**	**0**
DME DVT(PDU TESTS)(TASK 3.6)	8.97 m	Jan/02/97	Sep/30/97	0	0
DECISION TO IMPLEMENT	0.00 d	Mar/01/98	Mar/01/98	0	0
DESIGN, MODIFY & OPERATE(TASK 3.2.2)	31.27 m	Jul/01/98	Feb/02/01	0	0



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Milestone △ Summary

APPENDIX D. Cost Plan, 26 September 1994 (1 page)

DOE F 1:
(12-85)

U.S. DEPARTM OF ENERGY
COST PL. .N

OMB Contro .o.
1910-1400

1. TITLE	2. IDENTIFICATION NUMBER
Liquid Phase Methanol Demonstration	DE-FC22-92PC90543
2. PARTICIPANT NAME AND ADDRESS Air Products and Chemicals, Inc. 7201 Hamilton Boulevard Allentown, PA 18195-4911	4. COST PLAN DATE September 26, 1994
	5. START DATE January 1, 1990
	6. COMPLETION DATE December 30, 2001

7. Element Code	8. Reporting Element	9. Plan Prior Fiscal Years	10. Actual Prior Fiscal Years **	11. CURRENT FISCAL YEAR (FY95) OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	Total	12. FUTURE FISCAL YEARS 96	97	98	13. Sub-sequent Fiscal Years	14. Total
	Prior to Mod 2		16,851																		16,851
1.1.1	Project Definition		1,009	165	56	0	0	0	0	0	0	0	0	0	0	221	0	0	0	0	1,230
1.1.2	Permitting		162	40	40	30	10	6	0	0	0	0	0	0	0	126	0	0	0	0	288
1.1.3	Design Engr.		158	198	300	350	662	668	674	674	674	673	482	483	482	6,320	1,625	103	0	0	8,206
1.1.4	Off-SiteTest-Def&Desn		296	5	2	0	2	3	2	2	3	2	2	3	2	28	0	0	0	0	324
1.1.5	Plan, Admin, DME Verif Te		504	71	71	71	71	71	71	17	17	17	17	17	17	528	631	0	0	0	1,663
																		0			
1.2.1	Procurement		0	91	91	92	134	134	135	421	421	421	1,406	1,406	1,407	6,159	4,389	405	0	0	10,953
1.2.2	Construction		0	0	0	0	115	115	115	115	115	115	460	460	460	2,070	8,998	432	0	0	11,500
1.2.3	Training & Commissioning		0	0	0	0	0	0	0	0	0	0	0	0	0	0	863	34	0	0	897
1.2.4	Off-SiteTest-Proc.&Constr		0	0	0	0	0	0	0	0	0	0	0	0	0	0	229	76	0	0	305
1.2.5	Planning & Admin		0	0	0	0	0	0	0	54	54	54	54	54	54	324	351	6	0	0	681
1.3.1	Startup			0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,435	0	0	3,435
1.3.2	Operations																				
1.3.2.1	Methanol Operation			0	0	0	0	0	0	0	0	0	0	0	0	0	0	33,434	37,401	76,452	147,287
1.3.2.2	DME Design, Mod., Oper.			0	0	0	0	0	0	0	0	0	0	0	0	0	0	351	509	1,480	2,340
1.3.2.3	LPMEOH Dismantlement			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	425	425
1.3.3	On-Site Testing			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	4
1.3.4	Off-Site Testing			0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,422	1,896	474	3,792
1.3.5	Data Analysis & Reports			0	0	0	0	0	0	0	0	0	0	0	0	0	0	385	380	1,161	1,926
1.3.6	Planning & Admin			0	0	0	0	0	0	0	0	0	0	0	0	0	0	245	252	1,096	1,593
																					160,902
15. TOTAL			18,980	570	560	543	994	997	997	1,283	1,284	1,282	2,421	2,423	2,422	15,776	17,086	40,328	40,438	81,092	213,700

16. DOLLARS EXPRESSED IN:	17. SIGNATURE OF PARTICIPANT'S PROJECT MANAGER AND DATE	18. SIGNATURE OF PARTICIPANT'S AUTHORIZED FINANCIAL REPRESENTATIVE AND DATE
Thousands	D. D. Dunn 9/26/94	John R. Heppe 9/26/94

** Forecast through September 30, 1994.

APPENDIX E. Simplified Process Flow Diagram (1 page)

c:\tpr#3

SIMPLIFIED PROCESS DIAGRAM
KINGSPORT LPMEOH - 260 TPD PLANT

LPMEOH™ PROCESS DEMONSTRATION FACILITY