

LIQUID PHASE FISCHER-TROPSCH (III & IV) DEMONSTRATION
IN THE LAPORTE ALTERNATIVE FUELS DEVELOPMENT UNIT

Topical Report

FINAL

(Volume I/II: Main Report)

Task 1: Engineering Modifications (Fischer-Tropsch III & IV Demonstration)

and

Task 2: AFDU Shakedown, Operations, Deactivation (Shut-down) and Disposal
(Fischer-Tropsch III & IV Demonstration)

Contractor:

AIR PRODUCTS AND CHEMICALS
Allentown, PA 18195

Bharat L. Bhatt*
June 1999

Prepared for the United States Department of Energy
Under Contract No. DE-FC22-95PC93052--39
Contract Period January 1995 - March 1999

* Significant assistance was received from Shell Synthetic Fuels, Inc. (SSFI) in completing this report.

TABLE OF CONTENTS

	<u>Page</u>
EXECUTIVE SUMMARY	3
INTRODUCTION	4
OBJECTIVES	5
ENGINEERING AND MODIFICATIONS (F-T III)	6
Process Description	6
Bubble Column Reactor	7
Analytical Set-up	7
Catalyst-wax Separation System	7
27.15 Slurry Degasser	8
21.70 Slurry Cooler	8
10.62 Slurry Pump	8
22.62 Cross-flow Filters	9
Miscellaneous Modifications	9
Hazards Reviews	10
Metallurgical Review	11
Environmental Reviews	11
Reactor Cleaning	12
DEMONSTRATION RUN PLAN (F-T III)	13
PRE-RUN SET-UP AND TESTING (F-T III)	13
RESULTS AND DISCUSSION (F-T III)	14
Catalyst Activation	14
Process Variable Study	14
Mass Balance	17
Catalyst Inventory	17
Catalyst Concentration and Gas Hold-up Estimates	17
Dynamic Gas Disengagement and Reactor Temperature Control	18
Heat Balance and Heat Transfer in the Reactor	18
Reactor Performance	18
Filtration Loop	19
Catalyst Stability	19
Liquid/Wax/Slurry Analysis	19
POST FISCHER-TROPSCH III INVESTIGATIONS	21
Slurry Pump	21
Testing at SSFI	22
ENGINEERING AND MODIFICATIONS (F-T IV)	23
10.62 Slurry Pump	23
22.62 Cross-flow Filters	23
DEMONSTRATION RUN PLAN (F-T IV)	25
PRE-RUN SET-UP AND TESTING (F-T IV)	25
RESULTS AND DISCUSSION (F-T IV)	26

Catalyst Activation	26	
Process Variable Study	26	
Tracer Study	28	
Mass Balance	29	
Catalyst Inventory	29	
Catalyst Concentration and Gas Hold-up Estimates		29
Dynamic Gas Disengagement	29	
Heat Balance and Heat Transfer in the Reactor	30	
Reactor Performance	30	
Catalyst-wax Separation	30	
Catalyst Stability	30	
Liquid/Wax/Slurry Analysis	31	
CONCLUSIONS AND RECOMMENDATIONS	35	
ACKNOWLEDGMENTS	37	
REFERENCES	38	

APPENDIX

Volume II

- A: Fischer-Tropsch III Run Chronology
- B: Fischer-Tropsch III Mass Balances
- C: Fischer-Tropsch III Product Hydrocarbon Analysis
- D: Fischer-Tropsch IV Run Chronology
- E: Fischer-Tropsch IV Mass Balances
- F: Fischer-Tropsch IV Product Hydrocarbon Analysis