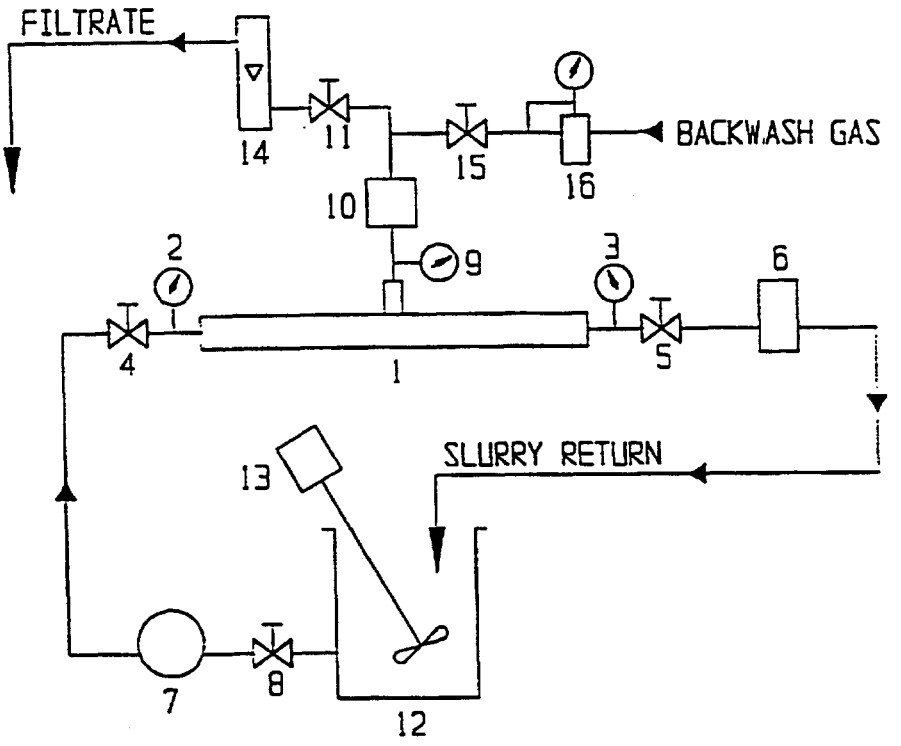
Laboratory Test Report

Equipment Arrangement: The equipment arrangement is described in Figure 4. The slurry was moved through the filter using a Wilden M-1 Champ diaphragm pump. The mainstream velocity thru the filter was measured using a RCM flowmeter. USG gauges were used to monitor system pressures. Filtrate turbidity was evaluated using a Hach turbidimeter. Manual ball valves were used to isolate the filter for the backwash sequence. The feed tank was agitated using a Stir-pak stirrer at a speed of 1. The feed tank was heated using a Thermolyne hot plate. The system piping was heat traced and insulated to prevent heat loss.

Backwash Technique: The inlet pressure to the filter was lowered to 10 PSI and the filtrate line was closed. The backwash gas valve was opened momentarily using 60 PSIG. The filtrate line was then opened to release trapped gas. The valve was closed and the filter was brought back to dynamic flow conditions.

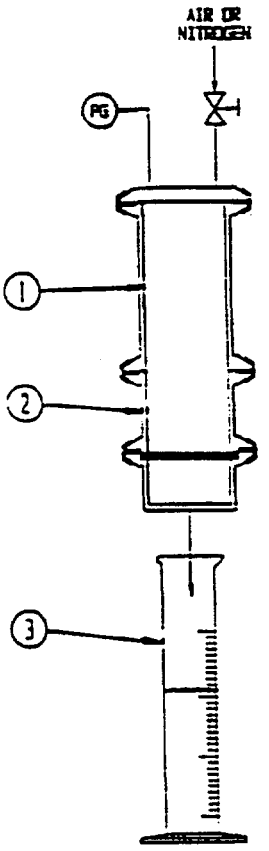
MOTT HyPulse™ LSX (INERTIAL) FILTER SYSTEM
SCHEMATIC FLOW DIAGRAM
MANUAL OPERATION



1. MOTT CAT No. 7000 LSX
2. INLET PRESSURE GAUGE
3. OUTLET PRESSURE GAUGE
4. INLET CONTROL VALVE
5. OUTLET CONTROL VALVE
6. FLOWMETER
7. PUMP
8. PUMP SHUT-OFF VALVE
9. FILTER PRESSURE GAUGE
10. FILTRATE RESERVOIR
11. FILTRATE CONTROL VALVE
12. FEED TANK
13. AGITATOR
14. FILTRATE FLOWMETER
15. BACKWASH VALVE
16. BACKWASH REGULATOR

Figure 4

MOTT LSP/LSX FEASIBILITY TEST SCHEDULE
PRESSURE TEST



Equipment

1. One liter reservoir
2. 70mm or 47mm disc fixture
3. Graduated cylinder

Test Procedure

1. Charge system with feed.
2. Run at desired flowrate and collect filtrate. Record filtrate turbidities.
3. Run the filter until the maximum Delta P is eached or the entire volume of feed is filtered.
4. Dewater, remove the upper housing and examine the cake.
5. Pressurize and backwash.
6. Inspect the disc for solids release, reassemble and resume the next cycle.

FIGURE 5

APPENDIX C

Fischer-Tropsch II Run Authorizations

TEST AUTHORIZATION # 41

LaPorte Alternative Fuels Development Unit (AFDU)

Sheet: 1 of 4
Date : 05/07/94
By: BLB

RUN NUMBER: AF-A7
APPROX START DATE: 10 May, 1994

TITLE: IN-SITU FISCHER-TROPSCH CATALYST ACTIVATION PRIOR TO SPRING 94 RUN (F-T II) USING CO & N2

OBJECTIVE:
To activate the Liquid-Phase Fischer-Tropsch (LPFT) synthesis catalyst.

SUMMARY:
Approximately 996 lbs of UCI L-3950 precipitated iron oxide is to be slurried with start-up wax provided by Shell, transferred to the 27.10 reactor and activated with 75% CO and 25 % N2. Approximate run time is 2 days.

TEST DETAILS: See pages 2 to 4 for details.

ANALYTICAL COMMENTS: See page 4.

SAFETY IMPLICATIONS:
Operators should wear protective gear while loading catalyst to protect them from the dust and hot vapor which may be released from the loading nozzle. Protective gear including face shield should be worn during slurry sampling.

ENVIRONMENTAL IMPLICATIONS:
A flame will be maintained at the flare.

SPECIAL REMARKS:
Gas composition in and out of the reactor must be monitored closely during the activation. Reactor temperature must be closely monitored and controlled per the attached TEST DETAILS. The temperature difference between the reactor slurry and utility oil in the new 27.10B internal heat exchanger must not exceed 350 deg F. When adjusting flows or pressure, care should be taken to minimize catalyst carryover (caused by high gas velocity).

AUTHORIZATIONS:

E. C. Heydorn, Plant Mgr

B. L. Bhatt, Process Engr

TEST DETAILS:

1. This activation procedure is based on CAER's bubble column activation of the catalyst (see attached).

2. Charge the 28.30 prep tank with 1132 lb of wax (176 gallons of wax at 80°F). Heat this wax to 150-200°F.

3. Fill the 22.14 intermediate V/L separator with approximately 20 gallons of Ethylflo-164 oil (1 nut on LG-688). Charge the 27.13 with approximately 50 gallons of Ethylflo-164 oil (~ 8.8 % on LIC-203).

4. When the prep tank wax is at 150-200°F, add 996 lb of UCI L-3950 precipitated iron oxide catalyst. Take about 1 lb catalyst sample from each of the four drum. Add the catalyst very slowly to make a 46.8 wt% oxide slurry. Keep the slurry well stirred to prevent agglomeration of the catalyst.

5. Heat the slurry to 200°F and continue agitation, under nitrogen, for at least 2 hours to ensure good mixing.

6. Establish gas flow through the reactor using nitrogen through V-1508 (V-2000 also open) to prevent slurry back-flow into the distributors. Vent the gas through PV-697.

7. Pressure transfer the slurry to the reactor and verify operation by noting level with the nuclear density gauge (NDG).

8. Flush out the prep tank with 136 lb of Ethylflo-164 (20 gallons of Ethylflo-164 at 80°F). Pressure transfer the flush oil to the reactor and verify level with the NDG.

9. Close V-645 to prevent utility oil flow back to the prep tank and establish full utility oil flow through the 27.10B internal heat exchanger.

10. Start 01.10/01.20 compressors with nitrogen. Pressurize the reactor loop to 150 psig. Ensure that the demister outlet (V-1476) is closed.

11. Begin heating the slurry to 302°F over a 6 hr period with a heat up rate of 16°F/hr (no more than 20°F/hr), following T-AVG on the reactor picture on the NextGen console. Check that the slurry temperatures are in reasonable agreement. Verify that the slurry is well mixed by performing a NDG scan. Maintain N_2 flow of 12,530 SCFH (FI-126, FI-187).

12. When the reactor temperature reaches 302°F (150°C), establish the activation gas flow at 20,883 SCFH (on FI-126) and vent the flow through PV-170. Establish the following composition:

	Composition	Est Flows (SCFH)
CO	75 %	15,662
N2	25 %	5,221
	100 %	20,883

MW = 28.0, SCF evaluated at 70°F, 14.7 psia

13. Wait for GC confirmation, then bring activation gas to the reactor slowly. Establish a final flow to the reactor of 20,883 SCFH. Maintain flow and activation gas composition as specified in step 12. The temperature-programmed activation consists of the following steps:

    * Heat the slurry at a target rate of 12°F/hr (no more than 15°F/hr, 8°C/hr) until the slurry temperature reaches 518°F (270°C). Due to absence of H2 in the activation gas, Fischer-Tropsch synthesis reaction will not occur during activation. Thus, significant exothermic heat release is not expected until syngas is introduced in the reactor after activation. If the heat up rate is greater than 15°F/hr, reduce CO inlet flow rate and proportionately increase N_2 flow rate.

    * Monitor reactor feed and effluent for CO, CO_2 and N_2 continuously.

    * After reaching 518°F, hold the slurry temperature at 518°F. If the reactor reaches 527°F, reduce the CO inlet flow rate and proportionately increase N_2 flow rate. Process and operations will monitor the effluent composition. If CO_2 level in the effluent increases rapidly, a decision may be made to terminate the activation and change conditions to start process variable study. The hold time at 518°F should not exceed 12 hrs.

14. The slurry level in the reactor should be maintained between 90 and 100% of NDG range using LIC 636. During the activation, the liquid level is expected to fall due loss of lighter components from wax. Line up 22.14 separator to 27.11 and 27.12.

15. Line up liquid flow from 22.18 separator to 22.11 degasser.

16. Record any indication of density or viscosity change, such as a change in the pressure drop across the reactor or shaking of the reactor during heat up and activation.

17. When the activation is completed, scan the reactor with the NDG. Record levels in the 22.11, 22.15, 22.16 and 22.14.

When TA #41 is done, consult TEST AUTHORIZATION #42 for the next step.

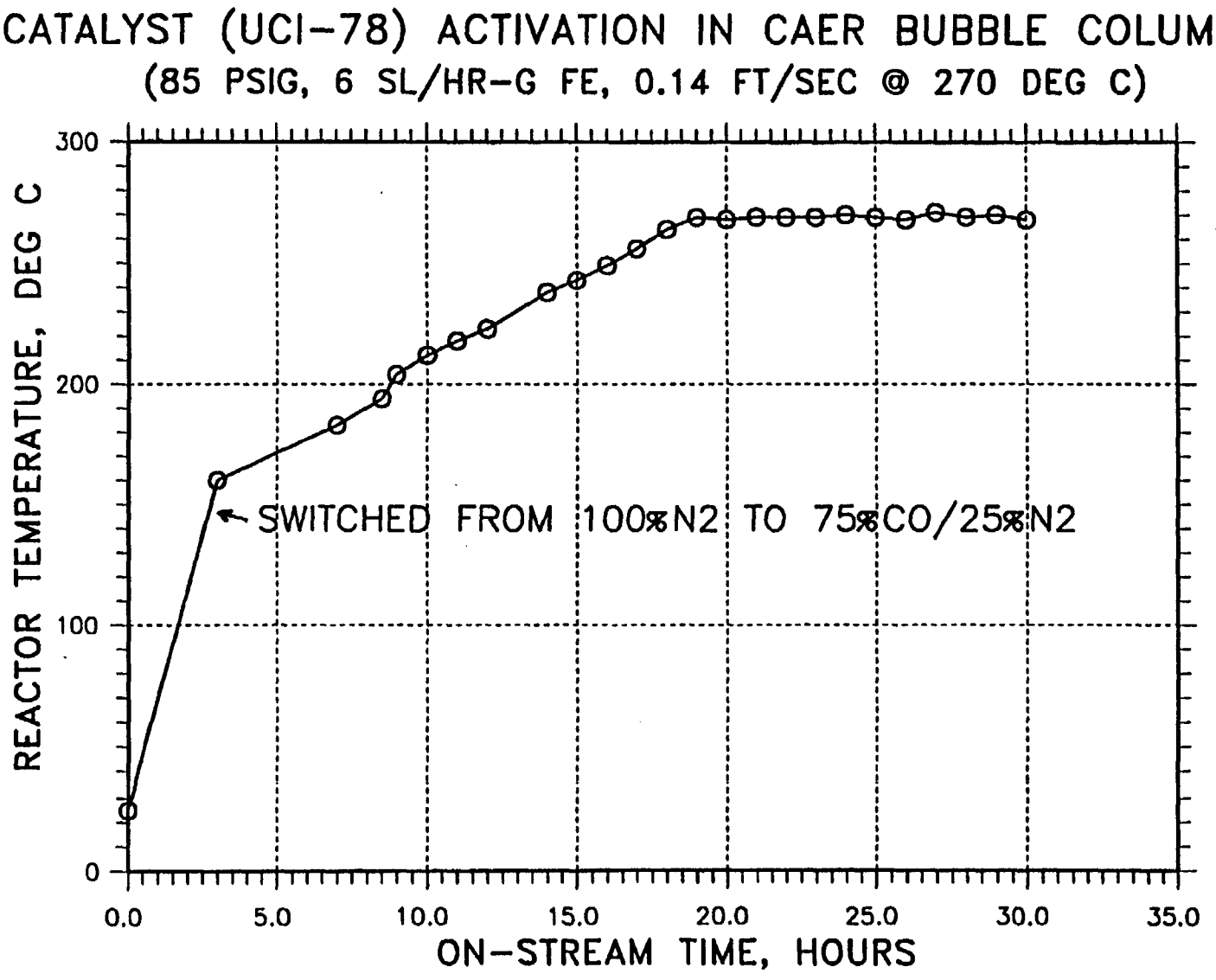
ANALYTICAL REQUIREMENTS:

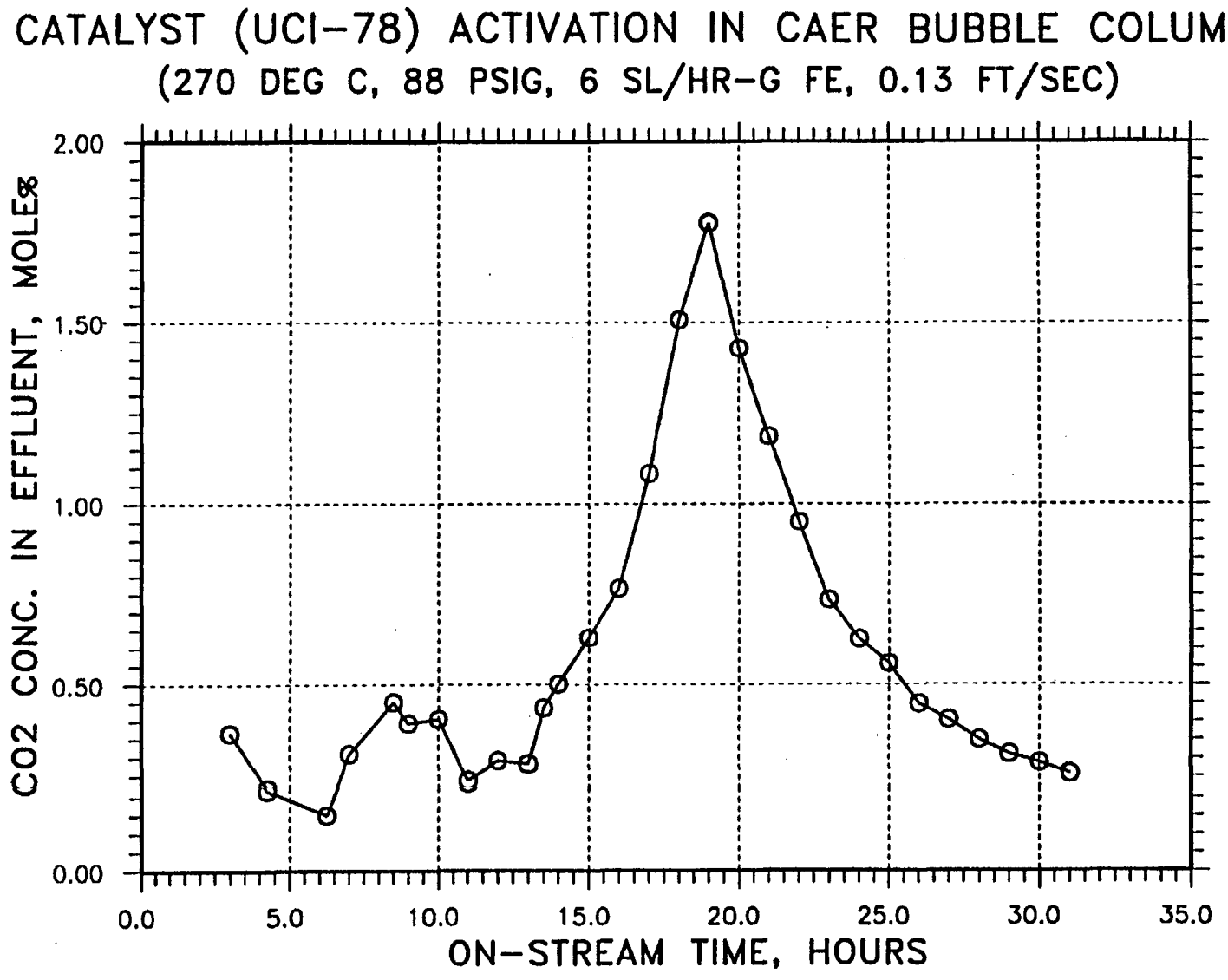
1. Gas Composition sampling requirements:
   - reactor in and out continuously

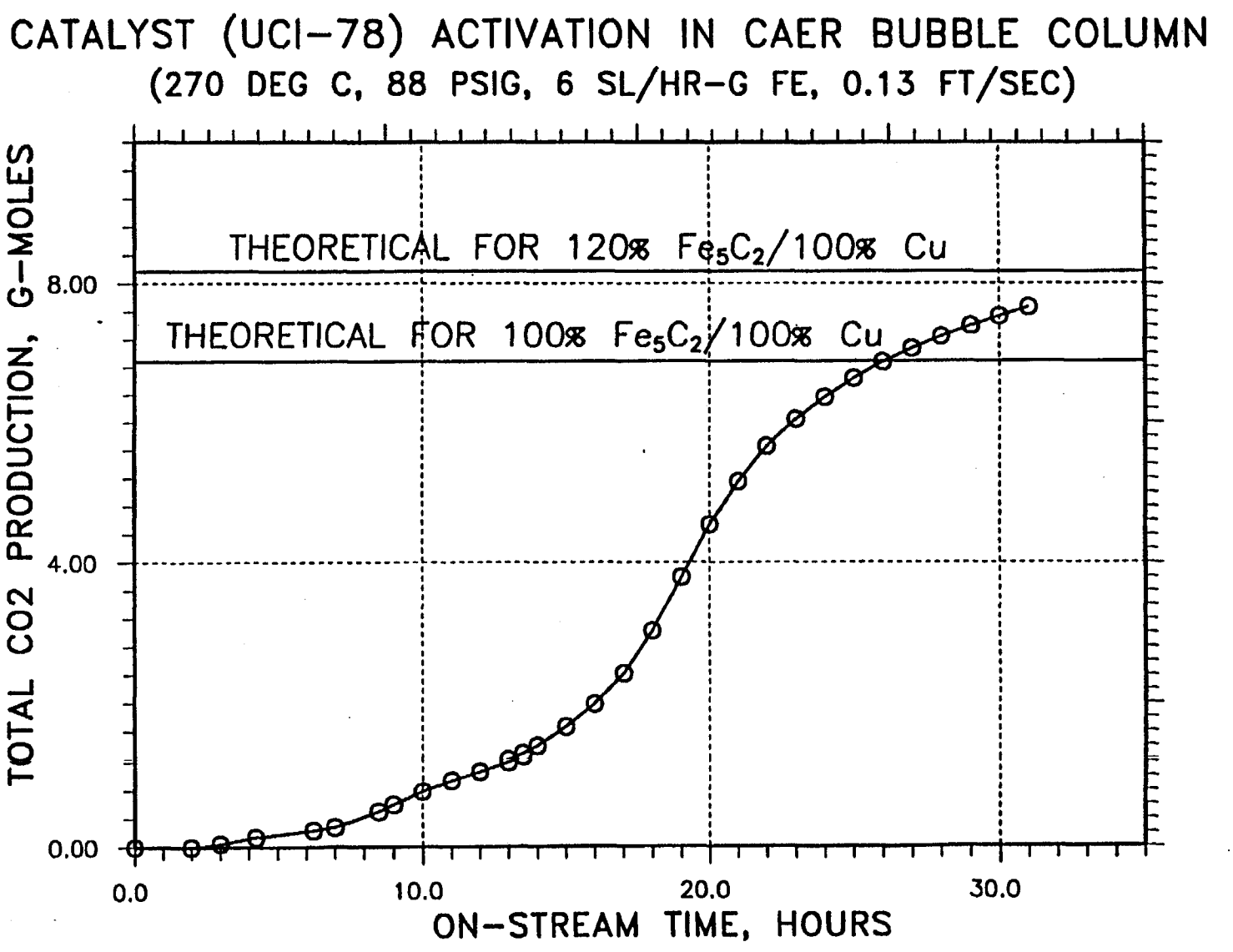
2. Flow measurement requirements:
   - reactor in at FI-126 and FI-187.
   - reactor out at FI-701.

REFERENCES:

1. CAER's Bubble Column Activation Results (attached).


CATALYST (UCI-78) ACTIVATION IN CAER BUBBLE COLUMN
(85 PSIG, 6 SL/HR-G FE, 0.14 FT/SEC @ 270 DEG C)
REACTOR TEMPERATURE, DEG C
300
200
100
0
SWITCHED FROM 100%N2 TO 75%CO/25%N2
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
ON-STREAM TIME, HOURS


CATALYST (UCI-78) ACTIVATION IN CAER BUBBLE COLUMN
(270 DEG C, 88 PSIG, 6 SL/HR-G FE, 0.13 FT/SEC)
CO2 CONC. IN EFFLUENT, MOLE%
2.00
1.50
1.00
0.50
0.00
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
ON-STREAM TIME, HOURS


CATALYST (UCI-78) ACTIVATION IN CAER BUBBLE COLUMN
(270 DEG C, 88 PSIG, 6 SL/HR-G FE, 0.13 FT/SEC)
THEORETICAL FOR 120% Fe5C2/100% Cu
THEORETICAL FOR 100% Fe5C2/100% Cu
TOTAL CO2 PRODUCTION, G-MOLES
8.00
4.00
0.00
0.0
10.0
20.0
30.0
ON-STREAM TIME, HOURS

TEST AUTHORIZATION # 42

LaPorte Alternative Fuels Development Unit (AFDU)

Date : 05/09/94
By: BLB

RUN NUMBER: AF-R11
APPROX START DATE: 12 May, 1994

TITLE: LIQUID PHASE FISCHER-TROPSCH II PROCESS VARIABLE STUDIES WITH UCI L-3950 IRON OXIDE CATALYST

OBJECTIVE:
To study the performance of UCI L-3950 precipitated iron oxide catalyst in a bubble column reactor at different space velocities and pressures.

SUMMARY:
Upon the activation of the UCI catalyst (TA #41, Run AF-A7), a process variable study will be started. Four different process conditions will be tested for a total of 14 days. This includes operations at three different pressures, three different space velocities as well as a baseline check at the end. The reactor temperature will be varied in the range of 265°C to 300°C to achieve about 80% CO conversion. Following the process variable study, a 1-day tracer study and a 3-day filter test will be conducted.

TEST DETAILS: See pages 2 to 4 for details.

ANALYTICAL COMMENTS: See page 4.

SAFETY IMPLICATIONS:
Protective gear including face shield should be worn during slurry sampling and wax transferring/sampling.

ENVIRONMENTAL IMPLICATIONS:
Minimal.

SPECIAL REMARKS:
See Test Details.

AUTHORIZATIONS:

E. C. Heydorn, Plant Mgr

B. L. Bhatt, Process Engr

TEST DETAILS:

1. Upon completion of the catalyst activation (Run AF-A7), start the process variable study.

2. Decrease the reactor temperature to 464°F (240°C) and increase the pressure to 200 psig. Slowly increase the CO-Rich syngas flow to 25,523 SCFH (on FI-126). Establish the following composition:

	Composition	Est Flows (SCFH)
H2	40 %	10,210
CO	57 %	14,547
N2	3 %	766
	100.0 %	25,523

MW = 17.6, SCF evaluated at 70°F, 14.7 psia

Slowly increase the reactor temperature to 509°F (265°C) to reach conditions for Run AF-R11.1.

3. PVS RUNS:

Process and control room targets are tabulated in Tables 1 and 2. The run descriptors are presented below:

RUN NO.	NO. OF DAYS ON-STREAM	SPACE VEL NL/KG-FE-HR	PRESSURE PSIG	TEMPERATURE DEG C
AF-R11.1	2	2500	200	265
AF-R11.2	2	3000	400	270
AF-R11.3	5	5600	750	300
AF-R11.4	3	5600	400	300
AF-R11.5	2	3000	400	270

4. The reactor slurry level should be maintained between 80 and 100% of NDG range, as specified in the Table 1, using LIC-636 (Oxygenates mode on HS-697). Pump 10.52.02 should be on all the time to bring light wax back to the reactor from 27.11/27.12. Line up 22.14 to 27.11. Maintain 27.12 level using LIC-639. Pump 10.52.01 should also be on all the time. Excess liquid from 22.14 should be transferred in batches to 28.30 periodically. Maintain 22.14 separator between 300-400°F. Maintain 22.18 separator between 90-115°F. Maintain prep tank 28.30 at 250°F.

If the catalyst does not behave as expected and the reactor slurry level increases due to significant wax production, then run the reactor in Fischer-Tropsch mode (HS-697). The reactor slurry level should be maintained between 90 and 100% of NDG range using LIC-585. Pump 10.52.02 should be on all the time to bring light wax back to the reactor from 27.13. Slurry level in 27.13 should be maintained at about 37% using LIC-203. Initially, operate LIC-203 in manual mode. Keep pump 10.60 flowing to 22.60 filters. Maintain the 22.60 filter system around 300°F and 65 psig. The 10.60 pump rate should be about 12 gpm. Maintain utility oil flow thru 21.85 heat exchanger. Monitor flow across the 22.60 filter using FI-715. Start with backflush time of 1800 seconds. If FI-715 is showing significant drop off before backflush, process and operations may make decide to increase the back-flush frequency. Maintain 100 psig backflush pressure.

5. Perform 15 min shut down tests, as necessary, to get Nuclear Density Gauge measurements for hold up and catalyst inventory estimate in the reactor. The timing of these tests will be determined by process and operations engineers.

6. SPECIAL CONSIDERATIONS:

Change of Conditions

During change of conditions, small step changes should be made to avoid temperature run-away. Also, change one parameter at a time. While changing to higher productivity conditions (AF-R11.2, 11.3, 11.4) temperature may be reduced and then slowly increased to target condition. The temperature target is a guide line, our actual target is CO conversion level (about 80% in most cases). Consult with process and operations engineers for each change of conditions.

Liquid Transfer

Liquid HC and Aqueous phases collected in day tank 22.16 should be transferred to the HC trailer as 22.16 fills up. The 22.16 liquid gauge should contain a single phase (water). The 22.16 actual level will be higher than the what the gauge indicates. The actual liquid level could be as much as 25% higher than indicated by gauge. Hence, conduct 22.16 transfers before the gauge shows 96". Follow sampling requirements described in analytical comments.

Wax Transfer

Wax from prep tank 28.30 should be transferred to drums every day. Follow sampling requirements described in analytical comments.

7. Upon completion of the PVS, refer to TA # 43 to begin the tracer study.

ANALYTICAL COMMENTS:

1. Continuous Gas Sampling (GC):
   - Fresh feed and reactor feed,
   - Main Gas Out (22.18 overhead),

2. Periodic Gas Sampling (GC):
   - Purge gas from 22.11

3. Periodic Liquid Sampling:
   - one sample/shift @ 22.11 (two 200 cc bottles)
   - two samples during liquid transfer from 22.16 to trailer
     [about 150 cc each, one sample (AQ) @ beginning of transfer and one sample (HC) @ end of transfer]

4. Periodic Wax Sampling:
   - one Sample/drum (two 20 cc bottles) after transferring wax from 28.30 prep tank to drums

5. Slurry Sampling:
   - 1 sample/day (two 200 cc bottles) @ filter system, if filters are operated.

RUN PLAN FOR SPRING '94 F-T II RUN - TABLE 1: SUMMARY

RUN	AF-A7	AF-R11.1	R11.2	R11.3	R11.4	R11.5	R11.6A	R11.6B	R11.7
TYPE	ACTVTN	F-T	F-T	F-T	F-T	F-T	TRACER	TRACER	FILTER
DURATION, DAYS	1	2	2	5	3	2	1	1	3
FEED GAS	N_2, CO	SG	SG	SG	SG	SG	SG	SG	
H_2/CO	0	0.7	0.7	0.7	0.7	0.7	0.7	0.7	
N_2, %	25.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
CATALYST LOAD, LBS	996								
WAX CHARGE TO REACTOR, GALS	196								
SPACE VELOCITY, SL/HR-KG FE	2000	2500	3000	5600	5600	3000	2500	5600	
REACTOR									
PRESSURE, PSIG	150	200	400	750	400	400	200	750	
TEMPERATURE, DEG F	518	509	518	572	572	518	509	572	
INLET SUPERFICIAL VEL, FT/SEC	0.38	0.36	0.23	0.24	0.45	0.23	0.36	0.24	
OUTLET SUPERFICIAL VEL, FT/SEC	0.38	0.17	0.11	0.12	0.31	0.11	0.17	0.12	
LIQUID LEVEL, INCHES ON TAPE	174	174	179	192	186	179	174	192	
CATALYST WT FRACTION, %	44	44	44	44	44	44	44	44	
VAPOR VOID FRACTION, %	18-22	15-22	15-24	18-28	21-26	15-24	15-22	18-28	
FLOWS									
FFED GAS, SCFH	20,883	25,523	30,936	58,005	58,005	30,936	25,523	58,005	
PRODUCTS									
PRODUCT GAS, SCFH		10,555	13610	11830	6110	13610	10,555	11830	
HC LIQUID, GPD		496	610	1118	691	610	496	1118	
WATER, GPD		142	175	343	203	175	142	343	
LIGHT WAX, GPD		51	107	287	66	107	51	287	
CO CONVERSION, %		80	80	83	50	80			
CO_2 SELECTVITY, MOLE %		45.4	45.4	45.4	45.4	45.4			
CH_4 SELECT. (CO_2 FREE), WT %		6.3	6.3	6.3	6.3	6.3			
SUM C_2 SELECT. (CO_2 FREE), WT %		9.4	9.4	9.4	9.4	9.4			
SUM C_3 SELECT. (CO_2 FREE), WT %		10.5	10.5	10.5	10.5	10.5			
SUM C_4 SELECT. (CO_2 FREE), WT %		10.5	10.5	10.5	10.5	10.5			

RUN PLAN FOR SPRING '94 F-T RUN - TABLE 2: CONTROL TARGETS

RUN	AF-A7	AF-R11.1	R11.2	R11.3	R11.4	R11.5	R11.6A	R11.6B	R11.7
TYPE	ACTVTN	F-T	F-T	F-T	F-T	F-T	TRACER	TRACER	FILTER
FEED GAS FLOWS									
CO, SCFH	15,662	14,547	17,634	33,063	33,063	17,634	14,547	33,063	
H_2, SCFH	0	10,210	12,374	23,202	23,202	12,374	10,210	23,202	
N_2, SCFH	5,221	766	928	1,740	1,740	928	766	1,740	
TOTAL, SCFH	20,883	25,523	30,936	58,005	58,005	30,936	25,523	58,005	
FEED GAS COMPOSITION (MOLE%)									
CO	75	57.0	57.0	57.0	57.0	57.0	57.0	57.0	
H_2	0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	
N_2	25.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
PRODUCT GAS - 22.18 OVERHEAD COMPOSITION (MOLE%)									
H_2		11.2	11.2	8.3	27.4	11.2			
N_2		6.9	6.9	7.5	4.6	6.9			
CO		26.2	26.2	23.3	43.5	26.2			
CH_4		3.2	3.2	3.6	1.4	3.2			
CO_2		46.2	46.2	51.2	20.0	46.2			
SUN C_2		2.5	2.5	2.7	1.1	2.5			
SUM C_3		1.8	1.8	1.8	0.8	1.8			
SUM C_4		1.1	1.1	1.0	0.6	1.1			
SUM C_5		0.6	0.6	0.5	0.4	0.6			
SUM C_6		0.2	0.2	0.2	0.2	0.2			
SUM $C_7 + C_8$		0.04	0.04	0.04	0.04	0.04			
SUM $C_9 + C_{10}$		0.003	0.003	0.004	0.003	0.003			
22.14 SEPARATOR TEMP., DEG F		300-400	300-400	300-400	300-400	300-400	300-400	300-400	
22.18 SEPARATOR TEMP, DEG F		90-115	90-115	90-115	90-115	90-115	90-115	90-115	
10.60 PUMP FLOW RATE, GPM									12
22.60 FILTER INLET PRESS., PSIG									65
21.85 HT EXCH OUTLET TEMP., DEG F									300

TEST AUTHORIZATION # 43

LaPorte Alternative Fuels Development Unit (AFDU)

Sheet: 1 of 4
Date : 05/08/94
By: BLB

RUN NUMBER: AF-R11.6
APPROX START DATE: 26 May, 1994

TITLE: TRACER STUDY FOR LIQUID PHASE FISCHER-TROPSCH II DEMONSTRATION RUN WITH UCI L-3950 IRON OXIDE CATALYST

OBJECTIVE:
To conduct a 1-day radioactive tracer study for the Fischer-Tropsch (II) synthesis run in a bubble column reactor.

SUMMARY:
A slurry of UCI precipitated iron oxide catalyst (L-3950) and start-up wax from Shell will be activated in the reactor (Test Authorization # 41). Upon completion of the activation, a process variable study will be conducted (Test Authorization # 42). A one day tracer study will follow the process variable study. Radioactive gas and liquid tracers will be injected at two process conditions to study the mixing in both the phases. A 3-day filter test will follow the tracer study.

TEST DETAILS: See pages 2 to 4 for details.

ANALYTICAL COMMENTS: See page 4.

SAFETY IMPLICATIONS:
Safety information available from ICI Tracerco is attached (Letters from D. A. Bucior to B. L. Bhatt, "Radiation Safety Analysis of Proposed Methanol Reactor Residence Time and Distribution Study", 3 June 1993 and "Radiation Safety Analysis of Proposed LaPorte Pilot Plant Radioactive Tracer Study", 10 February 1994.). Barricades will be erected by ICI Tracerco to prevent access to areas containing radioactive materials. Radiation film badges will be worn by all personnel present during the study.

We will have to allow 10 hours to elapse after the last liquid injection prior to draining the wax. Assuming a worst case scenario of all radioactive material depositing on one filter, 36 hours will be required after injection for the material to decay to the regulatory limit. Hence, no maintenance on the filters will be permitted for 36 hours after the last liquid injection.

ENVIRONMENTAL IMPLICATIONS:
A flame will be maintained at the flare.

SPECIAL REMARKS:
The radioactive tracer injection will be performed by ICI Tracerco personnel using their injection equipment. APCI personnel will be present during the injection and operate AFDU equipment.

AUTHORIZATIONS:

E. C. Heydorn, Plant Mgr

B. L. Bhatt, Process Engr

TEST DETAILS:

1. Upon completion of the Process Variable Study (Run AF-R11.1 thru 11.5), start the Tracer Study. A vapor residence time distribution study will be performed by injecting Argon-41 into the inlet gas line and monitoring its progress through the reactor by several detectors. Two different gas velocities will be tested. Also, two injections of radioactive Mn_2O_3 will be made in the reactor slurry at each condition to study liquid phase mixing.

   ICI Tracerco is licensed to conduct these tests and will conform to guidelines prescribed by the Texas Department of Health. Texas A&M will irradiate the Argon and Manganese on the morning of the tests, and it will be delivered to the LaPorte site by courier. The radioactive Ar-41 has a half life of 1.8 hrs and will be injected into the reactor and vented to the atmosphere in levels acceptable to the Texas Department of Health. The radioactive manganese is expected to have a half life of 2.5 hours; only small amounts acceptable to the Texas Department of Health will be injected. An irradiation test will be performed on Mn_2O_3 by Texas A&M to ensure that the radiation will decay to very low levels within several days.

2. Operating conditions of Run Nos. AF-R11.1 and 11.3 will be studied. Process and control targets for the study are tabulated in Table 1 and 2. The run descriptors are presented below:

RUN NO.	INJECTIONS	SPACE VEL SL/HR - KG FE	PRESSURE PSIG	TEMPERATURE DEG C	INLET GAS VEL, FT/SEC
AF-R11.6A	GAS-INLET (2)	2500	200	265	0.36
AF-R11.6A	LIQUID-TOP (1)	2500	200	265	0.36
AF-R11.6A	LIQUID-BOTTOM (1)	2500	200	265	0.36
AF-R811.6B	GAS-INLET (2)	5600	750	300	0.24
AF-R11.6B	LIQUID-TOP (1)	5600	750	300	0.24
AF-R11.6B	LIQUID-BOTTOM (1)	5600	750	300	0.24

3. The slurry level should be maintained between 80 and 100% of NDG range, as specified in Table 1. Leave the Nuclear Density Gauge at the normal controlling reactor height. Shut off the gauge for 10-15 minutes during the injections as cross-interference is

expected. Put LIC-636 on manual during the injections but bring it back on auto between runs. Pump 10.52.02 should be on all the time to bring light wax back to the reactor. Pump 10.52.01 should be on all the time to circulate light wax thru 22.14. Maintain 22.14 separator between 300-400^{o}F. Maintain 22.18 separator between 90-115^{o}F.

4. Day 1 (Approx. Date: 5/26/94)

Preparation and initial testing of the equipment will be conducted on the last day of the Process Variable Study. The electronic equipment includes 19 detectors connected to a data acquisition system. The process equipment includes a gas sample cylinder with adequate valves to allow filling of the cylinder with Ar-41 and subsequent injection into the reactor via a nitrogen flush. The Ar-41 will be injected thru valve V-1504. The radioactive manganese will be sluried in Ethylflo-164 and injected with a hand-powered piston pump. The liquid injections will be made at two locations on the side of the reactor: Top T-nozzle and Bottom T-nozzle.

During day 1, the electronic equipment will be connected and power supplied to it. A preliminary calibration will be performed to verify the equipment is operational. Arrangements will be made to support the detectors in their proper location, detectors will not be placed until day 2.

Personnel available during the study will include two persons from Tracerco, one operator, one PSG process engineer and the plant manager. A catalyst inventory will be determined during day 1 using the nuclear density gauge with no gas flow through the reactor.

Day 2 (Approx. Date: 5/27/94)

Prior to day 2, arrangements will be made to irradiate Ar-41 and Mn_2O_3 in a reactor at Texas A&M. The irradiation will take place on the morning of day 2 and be transported to LaPorte by 1 pm. The radioactive materials produced during day 2 can only be used during this day since the half life of these compounds is less than three hours.

During the morning of day 2, the Tracerco crew will calibrate and hang the 19 detectors at the LaPorte AFDU. Each detector will be subjected to a gamma-ray source, and the response will be measured. All the detectors will then be normalized relative to the most sensitive detector.

After the calibration is complete, the detectors will be placed at specified locations. Two conditions will be studied during the day. Due to change in gas holdup for each velocity, the slurry level will change for a constant slurry concentration and catalyst inventory. The Ar-41 injections will be made into the feed gas. For each case, two injections will be made. A reasonable amount of time must exist between injections so that either Ar-41 has left the system or a steady level of radiation is available to use as a baseline. Two liquid injections (one at top and one at bottom) will be made at each condition.