APPENDIX A
HAZOP SUMMARY AND WORKSHEETS

HAZOP SUMMARY

Nodes

1 Global 1 -- Nitrogen System
2 Retort/Gasifier
3 Coarse coal feed to retort
4 Fine coal feed to retort
5 Gasifier Booster Heater to Retort (Center)
6 Gasifier Booster Heater to Retort (Grid)
7 Inlet to Tar Quench Condenser
8 Tar Quench Condenser C-304
9 C-304 Bypass Line
10 Manual Tar Recirculation Line
11 Condenser C-304 to Tar Separator
12 Tar Quench Cooler Bypass
13 Quench Cooler to Condenser Nozzle
14 Tar Separator C-301
15 Suction to G-301 from C-301
16 Pump G-301 Tar Quench Pump
17 Pump Discharge to Tar Quench Cooler
18 Relief / Minimum Flow Path
19 Tar Quench Heat Exchanger E-301
20 C-301 to Relief Header
21 Product gas from C-301 to middle oil
22 Tar product to storage tank
23 Nat Gas Supply to Preheater
24 Recycle Gas from Preheater to Boosters
25 Air from Preheater to Boosters
26 Recycle Gas Inlet to Preheater
27 Air inlet to Preheater
28 Recycle gas inlet to Booster A
29 Air inlet to Booster A
30 Nat Gas inlet to Booster A
31 Booster Heater A
32 Recycle gas inlet to Booster B
33 Air inlet to Booster B
34 Nat Gas inlet to Booster B
35 Booster Heater B
36 Vent gases to Thermal oxidizer
37 Sour water to Thermal Oxidizer
38 Weigh Hopper for Coarse Coal attached tote bag unloader
39 Fill line from Weigh hopper to Lock hopper
40 Coarse coal lock hopper
41 Fill line from Lock hopper to Feed hopper
42 Coarse coal feed hopper
43 LT-0601,04,10,21,24 and 30
44 Rupture disc discharge lines
45 N2 feed to Hoppers
46 N2 Vent from Hoppers
47 Baghouse system
48 Coarse Char Surge Vessel C-703
49 Fill line from Coarse Char Surge Vessel to Blowcase
50 Coarse Char Blowcase C-704
51 Coarse char pneumatic conveyence to Storage Hopper D-702
52 Coarse char Storage Hopper D-702
53 Fill line from D-702 to Supersac
54 Char Storage Baghouse
55 Char Fines Surge Vessel C-701
56 Fill line from Char Fines Surge Vessel to Blowcase
57 Char Fines Blowcase C-702
58 Char Fines pneumatic conveyence to Storage Hopper D-701
59 Char Fines Storage Hopper D-701
60 Fill line from D-701 to Supersac
61 Weigh Hopper for Coal Fines and attached tote bag unloader
62 Fill line from Weigh Hopper to Lockhopper (fines)
63 Coal Fines Lockhopper
64 Fill Line from Lockhopper to Feed Vessel (Fines)
65 Coal Fines Feed Vessel
66 Flare
67 Bypass around T.O to K.O. pot
68 Emergency Shutdown
69 Tar Separator to middle oil separator (see node 21)
70 Middle oil separator
71 Middle oil separator to run tank
72 Run tank
73 Middle oil separator to the light oil separator
74 Recycle gas to return to the middle oil separator (HOLD)
75 Light oil separator
76 Light oil separator to run tank
77 Light oil separator sour water to incinerator
78 Low pressure depressurization line
79 High pressure depressurization line (DELETED FROM DESIGN)
80 Recycle gas to the T.O.
81 Recycle gas to preheater (See node 26)
82 Coarse char from retort to coarse char surge vessel
83 Fine char from cyclone to fine char surge vessel
84 Primary Cyclone
85 Secondary Cyclone
86 Glycol Cooling System

Session: 1 02-13-95 Revision: 0 02-13-95 Dwg#: 9417-1006-C
Node: 1 Global 1 -- Nitrogen System
Parameter: Flow Intention: Provide adequate flow to support all I/C and process operations

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
No/less Flow	1) Plugging	1.1) Inadequate supply to specific or all users	C1.1) Downstream flow ind. FIT-0904 and FAL-0904(S) C1.2) Local PI's	Ensure control room pressure ind. and alarm on N2 vendor package		B	
	2) Regulator failure	2.1) same as above	C2.1) same as C1.*)				
	3) Excessive user	3.1) Same as above	C3.1) FIT-0902, FIT-0903 and Hi/LO(S) on FIT-0902,3 and 4. C3.2) FIT-0733 and Hi/LO(S) course char cooler				
	4) Valve left or fails closed	4.1) Same as above	C4.1) Oper. Proc.				
	5) Line break, flange leak, etc.	5.1) Same as above	C5.1) same as above				

Session: 1 02-13-95 Revision: 0 02-13-95 Dwg#: 9417-1006-C
Node: 1 Global 1 -- Nitrogen System
Parameter: Composition Intention: Pure N2 in the lines at all times

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Other Than Composition	1) Failure to purge after outage or at start-up	1.1) Undesired combustion in the coal transfer lines, hoppers, and other blanketed storage vessels for liquids	C1.1) Operating procedures to include vent and purge C1.2) Pressure indication at various critical locations	Ensure inclusion in op. proc.		I B	
	2) Loss of N2 source	2.1) same as 1.1	C2.1) Pressure and level instrumentation	Verify low liq. level alarm is provided		B	
			C2.2) Oper proc. to ensure sufficient N2 to support run	Verify the need for emerg. S/D on lost of N2.		RS	
		2.2) loss of I/C		Review need for N2 back-up source		I B	

Session: 1 02-13-95 Revision: 0 02-13-95 Dwg#: 9417-1006-C
Node: 1 Global 1 -- Nitrogen System
Parameter: Composition Intention: Pure N2 in the lines at all times

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
		2.3) loss transport of material (coal and char)					

Session: 1 02-13-95 Revision: 0 02-13-95 Dwg#: 9417-1006-C
Node: 1 Global 1 -- Nitrogen System
Parameter: Level Intention: Contain the N2 as either liquid or gas as appropriate

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS

Session: 1 02-13-95 Revision: 0 02-13-95 Dwg#: 9417-1006-C
Node: 1 Global 1 -- Nitrogen System
Parameter: Safety Intention: To ensure operator and maintenance personnel safety

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
No Safety	1) Inappropriate confined space entry	1.1) Personnel injury or death	c1.1.1)Confined space entry procedures	Review current procedures to ensure they are adequate for this facility		I	

Session: 1 02-13-95 Revision: 0 02-13-95 Dwg#: 9417-1006-C
Node: 2 Retort/Gasifier
Parameter: Pressure Intention: Operate 35 psia

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Higher Pressure	1) Blocked/ restricted nozzle to cyclone			Add overpressure protection		RS	

Session: 1 02-13-95 Revision: 0 02-13-95 Dwg#: 9417-1006-C
Node: 3 Coarse coal feed to retort
Parameter: Flow Intention: Provide coarse coal at a rate of 1600 #/hr

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
No/less Flow	1) Conveyor failure	1.1) Inadequate supply to retort	C1.1) speed indication SI-0641	Review need for alarm on SI-0641 ????		I B	
		1.2) Overheating of coal	c1.2.1) Oil temp limit 600F				
		1.3) Retort temp rise	c1.3.1) TE-0729B indicate initial rise and control				
		1.4) Product gas make reduced	c1.3.2) TE-0710/27 indicate rise				
		1.5) Bed level reduction					
		1.6) Exit oil temp rise					
		1.7) Plugging of line and conveyor					
	2) Driver failure	2.1) same as 1.*)	c2.1.1) Same as 1.*)				
	3) Pluggage or blockage in line	3.1) same as 1.*)	C3.1) Pressure ind. PI-0640 will rise				PI-06-40 will move to downstream of N2 connect. No impact
			C3.2) If blockage upstream of N2 conn. then TE-0644 will indicate low				
	4) Slow speed on conveyor	4.1) same as 1.*) a slower rate					
	5) Pluggage or blockage in conveyor	5.1) same as 1.*)	c5.1.1) Same as 1.2.*) thru 1.3.*)				
More Flow	1) Improper speed control setting	1.1) Imbalance in gasifier control point level and temp	C1.1) Oper training				
			C1.2) Specific calibration by coal type				
			C1.3) Temp decrease at TE-0710/27				
			C1.4) Level via pressure dP at PDIT-0703				

Session: 1 02-13-95 Revision: 0 02-13-95 Dwg#: 9417-1006-C
Node: 3 Coarse coal feed to retort
Parameter; Flow Intention: Provide coarse coal at a rate of 1600 #/hr

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Reverse Flow	1) Loss of N2	1.1) TI-0644 reads HI	C1.1) N2 Control system see global node 1	Add alarm(S) on hi		RS	
		1.2) Disrupt bed control	C1.2) TI-0644 Hi				
	2) Failure of pressure boundary(lock hopper, seals, etc.)	2.1) Same as 1.*)	C2.1) Maintenance and oper. procedures	Review the need for auto S/D of line on Hi temp		I B	
		2.2) Release of haz. material	C2.2) same as C1.2				
		2.3) Damage instrumentation due to hi temp					
		2.4) Damage to screw conveyor					

Session: 1 02-13-95 Revision: 0 02-13-95 Dwg#: 9417-1006-C
Node: 3 Coarse coal feed to retort
Parameter: Temperature Intention: Supply coal at 500F

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Higher Temperature	1) TV-0615 too open	1.1) Coal discharge temp high	c1.1) Temp limited too oil temp of 600F				
		1.2) Potential for pluggage	C1.1) oper proc. and calibr.				
		1.3) Higher temp in gasifier	c1.3) Gasifier controls				
	2) SE-0641 too slow	2.1) see Flow No/Less	c2.1) same as No/Less Flow				
Lower Temperature	1) TV-0615 too closed	1.1) Lower bed temp in gasifier	c1.1) Gasifier controls				
		1.2) Coal discharge temp low	c1.2) Operating proc.				
	2) Failure of TE-	2.1) same as above	C2.1) deleted				

Session: 1 02-13-95 Revision: 0 02-13-95 Dwg#: 9417-1006-C
Node: 3 Coarse coal feed to retort
Parameter: Temperature Intention: Supply coal at 500F

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
	0615		C2.2) same as c1.*)				
	3) SE-0641 too fast	3.1) see Flow-High 3.2) same as 1.*)	3.1) see Flow- High c3.2) same as c1.*)				
	4) Fouling of screw	4.1) same as 1.*)	c4.1) same as c1.*)				
	5) Loss of N2	5.1) same as 1.*)	c5.1) same as c1.*)				

Session: 1 02-13-95 Revision: 0 02-13-95 Dwg#: 9417-1006-C
Node: 3 Coarse coal feed to retort
Parameter: Composition Intention: No contamination from heating oil

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Other Than Composition	1) Leakage from oil side to coal side	1.1) Pluggage/ blockage 1.2) No impact in gasifier 1.3) Recycle gas/liq product composition change (no impact) 1.4) Increase liq product 1.5) False test result (No impact) 1.6) Damage to hot system due to low volume	c1.1) same as Flow-No/less C1.1) Low level at LIT-0801 and 06 and alarm(S) at L and LL. C1.2) LALL-0801&06 causes S/D c1.6.1) same as C1.1 and C1.2	Review level control interlock with heater control and pump contol		RS	

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
No/less Flow	1) Conveyor failure	1.1) Inadequate supply to retort	C1.1) speed indication SI-0642	Review need for alarm on SI-0642 ????		I B	
		1.2) Overheating of coal	c1.2.1) Oil temp limit 600F				
		1.3) Retort temp rise	c1.3.1) TE-0729B indicate initial rise and control				
		1.4) Product gas make reduced	c1.3.2) TE-0710/27 indicate rise				
		1.5) Bed level reduction					
		1.6) Exit oil temp rise					
		1.7) Plugging of line and conveyor					
	2) Driver failure	2.1) same as 1.*)	c2.1.1) Same as 1.*)				
	3) Pluggage or blockage in line	3.1) same as 1.*)	C3.1) Pressure ind. PI-0643 will rise				PI-06-40 willmove to downstream of N2 connect. No impact
			C3.2) If blockage upstream of N2 conn. then TE-0645 will indicate low				
	4) Slow speed on conveyor	4.1) same as 1.*) a slower rate					
	5) Pluggage or blockage in conveyor	5.1) same as 1.*)	c5.1.1) Same as 1.2.*) thru 1.3.*)				
More Flow	1) Improper speed control setting	1.1) Imbalance in gasifier control point level and temp	C1.1) Oper training				
			C1.2) Specific calibration by coal type				
			C1.3) Temp decrease at TE-0710/27				
			C1.4) Level via pressure dP at PDIT-0703				

Session: 1 02-13-95 Revision: 0 02-13-95 Dwg#: 9417-1006-C
Node: 4 Fine coal feed to retort
Parameter: Flow Intention: Provide flow at rate of xxx

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Reverse Flow	1) Loss of N2	1.1) TI-0645 reads HI	C1.1) N2 Control system see global node 1	Add alarm(S) on hi		R	
		1.2) Disrupt bed control	C1.2) TI-0645 Hi				
	2) Failure of pressure boundary(lock hopper, seals, etc.)	2.1) Same as 1.*)	C2.1) Maintenance and oper. procedures	Review the need for auto S/D of line on Hi temp		I B	
		2.2) Release of haz. material	C2.2) same as C1.2				
		2.3) Damage instrumentation due to hi temp					
		2.4) Damage to screw conveyor					

Session: 1 02-13-95 Revision: 0 02-13-95 Dwg#: 9417-1006-C
Node: 4 Fine coal feed to retort
Parameter: Temperature Intention: To supply fine coal at ***F

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Higher Temperature	1) TV-0635 too open	1.1) Coal discharge temp high	c1.1) Temp limited too oil temp of 600F				
		1.2) Potential for pluggage	C1.1) oper proc. and calibr.				
		1.3) Higher temp in gasifier	c1.3) Gasifier controls				
	2) SE-0642 too slow	2.1) see Flow No/Less	c2.1) same as No/Less Flow				
Lower Temperature	1) TV-0635 too closed	1.1) Lower bed temp in gasifier	c1.1) Gasifier controls				
		1.2) Coal discharge temp low	c1.2) Operating proc.				
	2) Failure of TE-0635	2.1) same as above	C2.1) deleted				

Session: 1 02-13-95 Revision: 0 02-13-95 Dwg#: 9417-1006-C
Node: 4 Fine coal feed to retort
Parameter: Temperature Intention: To supply fine coal at ***F

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
			C2.2) same as c1.*)				
	3) SE-0642 too fast	3.1) see Flow- High	3.1) see Flow- High				
		3.2) same as 1.*)	c3.2) same as c1.*)				
	4) Fouling of screw	4.1) same as 1.*)	c4.1) same as c1.*)				
	5) Loss of N2	5.1) same as 1.*)	c5.1) same as c1.*)				

Session: 1 02-13-95 Revision: 0 02-13-95 Dwg#: 9417-1006-C
Node: 4 Fine coal feed to retort
Parameter: Composition Intention: No contamination from heating oil

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Other Than Composition	1) Leakage from oil side to coal side	1.1) Pluggage/ blockage	c1.1) same as Flow- No/less				
		1.2) No impact in gasifier	C1.1) Low level at LIT-0801 and 06 and alarm(S) at L and LL.				
		1.3) Recycle gas/liq product composition change (no impact)	C1.2) LALL-0801&06 causes S/D				
		1.4) Increase liq product	c1.6.1) same as C1.1 and C1.2	Review level control interlock with heater control and pump contol		RS	
		1.5) False test result (No impact)					
		1.6) Damage to hot system due to low volume					

Session: 1 02-13-95 Revision: 0 02-13-95 Dwg#: 9417-1006-C
Node: 5 Gasifier Booster Heater to Retort (Center)
Parameter: Flow Intention: Provide process heat input to gasifier to fluidize bed and maintain fluidization

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Less Flow	1) Restriction of air compressor flow	1.1) Booster heater temperature output low 1.2) Bed velocity fluidization reduced 1.3) Bed temp decreases 1.4) Recycle gas composition changes 1.5) Reduced cyclone performance, secondary cyclone duty increase, fines in heavy liq recovery 1.6) TV-0729C tries to maintain stoic. 1.7 Booster heater may respond	C1.1) Flow ind. at FIT-0736 and alarm (S)L c1.1) Low temp at TE-0729A and (S)L and LL c1.3.1) Low temp at TE-0710/27 and alarm (S) L and LL c1.4.1) At on-line GC (long response time) C2.2) Trouble alarm at compressor	Verify that vendor package has alarm Review the control strategy for ind. of secondary booster needed and manual permissive (remove as needed TY-0729A, etc.)		RS RS C	
	2) Restriction of recycle compressor flow	2.1) Booster heater discharge temp increases 2.2) same as 1.2) thru 1.5) 2.3 TV-0729B&C throttle back	C2.1) Flow ind. low at FE-0738 and alarm (S)L c2.1) Hi temp at TE-0729A and (S)H and HH C2.2) Trouble alarm at compressor	Verify vendor package has trouble alarm		RS	
	3) Restriction	3.1) Same as 1.*)	c2.2.1) Low temp at TE-				

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
	of nat gas flow	3.2) Possibility for excess O2 resulting in lower booster temp, hi local temp. and product slate differences	0710/27 and alarm (S) L and LL c2.2.2) At on-line GC (long response time) c3.1.1) same as air compr c3.2.1) Product testing at end of run				
	4) Leakage or line breakage	4.1) Release of haz mat	c4.1.1) Approved fire protection program C.4.1) Oper. training	Review whether or not PS's provide adequate/ recommended protection Review burner management I/C program (w/Callidus)		B C	
		4.2) release of VERY hot air 4.3) Personnel inj 4.4) Potential for fire/explosion					
	5) Firing of Booster Heater B	5.1) Changes balance of recycle gas flow		Review addition of control valves in the individual recycle feed lines and remove the control valve upstream of the fired heater		RS	
More Flow	1) Operator error or miscalib	1.1) Higher entrainment 1.2) Higher temp at TE-0710/27 due to hot fines 1.3) Higher duty					

Session: 1 02-13-95 Revision: 0 02-13-95 Dwg#: 9417-1006-C
Node: 5 Gasifier Booster Heater to Retort (Center)
Parameter: Flow Intention: Provide process heat input to gasifier to fluidize bed and maintain fluidization

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
		on liq recovery 1.4) Offspec operation-no hazards					

Session: 1 02-13-95 Revision: 0 02-13-95 Dwg#: 9417-1006-C
Node: 5 Gasifier Booster Heater to Retort (Center)
Parameter: Temperature Intention: Provide flow at 1771F to 1887F

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Higher Temperature	1) More Nat Gas and air flow	1.1) Higher bed temp 1.2) Slightly higher bed velocity 1.3) Product slate differences 1.4) Char composition changes 1.5) Approaching materials limits 1.6 Booster heater may respond	c1.1.1) TE-0710/27 read hi, alarm (S)H and HH c1.1.2) TE-0729A reads Hi and alarm (S)H and HH c1.5.1) 150F margin in gasifier and that less 100F in the coarse char cooler	Review the control strategy for ind. of secondary booster needed and manual permissive (remove as needed TY-0729A, etc.)		RS C	
	2) Excess air	2.1) same as 1.*) 2.2) excess O2 see Flow- Less item 3.2	c2.1.1) same as 1.1				
	3) Preheater too hot	3.1) Excess temp to gasifier 3.2) same as 1.*)	c3.2.1) same as 1.1 c3.2.2) preheater design margin XXXX	Review temp loop	Verify preheater design margin	B C	

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
			c3.1.3) Temp control at preheater	including TS and alarm with Callidus			
Lower Temperature	1) Preheater too cold	1.1) Lower bed temp	c1.1.1) TE-0710/27 read low, alarm (S)L and LL				
		1.2) Slightly lower bed velocity	c1.1.2) TE-0729A reads low and alarm (S)L and LL				
		1.3) Product slate differences	c1.1.3) Temp control at preheater	Review temp loop with Callidus		C	
		1.4) Char composition changes					
	2) Low nat gas flow	2.1) Same as 1.*)					
	3) Insufficient air	3.1) same as 1.*)					

Session: 1 02-13-95 Revision: 0 02-13-95 Dwg#: 9417-1006-C
Node: 6 Gasifier Booster Heater to Retort (Grid)
Parameter: Flow Intention: Provide 1/3 of total flow

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Less Flow	1) Restriction of air compressor flow	1.1) Booster heater temperature output low 1.2) Bed velocity fluidization reduced 1.3) Bed temp may decreases 1.4) Recycle gas composition changes 1.5) TV-0729E tries to maintain stoic.	C1.1) Flow ind. at FIT-0741 and alarm (S)L c1.1) Low temp at TE-0729B and (S)L and LL c1.3.1) Low temp at TE-0710/27 and alarm (S) L and LL c1.4.1) At on-line GC (long response time) C2.2) Trouble alarm at compressor	Verify that vendor package has alarm		RS	
	2) Restriction of recycle compressor flow	2.1) Booster heater discharge temp increases 2.2) same as 1.2) thru 1.4) 2.3) Reduced cyclone performance, secondary cyclone duty increase, fines in heavy liq recovery 2.3) TV-0729D&E throttle back 2.4) Blockage of grid	C2.1) Flow ind. low at FE-0743 and alarm (S)L c2.1) Hi temp at TE-0729B and (S)H and HH C2.2) Trouble alarm at compressor	Move TE-0729B to secondary booster heater exit line. Review alarms and setpts. Also revise TIC-0729A logic to get bed input from TE-0710/27. Verify vendor package has trouble alarm		RS C RS	
	3) Restriction	3.1) Same as 1.*)	c2.2.1) Low temp at TE-				

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
	of nat gas flow	3.2) Possibility for excess O2 resulting in lower booster temp., hi local temp. and prod. slate differences	0710/27 and alarm (S) L and LL c2.2.2) At on-line GC (long response time) c3.1.1) same as air compr c3.2.1) Product testing at end of run				
	4) Leakage or line breakage	4.1) Release of haz mat	c4.1.1) Approved fire protection program C.4.1) Oper. training	Review whether or not PS's provide adequate/ recommended protection Review burner management I/C program (w/Callidus)		B C	
		4.2) release of VERY hot air 4.3) Personnel inj 4.4) Potential for fire/explosion					
More Flow	1) Operator error or miscalib	1.1) Higher entrainment 1.2) Higher temp at TE-0710/27 due to hot fines 1.3) Higher duty on liq recovery 1.4) Offspec operation-no hazards					

Session: 1 02-13-95 Revision: 0 02-13-95 Dwg#: 9417-1006-C
Node: 6 Gasifier Booster Heater to Retort (Grid)
Parameter: Temperature Intention: Provide flow at 1100F to 1500F

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Higher Temperature	1) More Nat Gas and air flow	1.1) Higher bed temp	c1.1.1) TE-0710/27 read hi, alarm (S)H and HH				
		1.2) Slightly higher bed velocity	c1.1.2) TE-0729B reads Hi and alarm (S)H and HH				
		1.3) Product slate differences	c1.5.1) 150F margin in gasifier and that less 100F in the coarse char cooler				
		1.4) Approaching materials limits					
	2) Excess air	2.1) same as 1.*)	c2.1.1) same as 1.1				
		2.2) excess O2 see Flow 3.2					
	3) Preheater too hot	3.1) Excess temp to gasifier	c3.2.1) same as 1.1		Verify preheater design margin	B	
		3.2) same as 1.*)	c3.2.2) preheater design margin XXXX	Review temp loop including TS and alarm with Callidus		C	
			c3.1.3) Temp control at preheater				
Lower Temperature	1) Pre heater too cold	1.1) Lower bed temp	c1.1.1) TE-0710/27 read low, alarm (S)L and LL				
		1.2) Slightly lower bed velocity	c1.1.2) TE-0729B reads low and alarm (S)L and LL				
		1.3) Product slate differences	c1.1.3) Temp control at preheater	Review temp loop with Callidus		C	
	2) Low nat gas flow	2.1) Same as 1.*)					
	3) Insufficient air	3.1) same as 1.*)					

Session: 1 02-13-95 Revision: 0 02-14-95 Dwg#: 9417-1006-C
Node: 7 Inlet to Tar Quench Condenser
Parameter: Flow Intention: Provide flow to C-304 at a rate of 5744 #/hr (max 5800) at 1050F.

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
No/Less Flow	1) Valve XV-1101 fails closed due loss of N2	1.1) No flow to C-304 1.2) XV-1001 opens 1.3) Flow diverted to relief system. 1.4) Gasifier upset 1.5) Stoppage of liq's recovery	C1.1) see global node 1	Review need for XV-1101	To be reviewed at S/D philosophy session	B I	
	2) Valve XV-1101 fails closed (mechanical failure)						
	3) Valve XV-1001 fails open (mechanical failure or operator error)	3.1) Flow to relief system 3.2) Minimum liq's recovery 3.3) Gasifier upset	c3.2.1) TE-1104 decreases slowly c3.2.2) PIT-1109 decreases c3.2.3) PIT-0709 decreases	Review need for XV-1001 as part of SD session			
	4) XV-1001 fails open on loss of N2	4.1) Same as 3.*)	C4.1) see Global Node 1				

Session: 1 02-13-95 Revision: 0 02-14-95 Dwg#: 9417-1006-C
Node: 8 Tar Quench Condenser C-304
Parameter; Phase Intention: Heavy Vapor to Liquid

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Less Phase (less tar produced)	1) Less recirc. liquid flow	1.1) Less tar producted	C1.1) TE-1104 and (S)HH at 473F C1.2) FIT-1121 lower C1.3) PIT-1120A higher	Review increase HH setpt to say 500F. Watch for middle oil air cooler fouling Review removal/ relocation of PV20 Review removal of PIT-1120A loop completely		RS I B	
		1.2) Tars carried to middle oil recovery section					
		1.3) May upset/ fouling middle recovery					
	2) Higher recirc. liquid temp						
	3) Higher product gas temp						

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
More Flow	1) PV-1103 open or leaking	1.1) Less flow to spray nozzle	C1.1) PIT-1102 lower if valve full open	Review alternative methods for determining PV-1103 is open		B RS	
		1.2) May effect quench performance					
		1.3) May have higher temperature in tar separator					
No Flow (when required to open)	1) PV-1103 fails to open mechanical or control loop failure	1.1) Pressure increases in piping system	c1.1.1) PSE-1119 ruptures c1.1.2) Alarms at PIT-1102 (S)H and HH				

Session: 1 02-13-95 Revision: 0 02-14-95 Dwg#: 9417-1006-C
Node: 10 Manual Tar Recirculation Line
Parameter: Flow Intention: No flow under normal op's, recirc flow during S/D

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
More Flow (during operation)	1) Manual valve open or leaking	1.1) Insufficent cooling 1.2) Reduced quench performance 1.3) Heavy liquids to middle liquids separation	c1.1.1) FIT-1121 lower c1.1.2) TIC-1104 higher C1.1) Operator training and procedures				
No Flow (during bypass mode)	1) Manual valve closed (mechanical failure or operator error) 2) Blockage	1.1) Fouling of tar quench cooler 1.2) Reduced heat transfer in cooler and pluggage 2.1) Same as 1.*)	c1.1.1) TIC-1104 lower C1.1) Operator training and procedures c2.1.1 Same as c1.1.1) C2.1) Electric heat tracing				

Session: 1 02-13-95 Revision: 0 02-14-95 Dwg#: 9417-1006-C
Node: 11 Condenser C-304 to Tar Separator
Parameter: Flow Intention: Provide flow from C-304 to C-301

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
No/Less Flow	1) Blockage or plugging	1.1)Reduced flow to C-301 1.2) Reduced performance in C-304 1.3) C-301 operates more efficently	C1.1) Large line size C1.2) Electric heat trace C1.3) Sloped line				

Session: 1 02-13-95 Revision: 0 02-14-95 Dwg#: 9417-1006-C
Node: 12 Tar Quench Cooler Bypass
Parameter: Flow Intention: Provide bypass flow around E-301 as required by TIC-1104 logic

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Less Flow	1) TV-1104 doesn't open enough	1.1) Slight over-cooling of recirc fluid	c1.1.1) TIC-1104 slightly lower c1.1.2) Cooling loop will self-adjust	Change fail position of TV-1104 to FC		RS	
	2) Manual valve left closed	2.1) Same as 1.*)					
	3) Malfunction of TIC-1104 logic and devices	3.1) Same as 1.*)					
	4) Pluggage	4.1) Same as 1.*)					
	5) Loss of N2	5.1) Same as 1.*					
More Flow	1) TV-1104 doesn't close enough	1.1) Slight undercooling of recirc fluid	c1.1.1) Cooling loop will self-adjust c1.1.2) TIC-1104 slightly higher				
	2) Malfunction of TIC-1104 logic and devices	2.1) Same as 1.*)					

Session: 1 02-13-95 Revision: 0 02-14-95 Dwg#: 9417-1006-C
Node: 13 Quench Cooler to Condenser Nozzle
Parameter: Flow Intention: Provide flow from Cooler to Condenser

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
No/Less Flow	1) Pluggage and blockage in line or nozzle	1.1) Reduced performance of condenser 1.2) Higher temperature at TIC-1104 1.3) Higher pressure at PIT-1102, and later by PI-1103 1.4) Tars to the middle oils	C1.1) Electric heat trace c1.2.1) Temperature alarm at TIC-1104 (S)H and HH c.1.3.1) Pressure alarm at PIT-1102 (S)H and HH				

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Lower Level	1) Failure of LIC-1108 logic or devices	1.1) Pump runs dry	C1.1) Alarms at LIC-1108 (S)L and LL	Review addition of independent LS for low level alarm		I B	
			c1.1.1) Low flow alarm at FIT-1121 (S)L and LL				
		1.2) Reduced or no spray	c1.1.3) High temp alarm at TIC-1104 (S)H and HH				
		1.3) Poor condenser performance	c1.5.1) LIT-1404 wil not rise aspected				
		1.4) Heavy oils to middle oils					
		1.5) Low flow to heavy product storage					
	2) Low product input	2.1) Same as 1.*)	c2.1.1) Same as 1.*)				
	3) System leak	3.1) Same as 1.*)	c3.1.1) Same as 1.*)				
		3.2) Toxic and flammable product release to local area.	c3.2.1) Area slab drain drains to storage tank and pretreat prior to discharge				
			c3.2.2) Approved fire protection program				
			c3.2.3) Oper. training				
			c3.2.4) IEPA approved constr. plan				
			c3.2.5) NEPA approved siting				
Higher Level	1) Failure of LIC-1108 logic or devices	1.1) Heavy oil to middle oil due to poor separation in C-301	C1.1) Alarms at LIC-1108 (S)H and HH	Review addition of independent LS for high level alarm		I B	
		1.2) Spill over to middle oil					

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
	2) Line pluggage or LV-1108 closed	2.1) Same as 1.*)	c2.1.1) Same as C1.1) C2.1) No change in FQIT-1401. C2.2) Heat tracing to reduce probability of pluggage				

Session: 1 02-13-95 Revision: 0 02-14-95 Dwg#: 9417-1006-C
Node: 15 Suction to G-301 from C-301
Parameter: Flow Intention: To provide fluid to pump G-301

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
No/Less Flow	1) Blockage or plugging	1.1) See Level-Node 14	1.1) Electric heat trace to reduce probability of plugging				
	2) Valve left closed	2.1) See Level-Node 14					
	3) Flush connections left open	3.1) See Level-Node 14					
No/Less Flow (pressure relief path)				Review moving block valve upstream of PSE tie-in		RS	

Session: 1 02-13-95 Revision: 0 02-14-95 Dwg#: 9417-1006-C
Node: 16 Pump G-301 Tar Quench Pump
Parameter: Flow Intention: Provide flow to Tar Quench Condenser and Cooler

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
No/Less Flow	1) Mechanical failure of pump	1.1) See Level Node 14	c1.2.1) Low flow alarm at FIT-1121 (S)L and LL				
		1.2) Low flow at FIT-1121	c1.3.1) ES alarm at ES-1118				
		1.3) Breaker trip	c1.4.1) Low pressure alarm at PIT-1102 (S)L and LL				
		1.4) Low pressure at PIT-1102					
	2) Electrical failure	2.1) Same as 1.*) except 1.3)	c2.1) Same as 1.*)				
	3) Operator error	3.1) Same as 2.1	c3.1) Same as 1.*) except c1.3.1)				
	4) Vent left open	4.1) See Low Level- Node 14					
	5) Seal failure/leakage	5.1) See Low Level- Node 14					

Session: 1 02-13-95 Revision: 0 02-14-95 Dwg#: 9417-1006-C
Node: 17 Pump Discharge to Tar Quench Cooler
Parameter: Flow Intention: Provide flow from Pump G-301 to Cooler E-301

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
No/Less Flow	1) Manual valve closed or not open enough	1.1) See Level -- Node 14					Note PV-1120 and associated logic will be removed Note manual valves have been added to mainline up and down stream of tee to Tar Storage Tank
	2) Blockage or plugging	2.1) Same as 1.*)	c2.1.1) Heat trace to reduce probability of plugging				
	3) Drain valve left open	3.1) Same as 1.*)	c3.1.1) Valve and cap				
	4) Leak or rupture	4.1) Same as 1.*)					
Reverse Flow	1) New upstream valve left close, leaving path for hot vapor to tar storage		1.1) Only possible during start-up. Rapid detection results in system shutdown		To be reviewed in S/D session		

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
No/Less Flow (after rupture burst)	1) Blockage or plugging	1.1) System overpressure	1.1) Electric heat trace	Review piping design to minimize plugging potential		RS	
More Flow (after rupture disc bursts)	1) Undetected rupture disc burst	1.1) Similar to Low flow Node 17	c1.1.1) Reduced flow at FIT-1121 c1.1.2) Low pressure at PIT-1102	Review use of orifice plate flow meter in this service (considering plugging and erosion) Review method for detecting rupture disc burst		RS I B	

Session: 1 02-13-95 Revision: 0 02-14-95 Dwg#: 9417-1006-C
Node: 19 Tar Quench Heat Exchanger E-301
Parameter: Flow Intention: Flowpath for recirc fluid only

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
More Flow	1) Tube leak or rupture	1.1) Gylcol in recirc side 1.2) Low gylcol level at gage LG-1113 (sight gage) 1.3) Contaminate tar system. Significant clean-up required		Review necessity for leak detection		I B	

Session: 1 02-13-95 Revision: 0 02-14-95 Dwg#: 9417-1006-C
Node: 19 Tar Quench Heat Exchanger E-301
Parameter: Temperature Intention: Reduce inlet temperature from 450F to 415F (Approx.)

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Higher Temperature	1) Undercooling on secondary side	1.1) C-304 performance reduced (See Node XX)	C1.1) Glycol system temperature control c1.1.1) TIC-1104 reads high and alarms (S)H and HH				
	2) Tube fouling	2.1) Same as 1.1) 2.2) High diffential pressure across cooler 2.3) Pump motor runs hotter	C2.1) TIC-1104 reads high and alarms (S)H and HH C2.2) Periodic maintenance	Review need for cooler local dP		I B	
Lower Temperature	1) Overcooling on secondary side	1.1) C-304 performance increased (See Node XX) 1.2) TV-1104 opens	C1.1) Glycol system temperature control c1.2.1) TIC-1104 opens up TV-1104 and alarms at (S)L and LL				

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
No/Less Flow (when relieving)	None						
More Flow (when not relieving)	1) Leaking or burst rupture disc	1.1) Unwanted release to relief system	C1.1) Double disc protection PSE-1105 and PSE-1107 C1.2) Peaking pressure gage PI-1106				

Session: 1 02-13-95 Revision: 0 02-14-95 Dwg#: 9417-1006-C
Node: 21 Product gas from C-301 to middle oil
Parameter: Flow Intention: Provide product flow from C-301 to middle oil

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
No/Less Flow	None			Remove PV and PY-1109		RS	

Session: 1 02-13-95 Revision: 0 02-14-95 Dwg#: 9417-1006-C
Node: 22 Tar product to storage tank
Parameter: Flow Intention: Provide flow to tar storage tank

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
No/Less Flow	1) Plugging or blockage	1.1) High level in tar separator	c1.1.1) High level and alarm at LIT-1108 (S)H and HH	Review line sizing and considering salting velocity		RS	
		1.2) Low flow to tank D-503	c1.2.1) Low flow at FIT-1401				
		1.3) Plugging due to low velocity	C2.1) Operator training and procedures				
	2) Manual valve left closed	2.1) Same as 1.*)					
	3) Failure of LV-1108	3.1) Same as 1.*)	C3.1) LV-1108 is FO				
More Flow	1) Failure of LV-1108	1.1) Low level in C-301	c1.2.1) Hi flow at FIT-1401				
		1.2) Higher flow to tank D-503					

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Higher Pressure	1) Any cause	1.1) Over pressure of regulator body 1.2) Shutdown of preheater 1.3) Recycle gas and air temp drops 1.4) Bed temp drops	c1.2.1) High pressure switch (set at 15") downstream of reg.trips unit c.1.2.2) Loss of flame at tip will be seen by scanner and unit is tripped. c1.3.1) Low temp alarm TIC-0729A/B (S)L and LL c1.4.1) Low temp alarm TE-0710/27 (S)L and LL	Verify max nat gas supply pressure Common shutdown alarm will be provided via PLC interface Operating procedures to address reduced coal feed rate operations for this event		B C RS I	
Lower Pressure	1) Any cause	1.1) Shutdown of preheater 1.2) Recycle gas and air temp drops 1.3) Bed temp drops	c1.1.1) Low pressure switch downstream of reg.trips unit c.1.1.2) Loss of flame at tip will be seen by scanner and unit is tripped. c1.2.1) same as Higher pressure c1.3.1) same as Higher pressure				

Session: 1 02-13-95 Revision: 0 02-15-95 Dwg#: 9417-1006-C
Node: 24 Recycle Gas from Preheater to Boosters
Parameter: Temperature Intention: Provide recycle gas at 1100F nominal

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Higher Temperature	1) Instrument error	1) Recycle gas to booster has higher temp	1.1) Booster heater controls response	Determine maximum temp for materials		B C	
			2.1) Stack temp Hi shutdown	Add indep. TESHH on recycle and air lines to shutdown heater		C	
				Add TS(S)H alarm to existing TE		RS	
				Review stress analysis and support design for piping		RS	
				Review line sizing/materials		B RS	
		2) Stack temp increases					
Lower Temperature	1) Instrument error	1) Recycle gas to booster has lower temp	1.1) Booster controls respond	Operating procedures to address reduced operations mode		I	
		2) Stack temp decreases					

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Higher Temperature	1) Instrument error	1) Air to booster has higher temp	1.1) Booster heater controls response	Determine maximum temp for materials		B C	
			2.1) Stack temp Hi shutdown	Add indep. TESHH (1200F) on recycle and air lines to shutdown heater		C	
				Add TS(S)H alarm to existing TE (1150F)		RS	
				Review stress analysis and support design for piping		RS	
				Review line sizing/materials		B RS	
		2) Stack temp increases					
Lower Temperature	1) Instrument error	1) Air to booster has lower temp	1.1) Booster controls respond	Operating procedures to address reduced operations mode		I	
		2) Stack temp decreases					

Session: 1 02-13-95 Revision: 0 02-15-95 Dwg#: 9417-1006-C
Node: 26 Recycle Gas Inlet to Preheater
Parameter: Flow Intention: Provide recycle gas to preheater at a rate of 4200#/hr

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
No/Less Flow	1) Manual valve left closed	1.1) Low flow to preheater	c1.2.1) Low flow alarms on FE-0901,-0738,and -0743 (S)L and LL				Note: FV-0901 has been removed
		1.2) Low flow at FE-0901, and FE-0738 and FE-0743	c1.2.2) FE-0901 (S)LL results in shutdown	Review need for additional shutdown potection switch for feeds to boosters A&B.		I B	
		1.3) Higher preheater exit temp					
		1.4) Lower bed velocity					
		1.5) Higher tube wall temp					
	2) Any other cause	2.1) Same as 1.*)					
More Flow	1) Tube rupture	1.1) Stack temp may increase	c1.1.1) High stack temp alarm and S/D				
		1.2) deleted	c1.3.1) High flow alarm at FE-0901 (S)H c1.4.1) Low flow alarm at FE-0738 and 0743 (S)L	Review need for flow balance and associated operating procedures. Also consider envir. impact.		I	
		1.3) Higher flow at FE-0901					
		1.4) Lower flow at FE-0738 and FE-0743					
		1.5) Bed velocity flow decreases					
		1.6) Release to environment					
	2) Any other	1.1) Exit temp	c1.1.1) TE-0729A and B				

Session: 1 02-13-95 Revision: 0 02-15-95 Dwg#: 9417-1006-C
Node: 26 Recycle Gas Inlet to Preheater
Parameter: Flow Intention: Provide recycle gas to preheater at a rate of 4200#/hr

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
	cause	decreases 1.2) Higher flow at FE-0901, -0738 and -0743 1.3) Bed velocity increases	alarm (S)H c1.2.1) High flow alarm on FE-0901,-0738, and 0743 (S)H				

Session: 1 02-13-95 Revision: 0 02-15-95 Dwg#: 9417-1006-C
Node: 27 Air inlet to Preheater
Parameter: Flow Intention: Provide air to the preheater at 670#/hr or 1350#/hr for both boosters

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
No/Less Flow	1) Air compressor failure	1.1) Low flow to preheater	c1.2.1) Low flow alarms on FE-09**,-0736,and -0741 (S)L and LL				Note: Butterfly valve has been removed
		1.2) Low flow at FE-09**, and FE-0736 and FE-0741	c1.2.2) FE-09** (S)LL results in shutdown	Review need for additional shutdown potection switch for feeds to boosters A&B.		I B	
				Add start-up block valve in air line to allow for start-up N2		I B	
		1.3) Higher preheater exit temp					
		1.4) Lower bed velocity					
		1.5) Higher tube wall temp					
	2) Any other cause	2.1) Same as 1.*)					
More Flow	1) Tube rupture	1.1) Stack temp decrease	c1.3.1) High flow alarm at FE-09** (S)H				
		1.2) deleted	c1.4.1) Low flow alarm at FE-0736 and 0741 (S)L	Review need for flow balance and associated operating procedures.		I	
		1.3) Higher flow at FE-09**					
		1.4) Lower flow at FE-0736 and FE-0741					
		1.5) Bed velocity flow decreases					
	2) Any other	1.1) Exit temp	c1.1.1) TE-0729A and B				

Session: 1 02-13-95 Revision: 0 02-15-95 Dwg#: 9417-1006-C
Node: 27 Air inlet to Preheater
Parameter: Flow Intention: Provide air to the preheater at 670#/hr or 1350#/hr for both boosters

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
	cause	decreases	alarm (S)H				
		1.2) Higher flow at FE-09**, -0736 and -0741	c1.2.1) High flow alarm on FE-09**,-0736, and 0741 (S)H				
		1.3) Bed velocity increases					
	3) Increase flow demand for loss of preheater	3.1) Unknown		Review off-normal flow conditions and changed flow conditions		I B	

Session: 1 02-13-95 Revision: 0 02-15-95 Dwg#: 9417-1006-C
Node; 28 Recycle gas inlet to Booster A
Parameter: Flow Intention: Provide recycle gas to Booster A a rate of 2550#/hr

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
No/Less Flow	1) Valve failure FV-0738	1.1) Low flow at FIT-0738	C1.1) Valve fails open	Review need for mechanical		I	Note: Control valve will be added to line
			c1.1.2) Low flow alarm at FIT-0738 (S)L	percent closed limit		B C	
		1.2) High temperature in Booster A resulting in potential damage to vessel and refractory	c1.4.1) High temp alarm at TE-0729A (S)H and TSHH-07** resulting in S/D	TSHH07** and resulting S/D logic will be added		C	
			c1.5.1) High temp alarms at TE-0710/27 (S)H and HH	Review preheated recycle gas piping material spec.		B	
		1.3) Low bed velocity	C1.1) Booster A air and nat gas valves modulate down to as low as low fire				
		1.4) High outlet temp from Booster A					
		1.5) High bed temp					
		1.6) Bed upset/ coal feed interuption					
More Flow	1) Valve fails open mechanical or logic problem	1.1) Booster exit temperature goes down	c1.1.1) Low temp alarm TE-0729A (S)L	Review max. flow rate thru valve to assist in upset evaluation		C RS	
			c1.2.1) Low temp indication at TE-0710/27				
		1.2) Bed temp decreases slowly	c1.3.1) High flow alarm FIT-0738 (S)H				
		1.3) High flow at FIT-0738					

Session: 1 02-13-95 Revision: 0 02-15-95 Dwg#: 9417-1006-C
Node: 29 Air inlet to Booster A
Parameter: Flow Intention: Provide air at a rate of 670 #/hr

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Less Flow	1) Valve failure FV-0729B down to protective stop	1.1) Low flow at FIT-0736	c1.1.2) Low flow alarm at FIT-0736 (S)L and resulting S/D	TE-0729 (S)LL should be removed		RS	Note: Control valve will be added to linr
		1.2) Low temperature in Booster A	c1.4.1) Low temp alarm at TE-0729A (S)L and LL				
		1.3) Low bed velocity	c1.5.1) High temp alarms at TE-0710/27 (S)L and LL				
		1.4) Lower outlet temp from Booster A	C1.1) Booster A nat gas valve modulate down				
		1.5) Lower bed temp	C1.2) Auto S/D on loss of flame detector				
		1.6) Bed upset/ coal feed interuption	c1.4.1) Operator training and procedures				
		1.7) Nat gas will increase due to temp demand		Review how control logic will respond		C	
	2) Booster B inlet valve too open	2.1) Same as above	C2.1) Same as above				
			C2.2) High flow alarm at FIT-0741 (S) H and HH				
More Flow	1) Valve fails open mechanical or logic problem	1.1) Booster exit temperature goes up	c1.1.1) High temp alarm TE-0729A (S)H				
		1.2) Bed temp up slowly	c1.1.2) High temp alarm TSHH-07** and resulting S/D				
		1.3) High flow at FIT-0736	c1.2.1) High temp indication at TE-0710/27				
		1.4) Nat gas will back-off on temp rise	c1.3.1) High flow alarm FIT-0736 (S)H				

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Less Flow	1) Valve failure FV-0729C down to protective stop	1.1) Low flow at FIT-0737	c1.1.2) Low pressure alarm at PSL-07** and resulting S/D c1.4.1) Low temp alarm at TE-07** (S)L and LL c1.5.1) Low temp alarms at TE-0710/27 (S)L and LL	TE-07** (S)LL should be removed		RS	Note: Control valve will be added to line Note: The design and control philosophy is the same as the burner management system for the preheater.
		1.2) Low temperature in Booster A	C1.1) Booster A air valve modulate down				
		1.3) Low bed velocity	C1.2) Auto S/D on loss of flame detector				
		1.4) Lower outlet temp from Booster A	c1.4.1) Operator training and procedures				
		1.5) Lower bed temp					
		1.6) Bed upset/ coal feed interuption					
		1.7) Air will decrease following gas		Review how control logic will respond		C	
	2) Booster B inlet valve too open	2.1) Same as above	C2.1) Same as above 1.*) C2.2) High flow alarm at FIT-0742 (S) H and HH				
	3) Block valve fails closed	3.1) Same as 1.*)	C3.1) Same as above 1.*) except PSL doesn't close block valve				
	4) Regulator failure	3.1) Same as 1.*)	4.1) Same as above 1.*)				
More Flow	1) Valve fails open mechanical or logic problem	1.1) Booster exit temperature goes up 1.2) Bed temp	c1.1.1) High temp alarm TE-07** (S)H c1.1.2) High temp alarm TSHH-07** and resulting				

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
		up slowly	S/D				
		1.3) High flow at FIT-0737	c1.3.1) High pressure switch PSH-07** alarm and resulting S/D				
		1.4) Air will back-off on temp rise	c1.3.2) Loss of flame tip seen by scanner and resulting S/D				
			c1.2.1) High temp indication at TE-0710/27				
			c1.3.1) High flow alarm FIT-0737 (S)H				
	2) Regulator fails	2.1) Same as 1.*)	C2.1) Same as 1.*0				
			C2.2) Flow control valve throttles back				

Session: 1 02-13-95 Revision: 0 02-15-95 Dwg#: 9417-1006-C
Node: 31 Booster Heater A
Parameter: Pressure Intention: Retain process materials at less than 35 psia

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Lower Pressure	1) Any leak	1.1) Release of hazardous materials 1.2) Lower bed temp 1.3) Bed upset	C1.1.1) Approved fire protection plan C1.1.2) Lower pressure in retort and PIT-0706 (S)L and (S)LL C1.1.3) Lower bed temp at TE-0710/27				

Session: 1 02-13-95 Revision: 0 02-15-95 Dwg#: 9417-1006-C
Node: 31 Booster Heater A
Parameter: Safety Intention: Maintain integrity of refractory

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Less Safety	1) Partial loss of refractory			Review need for detecting refractory failure (eg. heat sensitive paint)		I	

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
No/Less Flow	1) Valve failure FV-0743	1.1) Low flow at FIT-0743	C1.1) Valve fails open c1.1.2) Low flow alarm at FIT-0743 (S)L	Review need for mechanical percent closed limit		I B C	Note: Control valve will be added to line
		1.2) High temperature in Booster B resulting in potential damage to vessel and refractory	c1.4.1) High temp alarm at TE-07** (S)H and TSHH-07** resulting in S/D c1.5.1) High temp alarms at TE-0710/27 (S)H and HH C1.1) Booster B air and nat gas valves modulate down to as low as low fire	TSHH07** and resulting S/D logic will be added Review preheated recycle gas piping material spec.		C B	
		1.3) Low bed velocity					
		1.4) High outlet temp from Booster B					
		1.5) High bed temp					
		1.6) Bed upset/ coal feed interuption					
More Flow	1) Valve fails open mechanical or logic problem	1.1) Booster exit temperature goes down	c1.1.1) Low temp alarm TE-07** (S)L c1.2.1) Low temp indication at TE-0710/27	Review max. flow rate thru valve to assist in upset evaluation		C RS	
		1.2) Bed temp decreases slowly					
		1.3) High flow at FIT-0743	c1.3.1) High flow alarm FIT-0743 (S)H				

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Less Flow	1) Valve failure FV-0729D down to protective stop	1.1) Low flow at FIT-0741	c1.1.2) Low flow alarm at FIT-0741 (S)L and resulting S/D	TE-0729 (S)LL should be removed		RS	Note: Control valve will be added to line
		1.2) Low temperature in Booster B	c1.4.1) Low temp alarm at TE-07** (S)L and LL				
		1.3) Low bed velocity	c1.5.1) High temp alarms at TE-0710/27 (S)L and LL				
		1.4) Lower outlet temp from Booster B	C1.1) Booster B nat gas valve modulate down				
		1.5) Lower bed temp	C1.2) Auto S/D on loss of flame detector				
		1.6) Bed upset/ coal feed interuption	c1.4.1) Operator training and procedures				
		1.7) Nat gas will increase due to temp demand		Review how control logic will respond		C	
	2) Booster A inlet valve too open	2.1) Same as above	C2.1) Same as above				
			C2.2) High flow alarm at FIT-0741 (S) H and HH				
More Flow	1) Valve fails open mechanical or logic problem	1.1) Booster exit temperature goes up	c1.1.1) High temp alarm TE-07** (S)H				
		1.2) Bed temp up slowly	c1.1.2) High temp alarm TSHH-07** and resulting S/D				
		1.3) High flow at FIT-0741	c1.2.1) High temp indication at TE-0710/27				
		1.4) Nat gas will back-off on temp rise	c1.3.1) High flow alarm FIT-0741 (S)H				

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Less Flow	1) Valve failure FV-0729E down to protective stop	1.1) Low flow at FIT-0742	c1.1.2) Low pressure alarm at PSL-07** and resulting S/D	TE-07** (S)LL should be removed		RS	Note: Control valve will be added to line Note: The design and control philosophy is the same as the burner management system for the preheater.
			c1.4.1) Low temp alarm at TE-07** (S)L and LL				
			c1.5.1) Low temp alarms at TE-0710/27 (S)L and LL				
		1.2) Low temperature in Booster B	C1.1) Booster B air valve modulate down				
		1.3) Low bed velocity	C1.2) Auto S/D on loss of flame detector				
		1.4) Lower outlet temp from Booster B	c1.4.1) Operator training and procedures				
		1.5) Lower bed temp					
		1.6) Bed upset/ coal feed interuption					
		1.7) Air will decrease following gas		Review how control logic will respond		C	
	2) Booster A inlet valve too open	2.1) Same as above	C2.1) Same as above 1.*)				
			C2.2) High flow alarm at FIT-0742 (S) H and HH				
	3) Block valve fails closed	3.1) Same as 1.*)	C3.1) Same as above 1.*) except PSL doesn't close block valve				
	4) Regulator failure	3.1) Same as 1.*)	4.1) Same as above 1.*)				
More Flow	1) Valve fails open mechanical or logic problem	1.1) Booster exit temperature goes up	c1.1.1) High temp alarm TE-07** (S)H				
		1.2) Bed temp	c1.1.2) High temp alarm TSHH-07** and resulting				

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
		up slowly 1.3) High flow at FIT-0742 1.4) Air will back-off on temp rise	S/D c1.3.1) High pressure switch PSH-07** alarm and resulting S/D c1.3.2) Loss of flame tip seen by scanner and resulting S/D c1.2.1) High temp indication at TE-0710/27 c1.3.1) High flow alarm FIT-0742 (S)H				
	2) Regulator fails	2.1) Same as 1.*)	C2.1) Same as 1.*0 C2.2) Flow control valve throttles back				

Session: 1 02-13-95 Revision: 0 02-15-95 Dwg#: 9417-1006-C
Node: 35 Booster Heater B
Parameter: Pressure Intention: Retain material at a pressure of 35 psia

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Lower Pressure	1) Any leak	1.1) Release of hazardous materials 1.2) Lower bed temp 1.3) Bed upset	C1.1.1) Approved fire protection plan C1.1.2) Lower pressure in retort and PIT-0706 (S)L and (S)LL C1.1.3) Lower bed temp at TE-0710/27				

Session: 1 02-13-95 Revision: 0 02-15-95 Dwg#: 9417-1006-C
Node: 35 Booster Heater B
Parameter: Safety Intention: Maintain refractory integrity

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Less Safety	1) Partial loss of refractory			Review need for detecting refractory failure (eg. heat sensitive paint)		I	

Session: 1 02-13-95 Revision: 0 02-15-95 Dwg#: 9417-1006-C
Node: 36 Vent gases to Thermal oxidizer
Parameter: Flow Intention: Route vents to T/O at a rate of 959 #/hr

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
No/Less Flow	1) FV-136 fails closed	1.1) Back-up of the vent system	C1.1) FV-135 interlocked to open				
		1.2) T/O continues to run consuming additional fuel gas					
	2) Upstream effects (eg. valve left closed, plugging, etc.)	2.1) Same as 1.*)	c2.2.1) Pressure indication at the upstream systems				
		2.2) Pressure will build-up in upstream sources					
More Flow	1) Upstream sources exceed expected values	1.1) Increase temp in T/O	c1.1.1) Hi temp trip TE-122 (S)HH	Revise P&ID to reflect shutdown via TE-122 loop. Also indicate open flare diversion valve		C	
				Review PFD stream 503 instant. flow		B	
	2) Valve not closed during maintenance	2.1) Release hot gas to maintenance operators	c2.1.1) Blind at T/O				
	3) Valve fails to close on signal from TIC-108	3.1) Continued flow from upstream sources	c3.1.1) Low temp alarm at TIC-108 (S)L				
		3.2) Possible releases at above permit limits					

Session: 1 02-13-95 Revision: 0 02-15-95 Dwg#: 9417-1006-C
Node: 36 Vent gases to Thermal oxidizer
Parameter: Composition Intention: Heating value not to exceed 4 MBtu/hr

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
More Composition	1) Unknown	1.1) High temp in T/O and exhaust	c1.1.1) TE-122 (S)HH causes S/D	Review max heat value expected		I B	

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
No/Less Flow	1) Valve fails shut	1.1) High temp at TE-122 and TE-108	c1.1.1) TE-122 (S)HH results in S/D				
		1.2) High level at LIC-1310	c1.2.1) High level alarm at LIC-1310 (S)H and HH				
		1.3) Water into the middle oil system					
	2) Manual valve left closed	2.1) Same as 1.*)					
	3) Plugging of tip	3.1) Same as 1.*)					
	4) Low level in light oil separator	4.1) Same as 1.1		Review need for LIC-1310 (S)L and LL and addition of city water quench Revise design to address loss of sour quench water		I B RS	
More Flow	1) Upstream pressure source	1.1) Lower temp at TIC-108 and TE-122				C	

Session: 1 02-13-95 Revision: 0 02-16-95 Dwg#: 9417-1006-C
Node: 38 Weigh Hopper for Coarse Coal attached tote bag unloader
Parameter: Composition Intention: Moisture control

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Other Than Composition	1) Weather induced moisture	1.1) Difficult operation and freeze-up		Review need for weather protection	Temporary wind protection (such as a wall tarp) will be provided in the field (closed --3/15/95)	I B	

Session: 1 02-13-95 Revision: 0 02-16-95 Dwg#: 9417-1006-C
Node: 38 Weigh Hopper for Coarse Coal attached tote bag unloader
Parameter: Level Intention: Hold and measure coarse coal load

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	OMMENTS
Higher Level	1) Overfill operator error	1.1) Overfill 1.2) Cleanout and maintain	C1.1) WT-0602	Review and recommend how and where to determine weight of coal for a given run	Coal feed will be determined by the decrease in weight in the weigh hopper and correlated by the feed screw rate. Additional isolation valves eliminate simultaneous fill and feed concerns. Interlock isolation valve to high weight in weigh hopper. Revise level loop to high level switch only, not continuous readout. (3/15/95) Delete liner tensioner and liner impaler from Reimelt scope (3/15/95)	I B	

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
	2) Failure to flow out due to sticking	2.1) Same as above		Operating and maintenance procedures will include inspection of the cone lining		I	

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Reverse Flow	1) Poor seal of block valve	1.1) Not able to equalize pressure		Investigate design change to knife gate or other alternative isolation valve	Design to reflect use of 8" Macawber dome valves for coarse inlet and 6" for fine and all other coarse for isolation. (Valve supply no longer part of Reimelt scope) (3/15/95)	ALL	Cost info and stack height are to be considered
		1.2) Not able to feed coal					Note: Reimelt system is completely automated, P&ID will reflect this
	2) Instrument loop failure	2.1) Same as 1.*)	C2.1) Weight and level in weigh hopper does not decrease C2.2) Valve position ind.	Reimelt will review and revise PLC program to include a trouble alarm on weight change rate	PLC program will be revised (3/15/95)	R	
		2.2) Seal Valve could jam and fail					
No Flow (when required to flow)	1) Valve fails to open	1.1) No flow to lock hopper	C.1.1)Valve position ind.				
		1.2) No flow from the Weigh hopper	C.1.2) Weight and level in weigh hopper does not decrease				
	2) Instrument loop fails	2.1) Same as 1.*)					
	3) Plugging	3.1) Same as 1.*)					

Session: 1 02-13-95 Revision: 0 02-16-95 Dwg#: 9417-1006-C
Node: 40 Coarse coal lock hopper
Parameter: Pressure Intention: Operate between atmos. and 40 psia

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Higher Pressure	1) Failure of instrument loop	1.1) Overpressurization of vessel	C1.1.1) Rupture disc	Investigate pressure rating and pressure relieving on the N2 feed to Feed System	A downstream line PSV set at 50 psi will be supplied by Reimelt. (3/15/95)	B I R	
		1.2) Rupture first disc	C1.2.1) Peaking PI-0607				
Less Pressure	1) Instrument failure	1.1) Reverse flow		Investigate and recommend the addition of redundant pressure loops or other alternative	Severity of failure and probabilty of failure low, no immediate action required. Note: Spare nozzles are provided on the vessels to accommodate later modifications. (3/15/95)	R	PDI alternative to be considered
		1.2) System upset					
	2) N2 failure	2.1) Can't pressurize	C2.1.1) Delta Pressure control				
		2.2) Can't operate	C.2.1.2) PI-0608A				
	3) Leak or gasket failure	3.1) Same as 2.*)	C.3.1.1) Maintenance procedures				

Session: 1 02-13-95 Revision: 0 02-16-95 Dwg#: 9417-1006-C
Node: 40 Coarse coal lock hopper
Parameter: Level Intention: To hold coarse coal (25 cuft gross)

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Higher Level	1) Instrument loop failure	1.1) Overfill	C1.1) Manual inspection of weigh change c1.2.1) See node 39	Review weight change vs. time alarm and possible cut-off	Improved reliability by using Celtek probe. No safety issue. Sufficient information is	I B R RS	

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
		1.2) Plugging of feed line			provided with the existing instrumentation. DCS will be used to generate alarm (3/15/95)		

Session: 1 02-13-95 Revision: 0 02-16-95 Dwg#: 9417-1006-C
Node: 41 Fill line from Lock hopper to Feed hopper
Parameter: Flow Intention: Provide coarse coal from lock hopper to feed hopper

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Reverse Flow	1) Poor seal of block valve	1.1) Heat-up of feed line, material and release of gas from coal	C1.1) Valve position indication and interlocks to PLC controls	Investigate design change to knife gate or other alternative isolation valve	Design to reflect use of 8" Macawber dome valves for coarse inlet and 6" for fine and all other coarse for isolation. (Valve supply no longer part of Reimelt scope) (3/15/95)	ALL	Cost info and stack height are to be considered Note: Reimelt system is completely automated, P&ID will reflect this
		1.2) Inability to feed coal					
		1.3) System upset					
		1.4) Potential baghouse damage					
	2) Instrument loop failure	2.1) No consequence	C2.1) Lock hopper at same pressure	Reimelt will review and revise PLC program to include a trouble alarm on weight change rate	PLC program will be revised (3/15/95)	R	
No Flow (when required to flow)	1) Valve fails to open	1.1) No flow to feed hopper	C.1.1)Valve position ind.				
		1.2) No flow from the lock hopper	C.1.2) Level in lock hopper does not decrease				
		1.3) System shutdown operator initiated	C1.3) Level in feed hopper does not increase				
	2) Instrument loop fails	2.1) Same as 1.*)					
	3) Plugging	3.1) Same as 1.*)					

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Higher Pressure	1) Failure of instrument loop	1.1) Overpressurization of vessel	C1.1.1) Rupture disc C1.2.1) Peaking PI-0613	Investigate pressure rating and pressure relieving on the N2 feed to Feed System	Add in N2 header downstream PSV set at 50 psi. PSV now in Reimelt scope (same valve as in node 40 (3/15/95)	B I R	
		1.2) Rupture first disc					
	2) Gasifier upset	1.1) Back pressure to feed hopper	C.2.1) Same as C1.*) C.2.2) Gasifier pressure indication	Review need for continous bleed flow N2 to the feed hopper	Add a manual adjust rotometer and remove PV-08B (3/15/95)	I B R	
		1.2) Hot gases back-up line					
		1.3) Eventual plugging. Cleaning required.					
Less Pressure	1) Instrument failure	1.1) Reverse flow		Include in the review of the lock hopper pressure protection issue the need to protect the feed hopper	Severity of failure and probabilty of failure low, no immediate action required. Note: Spare nozzles are provided on the vessels to accommodate later modifications. (3/15/95)	R	
		1.2) System upset					
	2) N2 failure	2.1) Can't pressurize	C.2.1.1) PI-0608B C.2.1.2) Gasifier instrumentation				
		2.2) Can't operate					
		2.3) Unit upset					
	3) Leak or	3.1) Same as 2.*)	C.3.1.1) Maintenance				

Session: 1 02-13-95 Revision: 0 02-16-95 Dwg#: 9417-1006-C
Node: 42 Coarse coal feed hopper
Parameter: Pressure Intention: Maintain pressure at 35-40 psia

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
	gasket failure 4) Rupture leak or failure		procedures C4.1) Double disc protection				

Session: 1 02-13-95 Revision: 0 02-16-95 Dwg#: 9417-1006-C
Node: 42 Coarse coal feed hopper
Parameter: Level Intention: To hold 45 cuft gross

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Higher Level	1) Instrument loop failure	1.1) Overfill 1.2) Plugging of feed line 1.3) Valve may not close and thus indicate so.	C1.1) Manual inspection of level change at lock hopper				
	2) Plugging		C2.1) LI-0610 and the PLC program control				
No/Lower Level	1) Instrument loop failure	1.1) Empty hopper 1.2) No feed to screws 1.3) System interruption	c1.1.1) TE-0615 may decrease c1.1.2) Gasifier temp increase at TE-0710/27 c1.1.3) Hot oil retrun temp will rise				

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Other Than Instrumentation	1) Any malfunction	1.1) Loss of all level information	C1.1) Failure mode is total failure. Set to zero C1.2) High reliability of LT				
	2) Trouble with limited depth			Review appropriateness of ultrasonic probes	Revise design to utilize Celtek probes (3/15/95)	I B R	

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
More Flow	1) Discs rupture	1.1) Damage to any downstream components		Review routing of rupture disc discharge lines to flare	Route to T.O. stack (3/15/95)	I B	

Revision: 0 02-16-95 Dwg#: 9417-1006-C

Intention: Provide purge and pressurization flow

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
No/Less Flow	1) Interruption of N2 supply	1.1) Can't pressurize	C1.1) Local ind. PI-0619 and PI-0636				
		1.2) Can't feed	C1.2) Coal feed system PIT's 0608A and 0608B read low	Add PIT's low alarms (S)L		RS	
		1.3) Unit interruption					
	2) Valve or regulator failure	1.4) Potential for hot gas back-up at retort entrance					
	3) Leak/rupture	3.1) Reverse flow from retort to break	3.1.1) Gasifier feed line temp increases TE-0644 or 0645				
		3.2) Plugging in feed line due to reverse flow					
More Flow	1) Regulator fails	1) Higher pressure in hopper		Review need for line PSV	Add per node 42 (3/15/95)	I B	

Revision: 0 02-16-95 Dwg#: 9417-1006-C

Intention: Provide adequate vent/equalization flow from hoppers

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
No Flow (equalization mode)	1) Valve fails to open	1.1) System may oper poorly	C1.1) PIT-0608A C1.2) PLC interlock on sequence and alarm C1.3) Valve position ind.	All hopper N2 fill and vent valves FC		R	
No Flow (the vent mode)	1) Valve fails to open	1.1) System interruption	C1.1) Valve position ind. C1.2) PLC interlock on sequence and alarm C1.3) PIT-0608A				
	2) Plugging	2.1) Same as 1.*)		Review need for procedure to "blow" line clean after venting		I B	
More Flow thru vent valve in pressurize mode	1) Valve fails to closed	1.1) Can't pressurize	C1.1) Valve position ind. C1.2) Low pressure at PIT-0608A				
More Flow (vent mode)	1) Equalization valve leaks or fails to close	1.1) Can't hold pressure in feed hopper 1.2) Backflow from retort 1.3) System inop	C1.1) Valve position ind. C1.2) Low pressure at PI-0608B C1.3) High temp at TE-0615				

Session: 1 02-13-95 Revision: 0 02-16-95 Dwg#: 9417-1006-C
Node: 47 Baghouse system
Parameter: Flow Intention: Free flow from weigh hoppers to baghouse

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
No/Less Flow (to the baghouse)	1) Blower failure	1.1) Dust at loading area	c1.1.1) Operating procedures require respirator and eye prot.				
		1.2) Settling in lines	C1.1) Low reading on bag dP				
	2) High dP on bag	2.1) Same as 1.*)	C2.1) High dP at PDIT-0620 and alarm (S)H				
	3) Plugging in lines	3.1) Same as 1.1)	C2.2) Maintain bag with bag cleaning system (N2 pulse)				
No/Less Flow (baghouse to fines weigh hopper)	1) Plugging	1.1) Build-up of fines baghouse		Review design of recycle of fines and/or disposal	Design to reflect disposal of baghouse fines. Rotary valve located at top by baghouse. Discharge routed to grade for collection. No recycle. (3/15/95)	I B	
		1.2) High dP at PDIT-0620					
	2) Too low pressure in baghouse						

Session: 1 02-13-95 Revision: 0 02-16-95 Dwg#: 9417-1006-C
Node: 47 Baghouse system
Parameter: Composition Intention: Discharge particle free air

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
More Composition	1) Bag failure	1.1) Dust release to stack	1.1) low dP at PDIT-0620				
			1.2) Visual insp and maintenance procedures				
			1.3) Visual plume out of stack				

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Less Safety	1) explosion in baghouse	1.1) Damage to equipment	C1.1) Overpressure panel is supplied. (Note: NOT Explosion panel)	Review need for additional protection	Reimelt to provide explosion panel (3/15/95)	R	

Session: 1 02-13-95 Revision: 0 02-17-95 Dwg#: 9417-1006-C
Node: 48 Coarse Char Surge Vessel C-703
Parameter: Pressure Intention: Maintain pressure at 35 psia (nominal)

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Higher Pressure	1) block valve leak or left open		C1.1) N2 system has pressure regulation C1.2) Rupture disc protection				
Lower Pressure	1) leaks	1.1) Hot gas thru screw cooler	C1.1) PIT-15** C1.2) TE-0740 C1.3) TE-0728 (S)H and HH alarms	Provide software comparison of bed free-board pressure PIT-0701 and PIT-15** and possible alarm		I B RS	
		1.2) Local operator hazard	C1.4.1) Cooling by screw cooler	Revise P&ID to move TE-0728 to char inlet line upstream of N2 Review TE-0740 (S)HH shutdown of screw	WIll add FS in cooling water return to ensure flow. FSL will stop masterial feed. (3/15/95)	RS I B RS	
		1.3) Environmental release 1.4) High temperature into vessel					

Session: 1 02-13-95 Revision: 0 02-17-95 Dwg#: 9417-1006-C
Node: 48 Coarse Char Surge Vessel C-703
Parameter: Level Intention: Retain up to 25 cuft gross of coarse char

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	OMMENTS
Higher Level	1) Failure to discharge any cause	1.1) Overfill vessel and backfill fill line	C1.1) LT-**	Revise logic to reflect alarm (S)HH trips screw Review addition of back-up LS stop thru PLC	 Not a safety issue. Not required. Sufficient additional	RS R	

Session: 1 02-13-95 Revision: 0 02-17-95 Dwg#: 9417-1006-C
Node: 48 Coarse Char Surge Vessel C-703
Parameter: Level Intention: Retain up to 25 cuft gross of coarse char

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
		1.2) Possibly jam char cooling screw			information available to assess plant condition. (3/15/95)		

Session: 1 02-13-95 Revision: 0 02-17-95 Dwg#: 9417-1006-C
Node: 48 Coarse Char Surge Vessel C-703
Parameter: Sampling Intention: Potential sample point

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
No Sampling	1) Sample point flanged off			When piping defined, review if sampling at this point is appropriate		I RS	

Session: 1 02-13-95 Revision: 0 02-17-95 Dwg#: 9417-1006-C
Node: 49 Fill line from Coarse Char Surge Vessel to Blowcase
Parameter: Flow Intention: Transfer of char from surge vessel to blowcase

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
No Flow (when required to flow)	1) Valve fails to open	1.1) Same as node 48 - high level 1.2) System shutdown operator initiated	C.1.1)Valve position ind. and cycle interrupt C.1.2) Level in surge vessel does not decrease C1.3) Level in blowcase does not increase C1.4) No or less weight increase at blowcase C1.5) Same as node 48 high level				
	2) Instrument loop fails	2.1) Same as 1.*)					
	3) Plugging	3.1) Same as 1.*)					
More Flow	1) Valve leaks or doesn't close	1.1) Same as node 48 low pressure 1.2) Unwanted overfill of blowcase	c1.1.1) Same as node 48 low pressure c1.2.1) High level blowcase WIT-15** c1.2.2) High level blowcase LIT-15** C.1.1) Valve position ind. and cycle interrupt				

Session: 1 02-13-95 Revision: 0 02-17-95 Dwg#: 9417-1006-C
Node: 50 Coarse Char Blowcase C-704
Parameter: Pressure Intention: Maintain between atmos. and 35 psia

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Lower Pressure (below equalized pressure)	1) No equalization line	1.1) Poor operation		Revise design to reflect equalization line	Reimelt will revise PFD design to reflect equalization line and elimination of secondary conveyance line (3/15/95)	R	
Lower Pressure (when repressurizing)	1) Leakage	1.1) Can't return to service	c1.1.1) PIT-15**	Review PLC program permissives for PIT-15** and alarming	Within Reimelt existing scope	R	
	2) N2 system failure						
	3) Control loop failure						
Higher Pressure	1) Overpressure by N2	1.1) Pressure surge back to retort	C1.1) N2 overpressurization protection				

Session: 1 02-13-95 Revision: 0 02-17-95 Dwg#: 9417-1006-C
Node: 50 Coarse Char Blowcase C-704
Parameter: Level Intention: Contain coarse char up to a volume 19 cuft gross

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Higher Level	1) Failure to discharge any cause	1.1) Overfill vessel and backfill fill line and surge vessel	C1.1) LT-15**	Revise logic to reflect alarm (S)HH		RS	
			C1.2) WIT-15**				
			c1.1.1) Operator training and procedures				

Session: 1 02-13-95 Revision: 0 02-17-95 Dwg#: 9417-1006-C
Node: 51 Coarse char pneumatic conveyence to Storage Hopper D-702
Parameter: Flow Intention: Convey char to storage vessel

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
No Flow	1) Discharge valve fails to open	1.1) Product not conveyed	c.1.1) Rate of discharge by weight PLC calc and alarm c1.2) Valve ind.				
	2) Plugging	2.1) Same as 1.1)	c2.1.1) Same as c.1.1)				
	3) N2 supply valves failure	2.1) Same as 1.1)	c.3.1.1) Same as c.1.1) c.3.1.2) PIT-15**				
More Flow (in the isolation mode)	1) Valve leakage or failure	1.1) Inability to pressurize the blowcase		Investigate design to increase reliability (eg. double valving)	Revise design to reflect Macawber valve and a butterfly valve on blowcase discharge. Between surge vessel and blowcase utilize 1 Macawber valve (3/15/95)	R I B	
				Investigate price of utilizing air for conveyence, followed by N2 purge of vessel	Reimelt's very approx. consumption of 4000 cfh is well within the current N2 supply capacity. Project will proceed with N2 supply only, no air system. (3/15/95)	R	

Session: 1 02-13-95 Revision: 0 02-17-95 Dwg#: 9417-1006-C
Node: 51 Coarse char pneumatic conveyence to Storage Hopper D-702
Parameter: Pressure Intention: Provide sufficient pressure to adequately convey char to storage vessel

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS

Session: 1 02-13-95 Revision: 0 02-17-95 Dwg#: 9417-1006-C
Node: 52 Coarse char Storage Hopper D-702
Parameter: Pressure Intention: Maintain vessel at near atmos

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Higher Pressure	1) During conveyence			Verify over/under pressure protection	Adequate protection already include in base design (3/15/95)	R	
Lower Pressure	1) During draining						

Session: 1 02-13-95 Revision: 0 02-17-95 Dwg#: 9417-1006-C
Node: 52 Coarse char Storage Hopper D-702
Parameter: Level Intention: Maintain Char level acceptable

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Higher Level	1) Overfill		C1.1) LIT-16**	Add (S)H alarm to PLC	Celtek probes will be provided RS will add to DCS logic (3/15/95)	R RS	

Session: 1 02-13-95 Revision: 0 02-17-95 Dwg#: 9417-1006-C
Node: 53 Fill line from D-702 to Supersac
Parameter: Flow Intention: Provide flow to the supersac

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
							Note: rotary valve no longer VS
No/Less Flow	1) Rotary valve failure	1.1) No flow to sac	c1.1.1) Visual insp. of bag fill c1.1.2) No weight gain in fill measuring system				
	2) Plugging	2.1) Same as 1.1) 2.2) Maintenance					
	3) Scale fails	3.1) Bag overfill and back-up 3.2) May damage rotary valve	c.3.1.1) Visual insp. of operation				

Session: 1 02-13-95 Revision: 0 02-17-95 Dwg#: 9417-1006-C
Node: 53 Fill line from D-702 to Supersac
Parameter: Temperature Intention: Temperature not hazardous to operators

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Higher Temperature	1) Any cause	1.1) Personnel safety		Add thermal couple bin cone area and interlock to rotary valve	IGT will incorporate into operating procedures (3/15/95)	R I	

Revision: 0 02-17-95 Dwg#: 9417-1006-C

Intention: Provide adequate flow to vent supported vessels and systems

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
No/Less Flow (to the baghouse)	1) Blower failure	1.1) Possible settling in lines	C1.1) Low reading on bag dP	Review impact of air conveying on the thermal oxidizer Also reverse flow	No air conveying. Non-issue. (3/15/95)	I B	
		1.2) Reverse flow from Thermal oxidizer					
	2) High dP on bag	2.1) Same as 1.*)	C2.1) High dP at PDIT-16** and alarm (S)H				
	3) Plugging in lines	3.1) Same as 1.1)	C2.2) Maintain bag with bag cleaning system (N2 pulse)				
No/Less Flow (baghouse to dump bag)	1) Failure of rotary valve	1.1) Build-up of fines baghouse	c1.2.1) Alarm on high dP at PDIT-16**	Review design of disposal (assuming continuous operation when conveyence in operation)	Baghouse routed to disposal. Rotary valve located near baghouse. Collect at grade. (3/15/95)	I B R	
		1.2) High dP at PDIT-16**					

Session: 1 02-13-95
Node: 54 Char Storage Baghouse
Parameter: Composition

Revision: 0 02-17-95 Dwg#: 9417-1006-C

Intention: Maintain discharge particle free

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
More Composition	1) Bag failure	1.1) Dust release to thermal oxidizer	1.1) low dP at PDIT-16**				
			1.2) Visual insp and maintenance procedures				
			1.3) Caught by scrubber				

Session: 1 02-13-95 Revision: 0 02-17-95 Dwg#: 9417-1006-C
Node: 55 Char Fines Surge Vessel C-701
Parameter: Pressure Intention: Maintain pressure at 35 psia (nominal)

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Higher Pressure	1) block valve leak or left open		C1.1) N2 system has pressure regulation C1.2) Rupture disc protection				
Lower Pressure	1) leaks	1.1) Hot gas thru screw cooler	C1.1) PIT-15** C1.2) TE-1003 C1.4.1) Cooling by screw cooler	Provide software comparison of bed free-board pressure PIT-0701 and PIT-15** and possible alarm		I B RS	
		1.2) Local operator hazard		Review TE-1003 (S)HH shutdown of screw	WIll add FS in cooling water return to ensure flow. FSL will stop masterial feed. (3/15/95)	I B RS	
		1.3) Environmental release					
		1.4) High temperature into vessel					

Session: 1 02-13-95 Revision: 0 02-17-95 Dwg#: 9417-1006-C
Node: 55 Char Fines Surge Vessel C-701
Parameter: Level Intention: Retain up to 25 cuft gross of coarse char

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Higher Level	1) Failure to discharge any cause	1.1) Overfill vessel and backfill fill line	C1.1) LT-**	Revise logic to reflect alarm (S)HH trips screw		RS	
				Review addition of back-up LS stop thru PLC	Not a safety issue. Not required. Sufficient additional information available to assess plant condition. (3/15/95)	R	

Session: 1 02-13-95 Revision: 0 02-17-95 Dwg#: 9417-1006-C
Node: 55 Char Fines Surge Vessel C-701
Parameter: Level Intention: Retain up to 25 cuft gross of coarse char

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
		1.2) Possibly jam char cooling screw					

Session: 1 02-13-95 Revision: 0 02-17-95 Dwg#: 9417-1006-C
Node: 55 Char Fines Surge Vessel C-701
Parameter: Sampling Intention: Potential sample point

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
No Sampling	1) Sample point flanged off			When piping defined, review if sampling at this point is appropriate		I RS	

Session: 1 02-13-95 Revision: 0 02-17-95 Dwg#: 9417-1006-C
Node: 56 Fill line from Char Fines Surge Vessel to Blowcase
Parameter: Flow Intention: Transfer of char from surge vessel to blowcase

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
No Flow (when required to flow)	1) Valve fails to open	1.1) Same as node 55 - high level 1.2) System shutdown operator initiated	C.1.1)Valve position ind. and cycle interrupt C.1.2) Level in surge vessel does not decrease C1.3) Level in blowcase does not increase C1.4) No or less weight increase at blowcase C1.5) Same as node 55 high level				
	2) Instrument loop fails	2.1) Same as 1.*)					
	3) Plugging	3.1) Same as 1.*)					
More Flow	1) Valve leaks or doesn't close	1.1) Same as node 48 low pressure 1.2) Unwanted overfill of blowcase	c1.1.1) Same as node 48 low pressure c1.2.1) High level blowcase WIT-15** c1.2.2) High level blowcase LIT-15** C.1.1) Valve position ind. and cycle interrupt				

Session: 1 02-13-95 Revision: 0 02-17-95 Dwg#: 9417-1006-C
Node: 57 Char Fines Blowcase C-702
Parameter: Pressure Intention: Maintain between atmos. and 35 psia

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Lower Pressure (below equalized pressure)	1) No equalization line	1.1) Poor operation		Revise design to reflect equalization line	Reimelt will revise PFD design to reflect equalization line and elimination of secondary conveyance line (3/15/95)	R	
Lower Pressure (when repressurizing)	1) Leakage	1.1) Can't return to service	c1.1.1) PIT-15**	Review PLC program permissives for PIT-15** and alarming	Within Reimelt existing scope	R	
	2) N2 system failure						
	3) Control loop failure						
Higher Pressure	1) Overpressure by N2	1.1) Pressure surge back to retort	C1.1) N2 overpressurization protection				

Session: 1 02-13-95 Revision: 0 02-17-95 Dwg#: 9417-1006-C e: 57 Char Fines Blowcase C-702
Parameter: Level Intention: Contain coarse char up to a volume 19 cuft gross

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Higher Level	1) Failure to discharge any cause	1.1) Overfill vessel and backfill fill line and surge vessel	C1.1) LT-15** C1.2) WIT-15** c1.1.1) Operator training and procedures	Revise logic to reflect alarm (S)HH		RS	

Session: 1 02-13-95 Revision: 0 02-17-95 Dwg#: 9417-1006-C
Node: 58 Char Fines pneumatic conveyence to Storage Hopper D-701
Parameter: Flow Intention: Convey char to storage vessel

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
No Flow	1) Discharge valve fails to open	1.1) Product not conveyed	c.1.1) Rate of discharge by weight PLC calc and alarm				
			c1.2) Valve ind.				
	2) Plugging	2.1) Same as 1.1)	c2.1.1) Same as c.1.1)				
	3) N2 supply valves failure	2.1) Same as 1.1)	c.3.1.1) Same as c.1.1)				
			c.3.1.2) PIT-15**				
More Flow (in the isolation mode)	1) Valve leakage or failure	1.1) Inability to pressurize the blowcase		Investigate design to increase reliability (eg. double valving)	Revise design to reflect Macawber valve and a butterfly valve on blowcase discharge. Between surge vessel and blowcase utilize 1 Macawber valve (3/15/95)	R I B	
				Investigate price of utilizing air for conveyence, followed by N2 purge of vessel	Reimelt's very approx. consumption of 4000 cfh is well within the current N2 supply capacity. Project will proceed with N2 supply only, no air system. (3/15/95)	R	

Session: 1 02-13-95 Revision: 0 02-17-95 Dwg#: 9417-1006-C
Node: 58 Char Fines pneumatic conveyence to Storage Hopper D-701
Parameter: Pressure Intention: Provide sufficient pressure to adequately convey char to storage vessel

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS

Session: 1 02-13-95 Revision: 0 02-17-95 Dwg#: 9417-1006-C
Node: 59 Char Fines Storage Hopper D-701
Parameter: Pressure Intention: Maintain vessel at near atmos

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Higher Pressure	1) During conveyence			Verify over/under pressure protection	Adequate protection already include in base design (3/15/95)	R	
Lower Pressure	1) During draining						

Session: 1 02-13-95 Revision: 0 02-17-95 Dwg#: 9417-1006-C
Node: 59 Char Fines Storage Hopper D-701
Parameter: Level Intention: Maintain Char level acceptable

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Higher Level	1) Overfill		C1.1) LIT-16**	Add (S)H alarm to PLC	Celtek probes will be provided RS will add to DCS logic (3/15/95)	R RS	

Session: 1 02-13-95 Revision: 0 02-17-95 Dwg#: 9417-1006-C
Node: 60 Fill line from D-701 to Supersac
Parameter: Flow Intention: Provide flow to the supersac

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
							Note: rotary valve no longer VS
No/Less Flow	1) Rotary valve failure	1.1) No flow to sac	c1.1.1) Visual insp. of bag fill c1.1.2) No weight gain in fill measuring system				
	2) Plugging	2.1) Same as 1.1) 2.2) Maintenance					
	3) Scale fails	3.1) Bag overfill and back-up 3.2) May damage rotary valve	c.3.1.1) Visual insp. of operation				

Session: 1 02-13-95 Revision: 0 02-17-95 Dwg#: 9417-1006-C
Node: 60 Fill line from D-701 to Supersac
Parameter: Temperature Intention: Temperature not hazardous to operators

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Higher Temperature	1) Any cause	1.1) Personnel safety		Add thermal couple bin cone area and interlock to rotary valve	IGT will incorporate into operating procedures (3/15/95)	R	

Session: 1 02-13-95 Revision: 0 02-16-95 Dwg#: 9417-1006-C
Node: 61 Weigh Hopper for Coal Fines and attached tote bag unloader
Parameter: Composition Intention: Moisture control

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Other Than Composition	1) Weather induced moisture	1.1) Difficult operation and freeze-up		Review need for weather protection	Provide roof and field installation of side wall tarp	I B	

Session: 1 02-13-95 Revision: 0 02-16-95 Dwg#: 9417-1006-C
Node: 61 Weigh Hopper for Coal Fines and attached tote bag unloader
Parameter: Level Intention: Hold and measure coarse coal load

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Higher Level	1) Overfill operator error	1.1) Overfill	C1.1) WT-0622	Review and recommend how and where to determine weight of coal for a given run	Coal feed will be determined by the decrease in weight in the weigh hopper and correlated by the feed screw rate. Additional isolation valves eliminate simultaneous fill and feed concerns. Interlock isolation valve to high weight in weigh hopper. Revise level loop to high level switch only, not continuous readout. (3/15/95)	I B	
		1.2) Cleanout and maintain			Delete liner tensioner and liner impaler from Reimelt scope (3/15/95)		
	2) Failure to flow out due to sticking	2.1) Same as above		Operating and maintenance procedures will include inspection of the cone lining		I	

Session: 1 02-13-95 Revision: 0 02-16-95 Dwg#: 9417-1006-C
Node: 62 Fill line from Weigh Hopper to Lockhopper (fines)
Parameter; Flow Intention: Flow control and isolation of transfer from weigh hopper to lock hopper

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Reverse Flow	1) Poor seal of block valve	1.1) Not able to equalize pressure		Investigate design change to knife gate or other alternative isolation valve	Design to reflect use of 8" Macawber dome valves for coarse inlet and 6" for fine and all other coarse for isolation. (Valve supply no longer part of Reimelt scope) (3/15/95)	ALL	Cost info and stack height are to be considered
		1.2) Not able to feed coal					Note: Reimelt system is completely automated, P&ID will reflect this
	2) Instrument loop failure	2.1) Same as 1.*)	C2.1) Weight and level in weigh hopper does not decrease C2.2) Valve position ind.	Reimelt will review and revise PLC program to includ a trouble alarm on weight change rate	PLC program will be revised (3/15/95)	R	
		2.2) Seal Valve could jam and fail					
No Flow (when required to flow)	1) Valve fails to open	1.1) No flow to lock hopper	C.1.1)Valve position ind.				
		1.2) No flow from the Weigh hopper	C.1.2) Weight and level in weigh hopper does not decrease				
	2) Instrument loop fails	2.1) Same as 1.*)					
	3) Plugging	3.1) Same as 1.*)					

Session: 1 02-13-95 Revision: 0 02-16-95 Dwg#: 9417-1006-C
Node: 63 Coal Fines Lockhopper
Parameter: Pressure Intention: Operate between atmos. and 40 psia

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Higher Pressure	1) Failure of instrument loop	1.1) Overpressurization of vessel	C1.1.1) Rupture disc	Investigate pressure rating and pressure relieving on the N2 feed to Feed System	A downstream line PSV set at 50 psi will be supplied by Reimelt. (3/15/95)	B I	
		1.2) Rupture first disc	C1.2.1) Peaking PI-0627				
Less Pressure	1) Instrument failure	1.1) Reverse flow		Investigate and recommend the addition of redundant pressure loops or other alternative	Severity of failure and probabilty of failure low, no immediate action required. Note: Spare nozzles are provided on the vessels to accommodate later modifications. (3/15/95)	R	PDI alternative to br considered
		1.2) System upset					
	2) N2 failure	2.1) Can't pressurize	C2.1.1) Delta Pressure control				
		2.2) Can't operate	C.2.1.2) PI-0628A				
	3) Leak or gasket failure	3.1) Same as 2.*)	C.3.1.1) Maintenance procedures				

Session: 1 02-13-95 Revision: 0 02-16-95 Dwg#: 9417-1006-C
Node: 63 Coal Fines Lockhopper
Parameter: Level Intention: To hold coarse coal (25 cuft gross)

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Higher Level	1) Instrument loop failure	1.1) Overfill	C1.1) Manual inspection of weigh change c1.2.1) See node 62	Review weigh change vs. time alarm and possible cut-off	Improved reliability by using Celtek probe. No safety issue. Sufficient information is provided with	I B R RS	

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
		1.2) Plugging of feed line			the existing instrumentation. DCS will be used to generate alarm (3/15/95)		

Session: 1 02-13-95 Revision: 0 02-16-95 Dwg#: 9417-1006-C
Node: 64 Fill Line from Lockhopper to Feed Vessel (Fines)
Parameter: Flow Intention: Provide coarse coal from lock hopper to feed hopper

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Reverse Flow	1) Poor seal of block valve	1.1) Heat-up of feed line, material and release of gas from coal	C1.1) Valve position indication and interlocks to PLC controls	Investigate design change to knife gate or other alternative isolation valve	Design to reflect use of 8" Macawber dome valves for coarse inlet and 6" for fine and all other coarse for isolation. (Valve supply no longer part of Reimelt scope) (3/15/95)	ALL	Cost info and stack height are to be considered Note: Reimelt system is completely automated, P&ID will reflect this
		1.2) Inability to feed coal					
		1.3) System upset					
		1.4) Potential baghouse damage					
	2) Instrument loop failure	2.1) No consequence	C2.1) Lock hopper at same pressure	Reimelt will review and revise PLC program to includ a trouble alarm on weight change rate	PLC program will be revised (3/15/95)	R	
No Flow (when required to flow)	1) Valve fails to open	1.1) No flow to feed hopper	C.1.1)Valve position ind.				
		1.2) No flow from the lock hopper	C.1.2) Level in lock hopper does not decrease				
		1.3) System shutdown operator initiated	C1.3) Level in feed hopper does not increase				
	2) Instrument loop fails	2.1) Same as 1.*)					
	3) Plugging	3.1) Same as 1.*)					

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Higher Pressure	1) Failure of instrument loop	1.1) Overpressurization of vessel	C1.1.1) Rupture disc C1.2.1) Peaking PI-0633	Investigate pressure rating and pressure relieving on the N2 feed to Feed System	Add in N2 header downstream PSV set at 50 psi. PSV now in Reimelt scope (same valve as in node 40 (3/15/95)	B I	
		1.2) Rupture first disc					
	2) Gasifier upset	1.1) Back pressure to feed hopper	C.2.1) Same as C1.*) C.2.2) Gasifier pressure indication	Review need for continous bleed flow N2 to the feed hopper	Add a manual adjust rotometer and remove PV-08B (3/15/95)	I B R	
		1.2) Hot gases back-up line					
		1.3) Eventual plugging. Cleaning required.					
Less Pressure	1) Instrument failure	1.1) Reverse flow		Include in the review of the lock hopper pressure protection issue the need to protect the feed hopper	Severity of failure and probabilty of failure low, no immediate action required. Note: Spare nozzles are provided on the vessels to accommodate later modifications. (3/15/95)	R	
		1.2) System upset					
	2) N2 failure	2.1) Can't pressurize	C.2.1.1) PI-0628B C.2.1.2) Gasifier instrumentation				
		2.2) Can't operate					
		2.3) Unit upset					
	3) Leak or	3.1) Same as 2.*)	C.3.1.1) Maintenance				

Session: 1 02-13-95 Revision: 0 02-16-95 Dwg#: 9417-1006-C
Node: 65 Coal Fines Feed Vessel
Parameter: Pressure Intention: Maintain pressure at 35-40 psia

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
	gasket failure		procedures				
	4) Rupture leak or failure		C4.1) Double disc protection				

Session: 1 02-13-95 Revision: 0 02-16-95 Dwg#: 9417-1006-C
Node: 65 Coal Fines Feed Vessel
Parameter: Level Intention: To hold 45 cuft gross

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Higher Level	1) Instrument loop failure	1.1) Overfill	C1.1) Manual inspection of level change at lock hopper				
		1.2) Plugging of feed line					
		1.3) Valve may not close and thus indicate so.					
	2) Plugging		C2.1) LI-0630 and the PLC program control				
No/Lower Level	1) Instrument loop failure	1.1) Empty hopper	c1.1.1) TE-0635 may decrease				
		1.2) No feed to screws	c1.1.2) Gasifier temp increase at TE-0710/27				
		1.3) System interruption	c1.1.3) Hot oil retrun temp will rise				

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Intention: Provide adequate flow for the various relief conditions

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
No/Less Flow (main flow)	1) Plugging	1.1) Back-up of relief header	C1.1) Knock-out drum protects discharge line				
	2) Valve fails closed	1.2) Same as 1.1	C1.2) Same as C1.1)				
(pilot gas)	1) Any cause	1.1) Loss of pilot	c1.1.1) Low temp alarms TSL445 and 444				
		1.2) Non-ignited atmospheric release					
More Flow	1) Any cause			Flare loads will be confirmed as part of the relief study		B	
Reverse Flow	1) Back flow from atmospheric conditions	1.1) Oxygen in relief system	C1.1) Check valve in line	Callidus to provide recommendation on flare design and replacement of check valve with molecule seal		C	

Session: 2 03-14-95
Node: 66 Flare
Parameter: Temperature

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Intention: Dual pilots always on

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Lower Temperature	1) Loss of either pilot (any cause)	1.1) None	C1.1) Dual pilots C1.2) Thermal couple on each pilot TE444A and 445 A.	Callidus will revise PLC to try to re-ignite pilot and alarm if unsuccessful		C	
	2) Loss of both pilots	2.1) Loss of flare combustion	C2.1) Low temp alarms TSL-444 and 445 C2.2) Cut-off gas to pilots				

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Other Than Composition	1) Pure N2 release	1.1) None					
	2) H2S and N2	2.1) Release to atmosphere	C2.1) Intermittant and unlikely. Release is elevated.				
	3) Hot Syntherm vapors	3.1) Release to atmosphere	c3.1.1) Non-toxic c3.1.2) K.O. pot protects against large liquid releases	MSDS required		B	

Session: 2 03-14-95 Revision: 0 03-14-95 Dwg#: 9417-1006-C
Node: 67 Bypass around T.O to K.O. pot
Parameter: Flow Intention: Flow to flare in the bypass mode

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
More Flow (not bypass mode)	1) FV-135 fails open	1.1) Flared release	C1.1) Limit switch on valve is monitored by the PLC	DCS will pick-up information and display as appropriate		RS	
		1.2) Reduced load on the T.O.					
No/Less Flow (bypass mode)	1) FV-135 fails in closed position when FV-136 closes	1.1) Back-up vent system	c1.1.1) Relieve via rupture discs	Review re-routing bypass to scubber instead of flare		B I	
			c1.1.2) Release to flare	Review routing of char baghouse vent to T.O.		B I	
				Review capacity of T.O. for the max flow condition		C	

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Intention: Isolate or purge as required by design

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Startup/SD Emergency Shutdown	1) Manual trip	1.1) Isolate nat gas to all heaters	c1.*.1) All valves spring to safe position				
		1.2) Open air valves to all heaters except the boosters					
		1.3) Closed air to booster heaters					
		1.4) Kill power to PLC outputs					
		1.5) N2 purge whole system		Add automated purge. Revise P&ID 009 to reflect automatic valve in N2 line upstream of FV-01.		RS	
		1.6) S/D all feed screws		Review ESD philosophy		B I	
		1.7) Trip hot oil pumps					
		1.8) Open ESD valve off of secondary cyclone					
		1.9) Relieve to flare		Provide max design capacity of flare		C	

Session: 2 03-14-95 Revision: 0 03-16-95 Dwg#: 9417-1006-C
Node: 69 Tar Separator to middle oil separator (see node 21)
Parameter: Flow Intention: Provide flow path from Tar Separator to Middle Oil Separator

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
No/Less Flow	1) Manual valve left closed	1.1) Unit upset 1.2) Pressure in retort increases	c1.2.1) PIT-1109 reads high c1.2.2) PIT-1109 PAH and (HH) alarms c1.2.3) Low pressure at PIT-1208 c1.2.4) Low pressure alarm at PAL and (LL)				
	2) XV-01A valve open	2.1) Release to flare 2.2) Pressure in system decreases 2.3) Unit upset	c2.1.1) Low pressure at PIT-1208, PIT-1202 and PIT-1109 c2.1.2) Low pressure alarms PAL and (LL) -1109 -1202 and -1208				
	3) Plugging in air cooler	3.1) Same as 1.*)	c3.1.1) Same as c1.*.*)				
	4) Flush valves left open	4.1) Release to environment	c4.1.1) Operator training and procedures c4.1.2) Odor detection	Add blind flange to flush connections		RS	
	5) Air cooler tube leak or rupture	5.1) Release to environment 5.2) Potential fire	c5.1.1) Located outside of primary structure c5.1.2) Possible odor detection c5.1.3) PIT-1208 reads lower than normal c5.1.4) Relatively low heating value.				

Session: 2 03-14-95 Revision: 0 03-16-95 Dwg#: 9417-1006-C
Node: 69 Tar Separator to middle oil separator (see node 21)
Parameter: Temperature Intention: Cool gas down to 170F

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Higher Temperature	1) Fan failure	1.1) Discharge temperature rises	c1.1.1) TAH-1206 (H) and (HH) alarms on the cooler skid				
		1.2) Less condensation of middle oil	c1.1.2) Local run lights				
		1.3) Middle oil carry-over to light oil					
	2) Tube fouling	2.1) Discharge temperature above normal	c2.1.1) Same as c1.1.1)	Add additional downstream TE (TIT-1216) off of cooler skid		RS	
			c2.1.2) Flush connections are provided				
		2.2) Higher upstream pressure (gradual)					
		2.3) Less condensation of middle oil					
		2.4) Middle oil carry-over to light oil					
	3) Damper failure	3.1) Similar to 1.*)	c3.1.1) Same as c1.1.1)				
	4) Instrument loop	4.1) Similar to 1.*)	c4.1.1) Same as c1.1.1)				
Lower Temperature	1) Loop calibration error	1.1) No significant consequences					
	2) Louver failure						

Session: 2 03-14-95 Revision: 0 03-16-95 Dwg#: 9417-1006-C
Node: 70 Middle oil separator
Parameter: Temperature Intention: Maintain temperature above 40F

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Lower Temperature	1) Failure of heat trace	1.1) No significant consequence, only affects start-up freeze protection					

Session: 2 03-14-95 Revision: 0 03-16-95 Dwg#: 9417-1006-C
Node: 70 Middle oil separator
Parameter: Pressure Intention: Maintain the pressure in the vessel between 23 and 27 psia

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Higher Pressure	1) Valve doesn't open enough						All issues covering pressure control other than PSE are on hold until compressor selection is completed
	2) Instrument loop calibr. error						
	3) ESD valve closed						
	4) Blocked nozzle	4.1) Overpressurize vessel	c4.1.1) PSE-1209 sized for worst case between blocked nozzle or fire				
	5) Fire	5.1) Overpressurize vessel	c5.1.1) Same as c4.1.1)				

Session: 2 03-14-95 Revision: 0 03-16-95 Dwg#: 9417-1006-C
Node: 70 Middle oil separator
Parameter: Level Intention: Maintain liquid level between 12" and 24"

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
No/Less Level	1) Level transmitter failure	1.1) Pump runs dry	c1.1.1) LG-1210 c1.1.2) Loop failure alarm	Add back-up low level switch on C-302 pump cut-off and alarm (LSH-1217)		RS	
		1.2) Pump gas to run tank					

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
	2) Loop calibration error	2.1) Pump runs dry	c2.1.1) LG-1210				
		1.2) Pump gas to run tank					
	3) Root valve left open		c3.1.1) Double protection via valve and cap				
Higher Level	1) Nozzle plugged	1.1) No flow of middle oil to run tank	c1.1.1) High level at LIT-1211 and alarm H(S)				
			c1.1.2) No or low full at FIT-1407 and alarm S(L)				
		1.2) Overfill separator and may damage compressor	c1.1.3) LG-1210				
			c1.1.4) High level alarm and compressor trip LSH-1214 S(H) and S(HH)				
	2) Loop calibration error	2.1) Same as 1.*)	c2.1.1) No or low full at FIT-1407 and alarm S(L)				
			c2.1.2) LG-1210				
			c2.1.3) High level alarm and compressor trip LSH-1214 S(H) and S(HH)				

Session: 2 03-14-95 Revision: 0 03-16-95 Dwg#: 9417-1006-C
Node: 71 Middle oil separator to run tank
Parameter: Flow Intention: Flow path from separator to run tank

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
No/Less Flow	1) Manual valve closed	1.1) Same as Node 70 Level High	c1.1.1) Same as Node 70 Level High c1.1.2) Low pressure at PI-1212				
	2) Pump failure	2.1) Same as 1.1	c2.1.1) Same as c1.1.1) c2.1.2) Pump motor status UA-1213				
	3) Control valve failure	3.1) Same as 1.1)	c3.1.1) Same as c1.1.1) c3.1.2) High pressure at PI-1212	Delete LV/LY-1211 and revise logic to pump control		RS	
	4) Plugging	4.1) Same as 1.1)	c4.1.1) Same as c1.1.1)				
Other Than Flow				Develop operating scenarios		I	

Session: 2 03-14-95 Revision: 0 03-16-95 Dwg#: 9417-1006-C
Node: 71 Middle oil separator to run tank
Parameter; Pressure Intention: Maintain pressure below design pressure for associated piping and equipment

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Higher Pressure	1) Dead head pump	1.1) Overpressurize system	C1.1) Internal relief on pump				

Session: 2 03-14-95 Revision: 0 03-17-95 Dwg#: 9417-1006-C
Node: 72 Run tank
Parameter: Temperature Intention: Maintain temperature above 40F

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Lower Temperature	1) Failure of heat trace	1.1) Set-up of fluid	c1.1.1) TIT-1412 low temp alarms (S)L and (S)LL				

Session: 2 03-14-95 Revision: 0 03-17-95 Dwg#: 9417-1006-C
Node: 72 Run tank
Parameter: Pressure Intention: Maintain the pressure between 0 and 1-2 psi

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Higher Pressure	1) PRV 1421 failure	1.1) Overpressurize vessel	c1.1.1) PSE 1409 set at 10 psig c1.1.2) PCV -1422 shuts off c1.1.3) PI-1410				
	2) PCV 1422 failure	2.1) Same as 1.1)	c2.1.1) PSE 1409 set at 10 psig c2.1.2) PRV -1421 opens c2.1.3) PI-1410				
Lower Pressure	1) PCV 1422 fails	1.1) Draw vacuum in vessel 1.2) Pump cavitation	c1.1.1) PI-1410 c1.1.2) Low level alarms LIT-1408 (S)L and (S)LL	Add vacuum breaker		RS	

Session: 2 03-14-95 Revision: 0 03-16-95 Dwg#: 9417-1006-C
Node: 72 Run tank
Parameter: Level Intention: Maintain level below 80% capacity

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Higher Level	1) Plugged discharge	1.1) Increased level in the tank 1.2) Overfill tank 1.3) Relieve thru rupture disc to K.O. pot and flare	c1.1.1) Hi level alarm LIT-1408 (S)H and (S)HH c1.1.2) Operator training and procedures				
	2) Instrument loop failure	2.1) Same as 1.*)	c2.1.1) Loop failure alarm				

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Intention: Maintain level below 80% capacity

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
			c2.1.2) Operator training and procedures				
	3) Loop calibration error	3.1) Same as 1.*)	c3.1.1) Operator training and procedures				
No/Less Level	1) Operator error	1.1) Pump runs dry	c1.1.1) Low level alarm LIT-1408 (S)L and (S)LL				
		1.2) Blow N2 to tanker	c1.1.2) Operator training and procedures				
	2) Loop calibr. error	2.1) Same as 1.*)	c2.1.1) Operator training and procedures				
	3) Loop failure	3.1) Same as 1.*)	c3.1.1) Operator training and procedures				
			c3.1.2) Loop failure alarm				

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
No/Less Flow	1) Manual valve closed	1.1) Dead head compressor	c1.1.1) Operator training and procedures				
		1.2) Unit upset	c1.1.2) High pressure at PIT-1301				
		1.3) High pressure in C-302	c1.1.3) High pressure alarms at PIT-1301 (S)H and (S)HH.				
		1.4) Low pressure in C-303	c1.1.4) High pressure at PIT1208	Review of set pressure to be performed with compressor selection and considering preheater coils		RS	
		1.5) High pressure upstream of manual valve	c1.1.5) High pressure alarms PIT-1208(S)H and (S)HH				
		1.6) No change in level in C-303	c1.1.6) PSV-1205 set ** psig design for compressor dead head flow				
		1.7) Reduced temperature at cooling water side discharge					
	2) Plugging in cooler	2.1) Same as 1.*)	c2.1.1) Same as c1.1.*)				
	3) Compressor failure	3.1) Unit upset	c3.1.1) Compressor trip alarm UA-1207				
		3.2) Low pressure in C-303	c3.1.2) High pressure alarm PIT-1208 (S)H and (S)HH				
		3.3) Higher pressure in C-302	3.1.3) Low pressure alarm in PIT-1301 (S)L and (S)LL				
Other Than Flow	1) Tube failure	1.1) Water in the light oil	c1.1.1) Reduce flow indication on cooling water return line	Add flow indication and totalizing logic on sour water to T.O. line. Remove solenoid LV-		RS	

Session: 2 03-14-95 Revision: 0 03-16-95 Dwg#: 9417-1006-C
Node: 73 Middle oil separator to the light oil separator
Parameter: Flow Intention: Flow path for recycle gas from middle oil separator to light oil separator

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
				1310A (not required, already supplied on Callidus skid) Review Callidus control logic to ensure that Callidus logic does not back-up sour water discharge		I B	
		1.2) Increase water at C-303 boot 1.3) Contaminated product at run tank					

Session: 2 03-14-95 Revision: 0 03-16-95 Dwg#: 9417-1006-C
Node: 73 Middle oil separator to the light oil separator
Parameter: Temperature Intention: Reduce temperature from 300F to 100F

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Higher Temperature	1) Loss of cooling water	1.1) High temperature in C-303 1.2) Less product 1.3) Higher load on T.O. 1.4) Higher heating valve of recycle gas 1.5) Increased potential for carbon deposition in preheater F-202 1.6) Less load on water boot	C1.1) FIT-1303 low flow c1.1.1) TIT-1306 high temp alarms (S)H and (S) HH	Add low flow alarms		RS	

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
		1.7) Less load on run tank					
	2) Fouling	2.1) Same as 1.*)	c2.1.1) TIT-1306 high temp alarms (S)H and (S) HH				
Lower Temperature	1) Overcooling due to any reason	No significant consequence					

Session: 2 03-14-95 Revision: 0 03-17-95 Dwg#: 9417-1006-C
Node: 75 Light oil separator
Parameter: Pressure Intention: Maintain pressure below vessel 75 (??) psig

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Higher Pressure	1) Any cause	1.1) Overpressurize vessel	c1.1.1) PSV-1309 set at 75 (??) psig and design capacity for fire or blocked outlet	Review pressure protection of the light oil quench cooler (gas side)			

Session: 2 03-14-95 Revision: 0 03-16-95 Dwg#: 9417-1006-C
Node: 75 Light oil separator
Parameter: Level Intention: Maintain light oil level at between ** and ** and the water level in the boot below **

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
No/Less Level (oil)	1) Instument loop failure	1.1) Recycle gas to the run tank	c1.1.1) Gear pump has minimum flow thru C1.1) Failure of instrument loop fails to the shut-off condition	Add low level LS (same as middle oil) with pump control and remove control valve		RS	
		1.2) Recycle gas then flows thru the run tank to the T.O.					
	2) Instrument loop calibr. error	2.1) Same as 1.*)	c2.1.1) Operator training and procedures				
(water)	1) Instument loop failure	1.1) Oil to the sour water line to the T.O.	C1.1) Failure of instrument loop fails to the shut-off condition	Add low water level switch protection		RS	
		1.2) Higher temp potential in T.O.	c1.2.1) High temperature alarm in T.O.				
	2) Instrument loop calibr. error		c2.1.1) Operator training and procedures				
Higher Level (oil)	1) Instument loop failure	1.1) Carry oil over with the recycle gas to the preheater	c1.1.1) Production rate low c1.1.2) Instrument failure alarm				
		1.2) May carbon up the preheater					
	2) Instrument loop calibr.	2.1) Same as 1.*)	c2.1.1) Low production rate				

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
	error						
(water)	1) Instument loop failure	1.1) High water level in C-303 boot	c1.1.1) Low production rate				
		1.2) Water into the run tank					
	2) Instrument loop calibr. error	2.1) Same as 1.*)	c2.1.1) Low production rate				

Session: 2 03-14-95 Revision: 0 03-16-95 Dwg#: 9417-1006-C
Node: 76 Light oil separator to run tank
Parameter: Flow Intention: Flow path from separator to run tank

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
No/Less Flow	1) Manual valve closed	1.1) Same as Node 75 Level High	c1.1.1) Same as Node 75 Level High c1.1.2) Low flow at FIT-1407	Delete manual valve downsteam of FIT		RS	
	2) Pump failure	2.1) Same as 1.1	c2.1.1) Same as c1.1.1) c2.1.2) Pump motor status UA-1311				
	3) Control valve failure	3.1) Same as 1.1)	c3.1.1) Same as c1.1.1)	Delete LV/LY-1308 and revise logic to pump control		RS	
	4) Plugging	4.1) Same as 1.1)	c4.1.1) Same as c1.1.1)				
	5) Drain open	5.1) Release to environment	c5.1.1) Operator training and procedures c5.1.2) Double protection block valve and cap				
Reverse Flow			Check valve and positive displacement pump				

Session: 2 03-14-95 Revision: 0 03-16-95 Dwg#: 9417-1006-C
Node: 76 Light oil separator to run tank
Parameter: Pressure Intention: Maintain pressure below design pressure for associated piping and equipment

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Higher Pressure	1) Dead head pump	1.1) Overpressurize system	C1.1) Internal relief on pump				

Session: 2 03-14-95 Revision: 0 03-17-95 Dwg#: 9417-1006-C
Node: 77 Light oil separator sour water to incinerator
Parameter: Flow Intention: Provide flow path from light oil boot to T.O.

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
No/Less Flow	1) Manual valve closed	1.1) Same as High level (water) in node 75 1.2) Low flow to T.O.	c1.1.1) Same as High level (water) in node 75 c.1.2.1) Fresh water make-up to T.O. (in Callidus design)				
	2) Plugging	2.1) Same as 1.*)	c2.1.1) Same as c1.*.*)				
	3) Control valve failure	3.1) Same as 1.*)	c3.1.1) Same as c1.*.*)				
Reverse Flow	1) Check valve failure		C1.1) C-303 operating pressure higher than T.O. C1.2) High level alarm in C-303 boot LIT-1310 (S)H and (S)HH				

Session: 2 03-14-95 Revision: 0 03-16-95 Dwg#: 9417-1006-C
Node: 78 Low pressure depressurization line
Parameter: Flow Intention: ESD line

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
More Flow	1) Valve fails open, any reason	1.1) Unit upset 1.2) Relieve to flare	C1.1) Unit shutdown as designed c1.2.1) Flare capacity designed for this event				

Parameter: Flow Intention: Provide flow path from light oil separator to T.O. during operation to bleed-off production

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
No/Less Flow	1) Manual valve closed	1.1) Higher pressure in C-303	c1.1.1) PSV 1309 lifts to flare c1.1.2) PI-1307 c.1.1.3) PIT-1301 high pressure alarm (S)H	Add flow measurement and indication		RS	
	2) Control valve failure	2.1) Same as 1.1)	c2.1.1) Same as c1.1.*) c2.1.2) PIT-1305 high pressure alarm (S)H and (S)HH				
More Flow	1) Control valve fails open	1.1) Insufficient recycle gas 1.2) Bed disturbance	c1.1.1) Low flow alarm FIT-0901 (S)L				

Session: 2 03-14-95 Revision: 0 03-17-95 Dwg#: 9417-1006-C e: 80 Recycle gas to the T.O.
Parameter: Pressure Intention: Control pressure in process loop

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Higher Pressure				To be reviewed as part of the over-all pressure regulation/ compressor control study		B I	

Session: 2 03-14-95 Revision: 0 03-17-95 Dwg#: 9417-1006-C
Node: 81 Recycle gas to preheater (See node 26)
Parameter: Flow Intention: Provide flow path from light oil separator to preheater

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
No/Less Flow	1) Manual or check valve closed	See node 26	See node 26				

Session: 2 03-14-95 Revision: 0 03-17-95 Dwg#: 9417-1006-C
Node: 82 Coarse char from retort to coarse char surge vessel
Parameter: Flow Intention: Provide flow from retort to surge vessel at approx. 900 lbs/hr

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
No/Less Flow	1) Plugging	1.1) Char build-up in bed 1.2) Unit upset 1.3) Low level in surge vessel 1.4) Lower temperature in flow lines 2.1) Same as 1.*)	c1.1.1) PDI-0703/02 high alarms (S)H and (S)HH c1.1.2) TE-0728/40 high temp alarms (S)L and (S)LL c2.1.1) Same as c1.*.*)				
	2) Driver failure	2.1) Same as 1.*)	c2.1.1) Driver status alarm UA-0746 c2.1.2) Same as c1.1.*)				
More Flow	1) Miscalibration of discharge rate	1.1) Bed goes to minimum draw-off point 1.2) No significant impact	c1.1.1) PDI-0703/02 low indication				
Other Than Flow	1) Cooling water leak into char side	1.1) Steam generation 1.2) Downstream condensation 1.3) Interrupt solids product flow 1.4) Run interruption	c1.1.1) Low flow switch FSL-0752 and alarm (S)L				

Session: 2 03-14-95 Revision: 0 03-17-95 Dwg#: 9417-1006-C
Node: 82 Coarse char from retort to coarse char surge vessel
Parameter: Temperature Intention: Discharge coarse char at 140F

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Higher Temperature	1) Insufficient cooling	1.1) Hot char at surge vessel	C1.1) Low flow on cooling water return line. Stops screw and alarms (S)H and (S)HH	Insure that over-pressurization protection on cooling water side		RS	
		1.2) Personnel hazard		Add no-touch screens in appropriate locations (such as C-703)		RS	

Session: 2 03-14-95 Revision: 0 03-17-95 Dwg#: 9417-1006-C
Node: 83 Fine char from cyclone to fine char surge vessel
Parameter: Flow Intention: Provide flow from cyclone to surge vessel at approx. 900 lbs/hr

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
No/Less Flow	1) Plugging	1.1) Char to liquid recovery	c1.1.1) TE-1003 high temp alarm (S)L and (S)LL				
		1.2) Low level in surge vessel	c1.1.2) No/less change in the fines surge vessel LIT-15**				
		1.3) Plugging in quench condenser and pump	c1.1.3) Eventually lower than expected fines discharge rate WE-15**				
		1.4) Lower temperature in flow lines					
	2) Driver failure	2.1) Same as 1.*)	c2.1.1) Driver status alarm UA-1004				
			c2.1.2) Same as c1.1.*)				
More Flow	1) Miscalibration of discharge rate	1.1) No significant impact					
Other Than Flow	1) Cooling water leak into char side	1.1) Steam generation	c1.1.1) Low flow switch FSL-1005 and alarm (S)L				
		1.2) Downstream condensation					
		1.3) Interrupt solids product flow					
		1.4) Run interruption					

Session: 2 03-14-95 Revision: 0 03-17-95 Dwg#: 9417-1006-C
Node: 83 Fine char from cyclone to fine char surge vessel
Parameter: Temperature Intention: Discharge coarse char at 140F

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
Higher Temperature	1) Insufficient cooling	1.1) Hot char at surge vessel	C1.1) Low flow on cooling water return line. Stops screw and alarms (S)H and (S)HH	Insure that over-pressurization protection on cooling water side		RS	

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Node: 83 Fine char from cyclone to fine char surge vessel
Parameter: Temperature Intention: Discharge coarse char at 140F

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
		1.2) Personnel hazard		Add no-touch screens in appropriate locations (such as C-701)		RS	

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Intention: Flow from gasifier to secondary cyclone and solids back to retort

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
No/Less Flow (inlet)	1) Plugging	1.1) Unit upset 1.2) Reverse flow in return dip leg 1.3) Dip leg plugging	c1.1.1) PIT-0709 low pressure alarm (S)L and (S)LL c1.1.2) PDIT-0705 alarms low (S)L and (S)LL				
(gas outlet)	1) Plugging	1.1) Unit upset	c1.1.1) PIT-0709 low pressure alarm (S)L and (S)LL c1.1.2) PIT-0706 high pressure alarm (S)H and (S)HH				
(solids return)	1) Plugging	1.1) Increase solids carry over to secondary cyclone 1.2) Overwhelm secondary cyclone yielding carry over to the liquids recovery					

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Intention: Provide flow path from primary cyclone to liquids recovery and solids to char fines collection

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
No/Less Flow (inlet)	1) Plugging	1.1) See node 84 outlet	c.1.1.1) See node 84 outlet				
(gas outlet)	1) Plugging	1.1) Stop gas flow from gasifier, unit upset	c1.1.1) See node 84 outlet	Review relief study, ESD philosophy, mechanical design limits of equipment and the compressor pressure control		B RS	
		1.2) Send gas to char fines collection					
(solids outlet)	1) Plugging	1.1) Same as No/less Flow node 83	c1.1.1) Same as No/less Flow node 83				

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Intention: Closed loop cooling of the tar quench cooler

DEVIATION	CAUSES	CONSEQUENCES	SAFEGUARDS	RECOMMENDATIONS	REMARKS	BY	COMMENTS
No/Less Flow	1) Leak or break	1.1) Potential environmental release	c1.1.1) Contaminated drain collection system provides environmental release protection				