APPENDIX A. Catalyst Life Test Data

Table A-1. PRELIMINARY LIFE TESTS
(Catalyst BASF K8-11)

Run No.	1		2		3		4	
Catalyst (BASF K8-11), g	30.8		30.8		30.8		30.8	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	0	0	200	200	425	425	630	630
Temperature, Furnace, °F	572	572	574	574	574	574	574	574
Temperature, Reactor Entrance, °F	515	515	566	566	569	569	543	543
Temperature, Middle Bed, °F	574	574	577	577	580	580	564	564
ΔP H_2S	2000	2000	1950	1950	1430	1430	1600	1600
Flow Rate, H_2S, lb-mol/hr	0.0015	0.0015	0.0012	0.0012	0.0011	0.0011	0.0012	0.0012
Flow Rate, Feed, lb-mol/hr	0.0053	0.0137	0.0053	0.0137	0.0053	0.0137	0.0053	0.0137
Flow Rate, H_2O, lb-mol/hr	0.007342	0.007342	0.007342	0.007342	0.007342	0.007342	0.007342	0.007342
Flow Rate, C_6H_6, lb-mol/hr	0.001095	0.001095	0.001095	0.001095	0.001095	0.001095	0.001095	0.001095
Temperature, Steam, °F	495	495	492	492	487	487	486	486
Temperature, Benzene, °F	75	75	75	75	75	75	75	75
Feed Composition, mol %								
CO	22.0	8.4	22.0	8.4	22.0	8.4	22.0	8.4
CO_2	15.2	5.8	15.2	5.8	15.2	5.8	15.2	5.8
H_2	40.7	15.6	40.7	15.6	40.7	15.6	40.7	15.6
CH_4	21.3	8.1	21.3	8.1	21.3	8.1	21.3	8.1
C_2H_6	0.1	0.04	0.1	0.04	0.1	0.04	0.1	0.04
H_2S	0.53	0.20	0.53	0.20	0.53	0.20	0.53	0.20
COS	0.15	0.06	0.15	0.06	0.15	0.06	0.15	0.06
C_6H_6	0.02	8.00	0.02	8.00	0.02	8.00	0.02	8.00
H_2O	--	53.80	--	53.80	--	53.80	--	53.80
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Product Flow Rate, lb-mol/hr	0.0055	0.0139	0.0064	0.0149	0.0051	0.0136	0.0053	0.0137
Product Composition, mol %								
CO	22.3	8.7	23.7	10.2	24.2	9.1	4.3	1.6
CO_2	14.3	5.6	15.8	6.8	16.2	6.1	26.2	10.1
H_2	42.0	16.5	37.4	16.2	36.3	13.7	50.06	19.2
CH_4	20.4	8.00	22.5	9.70	22.7	8.6	18.2	7.00
C_2H_6	0.1	0.04	0.1	0.04	0.1	0.04	0.10	0.04
H_2S	0.69	0.27	0.45	0.19	0.42	0.15	0.31	0.12
COS	0.15	0.06	0.03	0.01	0.03	0.01	0.01	--
C_6H_6	0.06	7.90	0.01	7.30	0.01	8.10	0.82	8.29
H_2O	--	52.93	--	49.56	--	54.20	--	53.65
Total	100.00	100.00	99.99	100.00	99.94	100.00	100.00	100.00
CO Consumed, lb-mol/hr	nil	--	nil	--	nil	--	0.000928	--
CO_2 Produced, lb-mol/hr	nil	--	0.00022	--	nil	--	0.000586	--
H_2 Produced, lb-mol/hr	0.00015	--	0.00027	--	nil	--	0.000504	--
H_2O Used, lb-mol/hr	--	--	--	--	--	--	0.001283	--
Space Velocity, SCF/hr-cu ft	3588	--	3852	--	3503	--	3544	--

Preceding page blank

Table A-2. PRELIMINARY LIFE TESTS (CCI Catalyst C-25-1-02, 1/16-in. Extruded Rods)

Run No.	5		6		7		8	
Catalyst (C-20-6-02), g	25.0		25.0		25.0		25.0	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	700	700	700	700	595	595	595	595
Temperature, Furnace, °F	720	720	740	740	680	680	680	680
Temperature, Reactor Entrance, °F	535	535	541	541	558	558	560	560
Temperature, Middle Bed, °F	478	478	478	478	560	560	555	555
Al H_2S	2000	2000	1850	1850	1800	1800	1800	1800
Flow Rate, H_2S, lb-mol./hr	0.0016	0.0016	0.0016	0.0016	0.0016	0.0016	0.0016	0.0016
Flow Rate, Feed, lb-mol./hr	0.02738	0.04635	0.02738	0.04838	0.02872	0.04562	0.02872	0.04880
Flow Rate, H_2O, lb-mol./hr	0.019	0.019	0.019	0.019	0.017	0.017	0.017	0.017
Flow Rate, C_6H_6, lb-mol/hr	--	--	0.002	0.002	--	--	0.003	0.003
Temperature, Steam, °F	500	500	500	500	500	500	500	500
Temperature, Benzene, °F	70	70	70	70	80	80	80	80
Feed Composition, mol %								
CO	28.2	16.6	28.2	15.9	13.1	8.2	13.1	7.7
CO_2	15.8	9.3	15.8	8.9	9.1	5.7	9.1	5.3
H_2	31.4	18.5	31.4	17.7	63.9	40.2	63.9	37.5
CH_4	22.7	13.4	22.7	12.8	12.0	7.6	12.0	7.1
C_2H_6	0.1	0.06	0.1	0.06	0.1	0.06	0.1	0.06
H_2S	1.7	0.99	1.7	0.95	1.7	1.1	1.7	1.0
COS	0.1	0.06	0.1	0.06	0.1	0.06	0.1	0.06
C_6H_6	--	--	--	4.1	--	--	--	6.7
H_2O	--	41.09	--	39.53	--	--	--	--
Total	100.0	100.00	100.0	100.00	100.0	100.00	100.0	100.00
Product Flow Rate, lb-mol./hr	0.02738	0.04635	0.02738	0.04836	0.02872	0.04562	0.02872	0.04886
Product Composition, mol %								
CO	17.9	10.6	17.8	10.1	8.1	5.1	5.7	3.3
CO_2	14.8	8.7	20.5	11.6	5.6	3.5	5.3	3.1
H_2	48.4	28.6	43.15	24.4	74.85	47.1	75.42	44.3
CH_4	18.0	10.6	17.5	9.9	7.5	4.7	6.1	3.6
C_2H_6	0.1	0.06	0.1	0.06	0.1	0.06	0.1	0.06
H_2S	0.7	0.4	0.9	0.5	3.8	2.4	7.2	4.2
COS	0.05	0.02	0.05	0.02	0.05	0.06	0.18	1.0
C_6H_6	--	--	--	4.2	--	--	--	6.7
H_2O	--	41.02	--	39.22	--	37.08	--	33.74
Total	99.95	100.00	100.00	100.00	100.00	100.00	100.00	100.00
CO Consumed, lb-mol./hr	0.00282	--	0.00285	--	0.00144	--	0.00212	--
CO_2 Produced, lb-mol./hr	0.00026	--	0.00128	--	0.00100	--	0.00109	--
H_2 Produced, lb-mol./hr	0.00466	--	0.00322	--	0.00314	--	0.00331	--
H_2O Used, lb-mol./hr	0.0055	--	0.0069	--	0.00198	--	0.00198	--
Space Velocity, SCF/hr-cu ft	14,627	--	15,199	--	14,358	--	15,387	--

Table A-3. PRELIMINARY LIFE TESTS
(Girdler Catalyst G-3B, −6+8 Mesh)

Run No.	9		10		11		12	
Catalyst, g	40.2		40.2		34.2		34.2	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	530	530	520	520	300	300	230	230
Temperature, Furnace, °F	720	720	720	720	660	660	650	650
Temperature, Reactor Entrance, °F	496	496	498	498	538	538	604	604
Temperature, Middle Bed, °F	715	715	712	712	731	731	750	750
ΔP H_2S	--	--	1280	1280	--	--	857	857
Flow Rate, H_2S, lb-mol./hr	--	--	0.0001	0.0001	--	--	0.00007	0.00007
Flow Rate, Feed, lb-mol./hr	0.0133	0.0212	0.0122	0.0198	0.0070	0.0186	0.0070	0.0236
Flow Rate, H_2O, lb-mol./hr	0.0079	0.0079	0.0076	0.0076	0.0115	0.0115	0.0166	0.0166
Flow Rate, C_6H_6, lb-mol./hr	0.0007	0.0007	--	--	--	--	--	--
Temperature, Steam, °F	700	700	700	700	660	660	650	650
Temperature, Benzene, °F	80	80	--	--	--	--	--	--
Feed Composition, mol %								
CO	22.5	14.1	21.1	13.0	23.0	8.7	23.0	6.8
CO_2	15.7	9.8	14.9	9.2	16.7	6.3	16.7	4.9
H_2	34.1	21.4	42.6	26.3	35.2	13.3	35.2	10.5
CH_4	21.2	13.3	20.0	12.3	21.8	8.3	21.8	6.5
C_2H_6	0.08	0.05	0.1	0.05	0.1	0.04	0.1	0.03
H_2S	0.04	0.02	0.5	0.3	0.16	0.05	0.16	0.05
COS	0.14	0.08	0.11	0.05	0.14	0.05	0.14	0.04
C_6H_6	5.5	3.5	0.2	0.1	0.1	0.04	0.1	0.03
N_2	0.74	0.5	0.5	0.3	2.7	1.0	2.7	0.8
H_2O	--	37.25	--	38.4	--	62.22	--	70.35
Total	100.00	100.00	100.01	100.00	99.90	100.00	99.90	100.00
Product Flow Rate, lb-mol./hr	0.0126	0.0205	0.0119	0.0196	0.0071	0.0186	0.0072	0.0237
Product Composition, mol %								
CO	22.1	13.6	20.3	12.4	22.8	8.7	19.2	5.8
CO_2	15.1	9.3	14.2	8.7	16.5	6.3	14.3	4.3
H_2	34.3	21.1	44.2	27.0	35.2	13.4	44.5	13.5
CH_4	20.9	12.9	18.9	11.6	22.0	8.4	18.4	5.6
C_2H_6	0.08	0.05	0.1	0.05	0.1	0.04	0.1	0.03
H_2S	0.08	0.05	0.84	0.5	0.15	0.05	0.88	0.2
COS	0.08	0.05	0.11	0.05	0.13	0.05	0.12	0.03
C_6H_6	6.66	3.9	0.8	0.46	0.6	0.2	1.0	0.3
N_2	0.7	0.4	0.5	0.30	2.5	0.95	1.4	0.4
H_2O	--	38.65	--	38.94	--	61.91	--	69.84
Total	100.00	100.00	99.95	100.00	99.98	100.00	99.90	100.00
CO Consumed, lb-mol./hr	nil	--	nil	--	nil	--	0.0002	--
CO_2 Produced, lb-mol./hr	nil	--	nil	--	nil	--	--	--
H_2 Produced, lb-mol./hr	nil	--	nil	--	nil	--	0.0007	--
H_2O Used, lb-mol./hr	--	--	--	--	--	--	0.0005	--
Space Velocity, SCF/hr-cu ft	2465	4150	2391	3880	1618	4273	1610	5419

Table A-4. LIFE TESTS (CCI Catalyst C-25-1-01)

Run No.	13		13a	
Catalyst, g	20.0		20.0	
Basis for Analysis	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000
Temperature, Furnace, °F	700	700	700	700
Temperature, Reactor Entrance, °F	600	600	530	530
Temperature, Middle Bed, °F	665	665	731	731
ΔT H_2S	890	890	800	800
Flow Rate, H_2S, lb-mol./hr	0.0006	0.0006	0.0006	0.0006
Flow Rate, Feed, lb-mol./hr	0.01234	0.03524	0.01234	
Flow Rate, H_2O, lb-mol./hr	0.0229	0.0229	0.0130	0.0130
Flow Rate, C_6H_6, lb-mol./hr	0	0	0.0008	0.0008
Temperature, Steam, °F	700	700	760	760
Temperature, Benzene, °F	100	100	100	100
Feed Composition, mol %				
CO	18.4	6.4	18.4	
CO_2	23.7	8.3	23.7	
H_2	16.7	5.8	16.7	
CH_4	37.8	13.2	37.8	
C_2H_6	2.56	0.9	2.56	
H_2S	0.16	0.06	0.16	
COS	--	--	--	
C_6H_6	--	--	--	
N_2	0.68	0.2	0.68	
H_2O	--	65.14	--	
Total	100.00	100.00	100.00	
Product Flow Rate, lb-mol./hr	0.01211	0.03501	0.01082	0.02467
Product Composition, mol %				
CO	19.6	6.7	20.5	8.9
CO_2	23.5	8.1	24.1	10.5
H_2	18.0	6.2	12.4	5.2
CH_4	35.8	12.4	39.4	17.0
C_2H_6	2.34	0.8	2.26	0.8
H_2S	0.17	0.06	0.12	0.04
COS	--	--	0.01	--
C_6H_6	--	--	0.95	3.5
N_2	0.59	0.2	0.26	0.1
H_2O	--	65.54	--	53.96
Total	100.00	100.00	100.00	100.00
CO Consumed, lb-mol./hr	--	--	--	--
CO_2 Produced, lb-mol/hr	--	--	--	--
H_2 Produced, lb-mol/hr	--	--	--	--
Space Velocity, SCF/hr-cu ft	4855	13866	4257	9707
Time of Run, hr	8.1	8.1	127.3	127.3

Table A-5. LIFE TESTS
(BASF K8-11 Catalyst, 4-mm Extrusions)

Run No.	14a		14b	
Catalyst, g	20.0		20.0	
Basis for Analysis	Dry	Wet	Dry	Wet
Pressure, psig	490	490	1000	1000
Temperature, Furnace, °F	560	560	560	560
Temperature, Reactor Entrance, °F	528	528	512	512
Temperature, Middle Bed, °F	582	582	583	583
ΔP H_2S	1000	1000	1200	1200
Flow Rate, H_2S, lb-mol/hr	0.0008	0.0008	0.0008	0.0008
Flow Rate, Feed, lb-mol/hr	0.00496	0.01109	0.00496	0.01109
Flow Rate, H_2O, lb-mol/hr	0.0058	0.0058	0.0058	0.0058
Flow Rate, C_6H_6, lb-mol./hr	--	--	0.0003	0.0003
Temperature, Steam, °F	620	620	600	600
Temperature, Benzene, °F	80	80	80	80
Feed Composition, mol %				
CO	20.0	9.2	20.0	9.2
CO_2	26.1	12.0	26.1	12.0
H_2	7.8	3.6	7.8	3.6
CH_4	42.3	19.5	42.3	19.5
C_2H_6	1.6	0.7	1.6	0.7
C_3+	0.68	0.3	0.68	0.3
H_2S	0.44	0.2	0.44	0.2
COS	--	--	--	--
C_6H_6	--	--	--	--
N_2	1.0	0.5	1.0	0.5
H_2O	--	54.0	--	54.0
Total	99.92	100.0	99.92	100.0
Product Flow Rate, lb-mol./hr	0.00502	0.0108	0.00512	0.0112
Product Composition, mol %				
CO	4.9	2.3	9.1	4.1
CO_2	36.0	16.7	35.6	16.2
H_2	19.7	9.1	17.9	8.1
CH_4	36.1	16.7	33.8	15.4
C_2H_6	1.4	0.6	1.6	0.7
C_3+	0.5	0.3	0.6	0.3
H_2S	0.4	0.2	0.4	0.2
COS	--	--	--	--
C_6H_6	--	--	--	3.0
N_2	1.0	0.5	1.0	0.4
H_2O	--	53.6	--	51.6
Total	100.0	100.0	100.0	100.0
CO Consumed, lb-mol./hr	0.00075	--	0.00053	--
CO_2 Produced, lb-mol./hr	0.00051	--	0.00053	--
H_2 Produced, lb-mol./hr	0.00060	--	0.00053	--
H_2O Used, lb-mol./hr	0.00128	--	0.00045	--
Space Velocity, SCF/hr-cu ft	1623	3631	1623	3631

B-122-1168-(R)

Table A-6, Part 1. LIFE TESTS
(BASF K8-11 Catalyst, 4-mm Extrusions, 20 g)

Run No.	15		15a		15b		15c	
Time, hr	0		28		51		170	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	0	0	630	630	980	980	1000	1000
Temperature, Furnace, °F	650	650	600	600	610	610	600	600
Temperature, Reactor Entrance, °F	680	680	630	630	648	648	646	646
Temperature, Middle Bed, °F	655	655	605	605	620	620	609	609
Δ P H_2S	--	--	770	770	240	240	1000	1000
H_2S Flow Rate, lb-mol./hr	--	--	0.0006	0.0006	0.0003	0.0003	0.0008	0.0008
Feed Flow Rate, lb-mol./hr	0.00467	0.01277	0.00467	0.01277	0.00467	0.01277	0.00467	0.01107
H_2O Flow Rate, lb-mol./hr	--	0.0081	--	0.0081	--	0.0081	--	0.0058
C_6H_6 Flow Rate, lb-mol./hr	--	--	--	--	--	--	0.0006	0.0006
Steam Temperature, °F	910	910	855	855	860	860	860	860
Benzene Temperature, °F	85	85	85	85	85	85	80	80
Feed Composition, mol %								
CO	20.0	7.3	20.0	7.3	20.0	7.3	18.0	7.6
CO_2	26.1	9.5	26.1	9.5	26.1	9.5	24.6	10.4
H_2	7.8	2.8	7.8	2.8	7.8	2.8	14.9	6.3
CH_4	42.3	15.5	42.3	15.5	42.3	15.5	38.1	16.1
C_2H_6	1.6	0.6	1.6	0.6	1.6	0.6	1.6	0.7
H_2S	0.44	0.2	0.44	0.2	0.44	0.2	1.2	0.5
C_3^+	0.68	0.3	0.68	0.3	0.68	0.3	0.69	0.3
C_6H_6	--	--	--	--	--	--	--	5.4
N_2	1.0	0.4	1.0	0.4	1.0	0.4	0.89	0.4
H_2O	--	63.4	--	63.4	--	63.4	--	52.3
Total	99.92	100.0	99.92	100.0	99.92	100.0	99.98	100.0
Product Flow Rate, lb-mol./hr	--	--	0.00513	0.01212	0.00676	0.01226	0.00500	0.01061
Product Composition, mol %								
CO	--	--	1.9	0.8	0.0	0.0	0.0	0.0
CO_2	--	--	38.9	16.5	36.3	20.0	36.3	17.1
H_2	--	--	17.0	7.2	24.9	13.7	25.0	11.8
CH_4	--	--	42.2	17.9	34.8	19.2	34.4	16.2
C_2H_6	--	--	--	--	1.4	0.8	1.5	0.7
H_2S	--	--	--	--	0.6	0.3	0.59	0.3
C_3^+	--	--	--	--	0.6	0.3	0.56	0.3
C_6H_6	--	--	--	--	0.01	--	0.01	4.8
N_2	--	--	--	--	1.4	0.8	1.6	0.7
H_2O	--	--	--	57.6	--	44.9	--	48.1
Total	--	--	100.0	100.0	100.01	100.0	99.96	100.0
CO Consumed, lb-mol./hr	--	--	0.00084	--	0.00084	--	0.00084	--
CO_2 Produced, lb-mol./hr	--	--	0.00078	--	0.00124	--	0.00067	--
H_2 Produced, lb-mol./hr	--	--	0.00051	--	0.00132	--	0.00056	--
H_2O Used, lb-mol./hr	--	--	0.0011	--	0.0026	--	0.0007	--
Space Velocity, SCF/hr-cu ft	1859	5080	1859	5080	1859	5080	1859	4404

B-23-251

Table A-6, Part 2. LIFE TESTS
(BASF K8-11 Catalyst, 4-mm Extrusions, 20 g)

Run No.	15d		15e		15f[a]		15g		15h	
Time, hr	177		225		249		285		321	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000	1000	1000	700	700	700	700
Temperature, Furnace, °F	600	600	605	605	605	605	610	610	610	610
Temperature, Reactor Entrance, °F	655	655	651	651	648	648	648	648	650	650
Temperature, Middle Bed, °F	620	620	615	615	618	618	610	610	624	624
ΔP H_2S	1010	1010	1010	1010	950	950	1300	1300	1300	1300
H_2S Flow Rate, lb-mol./hr	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.001	0.001	0.001	0.001
Feed Flow Rate, lb-mol./hr	0.00467	0.01107	0.00463	0.01242	0.00463	0.01242	0.00431	0.01311	0.00499	0.01228
H_2O Flow Rate, lb-mol./hr	--	0.0058	--	0.0074	--	0.0074	--	0.0088	--	0.0073
C_6H_6 Flow Rate, lb-mol./hr	0.0006	0.0006	0.00039	0.00039	0.00039	0.00039	--	--	--	--
Steam Temperature, °F	865	865	865	865	860	860	860	860	860	860
Benzene Temperature, °F	85	85	85	85	85	85	80	80	80	80
Feed Composition, mol %										
CO	18.0	7.6	18.0	6.7	18.0	6.7	18.0	5.9	15.4	6.2
CO_2	24.6	10.4	24.6	9.2	24.6	9.2	24.6	8.1	19.5	7.9
H_2	14.9	6.3	14.9	5.5	14.9	5.5	14.9	4.9	31.4	12.7
CH_4	38.1	16.1	38.1	14.2	38.1	14.2	38.1	12.5	29.3	11.9
C_2H_6	1.6	0.7	1.6	0.6	1.6	0.6	1.6	0.5	1.6	0.6
H_2S	1.2	0.5	1.2	0.4	1.2	0.4	1.2	0.4	1.2	0.5
C_3^+	0.69	0.3	0.69	0.2	0.69	0.2	0.69	0.2	0.69	0.3
C_6H_6	--	5.4	--	3.1	--	3.1	--	--	0.0	0.0
N_2	0.89	0.4	0.89	0.3	0.89	0.3	0.89	0.3	0.89	0.4
H_2O	--	52.3	--	59.8	--	59.8	--	67.2	--	59.5
Total	99.98	100.0	99.98	100.0	99.98	100.0	99.98	100.0	99.98	100.0
Product Flow Rate, lb-mol./hr	0.00416	0.00977	0.00463	0.01192	0.00493	0.00779	0.00431	0.01151	0.00499	0.00989
Product Composition, mol %										
CO	0.82	0.3	0.0	0.0	3.1	2.0	14.3	5.4	0.0	0.0
CO_2	26.3	11.2	24.1	9.4	21.4	13.5	21.4	8.0	27.1	13.7
H_2	41.6	17.7	46.3	18.0	45.8	28.9	28.6	10.7	40.6	20.5
CH_4	27.3	11.6	24.3	9.4	26.2	16.6	31.4	11.8	28.3	14.3
C_2H_6	1.0	0.4	1.0	0.4	0.64	0.4	1.5	0.6	0.74	0.4
H_2S	1.4	0.6	2.5	1.0	1.5	0.9	1.2	0.4	1.8	0.9
C_3^+	0.34	0.1	0.29	0.1	0.32	0.2	0.7	0.3	0.31	0.2
C_6H_6	0.7	5.5	0.69	3.5	0.3	1.1	--	--	--	--
N_2	0.5	0.2	0.85	0.3	0.69	0.4	0.9	0.3	1.2	0.6
H_2O	--	52.4	--	57.9	--	36.0	--	62.5	--	49.4
Total	99.96	100.0	100.03	100.0	99.95	100.0	100.0	100.0	100.05	100.0
CO Consumed, lb-mol./hr	0.00081	--	0.00083	--	0.00068	--	0.00016	--	0.00077	--
CO_2 Produced, lb-mol./hr	--	--	nil	--	nil	--	nil	--	0.00038	--
H_2 Produced, lb-mol./hr	0.00104	--	0.00146	--	0.00156	--	0.00059	--	0.00046	--
H_2O Used, lb-mol./hr	--	--	0.0005	--	0.0046	--	nil	--	0.0024	--
Space Velocity, SCF/hr-cu ft	1859	4404	1842	4941	1842	4941	1714	5215	1984	4887

B-23-251

Table A-6, Part 3. LIFE TESTS
(BASF K8-11 Catalyst, 4-mm Extrudates, 20 g)

Run No.	15i		15j		15k		15l[b]	
Time, hr	513		561		574		609	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	730	730	720	720	720	720	720	720
Temperature, Furnace, °F	610	610	610	610	610	610	610	610
Temperature, Reactor Entrance, °F	645	645	645	645	645	645	645	645
Temperature, Middle Bed, °F	625	625	620	620	618	618	625	625
ΔP H_2S	1120	1120	1120	1120	1160	1160	1180	1180
H_2S Flow Rate, lb-mol./hr	0.00006	0.00006	0.00004	0.00004	0.00006	0.00006	0.00006	0.00006
Feed Flow Rate, lb-mol./hr	0.00465	0.01205	0.00447	0.01166	0.004962	0.01226	0.00469	0.00945
H_2O Flow Rate, lb-mol./hr	--	0.0074	--	0.0072	--	0.00666	--	0.00439
C_6H_6 Flow Rate, lb-mol./hr	--	--	--	0.00015	--	0.00062	--	0.000357
Steam Temperature, °F	860	860	860	860	860	860	860	860
Benzene Temperature, °F	390	390	390	390	390	390	390	390
Feed Composition, mol %								
CO	15.7	6.0	15.7	6.0	15.7	6.3	15.7	7.8
CO_2	19.1	7.4	19.1	7.3	19.1	7.7	19.1	9.5
H_2	30.8	11.9	30.8	11.8	30.8	12.5	30.8	15.3
CH_4	29.9	11.5	29.9	11.4	29.9	12.1	29.9	14.8
C_2H_6	1.0	0.4	1.0	0.4	1.0	0.4	1.0	0.5
H_2S	1.2	0.5	1.2	0.5	1.2	0.5	1.2	0.6
C_3^+	0.4	0.1	0.4	0.2	0.4	0.2	0.4	0.2
C_6H_6	0.0	0.0	--	1.3	--	5.0	--	3.8
N_2	1.9	0.7	1.9	0.7	1.9	0.8	1.9	0.9
H_2O	--	61.5	--	60.4	--	54.5	--	46.5
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.9
Product Flow Rate, lb-mol./hr	0.00465	0.01055	0.00447	0.0110	0.00496	0.0086	0.00469	0.00908
Product Composition, mol %								
CO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CO_2	27.7	12.2	22.6	9.2	25.0	14.4	23.8	12.3
H_2	41.8	18.4	52.7	21.4	45.4	26.2	47.8	24.7
CH_4	25.5	11.2	21.5	8.7	25.3	14.6	23.9	12.3
C_2H_6	1.1	0.5	0.87	0.4	1.0	0.6	0.9	0.5
H_2S	1.6	0.7	0.88	0.4	1.4	0.8	1.6	0.8
C_3^+	0.4	0.2	0.6	0.2	0.27	0.2	0.25	0.1
C_6H_6	--	--	--	1.2	0.84	5.3	0.87	3.9
N_2	1.9	0.8	0.82	0.3	0.78	0.5	0.83	0.4
H_2O	--	56.0	--	58.2	--	37.4	--	45.0
Total	100.0	100.0	99.97	100.0	99.99	100.0	99.95	100.0
CO Consumed, lb-mol./hr	0.00073	--	0.00070	--	0.00078	--	0.00074	--
CO_2 Produced, lb-mol./hr	0.00040	--	0.00015	--	0.00029	--	0.00022	--
H_2 Produced, lb-mol./hr	0.00051	--	0.00098	--	0.00073	--	0.00079	--
H_2O Used, lb-mol./hr	0.0015	--	0.00080	--	0.0034	--	0.00032	--
Space Velocity, SCF/hr-cu ft	1850	4794	1778	4375	1974	4877	1868	3760

B-23-251

Table A-6, Part 4. LIFE TESTS
(BASF K8-11 Catalyst, 4-mm Extrudates, 20 g)

Run No.	15m[c]		15n		15o[d]		15p[e]	
Time, hr	843		872		915		939	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000	1000	1000	1000	1000
Temperature, Furnace, ° F	610	610	610	610	610	610	610	610
Temperature, Reactor Entrance, ° F	643	643	645	645	643	643	645	645
Temperature, Middle Bed, ° F	620	620	620	620	618	618	620	620
ΔP H_2S	1420	1420	1360	1360	1400	1400	1500	1500
H_2S Flow Rate, lb-mol./hr	0.00015	0.00015	0.00015	0.00015	0.00015	0.00015	0.00015	0.00015
Feed Flow Rate, lb-mol./hr	0.0049	0.01134	0.00504	0.01267	0.00498	0.01209	0.005090	0.01324
H_2O Flow Rate, lb-mol./hr	--	0.0064	--	0.007036	--	0.00656	--	0.00761
C_6H_6 Flow Rate, lb-mol./hr	--	--	--	0.0006	--	0.00055	--	0.00054
Steam Temperature, ° F	860	860	860	860	860	860	860	860
Benzene Temperature, ° F	390	390	390	390	390	390	390	390
Feed Composition, mol %								
CO	9.2	4.0	9.2	3.6	9.2	3.8	9.2	3.5
CO_2	16.8	7.2	16.8	6.7	16.8	6.9	16.8	6.5
H_2	50.4	21.8	50.4	20.0	50.4	20.8	50.4	19.4
CH_4	19.6	8.5	19.6	7.8	19.6	8.1	19.6	7.5
C_2H_4	0.18	0.08	0.18	0.07	0.18	0.07	0.18	0.07
H_2S	3.0	1.3	3.0	1.2	3.0	1.2	3.0	1.1
C_3^+	0.06	0.03	0.06	0.02	0.06	0.02	0.06	0.02
C_6H_6	0.0	0.0	0.0	4.7	0.0	4.5	0.0	4.0
N_2	0.76	0.3	0.76	0.3	0.76	0.3	0.76	0.3
H_2O	--	56.79	--	55.61	--	54.31	--	57.58
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	99.97
Product Flow Rate, lb-mol./hr	0.0049	0.0107	0.00504	0.01202	0.00498	0.01170	0.00509	0.01236
Product Composition, mol %								
CO	0.0	0.0	0.0	0.0	0.21	0.08	0.40	0.2
CO_2	18.6	8.5	18.3	7.6	23.3	9.9	21.7	8.9
H_2	63.8	29.2	61.3	25.7	54.0	22.9	54.9	22.6
CH_4	14.6	6.7	15.2	6.4	19.7	8.4	19.6	8.1
C_2H_4	0.12	0.06	0.11	0.04	0.15	0.06	0.14	0.06
H_2S	1.1	0.5	1.2	0.5	1.1	0.5	1.7	0.7
C_3^+	0.08	0.04	0.01	--	0.03	0.01	0.04	0.02
C_6H_6	0.03	0.01	2.3	5.6	0.81	4.4	0.75	4.1
N_2	1.6	0.7	1.6	0.7	0.68	0.3	0.81	0.3
H_2O	--	54.28	--	53.46	--	53.42	--	55.0
Total	99.93	99.99	100.02	100.00	99.98	99.99	100.04	99.98
CO Consumed, lb-mol./hr	0.00045	--	0.00046	--	0.00045	--	0.00045	--
CO_2 Produced, lb-mol./hr	0.00009	--	0.00008	--	0.00032	--	0.00025	--
H_2 Produced, lb-mol./hr	0.00066	--	0.00055	--	0.00018	--	0.00021	--
H_2O Used, lb-mol./hr	0.00061	--	0.00060	--	0.00030	--	0.00081	--
Space Velocity, SCF/hr-cu ft	1950	4511	2003	5040	1980	4810	2025	5267

H-23-251

Table A-6, Part 5. LIFE TESTS
(BASF K8-11 Catalyst, 4-mm Extrudates, 20 g)

Run No.	15q[f]		15r		15s		15t	
Time, hr	986		1010		1243		1343	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000	1000	1000	1000	1000
Temperature, Furnace, ° F	610	610	610	610	610	610	610	610
Temperature, Reactor Entrance, ° F	647	647	643	643	649	649	652	652
Temperature, Middle Bed, ° F	625	625	620	620	623	623	633	633
ΔP H_2S	1400	1400	1480	1480	1080	1080	1360	1360
H_2S Flow Rate, lb-mol./hr	0.00015	0.00015	~0.00015	0.00015	0.000004	0.000004	0.00006	0.00006
Feed Flow Rate, lb-mol./hr	0.005084	0.01256	0.005116	0.01274	0.00496	0.01293	0.009517	0.01757
H_2O Flow Rate, lb-mol./hr	--	0.00715	--	0.00704	--	0.00743	--	0.00726
C_6H_6 Flow Rate, lb-mol./hr	--	0.000316	--	0.00059	--	0.00054	--	0.00079
Steam Temperature, ° F	860	860	860	860	860	860	880	880
Benzene Temperature, ° F	390	390	390	390	390	390	390	390
Feed Composition, mol %								
CO	9.2	3.7	9.2	3.7	10.0	3.8	16.9	9.2
CO_2	16.8	6.8	16.8	6.7	16.7	6.4	19.7	10.7
H_2	50.4	20.4	50.4	20.2	50.4	19.3	36.2	19.6
CH_4	19.6	7.9	19.6	7.9	21.7	8.3	25.2	13.6
C_2H_6	0.18	0.07	0.18	0.07	0.59	0.2	0.73	0.4
H_2S	3.0	1.2	3.0	1.2	0.08	0.03	0.63	0.3
C_3^+	0.06	0.02	0.06	0.02	0.04	0.01	0.04	0.02
C_6H_6	0.0	2.5	0.0	4.6	--	4.2	0.02	4.5
N_2	0.76	0.3	0.76	0.3	0.47	0.18	0.59	0.3
H_2O	--	56.97	--	55.31	--	57.58	--	41.38
Total	100.00	99.86	100.00	100.00	99.98	100.00	100.01	100.00
Product Flow Rate, lb-mol./hr	0.005084	0.01094	0.005116	0.01206	0.00496	0.01183	0.00952	0.01611
Product Composition, mol %								
CO	0.83	0.4	0.0	0.0	0.18	0.08	1.2	0.7
CO_2	24.5	11.4	20.5	8.7	21.4	9.0	27.9	16.5
H_2	52.1	24.2	60.2	25.5	58.9	24.7	46.2	27.3
CH_4	20.1	9.3	16.4	7.0	16.7	7.0	21.9	12.9
C_2H_6	0.5	0.2	0.41	0.17	0.5	0.2	0.64	0.4
H_2S	0.59	0.27	0.9	0.38	0.73	0.3	0.47	0.3
C_3^+	0.03	0.01	0.03	0.01	0.02	0.01	0.03	0.02
C_6H_6	0.69	3.1	0.67	4.7	0.71	4.2	0.77	3.6
N_2	0.70	0.32	0.85	0.36	0.87	0.4	0.9	0.5
H_2O	-	50.79	--	53.18	--	54.11	--	37.78
Total	100.04	99.99	99.96	100.00	100.01	100.00	100.01	100.00
CO Consumed, lb-mol./hr	0.00043	--	0.00047	--	0.00049	--	0.00149	--
CO_2 Produced, lb-mol./hr	0.00039	--	0.00019	--	0.00023	--	0.00078	--
H_2 Produced, lb-mol./hr	0.00009	--	0.00050	--	0.00042	--	0.00095	--
H_2O Used, lb-mol./hr	0.0016	--	0.00062	--	0.0010	--	0.00116	--
Space Velocity, SCF/hr-cu ft	2022	4997	2035	5068	1972	5144	1778	4490

[illegible]

Table A-6, Part 6. LIFE TESTS
(BASF K8-11 Catalyst, 4-mm Extrudates, 20 g)

Run No.	15u		15v	
Time, hr	1447		1464	
Basis for Analysis	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000
Temperature, Furnace, ° F	610	610	610	610
Temperature, Reactor Entrance, ° F	650	650	654	654
Temperature, Middle Bed, ° F	631	631	633	633
ΔP H_2S	1100	1100	1020	1020
H_2S Flow Rate, lb-mol. /hr	0.00009	0.00009	0.00009	0.00009
Feed Flow Rate, lb-mol. /hr	0.00963	0.01734	0.00948	0.01679
H_2O Flow Rate, lb-mol. /hr	--	0.00705	--	0.00679
C_6H_6 Flow Rate, lb-mol. /hr	--	0.00067	--	0.00053
Steam Temperature, ° F	880	880	880	880
Benzene Temperature, ° F	390	390	390	390
Feed Composition, mol %				
CO	18.8	10.4	18.8	10.6
CO_2	22.8	12.7	22.8	12.9
H_2	26.2	14.5	26.2	14.8
CH_4	29.3	16.3	29.3	16.5
C_2H_6	0.27	0.4	0.27	0.4
H_2S	0.97	0.5	0.97	0.5
C_3^+	0.05	0.03	0.05	0.03
C_6H_6	0.01	3.9	0.01	3.2
N_2	1.1	0.6	1.1	0.6
H_2O	--	40.67	--	40.47
Total	99.50	100.00	99.50	100.00
Product Flow Rate, lb-mol. /hr	0.00963	0.01629		
Product Composition, mol %				
CO	0.72	0.4	1.2	0.7
CO_2	28.8	17.0	30.2	18.4
H_2	44.7	26.4	42.4	25.9
CH_4	21.7	12.8	22.4	13.7
C_2H_6	0.61	0.4	0.64	0.4
H_2S	1.7	1.0	1.4	0.8
C_3^+	0.03	0.02	0.02	0.01
C_6H_6	0.79	3.9	0.81	3.7
N_2	0.93	0.5	0.95	0.6
H_2O	--	37.58	--	35.79
Total	99.98	100.00	100.02	100.00
CO Consumed, lb-mol. /hr	0.00174	--	0.0017	--
CO_2 Produced, lb-mol. /hr	0.00058	--	0.0007	--
H_2 Produced, lb-mol. /hr	0.00178	--	0.0015	--
H_2O Used, lb-mol. /hr	0.00095	--	0.0013	--
Space Velocity, SCF/hr-cu ft	3829	6898	3770	6679

[a] After 8 hr in NH_4OH flowing at 0.000018 lb-mol. /hr or equivalent to 0.14 mol % in feed.

[b] After 11 hr in NH_4OH flowing at 0.000011 lb-mol. /hr or equivalent to 0.1 mol % in feed.

[c] After 5 hr in C_6H_5OH flowing at 0.000004 lb-mol. /hr or equivalent to 0.04 mol % in feed.

[d] After 31 hr in C_6H_5OH flowing at 0.000004 lb-mol. /hr or equivalent to 0.03 mol % in feed.

[e] After 55 hr in C_6H_5OH flowing at 0.000004 lb-mol. /hr or equivalent to 0.03 mol % in feed.

[f] After 6 hr in NH_4OH flowing at 0.000018 lb-mol. /hr or equivalent to 0.14 mol % in feed.

IS-23-251

Table A-7. PRELIMINARY LIFE TESTS
(Girdler G51-C Catalyst, 1/16-Inch Extrudates, 20 g)

Run No.	16a		16b	
Time, hr	4		23	
Basis for Analysis	Dry	Wet	Dry	Wet
Pressure, psig	400	400	950	950
Temperature, Furnace, °F	610	610	610	610
Temperature, Reactor Entrance, °F	640	640	640	640
Temperature, Middle Bed, °F	630	630	628	628
ΔP H_2S	1080	1080	1040	1040
H_2S Flow Rate, lb-mol./hr	0.00016	0.00016	0.00016	0.00016
Feed Flow Rate, lb-mol./hr	0.004866	0.01134	0.004866	0.01134
H_2O Flow Rate, lb-mol./hr	---	0.00692	---	0.00692
C_6H_6 Flow Rate, lb-mol./hr	0.0	0.0	0.0	0.0
Steam Temperature, °F	890	890	890	890
Benzene Temperature, °F	--	--	--	--
Feed Composition, mol %				
CO	13.9	5.9	13.9	5.9
CO_2	18.7	8.0	18.7	8.0
H_2	36.7	15.7	36.7	15.7
CH_4	25.5	10.9	25.5	10.9
C_2H_6	0.53	0.2	0.53	0.2
H_2S	3.4	1.5	3.4	1.5
C_3^+	0.01	--	0.01	--
C_6H_6	0	0	0	0
N_2	1.2	0.5	1.2	0.5
H_2O	0	57.3	0	57.3
Total	99.94	100.0	99.94	100.0
Product Flow Rate, lb-mol./hr	0.004585	0.01106	0.004585	0.01106
Product Composition, mol %				
CO	0.4	0.2	0.0	0.0
CO_2	27.7	11.5	30.6	12.7
H_2	51.5	21.3	41.2	17.1
CH_4	20.4	8.5	25.2	10.4
C_2H_6	--	--	0.52	0.2
H_2S	--	--	1.5	0.6
C_3^+	--	--	0.01	--
C_6H_6	--	--	0.0	0.0
N_2	--	--	0.95	0.4
H_2O	--	58.5	0	58.6
Total	100.0	100.0	99.98	100.0
CO Consumed, lb-mol./hr	0.00066	--	0.00067	--
CO_2 Produced, lb-mol./hr	0.00036	--	0.00049	--
H_2 Produced, lb-mol./hr	0.00058	--	0.00010	--
H_2O Used, lb-mol./hr	0.00044	--	0.00044	--
Space Velocity, SCF/hr-cu ft	2498	5824	2498	5824

B-73-1011

Table A-8, Part 1. LIFE TESTS — EFFECT OF NH_4OH ON CATALYST ACTIVITY (BASF K8-11 Catalyst, 4-mm Extrudates, 20 g)

Run No.	17a		17b		17c		17d	
Time, hr	1		33		57		81	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	200	200	980	980	1020	1020	1000	1000
Temperature, Furnace, °F	590	590	580	580	580	580	580	580
Temperature, Reactor Entrance, °F	610	610	640	640	653	653	600	600
Temperature, Middle Bed, °F	585	585	613	613	627	627	573	573
Δ P H_2S	1040	1040	1040	1040	1320	1320	1040	1040
H_2S Flow Rate, lb-mol./hr	0.00018	0.00018	0.00018	0.00018	0.00018	0.00018	0.00017	0.00017
Feed Flow Rate, lb-mol./hr	0.005116	0.01128	0.004849	0.01137	0.004858	0.01224	0.00466R	0.01283
H_2O Flow Rate, lb-mol./hr	--	0.00617	--	0.00652	--	0.0068	--	0.0075
C_6H_6 Flow Rate, lb-mol./hr	0	0	0	0	0.00056	0.00056	0.00057	0.00057
Steam Temperature, °F	890	890	890	890	890	890	890	890
Benzene Temperature, °F	80	80	290	290	290	290	280	280
Feed Composition, mol %								
CO	12.2	5.5	12.2	5.2	12.2	4.6	12.2	4.4
CO_2	15.8	7.2	15.8	6.7	15.8	6.3	15.8	5.8
H_2	48.4	21.9	48.4	20.6	48.4	19.2	48.4	17.6
CH_4	18.7	8.5	18.7	8.0	18.7	7.4	18.7	6.8
C_2H_4	0.57	0.2	0.57	0.2	0.57	0.2	0.57	0.2
H_2S	3.6	1.6	3.6	1.5	3.6	1.4	3.6	1.3
NH_4OH	0	0	0	0	0	0	0	0
C_6H_6	0	0	0	0	0	4.5	0	4.4
N_2	0.68	0.3	0.68	0.3	0.68	0.3	0.68	0.2
H_2O	0	54.8	0	57.5	0	55.9	0	59.3
Total	99.95	100.0	99.95	100.0	99.95	100.0	99.95	100.0
Product Flow Rate, lb-mol./hr	0.005116	0.01086	0.005030	0.01071	0.004858	0.01126	0.004668	0.01173
Product Composition, mol %								
CO	0	0	0	0	0	0	0	0
CO_2	26.9	12.7	24.8	11.6	24.7	10.7	25.9	10.3
H_2	49.9	23.5	53.5	25.1	52.3	22.6	50.1	19.9
CH_4	18.4	8.7	17.7	8.3	19.0	8.2	20.4	8.1
C_2H_4	0.5	0.2	0.53	0.3	0.53	0.2	0.32	0.1
H_2S	3.6	1.7	2.7	1.3	1.7	0.7	1.5	0.6
NH_4OH	0	0	0	0	0	0	0	0.02
C_6H_6	0	0	0	0	0.82	4.1	0.76	4.2
N_2	0.7	0.3	0.78	0.4	0.90	0.4	0.97	0.4
H_2O	0	52.9	0	53.0	0	53.1	0	56.38
Total	100.0	100.0	100.01	100.0	99.95	100.0	99.95	100.00
CO Consumed, lb-mol./hr	0.000624	--	0.000592	--	0.000592	--	0.000569	--
CO_2 Produced, lb-mol./hr	0.000568	--	0.000481	--	0.000432	--	0.000471	--
H_2 Produced, lb-mol./hr	0.000077	--	0.000344	--	0.00019	--	0.00008	--
H_2O Used, lb-mol./hr	0.00043	--	0.00084	--	0.00084	--	0.00096	--
Space Velocity, SCF/hr-cu ft	2035	4487	1929	4522	1932	4869	1857	5097

B-73-1012a

Table A-8, Part 2. LIFE TESTS — EFFECT OF NH_4OH ON CATALYST ACTIVITY
(BASF K8-11 Catalyst, 4-mm Extrudates, 20 g)

Run No.	17e		17f		17g		17h	
Time, hr	105		128		177		201	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	980	980	980	980	1000	1000	950	950
Temperature, Furnace, °F	590	590	590	590	580	580	580	580
Temperature, Reactor Entrance, °F	602	602	613	613	600	600	610	610
Temperature, Middle Bed, °F	579	579	585	585	579	579	586	586
Σ P H_2S	1180	1180	1200	1200	1320	1320	1320	1320
H_2S Flow Rate, lb-mol./hr	0.00018	0.00018	0.00017	0.00017	0.00018	0.00018	0.00017	0.00017
Feed Flow Rate, lb-mol./hr	0.004636	0.01275	0.004749	0.01282	0.005052	0.01314	0.004720	0.01302
H_2O Flow Rate, lb-mol./hr	--	0.0075	--	0.00744	--	0.0075	--	0.0077
C_6H_6 Flow Rate, lb-mol./hr	0.00061	0.00061	0.00061	0.00061	0.00055	0.00055	0.00060	0.00060
Steam Temperature, °F	890	890	890	890	890	890	890	890
Benzene Temperature, °F	290	290	290	290	290	290	290	290
Feed Composition, mole %								
CO	12.2	4.4	12.2	4.5	12.2	4.7	12.2	4.4
CO_2	15.8	5.7	15.8	5.9	15.8	6.0	15.8	5.7
H_2	48.4	17.6	48.4	17.9	48.4	18.6	48.4	17.5
CH_4	18.7	6.8	18.7	6.9	18.7	7.2	18.7	6.8
C_2H_6	0.57	0.2	0.57	0.2	0.57	0.2	0.57	0.2
H_2S	3.6	1.3	3.6	1.3	3.6	1.4	3.6	1.3
NH_4OH	0	0.2	0	0.1	0	0.1	0	0.3
C_6H_6	0	4.8	0	4.8	0	4.2	0	4.6
N_2	0.68	0.3	0.68	0.2	0.68	0.3	0.68	0.2
H_2O	0	58.7	0	58.2	0	57.3	0	59.0
Total	99.95	100.0	99.95	100.0	99.95	100.0	99.95	100.0
Product Flow Rate, lb-mol./hr	0.004636	0.01196	0.004749	0.01191	0.005052	0.01182	0.004720	0.01256
Product Composition, mol %								
CO	0	0	0	0	0	0	0	0
CO_2	24.0	9.3	22.6	9.0	21.9	9.4	19.5	7.3
H_2	53.3	20.7	55.2	22.0	55.6	23.8	59.9	22.5
CH_4	18.7	7.2	18.0	7.1	17.9	7.6	15.8	5.9
C_2H_6	0.31	0.1	0.27	0.1	0.27	0.1	0.26	0.1
H_2S	2.0	0.8	2.3	0.9	2.6	1.1	2.8	1.1
NH_4OH	--	0.02	--	0.02	--	0.02	0	--
C_6H_6	0.81	4.6	0.8	5.0	0.77	3.6	0.78	4.4
N_2	0.85	0.3	0.79	0.3	0.97	0.4	0.91	0.3
H_2O	0	56.98	0	55.58	0	53.98	0	58.4
Total	99.97	100.00	99.96	100.00	100.01	100.00	99.95	100.0
CO Consumed, lb-mol./hr	0.000566	--	0.000579	--	0.000616	--	0.000576	--
CO_2 Produced, lb-mol./hr	0.000381	--	0.000323	--	0.000308	--	0.000174	--
H_2 Produced, lb-mol./hr	0.000227	--	0.000322	--	0.000364	--	0.000543	--
H_2O Used, lb-mol./hr	0.000673	--	0.000844	--	0.00114	--	0.000328	--
Space Velocity, SCF/hr-cu ft	1844	5073	1889	5100	2009	5228	1877	5180

B-73-1012b

Table A-8, Part 3. LIFE TESTS — EFFECT OF NH_4OH ON CATALYST ACTIVITY
(BASF K8-11 Catalyst, 4-mm Extrudates, 20 g)

Run No.	17i		17j		17k		17 l	
Time, Hr.	271		288		319		342	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000	1000	1000	1000	1000
Temperature, Furnace, °F	580	580	580	580	580	580	580	580
Temperature, Reactor Entrance, °F	615	615	606	606	614	614	618	618
Temperature, Middle Bed, °F	588	588	579	579	588	588	593	593
± P H_2S	1200	1200	1160	1160	1140	1140	1160	1160
H_2S Flow Rate, lb-mol./hr	0.00012	0.00012	0.000135	0.000135	0.00014	0.00014	0.00014	0.00014
Feed Flow Rate, lb-mol./hr	0.00499	0.01289	0.004993	0.012928	0.00517	0.01308	0.00515	0.01341
H_2O Flow Rate, lb-mol/hr	--	0.00773	--	0.007329	--	0.00732	--	0.00762
C_6H_6 Flow Rate, lb-mol./hr	0.00053	0.00053	0.000568	0.000568	0.000553	0.00053	0.00059	0.00059
Steam Temperature, °F	900	900	900	900	890	890	900	900
Benzene Temperature, °F	290	290	290	290	290	290	290	290
Feed Composition, mol %								
CO	14.2	5.4	13.6	5.3	13.8	5.5	13.6	5.3
CO_2	16.6	6.4	16.3	6.3	16.3	6.4	16.3	6.3
H_2	41.8	16.2	45.0	17.4	45.0	17.8	45.0	17.3
CH_4	22.8	8.8	20.6	8.0	20.6	8.1	20.6	7.9
C_2H_4	0.84	0.3	0.80	0.3	0.8	0.3	0.8	0.3
H_2S	2.4	0.9	2.7	1.0	2.7	1.0	2.7	1.0
NH_4OH	--	0.3	--	0.3	--	0.3	--	0.3
C_6H_6	--	4.1	--	4.4	--	4.2	--	4.4
N_2	1.3	0.5	0.79	0.3	0.79	0.3	0.79	0.3
H_2O	--	57.1	--	56.7	--	56.1	--	56.9
Total	99.94	100.0	99.99	100.0	99.99	100.0	99.99	100.0
Product Flow Rate, lb-mol./hr	0.00528	0.01244	0.004993	0.011891	0.00517	0.01219	0.00515	0.01259
Product Composition, mol %								
CO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CO_2	23.7	10.1	24.0	10.0	25.8	10.9	24.9	10.2
H_2	52.0	22.1	51.1	21.5	48.6	20.6	48.8	20.0
CH_4	19.9	8.4	20.8	8.7	21.5	9.1	22.0	9.0
C_2H_4	0.65	0.3	0.65	0.3	0.71	0.3	0.63	0.3
H_2S	1.7	0.7	1.6	0.7	1.4	0.6	1.5	0.6
NH_4OH	--	--	--	0.06	--	0.06	--	0.06
C_6H_6	0.80	4.1	0.81	4.3	0.94	4.5	0.85	4.2
N_2	1.2	0.5	1.0	0.4	1.0	0.4	1.3	0.5
H_2O	--	53.8	--	53.95	--	53.45	--	55.14
Total	99.95	100.00	99.96	100.00	99.95	100.00	99.98	100.00
CO Consumed, lb-mol./hr	0.000709	--	0.000689	--	0.000713	--	0.000711	--
CO_2 Produced, lb-mol./hr	0.000422	--	0.000384	--	0.000491	--	0.000443	--
H_2 Produced, lb-mol./hr	0.000660	--	0.000304	--	0.000181	--	0.000196	--
H_2O Used, lb-mol./hr	0.000648	--	0.000905	--	0.000795	--	0.000672	--
Space Velocity, SCF/hr-cu ft	1985	5130	1986	5143	2056	5202	2022	5333

B-74-1012.

Table A-8, Part 4. LIFE TESTS — EFFECT OF NH_4OH ON CATALYST ACTIVITY
(BASF K8-11 Catalyst, 4-mm Extrudates, 20 g)

Run No.	17m		17n		17o		17p	
Time, hr.	366		414		438		462	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000	1000	1000	1000	1000
Temperature, Furnace, °F	580	580	580	580	580	580	580	580
Temperature, Reactor Entrance, °F	615	615	614	614	617	617	617	617
Temperature, Middle Bed, °F	590	590	588	588	589	589	589	589
δPH_2S	1200	1200	1000	1000	1000	1000	1000	1000
H_2S Flow Rate, lb-mol./hr	0.00013	0.00013	0.00006	0.00006	0.00006	0.00006	0.00006	0.00006
Feed Flow Rate, lb-mol./hr	0.00499	0.01312	0.00502	0.01353	0.00514	0.01324	0.00540	0.01303
H_2O Flow Rate, lb-mol./hr	--	0.00754	--	0.00781	--	0.00743	--	0.00705
C_6H_6 Flow Rate, lb-mol./hr	0.00055	0.00055	0.00066	0.00066	0.00064	0.00064	0.00055	0.00055
Steam Temperature, °F	900	900	890	890	890	890	890	890
Benzene Temperature, °F	290	290	290	290	290	290	290	290
Feed Composition, mol %								
CO	15.3	5.8	16.6	6.2	16.6	6.4	16.6	6.9
CO_2	16.7	6.4	17.2	6.4	17.2	6.7	17.2	7.1
H_2	41.8	15.9	36.6	13.6	36.6	14.2	36.6	15.2
CH_4	22.8	8.7	26.9	10.0	26.9	10.4	26.9	11.2
C_2H_6	0.43	0.2	0.69	0.3	0.69	0.3	0.69	0.3
H_2S	2.5	1.0	1.2	0.4	1.2	0.5	1.2	0.5
NH_4OH	--	0.3	--	0.3	--	0.3	--	0.3
C_6H_6	--	4.2	--	4.9	--	4.8	--	4.2
N_2	0.40	0.2	0.75	0.3	0.75	0.3	0.75	0.3
H_2O	--	57.5	--	57.7	--	56.1	--	54.0
Total	99.93	100.0	99.94	100.0	99.94	100.0	99.94	100.0
Product Flow Rate, lb-mol./hr	--	--	0.00509	0.01231	0.00514	0.01195	0.00540	0.01204
Product Composition, mol %								
CO	0.36	0.1	0.0	0.0	0.0	0.0	0.0	0.0
CO_2	23.8	9.8	25.9	10.7	26.1	11.2	26.7	12.0
H_2	52.7	21.8	48.0	19.9	47.5	20.4	46.5	20.9
CH_4	19.2	7.9	22.7	9.4	22.8	9.8	23.2	10.4
C_2H_6	0.31	0.1	0.55	0.2	0.53	0.2	0.57	0.3
H_2S	1.8	0.7	1.0	0.4	1.1	0.5	1.2	0.5
NH_4OH	--	0.06	--	0.06	--	0.06	--	0.06
C_6H_6	0.73	4.1	0.77	3.5	0.82	4.7	0.82	3.8
N_2	1.1	0.4	1.0	0.4	1.1	0.5	1.0	0.4
H_2O	--	54.94	--	55.44	--	52.55	--	51.55
Total	100.00	100.00	99.92	100.00	99.95	100.00	99.99	100.00
CO Consumed, lb-mol./hr	0.000746	--	0.000834	--	0.000854	--	0.000897	--
CO_2 Produced, lb-mol./hr	0.000355	--	0.000456	--	0.000457	--	0.000514	--
H_2 Produced, lb-mol./hr	0.000544	--	0.000608	--	0.000561	--	0.000535	--
H_2O Used, lb-mol./hr	0.000893	--	0.000979	--	0.00113	--	0.000832	--
Space Velocity, SCF/hr-cu ft	1987	5219	1998	5383	2046	5267	2150	5185

B-73-1012d

Table A-8, Part 5. LIFE TESTS — EFFECT OF NH_4OH ON CATALYST ACTIVITY (BASF K8-11 Catalyst, 4-mm Extrudates, 20 g)

Run No.	17q		17r		17s		17t	
Time, hr	486		519		537		546	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	980	980	1000	1000	1000	1000
Temperature, Furnace, °F	580	580	580	580	580	580	580	580
Temperature, Reactor Entrance, °F	617	617	626	626	611	611	619	619
Temperature, Middle Bed, °F	589	589	590	590	580	580	587	587
ΔP H_2S	1000	1000	1440	1440	1400	1400	680	680
H_2S Flow Rate, lb-mol./hr	0.00006	0.00006	0.000102	0.000102	0.000094	0.000094	0.000093	0.000093
Feed Flow Rate, lb-mol./hr	0.00539	0.01280	0.00539	0.01316	0.00492	0.01211	0.00518	0.01294
H_2O Flow Rate, lb-mol./hr	--	0.00680	--	0.00773	--	0.00715	--	0.00718
C_6H_6 Flow Rate, lb-mol./hr	0.00057	0.00057	0.0	0.0	0.0	0.0	0.00054	0.00054
Steam Temperature, °F	900	900	900	900	900	900	900	900
Benzene Temperature, °F	290	290	290	290	290	290	290	290
Feed Composition, mol %								
CO	16.6	7.0	20.7	8.4	20.7	8.4	21.0	8.4
CO_2	17.2	7.2	19.1	7.8	19.1	7.8	19.4	7.8
H_2	36.6	15.4	33.9	13.9	33.9	13.8	33.4	13.4
CH_4	26.9	11.3	22.4	9.2	22.4	9.1	22.1	8.8
C_2H_4	0.69	0.3	1.2	0.5	1.2	0.5	0.89	0.4
H_2S	1.2	0.5	1.9	0.8	1.9	0.8	1.8	0.7
NH_4OH	--	0.3	--	0.3	--	0.3	--	0.3
C_6H_6	--	4.5	--	--	--	--	--	4.2
N_2	0.75	0.3	0.80	0.3	0.80	0.3	1.4	0.6
H_2O	--	53.2	--	58.8	--	59.0	--	55.4
Total	99.94	100.0	100.00	100.0	100.00	100.0	99.99	100.0
Product Flow Rate, lb-mol./hr	0.00539	0.01185	0.00539	0.01101	0.00492	0.01109	0.00525	0.01150
Product Composition, mol %								
CO	0.0	0.0	0.6	0.3	0.0	0.0	0.0	0.0
CO_2	25.2	11.5	37.5	18.4	32.7	14.5	31.6	14.4
H_2	49.4	22.5	36.7	18.0	45.2	20.1	42.6	19.4
CH_4	21.7	9.9	22.0	10.8	18.7	8.3	21.3	9.7
C_2H_4	0.54	0.2	0.86	0.4	0.72	0.3	0.73	0.3
H_2S	1.2	0.5	0.9	0.4	1.5	0.7	0.92	0.4
NH_4OH	--	0.06	--	0.06	--	0.06	--	0.09
C_6H_6	0.83	4.4	--	--	--	--	0.74	3.9
N_2	1.1	0.5	1.4	0.7	1.1	0.5	2.1	1.0
H_2O	--	50.44	--	50.94	--	55.54	--	50.81
Total	99.97	100.00	99.96	100.00	99.92	100.00	99.99	100.00
CO Consumed, lb-mol./hr	0.000895	--	0.00108	--	0.00102	--	0.00109	--
CO_2 Produced, lb-mol./hr	0.000431	--	0.00099	--	0.00067	--	0.00065	--
H_2 Produced, lb-mol./hr	0.000691	--	0.00015	--	0.00056	--	0.00050	--
H_2O Used, lb-mol./hr	0.000832	--	0.00212	--	0.00098	--	0.00133	--
Space Velocity, SCF/hr-cu ft	2146	5093	2144	5236	1959	4816	2062	5148

B-73-1012e

Table A-8, Part 6. LIFE TESTS — EFFECT OF NH_4OH ON CATALYST ACTIVITY
(BASF K8-11 Catalyst, 4-mm Extrudates, 20 g)

Run No.	17u		17v	
Time, hr.	566		617	
Basis for Analysis	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000
Temperature, Furnace, °F	580	580	580	580
Temperature, Reactor Entrance, °F	616	616	624	624
Temperature, Middle Bed, °F	586	586	588	588
ΔP H_2S	420	420	420	420
H_2S Flow Rate, lb-mol./hr	0.000094	0.000094	0.000049	0.000049
Feed Flow Rate, lb-mol./hr	0.00519	0.01260	0.00486	0.01306
H_2O Flow Rate, lb-mol./hr	--	0.00684	--	0.00761
C_6H_6 Flow Rate, lb-mol./hr	0.00053	0.00053	0.00054	0.00054
Steam Temperature, °F	900	900	900	900
Benzene Temperature, °F	280	280	290	290
Feed Composition, mol %				
CO	21.0	8.7	23.9	8.9
CO_2	19.4	8.0	22.8	8.5
H_2	33.4	13.8	22.3	8.3
CH_4	22.1	9.1	27.2	10.1
C_2H_4	0.89	0.4	0.99	0.4
H_2S	1.8	0.7	1.0	0.4
NH_4OH	--	0.3	--	0.3
C_6H_6	--	4.2	--	4.1
N_2	1.4	0.6	1.8	0.7
H_2O	--	54.2	--	58.3
Total	99.99	100.0	99.99	100.0
Product Flow Rate, lb-mol./hr	0.00519	0.01153	0.00518	0.01216
Product Composition, mol %				
CO	0.0	0.0	0.0	0.0
CO_2	36.4	16.4	37.3	15.9
H_2	39.2	17.7	38.0	16.2
CH_4	21.0	9.5	21.9	9.5
C_2H_4	0.78	0.4	0.78	0.3
H_2S	0.64	0.3	0.59	0.3
NH_4OH	--	0.09	--	0.09
C_6H_6	0.84	4.4	0.3	3.4
N_2	1.1	0.5	1.1	0.5
H_2O	--	50.71	--	53.81
Total	99.96	100.00	99.99	100.00
CO Consumed, lb-mol./hr	0.00109	--	0.00116	--
CO_2 Produced, lb-mol./hr	0.00086	--	0.00082	--
H_2 Produced, lb-mol./hr	0.00030	--	0.00088	--
H_2O Used, lb-mol./hr	0.00097	--	0.00106	--
Space Velocity, SCF/hr-cu ft	2066	5012	1934	5196

B-73-1012f

Table A-8, Part 7. LIFE TESTS — EFFECT OF NH_4OH ON CATALYST ACTIVITY (BASF K8-11 Catalyst, 4-mm Extrusions, 20 g)

Run No.	17w		17x		17y		17z*	
Time, hr	641		665		689		704	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000	1000	1000	1000	1000
Temperature, Furnace, °F	580	580	580	580	580	580	580	580
Temperature, Reactor Entrance, °F	640	640	640	640	636	636	624	624
Temperature, Middle Bed, °F	626	626	626	626	618	618	614	614
Temperature, Exit, °F	580	580	588	589	579	579	571	571
Flow Rate, H_2S, lb-mol./hr	0.00005	0.00005	0	0	0	0	0	0
Flow Rate, Feed, lb-mol./hr	0.00488	0.01301	0.00518	0.01273	0.00499	0.01296	0.00495	0.01246
Flow Rate, H_2O, lb-mol./hr	--	0.00754	--	0.00694	--	0.00734	--	0.00693
Flow Rate, C_2H_4, lb-mol./hr	0.00055	0.00055	0.00057	0.00057	0.00059	0.00059	0.000548	0.000548
Temperature, Steam, °F	900	900	900	900	900	900	900	900
Temperature, Benzene, °F	290	290	290	290	290	290	280	280
Feed Composition, mol %								
CO	23.8	9.0	30.5	12.4	28.0	10.8	28.0	11.1
CO_2	22.6	8.5	27.8	11.3	31.5	12.1	31.5	12.5
H_2	22.3	8.4	6.6	2.7	5.8	2.2	5.8	2.3
CH_4	27.2	10.2	32.6	13.3	32.0	12.3	32.0	12.7
C_2H_6	0.94	0.4	1.2	0.5	1.3	0.4	1.1	0.4
C_3H_6*	0.01	0.01	--	--	--	--	--	--
H_2S	1.0	0.4	0	0	0	0	0	0
NH_4OH	--	0.3	--	0.3	--	0.3	--	0.3
C_6H_6	--	4.3	--	4.5	--	4.6	--	4.4
N_2	1.8	0.7	1.3	0.5	1.6	0.6	1.6	0.6
H_2O	--	57.79	--	54.5	--	56.7	--	55.7
Total	100.00	100.00	100.0	100.0	100.0	100.0	100.0	100.0
Product Flow Rate, lb-mol./hr	0.00485	0.01162	0.00516	0.01118	0.00498	0.01160	0.00495	0.01116
Product Composition, mol %								
CO	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CO_2	36.4	15.3	41.7	19.3	43.1	18.6	44.6	19.8
H_2	38.4	16.1	30.3	14.0	29.0	12.5	28.1	12.5
CH_4	21.8	9.1	25.1	11.6	25.0	10.8	24.4	10.8
C_2H_6	0.77	0.3	0.9	0.4	0.8	0.4	0.8	0.4
C_3H_6*	--	--	--	--	--	--	--	--
H_2S	0.53	0.2	0	0	0	0	0	0
NH_4OH	--	0.2	--	0.1	--	0.1	--	0.1
C_6H_6	1.0	4.7	0.8	4.6	0.9	4.3	0.9	4.4
N_2	1.1	0.5	1.2	0.6	1.2	0.5	1.2	0.5
H_2O	--	53.6	--	49.2	--	52.8	--	51.5
Total	100.00	100.0	100.0	100.0	100.0	100.0	100.0	100.0
CO Consumed, lb-mol./hr	0.00117	--	0.00158	--	0.00140	--	0.00138	--
CO_2 Produced, lb-mol./hr	0.00067	--	0.00072	--	0.00058	--	0.00065	--
H_2 Produced, lb-mol./hr	0.00078	--	0.00123	--	0.00116	--	0.00110	--
H_2O Used, lb-mol./hr	0.00131	--	0.00144	--	0.00120	--	0.00118	--
Space Velocity, SCF/hr-cu ft	1940	5175	2060	5064	1985	5156	1969	4957

D-93-1391a

*Reactor temperature was dropped to 80°F, and the reactor was purged with N_2 for 267 hours after Run 17z.

Table A-8, Part 8. LIFE TESTS — EFFECT OF NH_4OH ON CATALYST ACTIVITY (BASF K8-11 Catalyst, 4-mm Extrusions, 20 g)

Run No.	18a†		18b		18c		18d	
Time, hr	740		764		788		804	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000	1000	1000	1000	1000
Temperature, Furnace, °F	580	580	580	580	580	580	580	580
Temperature, Reactor Entrance, °F	642	642	643	643	636	636	628	628
Temperature, Middle Bed, °F	626	626	625	625	618	618	611	611
Temperature, Exit, °F	590	590	590	590	588	588	581	581
Flow Rate, H_2S, lb-mol./hr	0	0	0	0	0	0	0	0
Flow Rate, Feed, lb-mol./hr	0.00502	0.01289	0.00519	0.01303	0.00492	0.01291	0.00501	0.01295
Flow Rate, H_2O, lb-mol./hr	--	0.00727	--	0.00726	--	0.00737	--	0.00733
Flow Rate, C_6H_6, lb-mol.	0.00056	0.00056	0.00055	0.00055	0.00058	0.00058	0.00058	0.00058
Temperature, Steam, °F	900	900	900	900	900	900	900	900
Temperature, Benzene, °F	290	290	290	290	280	280	280	280
Feed Composition, mol %								
CO	28.0	10.9	27.9	11.1	27.9	10.6	27.9	10.8
CO_2	31.5	12.3	31.6	12.6	31.6	12.1	31.6	12.2
H_2	5.8	2.3	5.6	2.2	5.6	2.1	5.6	2.2
CH_4	32.0	12.5	32.0	12.7	32.0	12.2	32.0	12.4
C_2H_6	1.1	0.4	1.1	0.4	1.1	0.4	1.1	0.4
C_3H_8*	--	--	--	--	--	--	--	--
H_2S	0	0	0	0	0	0	0	0
NH_4OH	--	0.3	--	0.3	--	0.3	--	0.3
C_6H_6	--	4.4	--	4.2	--	4.5	--	4.4
N_2	1.6	0.6	1.8	0.7	1.8	0.7	1.8	0.7
H_2O	--	56.3	--	55.8	--	57.1	--	56.6
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Product Flow Rate, lb-mol./hr	0.00502	0.01090	0.00519	0.01177	0.00492	0.01161	0.00501	0.01169
Product Composition, mol %								
CO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CO_2	42.9	19.8	42.8	18.9	42.2	17.9	42.4	18.2
H_2	28.1	13.0	29.4	13.0	29.8	12.6	29.1	12.5
CH_4	25.9	11.9	24.8	10.9	25.2	10.7	25.5	10.9
C_2H_6	0.87	0.4	0.82	0.4	0.8	0.3	0.8	0.4
C_3H_8*	--	--	--	--	--	--	--	--
H_2S	0	0	0	0	0	0	0	0
NH_4OH	--	0.1	--	0.1	--	0.1	--	0.1
C_6H_6	0.93	4.2	0.84	4.4	0.8	4.6	0.83	4.6
N_2	1.3	0.6	1.34	0.6	1.2	0.6	1.37	0.6
H_2O	--	50.0	--	51.7	--	53.2	--	52.7
Total	100.00	100.0	100.00	100.0	100.0	100.0	100.00	100.0
CO Consumed, lb-mol./hr	0.00141	--	0.00144	--	0.00137	--	0.00139	--
CO_2 Produced, lb-mol./hr	0.00057	--	0.00058	--	0.00055	--	0.00054	--
H_2 Produced, lb-mol./hr	0.0011	--	0.00124	--	0.00119	--	0.00118	--
H_2O Used, lb-mol./hr	0.0018	--	0.00115	--	0.00119	--	0.00115	--
Space Velocity, SCF/hr-cu ft	1998	5130	2063	5185	1959	5135	1993	5153

D-93-1391b

†Reactor temperature was raised to 580°F while N_2 flowed for 120 hours before feed gas was introduced.

Table A-9, Part 1. LIFE TESTS — CATALYST EVALUATION (CCI C-20-6-03 Catalyst,* 1/16-Inch Extrudates, 20 g)

Run No.	19-1		19-2		19-3		19-4	
Time, hr	0		24		112		216	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000	980	980	1000	1000
Temperature, Furnace, °F	580	580	580	580	580	580	580	580
Temperature, Reactor Entrance, °F	640	640	642	642	653	653	647	647
Temperature, Middle Bed, °F	606	606	608	608	605	605	603	603
Temperature, Exit, °F	585	585	589	589	585	585	584	584
Flow Rate, H_2S, lb-mol./hr	0.00017	0.00017	0.00019	0.00019	0.00013	0.00013	0.00014	0.00014
Flow Rate, Feed, lb-mol/hr	0.00511	0.01141	0.00562	0.01366	0.00522	0.01298	0.00578	0.01359
Flow Rate, H_2O, lb-mol./hr	--	0.00630	--	0.00746	--	0.00715	--	0.00722
Flow Rate, C_6H_6, lb-mol./hr	0	0	0.00059	0.00059	0.00062	0.00062	0.00059	0.00059
Temperature, Steam, °F	900	900	900	900	900	900	900	900
Temperature, Benzene, °F	280	280	280	280	280	280	280	280
Feed Composition, mol %*								
CO	20.1	9.0	20.1	8.2	22.0	8.8	22.0	9.4
CO_2	21.8	9.8	21.8	9.0	24.5	9.8	24.5	10.4
H_2	32.0	14.3	32.0	13.1	24.7	9.9	24.7	10.5
CH_4	21.7	9.7	21.7	8.9	23.5	9.4	23.5	10.0
C_2H_4*	0.9	0.4	1.0	0.4	1.1	0.4	1.1	0.5
N_2	0	0	0	0	1.8	0.7	1.8	0.8
H_2S	3.45	1.5	3.4	1.4	2.4	1.0	2.4	1.0
NH_4OH	--	--	--	--	--	--	--	--
C_6H_6	0	0	--	4.3	--	4.8	--	4.3
C_6H_5OH	--	--	--	--	--	--	--	--
H_2O	--	55.3	--	54.7	--	55.2	--	53.1
Total	100.00	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Product Flow Rate, lb-mol./hr	0.00511	0.01043	0.00559	0.01270	0.00586	0.01239	0.00559	0.01189
Product Composition, mol %								
CO	0	0	0	0	0	0	0	0
CO_2	36.7	19.0	32.2	14.2	38.3	18.2	36.6	17.8
H_2	40.4	21.0	44.1	19.5	35.4	16.8	38.4	18.7
CH_4	18.9	9.6	18.2	8.0	22.0	10.4	20.6	10.0
C_2H_4*	0.8	0.4	0.77	0.3	0.9	0.4	0.8	0.4
N_2	1.0	0.5	1.2	0.5	1.3	0.6	1.3	0.6
H_2S	2.2	1.1	2.6	1.2	1.3	0.6	1.4	0.7
NH_4OH	--	--	--	--	--	--	--	--
C_6H_6	0	0	0.73	4.0	0.8	4.5	0.9	4.6
C_6H_5OH	--	--	--	--	--	--	--	--
H_2O	--	48.2	--	52.3	--	46.5	--	47.2
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
CO Consumed, lb-mol./hr	0.00103	--	0.00113	--	0.00115	--	0.00127	--
CO_2 Produced, lb-mol./hr	0.00087	--	0.00058	--	0.00096	--	0.00070	--
H_2 Produced, lb-mol./hr	0.00055	--	0.00068	--	0.00080	--	0.00079	--
H_2O Used, lb-mol./hr	0.00128	--	0.00086	--	0.00115	--	0.00163	--
Space Velocity, SCF/hr-cu ft	2033	4539	2236	5442	2076	5164	2299	5406

*This catalyst is also renumbered C25-1-02

†Feed gas also contains 1.3 ppm propyl mercaptan, 0.8 ppm thiophene, and 52 ppm COS.

D-93-1392a,RJ

Table A-9, Part 2. LIFE TESTS — CATALYST EVALUATION
(CCI C-20-6-03 Catalyst,* 1/16-Inch Extrudates, 20 g)

Run No.	19-5		19-6		19-7		19-8	
Time, hr	336		360		378		408	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000	1000	1000	1000	1000
Temperature, Furnace, °F	580	580	580	580	580	580	580	580
Temperature, Reactor Entrance, °F	650	650	648	648	641	641	649	649
Temperature, Middle Bed, °F	604	604	605	605	597	597	605	605
Temperature, Exit, °F	585	585	586	586	576	576	584	584
Flow Rate, H_2S, lb-mol./hr	0.00016	0.00016	0.00019	0.00019	0.00017	0.00017	0.00018	0.00018
Flow Rate, Feed, lb-mol./hr	0.00520	0.01285	0.00615	0.01395	0.00563	0.01382	0.00590	0.01380
Flow Rate, H_2O, lb-mol./hr	--	0.00710	--	0.00722	--	0.00762	--	0.00728
Flow Rate, C_6H_6, lb-mol./hr	0.00056	0.00056	0.00055	0.00055	0.00053	0.00053	0.00058	0.00058
Temperature, Steam, °F	900	900	900	900	900	900	900	900
Temperature, Benzene, °F	280	280	280	280	280	280	280	280
Feed Composition, mol %†								
CO	21.4	8.7	21.4	9.4	21.4	8.7	21.4	9.2
CO_2	22.0	8.9	22.0	9.7	22.0	9.0	22.0	9.4
H_2	27.4	11.1	27.4	12.1	27.4	11.2	27.4	11.7
CH_4	24.1	9.6	24.1	10.6	24.1	9.8	24.1	10.3
C_2H_6	1.0	0.4	1.0	0.4	1.0	0.4	1.0	0.4
N_2	1.0	0.4	1.0	0.4	1.0	0.4	1.0	0.4
H_2S	3.1	1.3	3.1	1.4	3.1	1.3	3.1	1.3
NH_4OH	--	0.1	--	0.3	--	0.3	--	0.3
C_6H_6	--	4.2	--	3.9	--	3.8	--	4.2
C_6H_5OH	--	--	--	--	--	--	--	--
H_2O	--	55.1	--	51.8	--	55.1	--	52.8
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Product Flow Rate, lb-mol./hr	0.00619	0.01186	0.00655	0.01246	0.00563	0.01278	0.00590	0.01229
Product Composition, mol %								
CO	0.5	0.3	0.6	0.3	0.5	0.2	0.5	0.2
CO_2	33.4	18.0	34.2	16.9	32.4	14.3	33.5	16.1
H_2	40.9	21.4	40.9	20.2	42.6	18.8	41.2	19.8
CH_4	20.5	10.7	20.3	10.0	20.3	8.9	20.5	9.8
C_2H_6	0.8	0.4	0.8	0.4	0.8	0.4	0.8	0.4
N_2	1.0	0.7	0.5	0.2	0.6	0.3	0.8	0.4
H_2S	2.0	1.0	1.8	0.9	1.9	0.8	1.9	0.9
NH_4OH	--	--	--	0.1	--	0.1	--	0.1
C_6H_6	0.9	4.0	0.9	3.9	0.9	4.1	0.8	4.1
C_6H_5OH	--	--	--	--	--	--	--	--
H_2O	--	43.5	--	47.1	--	52.1	--	48.2
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
CO Consumed, lb-mol./hr	0.00108	--	0.00128	--	0.00117	--	0.00124	--
CO_2 Produced, lb-mol./hr	0.00099	--	0.00075	--	0.00059	--	0.00068	--
H_2 Produced, lb-mol./hr	0.00110	--	0.00083	--	0.00086	--	0.00081	--
H_2O Used, lb-mol./hr	0.00186	--	0.00136	--	0.00095	--	0.00134	--
Space Velocity, SCF/hr-cu ft	2068	5112	2446	5550	2239	5498	2347	5490

*This catalyst is also renumbered C24-1-02

†Feed gas also contains 1.3 ppm propyl mercaptan, 0.8 ppm thiophene, and 52 ppm COS.

D-91-11926(R)

Table A-9, Part 3. LIFE TESTS — CATALYST EVALUATION
(CCI C-20-6-03 Catalyst,* 1/16-Inch Extrudates, 20 g)

Run No.	19-9		9-10		19-11	
Time, hr	504		528		552	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000	1000	1000
Temperature, Furnace, °F	580	580	580	580	580	580
Temperature, Reactor Entrance, °F	646	646	652	652	649	649
Temperature, Middle Bed, °F	604	604	604	604	605	605
Temperature, Exit, °F	585	585	585	584	585	585
Flow Rate, H_2S, lb-mol./hr	0.00016	0.00016	0.00018	0.00018	0.00018	0.00018
Flow Rate, Feed, lb-mol./hr	0.00509	0.01305	0.00579	0.01351	0.00586	0.01379
Flow Rate, H_2O, lb-mol./hr	--	0.00739	--	0.00717	--	0.00734
Flow Rate, C_4H_4, lb-mol./hr	0.00053	0.00053	0.00052	0.00052	0.00058	0.00058
Temperature, Steam, °F	900	900	900	900	900	900
Temperature, Benzene, °F	280	280	280	280	280	280
Feed Composition, mol %†						
CO	20.1	7.8	20.1	8.6	20.1	8.5
CO_2	22.2	8.7	22.2	9.5	22.2	9.4
H_2	29.8	11.6	29.8	12.8	29.8	12.7
CH_4	22.8	8.9	22.8	9.8	22.8	9.7
C_2H_4†	1.0	0.4	1.0	0.4	1.0	0.4
N_2	1.0	0.4	1.0	0.4	1.0	0.4
H_2S	3.1	1.2	3.1	1.3	3.1	1.3
NH_4OH	--	0.3	--	0.3	--	--
C_6H_6	--	4.0	--	3.8	--	4.2
C_6H_5OH	--	--	--	--	--	0.04
H_2O	--	56.7	--	53.1	--	53.36
Total	100.0	100.0	100.0	100.0	100.0	100.00
Product Flow Rate, lb-mol./hr	0.00565	0.01149	0.00579	0.01218	0.00586	0.01238
Product Composition, mol %						
CO	0.2	0.1	0.13	0.1	0.12	0.06
CO_2	34.8	17.1	34.8	16.5	33.6	15.9
H_2	39.6	19.5	39.5	18.8	40.8	19.3
CH_4	21.0	10.3	20.9	9.9	21.0	9.9
C_2H_4†	0.9	0.4	0.8	0.4	0.85	0.4
N_2	1.0	0.5	1.0	0.5	1.0	0.5
H_2S	1.8	0.9	1.8	0.9	1.8	0.9
NH_4OH	--	0.1	--	0.05	--	--
C_6H_6	0.7	3.9	1.07	4.0	0.83	4.6
C_6H_5OH	--	--	--	--	--	0.01
H_2O	--	47.2	--	48.85	--	48.43
Total	100.0	100.0	100.00	100.00	100.00	100.00
CO Consumed, lb-mol./hr	0.00101	--	0.00115	--	0.00117	--
CO_2 Produced, lb-mol./hr	0.00084	--	0.00073	--	0.00067	--
H_2 Produced, lb-mol./hr	0.00072	--	0.00056	--	0.00065	--
H_2O Used, lb-mol./hr	0.00197	--	0.00121	--	0.00134	--
Space Velocity, SCF/hr-cu ft	2025	5191	2301	5376	2332	5486

D-93-1392c(R)

*This catalyst is also renumbered C25-1-02

†Feed gas also contains 1.3 ppm propyl mercaptan, 0.8 ppm thiophene, and 52 ppm COS.

Table A-9, Part 4. LIFE TESTS – CATALYST EVALUATION
(CCI C-20-6-03 Catalyst, 1/16-Inch Extrudates, 20 g)

Run No.	19-12		19-13†		19-14	
Time, hr	576		600		624	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000	1000	1000
Temperature, Furnace, F	580	580	580	580	580	580
Temperature, Reactor Entrance, °F	650	650	650	650	650	650
Temperature, Middle Bed, °F	605	605	605	605	605	605
Temperature, Exit, °F	585	585	585	585	585	585
Flow Rate, H_2S, lb-mol./hr	0.00008	0.00008	0.00009	0.00009	0.00009	0.00009
Flow Rate, Feed, lb-mol./hr	0.00583	0.01291	0.00569	0.01311	0.00594	0.01345
Flow Rate, H_2O, lb-mol./hr	--	0.0072	--	0.0068	--	0.0069
Flow Rate, C_6H_6, lb-mol./hr	0.00057	0.00057	0.00056	0.00056	0.00056	0.00056
Temperature, Steam, °F	900	900	900	900	900	900
Temperature, Benzene, °F	290	290	280	280	280	280
Feed Composition, mol %						
CO	20.0	8.0	20.0	8.7	20.0	8.8
CO_2	21.7	8.6	21.7	9.4	21.7	9.6
H_2	32.8	13.0	32.8	14.2	32.8	14.5
CH_4	22.0	8.7	22.0	9.5	22.0	9.7
C_2H_6*	0.9	0.4	0.9	0.4	0.9	0.4
N_2	1.0	0.4	1.0	0.4	1.0	0.4
H_2S	1.6	0.6	1.6	0.7	1.6	0.7
NH_4OH	--	--	--	--	--	--
C_6H_6	--	4.4	--	4.2	--	4.2
C_6H_5OH	--	0.04	--	0.04	--	0.04
H_2O	--	55.86	--	52.46	--	51.66
Total	100.0	100.00	100.0	100.00	100.0	100.00
Product Flow Rate, lb-mol./hr	0.00598	0.01217	0.00569	0.01229	0.00594	0.01223
Product Composition, mol %						
CO	0.25	0.1	0.16	0.07	0.22	0.1
CO_2	31.4	15.4	34.6	16.0	35.3	17.1
H_2	46.6	22.9	41.1	19.0	41.3	20.0
CH_4	17.8	8.7	20.3	9.4	19.1	9.3
C_2H_6*	0.68	0.3	0.78	0.4	0.77	0.4
N_2	1.0	0.5	1.1	0.5	1.04	0.5
H_2S	1.5	0.7	1.2	0.6	1.5	0.7
NH_4OH	--	--	--	--	--	--
C_6H_6	0.77	4.1	0.76	4.6	0.77	4.3
C_6H_5OH	--	0.01	--	0.01	--	0.01
H_2O	--	47.29	--	49.42	--	47.59
Total	100.00	100.00	100.00	100.00	100.00	100.00
CO Consumed, lb-mol./hr	0.00101	--	0.00113	--	0.00117	--
CO_2 Produced, lb-mol./hr	0.00076	--	0.00073	--	0.00081	--
H_2 Produced, lb-mol./hr	0.00110	--	0.00047	--	0.00051	--
H_2O Used, lb-mol./hr	0.00146	--	0.00078	--	0.00114	--
Space Velocity, SCF/hr-cu ft	2042	5137	2262	5216	2362	5352

* Phenol was added and ammonia was discontinued.

† H_2S flow rate was increased.

B-24-227a

Table A-9, Part 5. LIFE TESTS – CATALYST EVALUATION
(CCI C-20-6-03 Catalyst, 1/16-Inch Extrudates, 20 g)

Run No.	19-15		19-16		19-17	
Time, hr	648		672		682	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000	1000	1000
Temperature, Furnace, °F	580	580	580	580	580	580
Temperature, Reactor Entrance, °F	651	651	651	651	651	651
Temperature, Middle Bed, °F	605	605	605	605	605	605
Temperature, Exit, °F	585	585	585	585	585	585
Flow Rate, H_2S, lb-mol./hr	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Flow Rate, Feed, lb-mol./hr	0.00512	0.01289	0.00512	0.0128	0.00512	0.0128
Flow Rate, H_2O, lb-mol./hr	--	0.0072	--	0.00715	--	0.00735
Flow Rate, C_6H_6, lb-mol./hr	0.00053	0.00053	0.00054	0.00054	0.000530	0.000530
Temperature, Steam, °F	900	900	900	900	900	900
Temperature, Benzene, °F	280	280	280	280	280	280
Feed Composition, mol %						
CO	22.1	8.8	22.1	8.83	22.1	8.7
CO_2	23.1	9.2	23.1	9.23	23.1	9.1
H_2	26.8	10.7	26.8	10.71	26.8	10.56
CH_4	24.0	9.5	24.0	9.58	24.0	9.45
C_2H_4*	1.0	0.4	1.0	0.40	1.0	0.39
N_2	1.1	0.4	1.1	0.43	--	--
H_2S	1.9	0.76	1.9	0.75	1.9	0.75
NH_4OH	--	--	--	--	--	--
C_6H_6	--	4.1	--	4.27	--	4.07
C_6H_5OH	--	0.04	--	0.03	--	0.03
H_2O	--	56.1	--	55.82	--	56.52
Total	100.00	100.00	100.00	100.00	100.00	100.00
Product Flow Rate, lb-mol./hr	0.00554	0.01144	0.00564	0.01165	0.00558	0.01256
Product Composition, mol %						
CO	0.28	0.1	0.25	0.12	0.13	0.06
CO_2	35.6	17.3	35.61	17.22	35.80	15.92
H_2	39.4	19.0	39.0	18.87	38.80	17.22
CH_4	20.8	10.1	20.9	10.11	21.1	9.37
C_2H_4*	0.90	0.4	1.1	0.53	1.1	0.48
N_2	1.10	0.5	1.2	0.58	1.2	0.53
H_2S	1.20	0.6	1.1	0.53	1.0	0.44
NH_4OH	--	--	--	--	--	--
C_6H_6	0.72	3.79	0.84	0.41	0.87	4.313
C_6H_5OH	--	0.01	--	0.01	--	0.007
H_2O	--	48.20	--	51.62	--	51.66
Total	100.00	100.00	100.00	100.00	100.00	100.00
CO Consumed, lb-mol./hr	0.00112	--	0.00112	--	0.00113	--
CO_2 Produced, lb-mol./hr	0.00079	--	0.00082	--	0.00082	--
H_2 Produced, lb-mol./hr	0.00081	--	0.00081	--	0.00077	--
H_2O Used, lb-mol./hr	0.00173	--	0.00114	--	0.00086	--
Space Velocity, SCF/hr-cu ft	2035	5124	2035	5088	2035	5088

* Steam-to-dry gas ratio was increased.

B-24-227b

Table A-9, Part 6. LIFE TESTS — CATALYST EVALUATION
(CCI C-20-6-03 Catalyst, 1/16-Inch Extrudates, 20 g)

Run No.	19-18		19-19		19-20	
Time, hr	696		706		713	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000	1000	1000
Temperature, Furnace, °F	580	580	580	580	580	580
Temperature, Reactor Entrance, °F	651	651	651	651	654	654
Temperature, Middle Bed, °F	605	605	605	605	605	605
Temperature, Exit, °F	585	585	585	585	585	585
Flow Rate, H_2S, lb-mol./hr	0.00010	0.00010	0.0001	0.0001	0.00012	0.00012
Flow Rate, Feed, lb-mol./hr	0.00515	0.0134	0.00512	0.0120	0.00521	0.01295
Flow Rate, H_2O, lb-mol./hr	--	0.0076	--	0.0064	--	0.00719
Flow Rate, C_6H_6, lb-mol./hr	0.00059	0.00059	0.00051	0.00051	0.00050	0.00050
Temperature, Steam, °F	900	900	900	900	900	900
Temperature, Benzene, °F	280	280	280	280	280	280
Feed Composition, mol %						
CO	22.1	8.5	22.1	9.39	22.7	9.15
CO_2	23.1	8.88	23.1	9.81	21.2	8.54
H_2	26.8	10.31	26.8	11.39	28.2	1.36
CH_4	24.0	9.22	24.0	10.20	23.5	9.47
C_2H_4*	1.0	0.39	1.0	0.42	1.0	0.40
N_2	1.1	0.43	1.1	0.47	1.1	0.44
H_2S	1.9	0.73	1.9	0.81	2.3	0.92
NH_4OH	--	0.29	--	0.27	--	0.29
C_6H_6	--	4.46	--	4.26	--	3.90
C_6H_5OH	--	0.03	--	0.03	--	0.03
H_2O	--	56.76	--	52.95	--	55.5
Total	100.00	100.00	100.00	100.00	100.00	100.00
Product Flow Rate, lb-mol./hr	0.00565	0.01227	0.005927	0.01191	0.00576	0.01158
Product Composition, mol %						
CO	0.22	0.10	0.2	0.11	0.30	0.15
CO_2	35.80	16.49	35.45	17.55	36.2	17.97
H_2	39.66	18.54	39.3	19.48	39.5	19.66
CH_4	20.40	9.40	21.3	10.56	20.1	10.01
C_2H_4*	0.8	0.37	0.8	0.4	0.84	0.42
N_2	1.1	0.51	1.1	0.55	1.1	0.55
H_2S	1.2	0.55	1.	0.55	1.1	0.55
NH_4OH	--	0.04	--	0.04	--	0.04
C_6H_6	0.82	3.79	0.82	4.35	0.86	3.04
C_6H_5OH	--	0.01	--	0.01	--	0.01
H_2O	--	50.2	--	46.4	--	47.6
Total	100.00	100.00	100.00	100.00	100.00	100.00
CO Consumed, lb-mol./hr	0.001127	--	0.00112	--	0.00117	--
CO_2 Produced, lb-mol./hr	0.000833	--	0.00092	--	0.00098	--
H_2 Produced, lb-mol./hr	0.000857	--	0.00096	--	0.00081	--
H_2O Used, lb-mol./hr	0.001447	--	0.000827	--	0.00167	--
Space Velocity, SCF/hr-cu ft	2047	5326	2035	4770	2071	5147

* Both phenol and ammonia were added.

B-24-227c

Table A-9, Part 7. LIFE TESTS — CATALYST EVALUATION
(CCI C-20-6-03 Catalyst, 1/16-Inch Extrudates, 20 g)

Run No.	19-21		19-22		19-23	
Time, hr	724		731		786	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000	1000	1000
Temperature, Furnace, °F	580	580	580	580	580	580
Temperature, Reactor Entrance, F	655	655	655	655	646	646
Temperature, Middle Bed, °F	605	605	605	605	605	605
Temperature, Exit, °F	585	585	585	585	585	585
Flow Rate, H_2S, lb-mol./hr	0.00012	0.00012	0.00012	0.00012	0.00013	0.00013
Flow Rate, Feed, lb-mol./hr	0.00524	0.01219	0.00522	0.01181	0.00507	0.0129
Flow Rate, H_2O, lb-mol./hr	--	0.00639	--	0.00602	--	0.00718
Flow Rate, C_6H_6, lb-mol./hr	0.00052	0.00052	0.00054	0.00054	0.00055	0.00055
Temperature, Steam, °F	900	900	900	900	900	900
Temperature, Benzene, °F	280	280	280	280	280	280
Feed Composition, mol %						
CO	22.7	9.77	22.7	10.00	20.6	8.12
CO_2	21.2	9.12	21.2	9.35	18.9	7.45
H_2	28.2	12.14	28.2	12.52	36.0	14.20
CH_4	23.5	10.11	23.5	10.37	20.03	7.88
$C_2H_4^+$	1.0	0.43	1.0	0.44	0.87	0.34
N_2	1.1	0.47	1.1	0.48	1.1	0.63
H_2S	2.3	0.99	2.3	1.01	2.5	0.99
NH_4OH	--	0.27	--	0.26	--	0.29
C_6H_6	--	4.26	--	4.55	--	4.26
C_6H_5OH	--	0.03	--	0.03	--	0.03
H_2O	--	52.41	--	50.99	--	55.81
Total	100.00	100.00	100.00	100.00	100.00	100.00
Product Flow Rate, lb-mol./hr	0.00574	0.0120	0.00573	0.0106	0.00562	0.0121
Product Composition, mol %						
CO	0.34	0.16	0.81	0.43	3.3	1.53
CO_2	35.0	16.75	35.1	18.97	33.6	15.14
H_2	39.4	18.85	39.4	21.26	41.9	19.46
CH_4	21.3	10.14	20.3	10.96	18.02	8.82
$C_2H_4^+$	0.89	0.40	0.82	0.43	0.88	0.41
N_2	1.1	0.53	1.1	0.58	1.0	0.46
H_2S	1.1	0.53	1.37	0.69	1.3	0.60
NH_4OH	--	0.04	--	0.04	--	0.07
C_6H_6	0.87	4.04	1.1	3.74	--	3.62
C_6H_5OH	--	0.01	--	0.01	--	0.01
H_2O	--	48.55	--	43.49	--	49.88
Total	100.00	100.00	100.00	100.00	100.00	100.00
CO Consumed, lb-mol./hr	0.00117	--	0.00114	--	0.00086	--
CO_2 Produced, lb-mol./hr	0.00090	--	0.00091	--	0.00088	--
H_2 Produced, lb-mol./hr	0.00079	--	0.00079	--	0.00053	--
H_2O Used, lb-mol./hr	0.00056	--	0.00131	--	0.00114	--
Space Velocity, SCF/hr-cu ft	2083	4845	2075	4694	2015	5128

B-24-227d

‹ Equipment was repaired after this run.

Table A-9, Part 8. LIFE TESTS — CATALYST EVALUATION
(CCI C-20-6-03 Catalyst, 1/16-Inch Extrudates, 20 g)

Run No.	19-24		19-25		19-26	
Time, hr	889		901		913	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000	1000	1000
Temperature, Furnace, °F	580	580	580	580	580	580
Temperature, Reactor Entrance, °F	640	640	643	643	643	643
Temperature, Middle Bed, °F	600	600	601	601	602	602
Temperature, Exit, °F	580	580	581	581	582	582
Flow Rate, H_2S, lb-mol./hr	0.00013	0.00013	0.00012	0.00012	0.00012	0.00012
Flow Rate, Feed, lb-mol./hr	0.00503	0.01284	0.00500	0.0133	0.00502	0.01118
Flow Rate, H_2O, lb-mol./hr	--	0.00725	--	0.00762	--	0.00568
Flow Rate, C_6H_6, lb-mol./hr	0.00052	0.00052	0.00060	0.00060	0.00045	0.00045
Temperature, Steam, °F	900	900	900	900	900	900
Temperature, Benzene, °F	280	280	280	280	280	280
Feed Composition, mol %						
CO	19.5	7.6	21.5	8.12	21.5	9.65
CO_2	20.6	8.1	22.9	8.64	22.9	10.29
H_2	33.69	13.2	27.49	10.34	27.49	12.31
CH_4	21.6	8.43	23.7	8.94	23.7	10.64
$C_2H_6^+$	0.91	0.36	0.91	0.34	0.91	0.41
N_2	1.1	0.43	1.0	0.38	1.0	0.45
H_2S	2.6	1.02	2.5	0.94	2.5	1.12
NH_4OH	--	0.29	--	0.30	--	0.26
C_6H_6	--	4.04	--	4.54	--	3.99
C_6H_5OH	--	0.03	--	0.03	--	0.03
H_2O	--	56.50	--	57.43	--	50.85
Total	100.00	100.00	100.00	100.00	100.00	100.00
Product Flow Rate, lb-mol./hr	0.00542	0.0122	0.00578	0.0124	0.00570	0.0106
Product Composition, mol %						
CO	3.9	1.73	3.2	1.50	5.0	2.70
CO_2	30.9	13.77	30.12	14.10	34.9	18.83
H_2	42.9	19.11	43.60	20.38	36.6	19.75
CH_4	19.0	8.47	19.23	9.00	20.0	10.79
$C_2H_6^+$	0.91	0.41	0.79	0.37	0.87	0.47
N_2	0.82	0.37	1.1	0.52	1.1	0.59
H_2S	1.57	0.70	1.4	0.66	1.53	0.82
NH_4OH	--	0.07	0.56	0.07	--	0.06
C_6H_6	--	3.30	--	4.07	--	3.7
C_6H_5OH	--	0.01	--	0.01	--	0.01
H_2O	--	52.06	--	49.32	--	42.28
Total	100.00	100.00	100.00	100.00	100.00	100.00
CO Consumed, lb-mol./hr	0.00077	--	0.00089	--	0.00079	--
CO_2 Produced, lb-mol./hr	0.00064	--	0.00059	--	0.00084	--
H_2 Produced, lb-mol./hr	0.00063	--	0.00115	--	0.00071	--
H_2O Used, lb-mol./hr	0.00092	--	0.00151	--	0.00121	--
Space Velocity, SCF/hr-cu ft	1999	5103	1988	5286	1995	4444

B-24-227e

Table A-9, Part 9. LIFE TESTS — CATALYST EVALUATION
(CCI C-20-6-03 Catalyst, 1/16-Inch Extrudates, 20 g)

Run No.	19-27		19-28		19-29	
Time, hr	950		976		1082	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000	1000	1000
Temperature, Furnace, °F	580	580	580	580	580	580
Temperature, Reactor Entrance, °F	641	641	644	644	646	646
Temperature, Middle Bed, °F	602	602	603	603	602	602
Temperature, Exit, °F	581	581	582	582	580	580
Flow Rate, H_2S, lb-mol./hr	0.00013	0.00013	0.00013	0.00013	0.00014	0.00014
Flow Rate, Feed, lb-mol./hr	0.00526	0.01275	0.00529	0.0132	0.01515	0.0131
Flow Rate, H_2O, lb-mol./hr	--	0.00696	--	0.00739	--	0.00740
Flow Rate, C_6H_6, lb-mol./hr	0.0048	0.00048	0.00046	0.00046	0.00053	0.00053
Temperature, Steam, °F	900	900	900	900	900	900
Temperature, Benzene, °F	280	280	280	280	280	280
Feed Composition, mol %						
CO	21.5	8.88	21.5	8.62	18.6	7.31
CO_2	22.9	9.91	24.0	9.63	24.8	9.63
H_2	27.5	10.73	26.0	10.43	28.2	11.08
CH_4	23.7	9.99	24.2	9.7	23.3	9.16
$C_2H_6^+$	0.9	0.33	0.8	0.32	1.2	0.47
N_2	1.0	0.45	1.1	0.44	1.2	0.47
H_2S	2.5	0.99	2.4	0.96	2.7	1.06
NH_4OH	--	0.28	--	0.30	--	0.29
C_6H_6	--	3.78	--	3.47	--	4.07
C_6H_5OH	--	0.03	--	0.03	--	0.03
H_2O	--	54.63	--	56.10	--	56.43
Total	100.00	100.00	100.00	100.00	100.00	100.00
Product Flow Rate, lb-mol./hr	0.00573	0.01195	0.00577	0.0125	0.00572	0.01189
Product Composition, mol %						
CO	3.9	1.87	4.8	2.22	4.2	2.02
CO_2	38.8	17.54	31.89	14.66	32.8	15.79
H_2	32.9	15.76	42.0	19.42	40.7	19.59
CH_4	21.2	10.16	18.0	8.32	18.72	8.71
$C_2H_6^+$	1.0	0.48	0.91	0.42	0.88	0.42
N_2	1.2	0.57	1.0	0.46	1.	0.53
H_2S	1.0	0.48	1.4	0.65	1.7	0.82
NH_4OH	--	0.07	--	0.07	--	0.06
C_6H_6	--	2.9	--	2.83	--	3.52
C_6H_5OH	--	0.01	--	0.01	--	0.01
H_2O	--	50.16	--	50.94	--	48.53
Total	100.00	100.00	100.00	100.00	100.00	100.00
CO Consumed, lb-mol./hr	0.00091	--	0.00086	--	0.00072	--
CO_2 Produced, lb-mol./hr	0.000833	--	0.00056	--	0.00063	--
H_2 Produced, lb-mol./hr	0.00052	--	0.00105	--	0.00088	--
H_2O Used, lb-mol./hr	0.00097	--	0.00104	--	0.00163	--
Space Velocity, SCF/hr-cu ft	2090	5068	2103	5247	2047	5207

B-24-227I

Table A-9, Part 10. LIFE TESTS — CATALYST EVALUATION
(CCI C-20-6-03 Catalyst, 1/16-Inch Extrudates, 20 g)

Run No.	19-30		19-31		19-32	
Time, hr	1101		1126		1257	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000	1000	1000
Temperature, Furnace, °F	580	580	580	580	580	580
Temperature, Reactor Entrance, °F	646	646	646	647	647	647
Temperature, Middle Bed, °F	603	603	603	603	603	603
Temperature, Exit, °F	580	580	582	582	581	581
Flow Rate, H_2S, lb-mol./hr	0.00014	0.00014	0.00014	0.00014	0.00012	0.00012
Flow Rate, Feed, lb-mol./hr	0.00515	0.01284	0.00550	0.01193	0.00508	0.0129
Flow Rate, H_2O, lb-mol./hr	--	0.00707	--	0.00623	--	0.00720
Flow Rate, C_6H_6, lb-mol./hr	0.00059	0.00059	0.00046	0.00046	0.00053	0.00053
Temperature, Steam, °F	900	900	900	900	900	900
Temperature, Benzene, °F	280	280	280	280	280	280
Feed Composition, mol %						
CO	18.6	7.47	19.0	7.97	24.03	9.55
CO_2	24.08	9.83	24.1	10.11	22.9	9.04
H_2	28.2	11.32	28.6	11.99	25.0	9.87
CH_4	23.3	9.35	23.3	9.77	23.8	9.40
$C_2H_6^+$	1.2	0.48	1.	0.46	0.77	0.30
N_2	1.2	0.48	1.2	0.50	1.2	0.47
H_2S	2.7	1.08	2.8	1.17	2.4	0.95
NH_4OH	--	0.28	--	0.28	--	0.29
C_6H_6	--	4.57	--	3.86	--	4.13
C_6H_5OH	--	0.03	--	0.03	--	0.03
H_2O	--	55.11	--	53.86	--	55.97
Total	100.00	100.00	100.00	100.00	100.00	100.00
Product Flow Rate, lb-mol./hr	0.00553	0.01197	0.00560	0.01190	0.00589	0.01141
Product Composition, mol %						
CO	4.2	1.94	2.6	1.22	4.6	2.38
CO_2	32.9	15.19	35.0	16.47	33.0	17.08
H_2	41.0	18.93	39.6	18.62	38.1	19.73
CH_4	18.2	8.40	18.7	8.80	20.2	10.46
$C_2H_6^+$	0.90	0.42	0.9	0.43	0.8	0.41
N_2	1.1	0.51	1.0	0.47	1.0	0.52
H_2S	1.7	0.78	2.2	1.04	1.9	0.98
NH_4OH	--	0.07	--	0.07	--	0.06
C_6H_6	--	3.01	--	3.5	0.4	2.90
C_6H_5OH	--	0.01	--	0.01	--	0.01
H_2O	--	50.74	--	49.37	--	45.47
Total	100.00	100.00	100.00	100.00	100.00	100.00
CO Consumed, lb-mol./hr	0.00073	--	0.00045	--	0.00096	--
CO_2 Produced, lb-mol./hr	0.00056	--	0.00075	--	0.00078	--
H_2 Produced, lb-mol./hr	0.00081	--	0.00069	--	0.00098	--
H_2O Used, lb-mol./hr	0.000999	--	0.00056	--	0.00200	--
Space Velocity, SCF/hr-cu ft	2047	5140	1988	4742	2019	5127

B-24-227g

Table A-9, Part 11. LIFE TESTS – CATALYST EVALUATION
(CCI C-20-6-03 Catalyst, 1/16-Inch Extrudates, 20 g)

Run No.	19-33		19-34		19-35*	
Time, hr	1288		1300		1409	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000	1000	1000
Temperature, Furnace, °F	580	580	580	580	580	580
Temperature, Reactor Entrance, °F	647	647	647	647	652	652
Temperature, Middle Bed, °F	603	603	602	602	605	605
Temperature, Exit, °F	581	581	580	580	582	582
Flow Rate, H_2S, lb-mol./hr	0.00012	0.00012	0.00012	0.00012	0.00022	0.00022
Flow Rate, Feed, lb-mol./hr	0.00508	0.0129	0.000508	0.0130	0.00967	0.02473
Flow Rate, H_2O, lb-mol./hr	--	0.00717	--	0.00724	--	0.0138
Flow Rate, C_6H_6, lb-mol./hr	0.00059	0.00059	0.00062	0.00062	0.00118	0.00118
Temperature, Steam, °F	900	900	900	900	900	900
Temperature, Benzene, °F	280	280	280	280	280	280
Feed Composition, mol %						
CO	24.03	9.53	24.03	9.46	25.2	9.85
CO_2	22.9	9.02	22.8	8.95	23.0	8.99
H_2	25.0	9.85	25.0	9.77	24.3	9.50
CH_4	23.8	9.37	23.8	9.30	23.1	9.03
C_2H_6	0.77	0.30	0.77	0.30	0.9	0.35
N_2	1.2	0.47	1.2	0.47	1.2	0.47
H_2S	2.4	0.94	2.4	0.94	2.3	0.90
NH_4OH	--	0.29	--	0.29	--	0.29
C_6H_6	--	4.55	--	4.77	--	4.77
C_6H_5OH	--	0.03	--	0.04	--	0.04
H_2O	--	55.65	--	55.71	--	55.81
Total	100.00	100.00	100.00	100.00	100.00	100.00
Product Flow Rate, lb-mol./hr	0.00593	0.01246	0.00588	0.0126	0.0105	0.0231
Product Composition, mol %						
CO	4.2	2.0	4.2	1.96	6.4	2.91
CO_2	33.0	15.74	32.0	14.96	32.0	14.55
H_2	38.76	18.46	40.9	19.11	40.7	18.50
CH_4	20.0	9.54	19.0	8.88	18.00	8.68
C_2H_6	0.8	0.40	0.8	0.37	0.8	0.40
N_2	1.0	0.48	1.0	0.47	1.0	0.45
H_2S	1.8	0.86	1.8	0.84	1.1	0.50
NH_4OH	--	0.06	--	0.07	--	0.06
C_6H_6	0.4	4.15	0.3	4.81	--	4.09
C_6H_5OH	--	0.01	--	0.01	--	0.01
H_2O	--	48.30	--	48.50	--	49.85
Total	100.00	100.00	100.00	100.00	100.00	100.00
CO Consumed, lb-mol./hr	0.00098	--	0.000983	--	0.00177	--
CO_2 Produced, lb-mol./hr	0.00039	--	0.000718	--	0.00113	--
H_2 Produced, lb-mol./hr	0.00103	--	0.00114	--	0.00192	--
H_2O Used, lb-mol./hr	0.00114	--	0.00113	--	0.00232	--
Space Velocity, SCF/hr-cu ft	2019	5127	2019	5167	3844	9830

* Total space velocity was doubled.

B-24-227h

Table A-9, Part 12. LIFE TESTS — CATALYST EVALUATION
(CCI C-20-6-03 Catalyst, 1/16-Inch Extrudates, 20 g)

Run No.	19-36		19-37		19-38	
Time, hr	1472		1496		1575	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000	1000	1000
Temperature, Furnace, °F	580	580	580	580	580	580
Temperature, Reactor Entrance, F	654	654	655	655	655	655
Temperature, Middle Bed, °F	605	605	605	605	605	605
Temperature, Exit, °F	583	583	585	585	585	585
Flow Rate, H_2S, lb-mol/hr	0.00024	0.00024	0.0002	0.0002	0.00025	0.00025
Flow Rate, Feed, lb-mol./hr	0.00977	0.02661	0.01003	0.0248	0.01041	0.02561
Flow Rate, H_2O, lb-mol./hr	--	0.01543	--	0.0136	--	0.01397
Flow Rate, C_6H_6, lb-mol./hr	0.00131	0.00131	0.00107	0.00107	0.001147	0.001147
Temperature, Steam, °F	900	900	900	900	900	900
Temperature, Benzene, °F	280	280	280	280	280	280
Feed Composition, mol %						
CO	24.8	9.11	23.1	9.35	24.9	10.12
CO_2	23.0	8.45	22.6	9.14	23.0	9.35
H_2	25.0	9.18	28.0	11.33	25.1	10.20
CH_4	22.8	8.38	22.4	9.06	22.6	9.18
$C_2H_4^+$	0.9	0.33	0.9	0.37	0.9	0.37
N_2	1.1	0.40	1.0	0.40	1.1	0.45
H_2S	2.4	0.88	2.0	0.82	2.4	0.98
NH_4OH	--	0.30	--	0.28	--	0.28
C_6H_6	--	4.93	--	4.30	--	4.48
C_6H_5OH	--	0.04	--	0.03	--	0.03
H_2O	--	58.00	--	54.92	--	54.56
Total	100.00	100.00	100.00	100.00	100.00	100.00
Product Flow Rate, lb-mol./hr	0.0112	0.0270	0.0107	0.0226	0.01134	0.0249
Product Composition, mol %						
CO	6.7	2.78	7.0	3.31	7.0	3.19
CO_2	28.4	11.80	30.8	14.58	30.7	13.97
H_2	42.6	17.70	39.5	18.70	40.0	18.21
CH_4	18.94	7.81	19.2	9.09	19.0	8.65
$C_2H_4^+$	0.86	0.36	0.8	0.38	0.79	0.36
N_2	1.0	0.42	1.1	0.52	1.1	0.64
H_2S	1.5	0.62	1.6	0.76	1.41	0.50
NH_4OH	--	0.07	--	0.06	--	0.06
C_6H_6	--	4.0	--	3.92	--	4.15
C_6H_5OH	--	0.02	--	0.01	--	0.01
H_2O	--	54.42	--	48.07	--	50.26
Total	100.00	100.00	100.00	100.00	100.00	100.00
CO Consumed, lb-mol./hr	0.00167	--	0.00157	--	0.001798	--
CO_2 Produced, lb-mol./hr	0.00093	--	0.00103	--	0.001088	--
H_2 Produced, lb-mol./hr	0.00233	--	0.00142	--	0.001924	--
H_2O Used, lb-mol./hr	0.00766	--	0.00262	--	0.001450	--
Space Velocity, SCF/hr-cu ft	3883	10577	3987	9858	4138	10,108

B-24-2271

Table A-9, Part 13. LIFE TESTS — CATALYST EVALUATION
(CCI C-20-6-03 Catalyst, 1/16-Inch Extrudates, 20 g)

Run No.	19-39		19-40		19-41	
Time, hr	1591		1639		1663	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000	1000	1000
Temperature, Furnace, °F	580	580	580	580	580	580
Temperature, Reactor Entrance, °F	655	655	655	655	655	655
Temperature, Middle Bed, °F	605	605	605	605	605	605
Temperature, Exit, °F	585	585	585	585	585	585
Flow Rate, H_2S, lb-mol./hr	0.00025	0.00025	0.000246	0.000246	0.000248	0.000248
Flow Rate, Feed, lb-mol./hr	0.01037	0.02581	0.01028	0.02744	0.01037	0.02550
Flow Rate, H_2O, lb-mol./hr	--	0.01422	--	0.01582	--	0.01389
Flow Rate, C_6H_6, lb-mol./hr	0.001134	0.001134	0.001252	0.001252	0.001158	0.001158
Temperature, Steam, °F	900	900	900	900	900	900
Temperature, Benzene, °F	280	280	280	280	280	280
Feed Composition, mol %						
CO	24.9	10.0	24.9	9.32	24.9	10.13
CO_2	23.0	9.24	23.0	8.61	23.0	9.35
H_2	25.1	10.08	25.1	9.40	25.1	10.21
CH_4	22.6	9.08	22.6	8.46	22.6	9.19
$C_2H_4^+$	0.9	0.37	0.9	0.34	0.9	0.37
N_2	1.1	0.44	1.1	0.41	1.1	0.45
H_2S	2.4	0.96	2.4	0.90	2.4	0.98
NH_4OH	--	0.28	--	0.30	--	0.28
C_6H_6	--	4.39	--	4.56	--	4.54
C_6H_5OH	--	0.03	--	0.05	--	0.03
H_2O	--	55.13	--	57.65	--	54.47
Total	100.00	100.00	100.00	100.00	100.00	100.00
Product Flow Rate, lb-mol./hr	0.0114	0.02390	0.0109	0.02543	0.01123	0.0234
Product Composition, mol %						
CO	7.5	3.61	6.7	2.84	7.7	3.7
CO_2	30.6	14.72	28.1	11.90	30.0	14.4
H_2	39.62	19.05	40.7	17.26	38.5	18.48
CH_4	19.0	9.14	21.0	8.90	20.8	9.99
$C_2H_4^+$	0.88	0.42	0.8	0.34	0.8	0.38
N_2	1.0	0.48	1.1	0.68	1.1	0.53
H_2S	1.4	0.67	1.6	0.47	1.1	0.53
NH_4OH	--	0.06	--	0.07	--	0.06
C_6H_6	--	4.04	--	3.57	--	4.27
C_6H_5OH	--	0.01	--	0.02	--	0.01
H_2O	--	47.80	--	53.95	--	47.65
Total	100.00	100.00	100.00	100.00	100.00	100.00
CO Consumed, lb-mol./hr	0.001724	--	0.001836	--	0.002006	--
CO_2 Produced, lb-mol./hr	0.001118	--	0.000667	--	0.000983	--
H_2 Produced, lb-mol./hr	0.001930	--	0.001809	--	0.001720	--
H_2O Used, lb-mol./hr	0.002845	--	0.002100	--	0.002743	--
Space Velocity, SCF/hr-cu ft	4122	10,259	4086	10907	4122	10136

B-24-227j

Table A-9, Part 14. LIFE TESTS — CATALYST EVALUATION (CCI C-20-6-03 Catalyst, 1/16-Inch Extrudates, 20 g)

Run No.	20-1		20-2		20-3	
Time, hr	9		33		57	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000	1000	1000
Temperature, Furnace, °F	580	580	580	580	580	580
Temperature, Reactor Entrance, °F	646	646	647	647	645	645
Temperature, Quarter Bed, °F	653	653	655	655	653	653
Temperature, Middle Bed, °F	645	645	646	646	645	645
Temperature, Exit, °F	620	620	621	621	620	620
Flow Rate, H_2S, lb-mol./hr	0.000050	0.000050	0.000050	0.000050	0.000052	0.000052
Flow Rate, Feed, lb-mol./hr	0.004966	0.012037	0.005044	0.012177	0.005151	0.012246
Flow Rate, H_2O, lb-mol./hr	--	0.007076	--	0.007051	--	0.007099
Flow Rate, C_6H_6, lb-mol./hr	--	--	--	--	--	--
Temperature, Steam, °F	900	900	900	900	900	900
Temperature, Benzene, °F	280	280	280	280	280	280
Feed Composition, mol %*						
CO	23.8	9.82	23.6	10.63	23.8	10.01
CO_2	23.0	9.48	23.0	9.54	23.0	9.68
H_2	20.6	8.46	20.6	8.49	20.6	8.62
CH_4	28.4	11.71	28.4	11.70	28.4	11.95
C_2H_6+	1.2	0.50	1.2	0.50	1.2	0.51
N_2	2.0	0.83	2.0	0.83	2.0	0.84
H_2S	1.0	0.41	1.0	0.41	1.0	0.42
NH_4OH	--	--	--	--	--	--
C_4H_n	--	--	--	--	--	--
C_6H_5OH	--	--	--	--	--	--
H_2O	--	58.79	--	57.90	--	57.97
Total	100.00	100.00	100.00	100.00	100.00	100.00
Product Flow Rate, lb-mol./hr	0.005723	0.011048	0.005568	0.012022	0.005650	0.011212
Product Composition, mol %						
CO	--	--	--	--	--	--
CO_2	39.1	20.20	38.0	17.95	37.4	18.72
H_2	33.4	17.30	35.5	16.44	36.4	18.22
CH_4	24.5	12.69	23.2	10.74	22.8	11.53
C_2H_6+	1.0	0.52	0.9	0.42	0.9	0.45
N_2	1.3	0.36	1.4	0.65	1.5	0.76
H_2S	0.7	0.67	1.0	0.47	1.0	0.51
NH_4OH	--	--	--	--	--	--
C_6H_6	--	--	--	--	--	--
C_6H_5OH	--	--	--	--	--	--
H_2O	--	48.26	--	53.33	--	49.81
Total	100.00	100.00	100.00	100.00	100.00	100.00
CO Consumed, lb-mol./hr	0.001182	--	0.001295	--	0.001226	--
CO_2 Produced, lb-mol./hr	0.001090	--	0.001025	--	0.000948	--
H_2 Produced, lb-mol./hr	0.000893	--	0.000943	--	0.001001	--
H_2O Used, lb-mol./hr	0.001477	--	0.000640	--	0.001537	--
Space Velocity, SCF/hr-cu ft	2843	5488	2766	5972	2807	5570

*The feed gas contains about 1.3 ppm propyl mercaptan, 0.8 ppm thiophene, and 52 ppm COS.

B-44-604a

Table A-10, Part 1. LIFE TESTS (Girdler G-93 Comoloy High-Temperature Shift Catalyst, 4 x 6 Mesh Spheres, 20.2 g)

Run No.	20-1		20-2		20-3	
Time, hr	9		33		57	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000	1000	1000
Temperature, Furnace, °F	580	580	580	580	580	580
Temperature, Reactor Entrance, °F	646	646	647	647	645	645
Temperature, Quarter Bed, °F	653	653	655	655	653	653
Temperature, Middle Bed, °F	645	645	646	646	645	645
Temperature, Exit, °F	620	620	621	621	620	620
Flow Rate, H_2S, lb-mol/hr	0.000050	0.000050	0.000050	0.000050	0.000052	0.000052
Flow Rate, Feed, lb-mol/hr	0.004966	0.012037	0.005044	0.012177	0.005151	0.012246
Flow Rate, H_2O, lb-mol/hr	--	0.007076	--	0.007051	--	0.007099
Flow Rate, C_6H_6, lb-mol/hr	--	--	--	--	--	--
Temperature, Steam, °F	900	900	900	900	900	900
Temperature, Benzene, °F	280	280	280	280	280	280
Feed Composition, mol %*						
CO	23.8	9.82	23.8	10.63	23.8	10.01
CO_2	23.0	9.44	23.0	9.54	23.0	9.68
H_2	20.6	8.41	20.6	8.42	20.6	8.62
CH_4	28.4	11.71	28.4	11.70	28.4	11.95
$C_2H_6^+$	1.2	0.50	1.2	0.50	1.2	0.51
N_2	2.0	0.83	2.0	0.83	2.0	0.84
H_2S	1.0	0.41	1.0	0.41	1.0	0.42
NH_4OH	--	--	--	--	--	--
C_6H_6	--	--	--	--	--	--
C_6H_5OH	--	--	--	--	--	--
H_2O	--	58.78	--	57.90	--	57.97
Total	100.00	100.00	100.00	100.00	100.00	100.00
Product Flow Rate, lb-mol/hr	0.005723	0.011048	0.005559	0.012022	0.005650	0.011212
Product Composition, mol %						
CO	--	--	--	--	--	--
CO_2	39.1	20.20	38.0	17.95	37.4	15.72
H_2	33.4	17.30	35.5	16.44	36.4	15.22
CH_4	24.5	12.69	23.2	10.74	22.8	11.53
$C_2H_6^+$	1.0	0.52	0.9	0.42	0.9	0.45
N_2	1.3	0.36	1.4	0.65	1.5	0.76
H_2S	0.7	0.67	1.0	0.47	1.0	0.41
NH_4OH	--	--	--	--	--	--
C_6H_6	--	--	--	--	--	--
C_6H_5OH	--	--	--	--	--	--
H_2O	--	48.26	--	54.33	--	44.81
Total	100.00	100.00	100.00	100.00	100.00	100.00
CO Consumed, lb-mol/hr	0.001182	--	0.001235	--	0.001226	--
CO_2 Produced, lb-mol/hr	0.001730	--	0.001023	--	0.000945	--
H_2 Produced, lb-mol/hr	0.000833	--	0.001343	--	0.001001	--
H_2O Used, lb-mol/hr	0.001477	--	0.001641	--	0.001537	--
Space Velocity, SCF/hr-cu ft	2543	5454	2766	5972	2607	5570

*The feed gas contains about 1.3 ppm propyl mercaptan, 0.8 ppm thiophene, and 52 ppm COS.

B-44-604

Table A-10, Part 2. LIFE TESTS (Girdler G-93 Comoloy High-Temperature Shift Catalyst, 4 x 6 Mesh Spheres, 20.2 g)

Run No.	20-4		20-5		20-6	
Time, hr	81		147		176	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000	1000	1000
Temperature, Furnace, °F	580	580	580	580	580	580
Temperature, Reactor Entrance, °F	645	645	645	645	645	645
Temperature, Quarter Bed, °F	651	651	651	651	652	652
Temperature, Middle Bed, °F	643	643	643	643	644	644
Temperature, Exit, °F	620	620	620	620	619	619
Flow Rate, H_2S, lb-mol/hr	0.000051	0.000051	0.000051	0.000051	0.000086	0.000086
Flow Rate, Feed, lb-mol/hr	0.005143	0.012310	0.005066	0.012430	0.005056	0.012878
Flow Rate, H_2O, lb-mol/hr	--	0.007175	--	0.007349	--	0.007226
Flow Rate, C_2H_5, lb-mol/hr	--	--	--	--	--	0.000597
Temperature, Steam, °F	900	900	900	900	900	900
Temperature, Benzene, °F	280	280	280	280	280	280
Feed Composition, mol %*						
CO	23.6	9.94	23.8	9.73	23.0	9.03
CO_2	23.0	9.60	23.0	9.41	22.6	8.88
H_2	20.6	8.56	20.6	8.39	20.2	7.93
CH_4	28.4	11.86	28.4	11.62	28.9	11.34
C_2H_6*	1.2	0.50	1.2	0.49	1.2	0.47
N_2	2.0	0.84	2.0	0.82	2.4	0.94
H_2S	1.0	0.41	1.0	0.41	1.7	0.67
NH_4OH	--	--	--	--	--	--
C_2H_4	--	--	--	--	--	4.64
C_2H_5OH	--	--	--	--	--	--
H_2O	--	56.29	--	59.12	--	56.10
Total	100.00	100.00	100.00	100.00	100.00	100.00
Product Flow Rate, lb-mol/hr	0.005749	0.011825	0.005523	0.012016	0.005815	0.012837
Product Composition, mol %						
CO	--	--	--	--	--	--
CO_2	37.4	15.18	36.80	17.63	37.7	17.08
H_2	36.4	17.70	37.10	17.96	35.4	16.04
CH_4	23.0	11.19	23.00	11.05	23.4	10.59
C_2H_6*	0.9	0.44	1.00	0.48	0.9	0.41
N_2	1.3	0.63	1.40	0.68	1.3	0.59
H_2S	1.0	0.48	0.70	0.34	1.0	0.45
NH_4OH	--	--	--	--	--	--
C_2H_4	--	--	--	--	0.3	3.95
C_2H_5OH	--	--	--	--	--	--
H_2O	--	51.39	--	51.64	--	50.89
Total	100.00	100.00	100.00	100.00	100.00	100.00
CO Consumed, lb-mol/hr	0.001223	--	0.001210	--	0.001163	--
CO_2 Produced, lb-mol/hr	0.000882	--	0.000973	--	0.001049	--
H_2 Produced, lb-mol/hr	0.001039	--	0.001117	--	0.001037	--
H_2O Used, lb-mol/hr	0.001108	--	0.001144	--	0.000694	--
Space Velocity, SCF/hr-cu ft	2556	6874	2533	5960	2689	6377

* Feed gas contains about 1.5 ppm propyl mercaptan, 0.8 ppm thiophene, and 52 ppm COS.

B-44-604b

Table A-10, Part 3. LIFE TESTS (Girdler G-93 Comoloy High-Temperature Shift Catalyst, 4 x 6 Mesh Spheres, 20.2 g)

Run No.	20-7		20-8		20-9	
Time, hr	203		218		242	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000	1000	1000
Temperature, Furnace, °F	580	580	580	580	580	580
Temperature, Reactor Entrance, °F	645	645	646	646	645	646
Temperature, Quarter Bed, °F	652	652	653	653	655	655
Temperature, Middle Bed, °F	644	644	645	645	644	644
Temperature, Exit, °F	620	620	621	621	621	621
Flow Rate, H_2S, lb-mol./hr	0.000085	0.000085	0.000084	0.000084	0.000085	0.000085
Flow Rate, Feed, lb-mol./hr	0.004980	0.012875	0.004967	0.012753	0.004993	0.012833
Flow Rate, H_2O, lb-mol./hr	--	0.007315	--	0.007240	--	0.007246
Flow Rate, C_6H_6, lb-mol./hr	--	0.000579	--	0.000547	--	0.000545
Temperature, Steam, °F	900	900	900	900	900	900
Temperature, Benzene, °F	280	280	280	280	280	280
Feed Composition, mol %*						
CO	23.0	8.89	23.0	8.95	23.0	8.95
CO_2	22.6	8.75	22.6	8.81	22.6	8.79
H_2	20.2	7.81	20.2	7.86	20.2	7.85
CH_4	28.9	11.18	28.9	11.26	28.9	11.24
C_2H_6*	1.2	0.47	1.2	0.47	1.2	0.47
N_2	2.4	0.93	2.4	0.93	2.4	0.94
H_2S	1.7	0.66	1.7	0.66	1.7	0.66
NH_4OH	--	--	--	--	--	--
C_6H_6	--	4.49	--	4.29	--	4.25
C_6H_5OH	--	--	--	--	--	--
H_2O	--	56.82	--	56.77	--	56.85
Total	100.00	100.00	100.00	100.00	100.00	100.00
Product Flow Rate, lb-mol./hr	0.005925	0.012069	0.005950	0.012212	0.005826	0.011967
Product Composition, mol %						
CO	--	--	--	--	--	--
CO_2	37.8	18.55	37.7	18.37	37.8	18.40
H_2	34.9	17.14	35.1	17.11	34.9	16.99
CH_4	23.5	11.53	23.4	11.40	23.5	11.44
C_2H_6*	0.7	0.34	0.9	0.44	0.8	0.39
N_2	1.8	0.89	1.6	0.78	1.7	0.83
H_2S	1.0	0.49	1.0	0.49	1.0	0.48
NH_4OH	--	--	--	--	--	--
C_6H_6	0.3	3.94	0.3	3.80	0.3	3.78
C_6H_5OH	--	--	--	--	--	--
H_2O	--	47.12	--	47.81	--	47.69
Total	100.00	100.00	100.00	100.00	100.00	100.00
CO Consumed, lb-mol./hr	0.001145	--	0.001142	--	0.001148	--
CO_2 Produced, lb-mol./hr	0.001113	--	0.001120	--	0.001074	--
H_2 Produced, lb-mol./hr	0.001062	--	0.001086	--	0.001025	--
H_2O Used, lb-mol./hr	0.001628	--	0.001402	--	0.001589	--
Space Velocity, SCF/hr-cu ft	2943	5995	2956	6066	2894	5945

*The feed gas contains about 1.3 ppm propyl mercaptan, 0.8 ppm thiophene, and 52 ppm COS.

B-44-004c

Table A-10, Part 4. LIFE TESTS (Girdler G-93 Comoloy High-Temperature Shift Catalyst, 4 x 6 Mesh Spheres, 20.2 g)

Run No.	20-10		20-11*		20-12	
Time, hr	314		323		331	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000	1000	1000
Temperature, Furnace, °F	580	580	580	580	580	580
Temperature, Reactor Entrance, °F	646	646	645	645	645	645
Temperature, Quarter Bed, °F	656	656	656	656	654	654
Temperature, Middle Bed, °F	644	644	644	644	644	644
Temperature, Exit, °F	620	620	621	621	620	620
Flow Rate, H_2S, lb-mol./hr	0.000085	0.000085	0.000085	0.000085	0.000085	0.000085
Flow Rate, Feed, lb-mol./hr	0.004987	0.012645	0.005008	0.012871	0.004995	0.012833
Flow Rate, H_2O, lb-mol./hr	--	0.007055	--	0.007248	--	0.007272
Flow Rate, C_6H_6, lb-mol./hr	--	0.000603	--	0.000615	--	0.000565
Temperature, Steam, °F	900	900	900	900	900	900
Temperature, Benzene, °F	280	280	280	280	280	280
Feed Composition, mol %*						
CO	23.0	9.07	23.0	8.95	23.0	8.95
CO_2	22.6	8.91	22.6	8.79	22.6	8.80
H_2	20.2	7.96	20.2	7.86	20.2	7.86
CH_4	28.9	11.41	28.9	11.24	28.9	11.25
C_2H_6*	1.2	0.47	1.2	0.47	1.2	0.47
N_2	2.4	0.95	2.4	0.93	2.4	0.94
H_2S	1.7	0.67	1.7	0.66	1.7	0.66
NH_4OH	--	--	--	--	--	--
C_6H_6	--	4.77	--	4.78	--	4.40
C_6H_5OH	--	--	--	--	--	--
H_2O	--	55.79	--	56.32	--	56.67
Total	100.00	100.00	100.00	100.00	100.00	100.00
Product Flow Rate, lb-mol./hr	0.005819	0.011325	0.005785	0.012248	0.005833	0.012076
Product Composition, mol %						
CO	--	--	--	--	--	--
CO_2	37.6	19.42	38.0	17.95	37.7	18.21
H_2	34.9	17.93	34.9	16.48	34.3	16.58
CH_4	23.5	12.07	23.4	11.05	23.8	11.49
C_2H_6*	0.8	0.42	0.8	0.38	0.9	0.43
N_2	1.6	0.82	1.6	0.76	1.9	0.92
H_2S	1.1	0.57	1.0	0.47	1.0	0.48
NH_4OH	--	--	--	--	--	--
C_6H_6	0.3	3.5	0.3	4.37	0.4	3.97
C_6H_5OH	--	--	--	--	--	--
H_2O	--	45.27	--	48.54	--	47.92
Total	100.00	100.00	100.00	100.00	100.00	100.00
CO Consumed, lb-mol./hr	0.001147	--	0.001152	--	0.001149	--
CO_2 Produced, lb-mol./hr	0.001072	--	0.001066	--	0.001070	--
H_2 Produced, lb-mol./hr	0.001024	--	0.001077	--	0.000992	--
H_2O Used, lb-mol./hr	0.001927	--	0.001303	--	0.001485	--
Space Velocity, SCF/hr-cu ft	2890	5926	2874	6084	2898	5999

* The feed gas contains about 1.3 ppm propyl mercaptan, 0.8 ppm thiophene, and 52 ppm COS.

* The reactor was purged with N_2 before this run for about 130 hours.

D-44-c048

Table A-10, Part 5. LIFE TESTS (Girdler G-93 Comoloy High-Temperature Shift Catalyst, 4 x 6 Mesh Spheres, 20.2 g)

Run No.	20-13		20-14[†]		20-15[‡]	
Time, hr	349		469		475	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000	1000	1000
Temperature, Furnace, °F	580	580	580	580	580	580
Temperature, Reactor Entrance, °F	645	645	645	645	645	645
Temperature, Quarter Bed, °F	655	655	654	654	654	654
Temperature, Middle Bed, °F	645	645	645	645	644	644
Temperature, Exit, °F	621	621	621	621	620	620
Flow Rate, H_2S, lb-mol./hr	0.000085	0.000085	0.000086	0.000086	0.000075	0.000075
Flow Rate, Feed, lb-mol./hr	0.005005	0.012919	0.005036	0.012772	0.005031	0.012937
Flow Rate, H_2O, lb-mol./hr	--	0.007349	--	0.007139	--	0.007320
Flow Rate, C_6H_6, lb-mol./hr	--	0.000565	--	0.000598	--	0.000559
Temperature, Steam, °F	900	900	900	900	900	900
Temperature, Benzene, °F	280	280	280	280	280	280
Feed Composition, mol %[*]						
CO	23.0	8.92	23.0	9.07	21.8	8.48
CO_2	22.6	8.75	22.6	8.91	23.6	9.18
H_2	20.2	7.83	20.2	7.96	25.0	9.73
CH_4	28.9	11.19	28.9	11.39	26.4	10.26
C_2H_6[*]	1.2	0.46	1.2	0.47	0.5	0.19
N_2	2.4	0.93	2.4	0.95	1.2	0.46
H_2S	1.7	0.66	1.7	0.67	1.5	0.58
NH_4OH	--	--	--	--	--	0.21
C_6H_6	--	4.37	--	4.68	--	4.33
C_6H_5OH	--	--	--	--	--	--
H_2O	--	56.89	--	55.90	--	56.58
Total	100.00	100.00	100.00	100.00	100.00	100.00
Product Flow Rate, lb-mol./hr	0.005845	0.012111	0.005883	0.012050	0.005831	0.012312
Product Composition, mol %						
CO	--	--	--	--	0.1	0.05
CO_2	37.8	16.24	37.7	16.41	35.4	16.76
H_2	34.2	16.50	4.1	16.65	38.3	18.15
CH_4	23.9	11.53	24.1	11.77	23.0	10.89
C_2H_6[*]	0.9	0.44	0.9	0.44	0.4	0.19
N_2	1.8	0.87	1.8	0.88	1.1	0.52
H_2S	1.0	0.48	1.0	0.49	1.3	0.62
NH_4OH	--	--	--	--	--	0.16
C_6H_6	0.4	3.99	0.4	4.17	0.4	3.82
C_6H_5OH	--	--	--	--	--	--
H_2O	--	47.95	--	47.19	--	49.04
Total	100.00	100.00	100.00	100.00	100.00	100.00
CO Consumed, lb-mol./hr	0.001161	--	0.001158	--	0.001091	--
CO_2 Produced, lb-mol./hr	0.001076	--	0.001080	--	0.000877	--
H_2 Produced, lb-mol./hr	0.000986	--	0.000989	--	0.000975	--
H_2O Used, lb-mol./hr	0.001541	--	0.001451	--	0.001282	--
Space Velocity, SCF/hr-cu ft	2904	6017	2922	5986	2897	6116

[*] The feed gas contains about 1.3 ppm propyl mercaptan, 0.8 ppm thiophene, and 52 ppm COS. B-44-604e

[†] The equipment was repaired after this run.

[‡] Ammonia was added before this run.

Table A-10, Part 6. LIFE TESTS (Girdler G-93 Comoloy High-Temperature Shift Catalyst, 4 x 6 Mesh Spheres, 20.2 g)

Run No.	20-16		20-17		20-18	
Time, hr	548		572		596	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000	1000	1000
Temperature, Furnace, °F	580	580	580	580	580	580
Temperature, Reactor Entrance, °F	646	646	645	645	646	646
Temperature, Quarter Bed, °F	655	655	655	655	655	655
Temperature, Middle Bed, °F	645	645	644	644	645	645
Temperature, Exit, °F	621	621	621	621	622	622
Flow Rate, H_2S, lb-mol./hr	0.000076	0.000076	0.000076	0.000076	0.000076	0.000076
Flow Rate, Feed, lb-mol./hr	0.005038	0.012847	0.005042	0.012972	0.005041	0.013015
Flow Rate, H_2O, lb-mol./hr	--	0.007218	--	0.007314	--	0.007349
Flow Rate, C_6H_6, lb-mol./hr	--	0.000565	--	0.000589	--	0.000548
Temperature, Steam, °F	900	900	900	900	900	900
Temperature, Benzene, °F	280	280	280	280	280	280
Feed Composition, mol %*						
CO	21.8	8.55	21.8	8.47	21.8	8.53
CO_2	23.6	9.26	23.6	9.17	23.6	9.24
H_2	25.0	9.80	25.0	9.72	25.0	9.78
CH_4	26.4	10.35	26.4	10.26	26.4	10.33
$C_2H_6^+$	0.5	0.19	0.5	0.19	0.5	0.19
N_2	1.2	0.47	1.2	0.47	1.2	0.47
H_2S	1.5	0.59	1.5	0.59	1.5	0.58
NH_4OH	--	0.21	--	0.21	--	0.20
C_6H_6	--	4.40	--	4.54	--	4.21
C_6H_5OH	--	--	--	--	--	--
H_2O	--	56.18	--	56.38	--	56.47
Total	100.00	100.00	100.00	100.00	100.00	100.00
Product Flow Rate, lb-mol./hr	0.005846	0.012270	0.005876	0.011548	0.005888	0.012398
Product Composition, mol %						
CO	0.1	0.05	0.1	0.05	0.1	0.05
CO_2	35.5	16.91	35.7	18.16	35.7	16.95
H_2	38.5	18.34	38.4	19.54	38.5	18.27
CH_4	22.8	10.85	22.8	11.60	22.7	10.78
$C_2H_6^+$	0.4	0.19	0.4	0.21	0.4	0.19
N_2	1.0	0.47	1.0	0.51	1.0	0.48
H_2S	1.3	0.62	1.2	0.61	1.2	0.57
NH_4OH	--	0.15	--	0.15	--	0.16
C_6H_6	0.4	3.85	0.4	4.10	0.4	3.60
C_6H_5OH	--	--	--	--	--	--
H_2O	--	48.57	--	45.07	--	49.95
Total	100.00	100.00	100.00	100.00	100.00	100.00
CO Consumed, lb-mol./hr	0.001092	--	0.001093	--	0.001104	--
CO_2 Produced, lb-mol./hr	0.000886	--	0.000908	--	0.000900	--
H_2 Produced, lb-mol./hr	0.000992	--	0.000997	--	0.000994	--
H_2O Used, lb-mol./hr	0.001257	--	0.002109	--	0.001280	--
Space Velocity, SCF/hr-cu ft	2904	6095	2919	5737	2925	6159

*The feed gas contains about 1.3 ppm propyl mercaptan, 0.8 ppm thiophene, and 52 ppm COS.

B-44-604f

Table A-10, Part 7. LIFE TESTS (Girdler G-93 Comoloy High-Temperature Shift Catalyst, 4 x 6 Mesh Spheres, 20.2 g)

Run No.	20-19		20-20		20-21	
Time, hr	668		697		733	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000	1000	1000
Temperature, Furnace, °F	580	580	580	580	580	580
Temperature, Reactor Entrance, °F	644	644	644	644	645	645
Temperature, Quarter Bed, °F	655	655	654	654	655	655
Temperature, Middle Bed, °F	644	644	643	643	646	646
Temperature, Exit, °F	618	618	618	618	617	617
Flow Rate, H_2S, lb-mol./hr	0.000076	0.000076	0.000076	0.000076	0.000076	0.000076
Flow Rate, Feed, lb-mol./hr	0.005075	0.012860	0.005040	0.012888	0.005035	0.013020
Flow Rate, H_2O, lb-mol./hr	--	0.007196	--	0.007242	--	0.007349
Flow Rate, C_6H_6, lb-mol./hr	--	0.000562	--	0.000578	--	0.000609
Temperature, Steam, °F	900	900	900	900	900	900
Temperature, Benzene, °F	280	280	280	280	280	280
Feed Composition, mol %*						
CO	21.8	8.60	21.8	8.53	21.8	8.43
CO_2	23.6	9.32	23.6	9.23	23.6	9.12
H_2	25.0	9.87	25.0	9.78	25.0	9.68
CH_4	26.4	10.42	26.4	10.33	26.4	10.21
C_2H_6+	0.5	0.19	0.5	0.19	0.5	0.19
N_2	1.2	0.47	1.2	0.47	1.2	0.46
H_2S	1.5	0.59	1.5	0.59	1.5	0.58
NH_4OH	--	0.21	--	0.21	--	0.21
C_6H_6	--	4.37	--	4.48	--	4.68
C_6H_5OH	--	--	--	--	--	--
H_2O	--	55.96	--	56.19	--	56.44
Total	100.00	100.00	100.00	100.00	100.00	100.00
Product Flow Rate, lb-mol./hr	0.005909	0.012439	0.005980	0.012486	0.005886	0.012451
Product Composition, mol %						
CO	0.1	0.05	0.1	0.05	0.1	0.05
CO_2	35.6	16.92	35.5	17.00	34.3	16.22
H_2	38.6	18.33	38.4	18.39	40.0	18.91
CH_4	22.5	10.69	22.8	10.92	22.2	10.50
C_2H_6+	0.4	0.19	0.4	0.19	0.5	0.23
N_2	1.1	0.52	1.1	0.53	1.6	0.75
H_2S	1.3	0.62	1.3	0.62	0.9	0.43
NH_4OH	--	0.16	--	0.15	--	0.15
C_6H_6	0.4	4.02	0.4	4.64	0.4	4.25
C_6H_5OH	--	--	--	--	--	--
H_2O	--	48.50	--	47.51	--	48.51
Total	100.00	100.00	100.00	100.00	100.00	100.00
CO Consumed, lb-mol./hr	0.001100	--	0.001093	--	0.001092	--
CO_2 Produced, lb-mol./hr	0.000906	--	0.000933	--	0.000831	--
H_2 Produced, lb-mol./hr	0.001012	--	0.001036	--	0.001095	--
H_2O Used, lb-mol./hr	0.001164	--	0.001310	--	0.001309	--
Space Velocity, SCF/hr-cu ft	2935	6179	2971	6203	2924	6185

The feed gas contains about 1.3 ppm propyl mercaptan, 0.8 ppm thiophene, and 52 ppm COS.

B-44-604g

Table A-10, Part 8. LIFE TESTS
(Girdler G-93 Comoloy High-Temperature Shift Catalyst, 4 x 6 Mesh Spheres, 20.2 g)

Run No.	20-22†		20-23		20-24	
Time, hr	757		784		808	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000	1000	1000
Temperature, Furnace, °F	580	580	580	580	580	580
Temperature, Reactor Entrance, °F	643	643	656	656	659	659
Temperature, Quarter Bed, °F	651	651	651	651	649	649
Temperature, Middle Bed, °F	645	645	643	643	644	644
Temperature, Exit, °F	616	616	615	615	614	614
Flow Rate, H_2S, lb-mol./hr	0.000075	0.000075	0.000075	0.000075	0.000075	0.000075
Flow Rate, Feed, lb-mol./hr	0.004995	0.012794	0.005011	0.012790	0.005005	0.012858
Flow Rate, H_2O, lb-mol./hr	--	0.007213	--	0.007200	--	0.007260
Flow Rate, C_6H_6, lb-mol./hr	--	0.000581	--	0.000575	--	0.000590
Temperature, Steam, °F	900	900	900	900	900	900
Temperature, Benzene, °F	280	280	280	280	280	280
Feed Composition, mol %*						
CO	21.8	8.51	21.8	8.54	21.8	8.48
CO_2	23.6	9.22	23.6	9.25	23.6	9.18
H_2	25.0	9.76	25.0	9.80	25.0	9.73
CH_4	26.4	10.31	26.4	10.34	26.4	10.29
C_2H_6+	0.5	0.20	0.5	0.20	0.5	0.19
N_2	1.2	0.47	1.2	0.47	1.2	0.47
H_2S	1.5	0.60	1.5	0.59	1.5	0.58
NH_4OH	--	--	--	--	--	--
C_6H_6	--	4.54	--	4.50	--	4.59
C_6H_5OH	--	0.03	--	0.03	--	0.03
H_2O	--	56.36	--	56.28	--	56.46
Total	100.00	100.00	100.00	100.00	100.00	100.00
Product Flow Rate, lb-mol./hr	0.005833	0.012235	0.005806	0.012336	0.005583	0.012070
Product Composition, mol %						
CO	0.1	0.05	0.1	0.05	0.1	0.05
CO_2	34.5	16.44	34.5	16.24	34.4	15.92
H_2	39.5	18.83	39.6	18.63	40.0	18.50
CH_4	22.4	10.68	22.5	10.59	22.1	10.22
C_2H_6+	0.5	0.24	0.4	0.19	0.5	0.23
N_2	1.6	0.76	1.6	0.75	1.6	0.74
H_2S	1.0	0.47	0.9	0.42	0.9	0.41
NH_4OH	--	--	--	--	--	--
C_6H_6	0.4	4.48	0.4	4.32	0.4	4.47
C_6H_5OH	--	0.02	--	0.02	--	0.02
H_2O	--	48.03	--	48.79	--	49.44
Total	100.00	100.00	100.00	100.00	100.00	100.00
CO Consumed, lb-mol./hr	0.001083	--	0.001086	--	0.001085	--
CO_2 Produced, lb-mol./hr	0.000833	--	0.000820	--	0.000740	--
H_2 Produced, lb-mol./hr	0.001055	--	0.001046	--	0.000982	--
H_2O Used, lb-mol./hr	0.001348	--	0.001108	--	0.001292	--
Space Velocity, SCF/hr-cu ft	2898	6078	2884	6128	2773	5996

B-44-604h

* The feed gas contains about 1.3 ppm propyl mercaptan, 0.8 ppm thiophene, and 52 ppm COS.

† Phenol was added before this run.

Table A-10, Part 9. LIFE TESTS (Girdler G-93 Comoloy High-Temperature Shift Catalyst, 4 x 6 Mesh Spheres, 20.2 g)

Run No.	20-25		20-26†		20-27	
Time, hr	831		903		970	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000	1000	1000
Temperature, Furnace, °F	580	580	580	580	580	580
Temperature, Reactor Entrance, °F	660	660	665	665	664	664
Temperature, Quarter Bed, °F	650	650	650	650	650	650
Temperature, Middle Bed, °F	643	643	644	644	641	641
Temperature, Exit, °F	615	615	615	615	615	615
Flow Rate, H_2S, lb-mol./hr	0.000075	0.000075	0.000075	0.000075	0.000075	0.000075
Flow Rate, Feed, lb-mol./hr	0.005007	0.012746	0.005016	0.013019	0.005025	0.012429
Flow Rate, H_2O, lb-mol./hr	--	0.007174	--	0.007389	--	0.006782
Flow Rate, C_6H_6, lb-mol./hr	--	0.000561	--	0.000584	--	0.000594
Temperature, Steam, °F	900	900	900	900	900	900
Temperature, Benzene, °F	280	280	280	280	280	280
Feed Composition, mol %*						
CO	21.8	8.57	21.8	8.40	21.8	8.81
CO_2	23.6	9.27	23.6	9.09	23.6	9.54
H_2	25.0	9.82	25.0	9.63	25.0	10.11
CH_4	26.4	10.37	26.4	10.17	26.4	10.68
C_2H_6*	0.5	0.20	0.5	0.19	0.5	0.20
N_2	1.2	0.47	1.2	0.46	1.2	0.48
H_2S	1.5	0.59	1.5	0.58	1.5	0.60
NH_4OH	--	--	--	0.21	--	0.20
C_6H_6	--	4.40	--	4.48	--	4.78
C_6H_5OH	--	0.03	--	0.03	--	0.03
H_2O	--	56.76	--	56.76	--	54.57
Total	100.00	100.00	100.00	100.00	100.00	100.00
Product Flow Rate, lb-mol./hr	0.005933	0.012376	0.005892	0.012488	0.005843	0.012022
Product Composition, mol %						
CO	0.1	0.05	0.2	0.10	0.2	0.09
CO_2	34.3	16.44	34.3	16.18	34.2	16.63
H_2	39.9	19.13	39.7	18.73	39.3	19.10
CH_4	22.3	10.69	22.3	10.52	22.8	11.08
C_2H_6*	0.5	0.24	0.5	0.23	0.5	0.24
N_2	1.6	0.77	1.7	0.80	1.5	0.73
H_2S	0.9	0.43	0.9	0.42	1.1	0.53
NH_4OH	--	--	--	0.16	--	0.17
C_6H_6	0.4	4.27	0.4	4.09	0.4	4.23
C_6H_5OH	--	0.02	--	0.02	--	0.02
H_2O	--	47.96	--	48.75	--	47.18
Total	100.00	100.00	100.00	100.00	100.00	100.00
CO Consumed, lb-mol./hr	0.001086	--	0.001081	--	0.001089	--
CO_2 Produced, lb-mol./hr	0.000853	--	0.000837	--	0.000818	--
H_2 Produced, lb-mol./hr	0.001115	--	0.001085	--	0.001040	--
H_2O Used, lb-mol./hr	0.001237	--	0.001306	--	0.001110	--
Space Velocity, SCF/hr-cu ft	2947	6148	2929	6204	2903	5972

* The feed gas contains about 1.3 ppm propyl mercaptan, 0.8 ppm thiophene, and 52 ppm COS.

† Both phenol and ammonia were added before this run.

B-44-604i

Table A-10, Part 10. LIFE TESTS (Girdler G-93 Comoloy High-Temperature Shift Catalyst, 4 x 6 Mesh Spheres, 20.2 g)

Run No.	20-28		20-29		20-30	
Time, hr	998		1070		1118	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000	1000	1000
Temperature, Furnace, °F	580	580	580	580	580	580
Temperature, Reactor Entrance, °F	663	663	665	665	674	674
Temperature, Quarter Bed, °F	650	650	650	650	664	664
Temperature, Middle Bed, °F	641	641	642	642	655	655
Temperature, Exit, °F	615	615	615	615	625	625
Flow Rate, H_2S, lb-mol./hr	0.000076	0.000076	0.000076	0.000076	0.000076	0.000076
Flow Rate, Feed, lb-mol./hr	0.005034	0.012931	0.005045	0.012990	0.005045	0.012990
Flow Rate, H_2O, lb-mol./hr	--	0.007308	--	0.007349	--	0.007373
Flow Rate, C_6H_6, lb-mol./hr	--	0.000558	--	0.000565	--	0.000555
Temperature, Steam, °F	900	900	900	900	900	900
Temperature, Benzene, °F	280	280	280	280	280	280
Feed Composition, mol %*						
CO	21.8	8.48	21.8	8.47	21.8	8.47
CO_2	23.6	9.19	23.6	9.17	23.6	9.17
H_2	25.0	9.74	25.0	9.71	25.0	9.71
CH_4	26.4	10.28	26.4	10.25	26.4	10.25
C_2H_6+	0.5	0.19	0.5	0.19	0.5	0.19
N_2	1.2	0.46	1.2	0.47	1.2	0.47
H_2S	1.5	0.59	1.5	0.59	1.5	0.59
NH_4OH	--	0.21	--	0.21	--	0.21
C_6H_6	--	4.32	--	4.35	--	4.33
C_6H_5OH	--	0.03	--	0.03	--	0.03
H_2O	--	56.51	--	56.56	--	56.58
Total	100.00	100.00	100.00	100.00	100.00	100.00
Product Flow Rate, lb-mol./hr	0.005822	0.012545	0.005841	0.012601	0.005977	0.013876
Product Composition, mol %						
CO	0.2	0.09	0.2	0.09	0.2	0.08
CO_2	34.2	15.90	34.3	15.90	34.1	14.70
H_2	39.3	18.22	38.8	17.98	39.5	17.01
CH_4	22.8	10.58	23.1	10.71	22.7	9.77
C_2H_6+	0.5	0.23	0.5	0.23	0.5	0.22
N_2	1.5	0.69	1.5	0.69	1.5	0.65
H_2S	1.1	0.51	1.2	0.56	1.1	0.48
NH_4OH	--	0.16	--	0.16	--	0.16
C_6H_6	0.4	3.85	0.4	3.82	0.4	3.79
C_6H_5OH	--	0.02	--	0.02	--	0.01
H_2O	--	49.75	--	49.84	--	53.13
Total	100.00	100.00	100.00	100.00	100.00	100.00
CO Consumed, lb-mol./hr	0.001091	--	0.001094	--	0.001094	--
CO_2 Produced, lb-mol./hr	0.000809	--	0.000818	--	0.000853	--
H_2 Produced, lb-mol./hr	0.001029	--	0.001005	--	0.001100	--
H_2O Used, lb-mol./hr	0.001067	--	0.001069	--	0.000655	--
Space Velocity, SCF/hr-cu ft	2892	6232	2901	6260	2969	6893

The feed gas contains about 1.3 ppm propyl mercaptan, 0.8 ppm thiophene, and 52 ppm COS.

B-44-604j

Table A-10, Part 11. LIFE TESTS
(Girdler G-93 Comoloy High-Temperature Shift Catalyst, 4 x 6 Mesh Spheres, 20.2 g)

Run No.	20-31		20-32		20-33	
Time, hr	1143		1162		1234	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000	1000	1000
Temperature, Furnace, °F	580	580	580	580	580	580
Temperature, Reactor Entrance, °F	661	661	658	658	659	659
Temperature, Quarter Bed, °F	649	649	649	649	649	649
Temperature, Middle Bed, °F	642	642	641	641	642	642
Temperature, Exit, °F	614	614	614	614	615	615
Flow Rate, H_2S, lb-mol./hr	0.000075	0.000075	0.000075	0.000075	0.000075	0.000075
Flow Rate, Feed, lb-mol./hr	0.005029	0.013067	0.005025	0.012965	0.005035	0.013069
Flow Rate, H_2O, lb-mol./hr	--	0.007441	--	0.007345	--	0.007349
Flow Rate, C_6H_6, lb-mol./hr	--	0.000565	--	0.000564	--	0.000655
Temperature, Steam, °F	900	900	900	900	900	900
Temperature, Benzene, °F	280	280	280	280	280	280
Feed Composition, mol %*						
CO	21.8	8.39	21.8	8.45	21.8	8.39
CO_2	23.6	9.08	23.6	9.15	23.6	9.09
H_2	25.0	9.62	25.0	9.69	25.0	9.63
CH_4	26.4	10.17	26.4	10.24	26.4	10.17
$C_2H_6^+$	0.5	0.19	0.5	0.19	0.5	0.19
N_2	1.2	0.46	1.2	0.46	1.2	0.46
H_2S	1.5	0.57	1.5	0.58	1.5	0.57
NH_4OH	--	0.21	--	0.21	--	0.20
C_6H_6	--	4.32	--	4.35	--	5.01
C_6H_5OH	--	0.03	--	0.03	--	0.04
H_2O	--	56.96	--	56.65	--	56.25
Total	100.00	100.00	100.00	100.00	100.00	100.00
Product Flow Rate, lb-mol./hr	0.005809	0.012512	0.005883	0.012495	0.005843	0.012391
Product Composition, mol %						
CO	0.1	0.05	0.2	0.09	0.2	0.09
CO_2	34.3	15.92	34.3	16.16	34.3	16.18
H_2	39.5	18.34	39.5	18.60	39.5	18.63
CH_4	22.7	10.54	22.7	10.68	22.6	10.66
$C_2H_6^+$	0.5	0.23	0.5	0.23	0.5	0.23
N_2	1.5	0.70	1.4	0.66	1.4	0.66
H_2S	1.0	0.46	1.0	0.47	1.1	0.51
NH_4OH	--	0.16	--	0.16	--	0.16
C_6H_6	0.4	4.08	0.4	3.79	0.4	4.62
C_6H_5OH	--	0.02	--	0.02	--	0.02
H_2O	--	49.50	--	49.14	--	48.24
Total	100.00	100.00	100.00	100.00	100.00	100.00
CO Consumed, lb-mol./hr	0.001090	--	0.001089	--	0.001091	--
CO_2 Produced, lb-mol./hr	0.000805	--	0.000838	--	0.000822	--
H_2 Produced, lb-mol./hr	0.001038	--	0.001068	--	0.001049	--
H_2O Used, lb-mol./hr	0.001248	--	0.001205	--	0.001372	--
Space Velocity, SCF/hr-cu ft	2885	6216	2922	6207	2902	6156

The feed gas contains about 1.3 ppm propyl mercaptan, 0.8 ppm thiophene, and 52 ppm COS.

B-44-604k

Table A-10, Part 12. LIFE TESTS (Girdler G-93 Comoloy High-Temperature Shift Catalyst, 4 x 6 Mesh Spheres, 20.2 g)

Run No.	20-34		20-35†		20-36	
Time, hr	1234		1263		1309	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000	1000	1000
Temperature, Furnace, °F	580	580	580	580	580	580
Temperature, Reactor Entrance, °F	655	655	660	660	660	660
Temperature, Quarter Bed, °F	649	649	653	653	654	654
Temperature, Middle Bed, °F	643	643	643	643	642	642
Temperature, Exit, °F	615	615	613	613	616	616
Flow Rate, H_2S, lb-mol./hr	0.000076	0.000076	0.000106	0.000106	0.000106	0.000106
Flow Rate, Feed, lb-mol./hr	0.005032	0.012977	0.005053	0.013558	0.005029	0.012974
Flow Rate, H_2O, lb-mol./hr	--	0.007349	--	0.007911	--	0.007349
Flow Rate, C_6H_6, lb-mol./hr	--	0.000565	--	0.000561	--	0.000565
Temperature, Steam, °F	900	900	900	900	900	900
Temperature, Benzene, °F	280	280	280	280	280	280
Feed Composition, mol %*						
CO	21.8	8.45	24.1	8.98	24.1	9.34
CO_2	23.6	9.15	24.7	9.20	24.7	9.57
H_2	25.0	9.69	16.5	6.16	16.5	6.40
CH_4	26.4	10.23	30.1	11.22	30.1	11.67
C_2H_6+	0.5	0.19	0.6	0.22	0.6	0.23
N_2	1.2	0.46	1.9	0.71	1.9	0.74
H_2S	1.5	0.59	2.1	0.78	2.1	0.82
NH_4OH	--	0.21	--	0.21	--	0.21
C_6H_6	--	4.35	--	4.14	--	4.35
C_6H_5OH	--	0.03	--	0.03	--	0.03
H_2O	--	56.65	--	58.35	--	56.64
Total	100.00	100.00	100.00	100.00	100.00	100.00
Product Flow Rate, lb-mol./hr	0.005839	0.012952	0.005945	0.012696	0.005901	0.012266
Product Composition, mol %						
CO	0.2	0.09	0.3	0.09	0.3	0.10
CO_2	34.3	15.46	39.4	18.49	39.3	18.95
H_2	39.2	17.68	30.5	14.28	30.6	14.73
CH_4	22.8	10.28	26.6	12.46	26.6	12.79
C_2H_6+	0.5	0.22	0.4	0.19	0.4	0.20
N_2	1.5	0.68	1.3	0.61	1.3	0.63
H_2S	1.1	0.49	1.2	0.56	1.2	0.58
NH_4OH	--	0.16	--	0.16	--	0.16
C_6H_6	0.4	4.33	0.3	3.97	0.3	4.20
C_6H_5OH	--	0.02	--	0.01	--	0.02
H_2O	--	50.59	--	49.18	--	47.64
Total	100.00	100.00	100.00	100.00	100.00	100.00
CO Consumed, lb-mol./hr	0.001067	--	0.001206	--	0.001200	--
CO_2 Produced, lb-mol./hr	0.000815	--	0.001100	--	0.001083	--
H_2 Produced, lb-mol./hr	0.001031	--	0.000979	--	0.000976	--
H_2O Used, lb-mol./hr	0.000796	--	0.001667	--	0.001505	--
Space Velocity, SCF/hr-cu ft	2900	6434	2453	6307	2931	6094

* The feed gas contains about 1.3 ppm propyl mercaptan, 0.8 ppm thiophene, and 52 ppm COS.

† The inlet feed system was cleaned after this run. The flow rate of the feed gas was doubled.

B-44-604 I

Table A-10, Part 13. LIFE TESTS (Girdler G-93 Comoloy High-Temperature Shift Catalyst, 4 x 6 Mesh Spheres, 20.2 g)

Run No.	20-37		20-38		20-39	
Time, hr	1341		1365		1391	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000	1000	1000
Temperature, Furnace, °F	580	580	580	580	580	580
Temperature, Reactor Entrance, °F	677	677	681	681	676	676
Temperature, Quarter Bed, °F	661	661	662	662	659	659
Temperature, Middle Bed, °F	664	664	665	665	662	662
Temperature, Exit, °F	636	636	634	634	636	636
Flow Rate, H_2S, lb-mol./hr	0.000206	0.000206	0.000207	0.000207	0.000203	0.000203
Flow Rate, Feed, lb-mol./hr	0.009806	0.025220	0.009861	0.025521	0.009689	0.025091
Flow Rate, H_2O, lb-mol./hr	--	0.014362	--	0.014610	--	0.014349
Flow Rate, C_6H_6, lb-mol./hr	--	0.000992	--	0.000989	--	0.000993
Temperature, Steam, °F	900	900	900	900	900	900
Temperature, Benzene, °F	280	280	280	280	280	280
Feed Composition, mol %*						
CO	24.1	9.37	24.1	9.31	24.1	9.31
CO_2	25.0	9.72	25.0	9.66	25.0	9.65
H_2	16.3	6.34	16.3	6.30	16.3	6.29
CH_4	30.0	11.66	30.0	11.59	30.0	11.59
C_2H_4*	0.6	0.23	0.6	0.23	0.6	0.23
N_2	1.9	0.74	1.9	0.73	1.9	0.73
H_2S	2.1	0.82	2.1	0.81	2.1	0.81
NH_4OH	--	0.21	--	0.21	--	0.21
C_6H_6	--	3.93	--	3.88	--	3.96
C_6H_5OH	--	0.03	--	0.03	--	0.03
H_2O	--	56.95	--	57.25	--	57.19
Total	100.00	100.00	100.00	100.00	100.00	100.00
Product Flow Rate, lb-mol./hr	0.011171	0.024171	0.011270	0.024265	0.011190	0.024140
Product Composition, mol %						
CO	0.7	0.32	0.6	0.28	0.7	0.32
CO_2	39.5	18.26	39.5	18.35	39.5	18.32
H_2	29.8	13.77	30.0	13.93	29.9	13.86
CH_4	26.9	12.43	26.7	12.40	26.7	12.38
C_2H_6*	0.4	0.19	0.4	0.19	0.4	0.19
N_2	1.3	0.60	1.3	0.61	1.3	0.60
H_2S	1.1	0.51	1.2	0.56	1.2	0.56
NH_4OH	--	0.17	--	0.16	--	0.17
C_6H_6	0.3	3.87	0.3	3.26	0.3	3.72
C_6H_5OH	--	0.02	--	0.02	--	0.02
H_2O	--	49.86	--	50.24	--	49.86
Total	100.00	100.00	100.00	100.00	100.00	100.00
CO Consumed, lb-mol./hr	0.002185	--	0.002309	--	0.002257	--
CO_2 Produced, lb-mol./hr	0.001961	--	0.001987	--	0.001998	--
H_2 Produced, lb-mol./hr	0.001731	--	0.001774	--	0.001767	--
H_2O Used, lb-mol./hr	0.002310	--	0.002420	--	0.002311	--
Space Velocity, SCF/hr-cu ft	5550	12,008	5599	12,005	5559	11,993

The feed gas contains about 1.3 ppm propyl mercaptan, 0.8 ppm thiophene, and 52 ppm COS.

B-44-604m

Table A-10, Part 14. LIFE TESTS (Girdler G-93 Comoloy High-Temperature Shift Catalyst, 4 x 6 Mesh Spheres, 20.2 g)

Run No.	20-40		20-41*		20-42	
Time, hr	1415		1422		1487	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000	1000	1000
Temperature, Furnace, °F	580	580	580	580	580	580
Temperature, Reactor Entrance, °F	677	677	680	680	676	676
Temperature, Quarter Bed, °F	661	661	670	670	670	670
Temperature, Middle Bed, °F	663	663	680	680	677	677
Temperature, Exit, °F	636	636	656	656	656	656
Flow Rate, H_2S, lb-mol./hr	0.000201	0.000201	0.000275	0.000275	0.000269	0.000269
Flow Rate, Feed, lb-mol./hr	0.009580	0.024481	0.012479	0.033087	0.012241	0.034424
Flow Rate, H_2O, lb-mol./hr	--	0.013804	--	0.019127	--	0.020635
Flow Rate, C_6H_6, lb-mol./hr	--	0.001038	--	0.001276	--	0.001339
Temperature, Steam, °F	900	900	900	900	900	900
Temperature, Benzene, °F	280	280	280	280	280	280
Feed Composition, mol %*						
CO	24.1	9.43	24.4	9.20	24.4	8.68
CO_2	25.0	9.78	24.8	9.35	24.8	8.82
H_2	16.3	6.38	17.0	6.41	17.0	6.05
CH_4	30.0	11.75	30.1	11.35	30.1	10.70
C_2H_6+	0.6	0.23	0.6	0.23	0.6	0.21
N_2	1.9	0.74	1.9	0.72	1.9	0.68
H_2S	2.1	0.82	2.2	0.83	2.2	0.78
NH_4OH	--	0.21	--	0.21	--	0.22
C_6H_6	--	4.24	--	3.86	--	3.89
C_6H_5OH	--	0.03	--	0.03	--	0.03
H_2O	--	56.39	--	57.81	--	59.94
Total	100.00	100.00	100.00	100.00	100.00	100.00
Product Flow Rate, lb-mol./hr	0.010897	0.023672	0.015514	0.033014	0.014752	0.033636
Product Composition, mol %						
CO	0.7	0.32	1.4	0.66	1.5	0.66
CO_2	39.5	18.18	39.4	18.62	39.4	17.28
H_2	30.0	13.82	30.0	14.10	30.0	13.16
CH_4	26.7	12.29	26.0	12.22	26.0	11.40
C_2H_6+	0.4	0.19	0.5	0.23	0.5	0.22
N_2	1.2	0.55	1.2	0.56	1.2	0.53
H_2S	1.2	0.55	1.1	0.51	1.0	0.44
NH_4OH	--	0.17	--	0.16	--	0.17
C_6H_6	0.3	3.74	0.4	3.81	0.4	4.16
C_6H_5OH	--	0.02	--	0.02	--	0.02
H_2O	--	50.17	--	49.11	--	51.89
Total	100.00	100.00	100.00	100.00	100.00	100.00
CO Consumed, lb-mol./hr	0.002233	--	0.002828	--	0.002766	--
CO_2 Produced, lb-mol./hr	0.001909	--	0.002918	--	0.002776	--
H_2 Produced, lb-mol./hr	0.001707	--	0.000253	--	0.002345	--
H_2O Used, lb-mol./hr	0.001926	--	0.002943	--	0.003155	--
Space Velocity, SCF/hr-cu ft	5414	11,761	7783	16,562	7401	16,874

The feed gas contains about 1.3 ppm propyl mercaptan, 0.8 ppm thiophene, and 52 ppm COS. B-44-604n

* Total space velocity was tripled.

Table A-10, Part 15. LIFE TESTS (Girdler G-93 Comoloy High-Temperature Shift Catalyst, 4 x 6 Mesh Spheres, 20.2 g)

Run No.	20-43	
Time, hr	1583	
Basis for Analysis	**Dry**	**Wet**
Pressure, psig	1000	1000
Temperature, Furnace, °F	580	580
Temperature, Reactor Entrance, °F	676	676
Temperature, Quarter Bed, °F	670	670
Temperature, Middle Bed, °F	678	678
Temperature, Exit, °F	656	656
Flow Rate, H_2S, lb-mol./hr	0.000268	0.000268
Flow Rate, Feed, lb-mol./hr	0.012192	0.034884
Flow Rate, H_2O, lb-mol./hr	--	0.020984
Flow Rate, C_6H_6, lb-mol./hr	--	0.001498
Temperature, Steam, °F	900	900
Temperature, Benzene, °F	280	280
Feed Composition, mol %*		
CO	24.4	8.53
CO_2	24.8	8.66
H_2	17.0	5.96
CH_4	30.1	10.51
C_2H_6+	0.6	0.21
N_2	1.9	0.66
H_2S	2.2	0.76
NH_4OH	--	0.22
C_6H_6	--	4.29
C_6H_5OH	--	0.03
H_2O	--	60.17
Total	100.00	100.00
Product Flow Rate, lb-mol./hr	0.015080	0.034212
Product Composition, mol %		
CO	1.5	0.66
CO_2	39.5	17.41
H_2	29.9	13.18
CH_4	26.0	11.46
C_2H_6+	0.5	0.22
N_2	1.2	0.53
H_2S	1.0	0.44
NH_4OH	--	1.17
C_6H_6	0.4	4.02
C_6H_5OH	--	0.02
H_2O	--	51.89
Total	100.00	100.00
CO Consumed, lb-mol./hr	0.002749	--
CO_2 Produced, lb-mol./hr	0.002934	--
H_2 Produced, lb-mol./hr	0.002437	--
H_2O Used, lb-mol./hr	0.003233	--
Space Velocity, SCF/hr-cu ft	7565	17,208

* The feed gas contains about 1.3 ppm propyl mercaptan, 0.8 ppm thiophene, and 52 ppm COS.

B-44-604o

Table A-10, Part 16. LIFE TESTS (Girdler G-93 Comoloy High-Temperature Shift Catalyst, 4 x 6 Mesh Spheres, 20.2 g)

Run No.	20-44		20-45	
Time, hr	1589		1613	
Basis for Analysis	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000
Temperature, Furnace, °F	730	730	730	730
Temperature, Reactor Entrance, °F	765	765	765	765
Temperature, Quarter Bed, °F	816	816	817	817
Temperature, Middle Bed, °F	800	800	800	800
Temperature, Exit, °F	776	776	775	775
Flow Rate, H_2S, lb-mol./hr	0.000270	0.000270	0.000269	0.000269
Flow Rate, Feed, lb-mol./hr	0.012283	0.035020	0.012231	0.034982
Flow Rate, H_2O, lb-mol./hr	--	0.021025	--	0.020821
Flow Rate, C_6H_6, lb-mol./hr	--	0.001512	--	0.001716
Temperature, Steam, °F	900	900	900	900
Temperature, Benzene, °F	280	280	280	280
Feed Composition, mol %*				
CO	24.4	8.55	24.4	8.53
CO_2	24.8	8.70	24.8	8.67
H_2	16.0	5.96	16.0	5.94
CH_4	30.1	10.54	30.1	10.53
C_2H_6+	0.6	0.21	0.6	0.21
N_2	1.9	0.67	1.9	0.66
H_2S	2.2	0.77	2.2	0.77
NH_3	--	0.22	--	0.23
C_6H_6	--	4.32	--	4.91
C_6H_5OH	--	0.03	--	0.04
H_2O	--	60.04	--	59.51
Total	100.0	100.0	100.0	100.0
Product Flow Rate, lb-mol./hr	0.014824	0.034053	0.014732	0.034383
Product Composition, mol %				
CO	1.8	0.78	1.8	0.77
CO_2	39.4	17.15	39.6	16.97
H_2	29.7	12.93	29.5	12.64
CH_4	25.9	11.28	26.0	11.14
C_2H_6+	0.5	0.22	0.5	0.22
N_2	1.3	0.57	1.2	0.51
H_2S	1.0	0.43	1.0	0.43
NH_3	--	0.17	--	0.17
C_6H_6	0.4	4.24	0.4	4.67
C_6H_5OH	--	0.02	--	0.02
H_2O	--	52.21	--	52.46
Total	100.0	100.0	100.0	100.0
CO Consumed, lb-mol./hr	0.002730	--	0.002719	--
CO_2 Produced, lb-mol./hr	0.002795	--	0.002801	--
H_2 Produced, lb-mol./hr	0.002315	--	0.002287	--
H_2O Used, lb-mol./hr	0.003246	--	0.002783	--
Space Velocity, SCF/hr-cu ft	7363	16,913	7317	17,077

* The feed gas contains about 1.3 ppm propyl mercaptan, 0.8 ppm thiophene, and 52 ppm carbonyl sulfide

B-64-1064a

Table A-10, Part 17. LIFE TESTS (Girdler G-93 Comoloy High-Temperature Shift Catalyst, 4 x 6 Mesh Spheres, 20.2 g)

Run No.	20-46		20-47	
Time, hr	1637		1647	
Basis for Analysis	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000
Temperature, Furnace, °F	730	730	730	730
Temperature, Reactor Entrance, °F	--	--	--	--
Temperature, Quarter Bed, °F	816	816	810	810
Temperature, Middle Bed, °F	800	800	791	791
Temperature, Exit, °F	775	775	765	765
Flow Rate, H_2S, lb-mol./hr	0.000252	0.000252	0.000105	0.000105
Flow Rate, Feed, lb-mol./hr	0.012030	0.034884	0.005012	0.013016
Flow Rate, H_2O, lb-mol./hr	--	0.020943	--	0.007348
Flow Rate, C_6H_6, lb-mol./hr	--	0.001701	--	0.000575
Temperature, Steam, °F	900	900	900	900
Temperature, Benzene, °F	280	280	280	280
Feed Composition, mol %*				
CO	25.0	8.62	25.0	9.60
CO_2	24.7	8.52	24.7	9.51
H_2	15.4	5.66	15.4	6.32
CH_4	30.3	10.45	30.3	11.67
C_2H_6+	0.6	0.21	0.6	0.23
N_2	1.9	0.66	1.9	0.73
H_2S	2.1	0.72	2.1	0.81
NH_3	--	0.22	--	0.21
C_6H_6	--	4.88	--	4.43
C_6H_5OH	--	0.04	--	0.03
H_2O	--	60.02	--	56.46
Total	100.0	100.0	100.0	100.0
Product Flow Rate, lb-mol./hr	0.014910	0.034267	0.005805	0.012505
Product Composition, mol %				
CO	1.8	0.78	0.7	0.33
CO_2	39.3	17.10	39.5	18.34
H_2	30.0	13.05	29.9	13.88
CH_4	25.7	11.18	26.8	12.44
C_2H_6+	0.5	0.22	0.4	0.18
N_2	1.0	0.57	1.1	0.60
H_2S	1.3	0.43	1.3	0.51
NH_3	--	0.17	--	0.16
C_6H_6	0.4	4.65	0.3	4.24
C_6H_5OH	--	0.02	--	0.02
H_2O	--	51.83	--	49.30
Total	100.0	100.0	100.0	100.0
CO Consumed, lb-mol./hr	0.002740	--	0.001212	--
CO_2 Produced, lb-mol./hr	0.002888	--	0.001055	--
H_2 Produced, lb-mol./hr	0.002500	--	0.000914	--
H_2O Used, lb-mol./hr	0.003183	--	0.001183	--
Space Velocity, SCF/hr-cu ft	7405	17,020	2883	6211

* The feed gas contains about 1.3 ppm propyl mercaptan, 0.8 ppm thiophene, and 52 ppm carbonyl sulfide

B-64-1064b

Table A-11, Part 1. LIFE TESTS (Union Carbide UC-1870-46-1 Shift Catalyst, 1/16-Inch Extrudates, 21.0 g)

Run No.	21-1		21-2		21-3	
Time, hr	1		2		4	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000	1000	1000
Temperature, Furnace, °F	580	580	580	580	580	580
Temperature, Reactor Entrance, °F	643	643	655	655	653	653
Temperature, Quarter Bed, °F	640	640	640	640	641	641
Temperature, Middle Bed, °F	610	610	613	613	615	615
Temperature, Exit, °F	604	604	605	605	605	605
Flow Rate, H_2S, lb-mol./hr	0.000086	0.000086	0.000086	0.000086	0.000086	0.000086
Flow Rate, Feed, lb-mol./hr	0.005063	0.012350	0.005063	0.012350	0.005063	0.012350
Flow Rate, H_2O, lb-mol./hr	--	0.007287	--	0.007287	--	0.007287
Flow Rate, C_6H_6, lb-mol./hr	--	--	--	--	--	--
Temperature, Steam, °F	900	900	900	900	900	900
Temperature, Benzene, °F	280	280	280	280	280	280
Feed Composition, mol %*						
CO	20.4	8.36	20.4	8.36	20.4	8.36
CO_2	23.1	9.48	23.1	9.48	23.1	9.48
H_2	20.6	8.45	20.6	8.45	20.6	8.45
CH_4	32.4	13.28	32.4	13.28	32.4	13.28
C_2H_6	0.5	0.20	0.5	0.20	0.5	0.20
N_2	1.3	0.53	1.3	0.53	1.3	0.53
H_2S	1.7	0.70	1.7	0.70	1.7	0.70
NH_3	--	--	--	--	--	--
C_6H_6	--	--	--	--	--	--
C_6H_5OH	--	--	--	--	--	--
H_2O	--	59.00	--	59.00	--	59.00
Total	100.0	100.0	100.0	100.0	100.0	100.0
Product Flow Rate, lb-mol./hr	0.005618	0.012555	0.005767	0.012444	0.005864	0.012319
Product Composition, mol %						
CO	11.6	5.37	7.3	3.44	3.5	1.68
CO_2	30.1	12.81	33.7	14.48	35.7	16.51
H_2	25.5	11.75	26.8	12.65	28.7	14.42
CH_4	29.5	14.81	29.1	15.15	29.0	13.85
C_2H_6	0.4	0.19	0.4	0.19	0.4	0.19
N_2	1.2	0.56	1.2	0.57	1.2	0.58
H_2S	1.5	0.69	1.5	0.70	1.5	0.72
NH_3	--	--	--	--	--	--
C_6H_6	--	--	--	--	--	--
C_6H_5OH	--	--	--	--	--	--
H_2O	--	53.82	--	52.82	--	52.05
Total	100.0	100.0	100.0	100.0	100.0	100.0
CO Consumed, lb-mol./hr	0.000341	--	0.000598	--	0.000824	--
CO_2 Produced, lb-mol./hr	0.000482	--	0.000661	--	0.000882	--
H_2 Produced, lb-mol./hr	0.000472	--	0.000556	--	0.000747	--
H_2O Used, lb-mol./hr	0.000349	--	0.000609	--	0.000830	--
Space Velocity, SCF/hr-cu ft	2261	5052	2320	5007	2359	4957

* The feed gas contains about 1.3 ppm propyl mercaptan, 0.8 ppm thiophene, and 52 ppm carbonyl sulfide.

B-64-1065a

Table A-11, Part 2. LIFE TESTS (Union Carbide UC-1870-46-1 Shift Catalyst, 1/16-Inch Extrudates, 21.0 g)

Run No.	21-4		21-5		21-6	
Time, hr	6		30		198	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000	170	170
Temperature, Furnace, °F	580	580	580	580	580	580
Temperature, Reactor Entrance, °F	653	653	661	661	641	641
Temperature, Quarter Bed, °F	642	642	645	645	644	644
Temperature, Middle Bed, °F	617	617	621	621	625	625
Temperature, Exit, °F	606	606	605	605	607	607
Flow Rate, H_2S, lb-mol./hr	0.000086	0.000086	0.000087	0.000087	0.000049	0.000049
Flow Rate, Feed, lb-mol./hr	0.005063	0.012350	0.005100	0.011067	0.004890	0.010987
Flow Rate, H_2O, lb-mol./hr	--	0.007287	--	0.005967	--	0.006097
Flow Rate, C_6H_6, lb-mol./hr	--	--	--	--	--	--
Temperature, Steam, °F	900	900	900	900	900	900
Temperature, Benzene, °F	280	280	280	280	280	280
Feed Composition, mol %*						
CO	20.4	8.36	20.4	9.40	23.4	10.41
CO_2	23.1	9.48	23.1	10.64	26.2	11.66
H_2	20.6	8.45	20.6	9.50	11.0	4.90
CH_4	32.4	13.28	32.4	14.92	36.3	16.17
$C_2H_6^+$	0.5	0.20	0.5	0.23	0.6	0.26
N_2	1.3	0.53	1.3	0.60	1.5	0.66
H_2S	1.7	0.70	1.7	0.79	1.0	0.45
NH_3	--	--	--	--	--	--
C_6H_6	--	--	--	--	--	--
C_6H_5OH	--	--	--	--	--	--
H_2O	--	59.00	--	53.92	--	55.49
Total	100.0	100.0	100.0	100.0	100.0	100.0
Product Flow Rate, lb-mol./hr	0.005965	0.012235	0.005997	0.011184	0.005187	0.009896
Product Composition, mol %						
CO	0.3	0.15	0.2	0.10	1.2	0.63
CO_2	37.5	18.25	37.7	20.23	39.6	20.44
H_2	31.8	15.86	31.8	17.05	27.5	14.41
CH_4	27.6	13.39	27.5	14.64	29.4	15.74
$C_2H_6^+$	0.4	0.20	0.4	0.21	0.4	0.21
N_2	1.1	0.54	1.1	0.59	1.2	0.63
H_2S	1.3	0.64	1.3	0.70	0.7	0.36
NH_3	--	--	--	--	--	--
C_6H_6	--	--	--	--	--	--
C_6H_5OH	--	--	--	--	--	--
H_2O	--	50.97	--	46.48	--	47.58
Total	100.0	100.0	100.0	100.0	100.0	100.0
CO Consumed, lb-mol./hr	0.001015	--	0.001028	--	0.001082	--
CO_2 Produced, lb-mol./hr	0.001067	--	0.001077	--	0.000873	--
H_2 Produced, lb-mol./hr	0.000896	--	0.000856	--	0.000882	--
H_2O Used, lb-mol./hr	0.001036	--	0.000762	--	0.001388	--
Space Velocity, SCF/hr-cu ft	2400	4923	2413	4500	2087	3982

* The feed gas contains about 1.3 ppm propyl mercaptan, 0.8 ppm thiophene, and 52 ppm carbonyl sulfide

B-54-1065b

Table A-11, Part 3. LIFE TESTS (Union Carbide UC-1870-46-1 Shift Catalyst, 1/16-Inch Extrudates, 21.0 g)

Run No.	21-7		21-8		21-9	
Time, hr	222		246		268	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	400	400	500	500	600	600
Temperature, Furnace, °F	580	580	580	580	580	580
Temperature, Reactor Entrance, °F	650	650	653	653	647	647
Temperature, Quarter Bed, °F	646	646	646	646	648	648
Temperature, Middle Bed, °F	623	623	623	623	621	621
Temperature, Exit, °F	606	606	606	606	606	606
Flow Rate, H_2S, lb-mol./hr	0.000043	0.000043	0.000047	0.000047	0.000043	0.000043
Flow Rate, Feed, lb-mol./hr	0.004815	0.004815	0.004704	0.004804	0.004804	0.011339
Flow Rate, H_2O, lb-mol./hr	--	0.005077	--	0.004976	--	0.006595
Flow Rate, C_6H_6, lb-mol./hr	--	--	--	--	--	--
Temperature, Steam, °F	900	900	900	900	900	900
Temperature, Benzene, °F	280	280	280	280	280	280
Feed Composition, mol %*						
CO	23.1	11.24	23.4	11.38	23.2	9.78
CO_2	26.0	12.66	26.0	12.64	26.0	10.96
H_2	12.2	5.79	11.5	5.60	12.0	5.05
CH_4	36.0	17.52	35.3	17.63	36.1	15.22
C_2H_6*	0.5	0.24	0.5	0.25	0.5	0.21
N_2	1.3	0.64	1.3	0.63	1.3	0.54
H_2S	0.9	0.43	1.0	0.49	0.9	0.38
NH_3	--	--	--	--	--	--
C_6H_6	--	--	--	--	--	--
C_6H_5OH	--	--	--	--	--	--
H_2O	--	51.28	--	51.35	--	57.86
Total	100.0	100.0	100.0	100.0	100.0	100.0
Product Flow Rate, lb-mol./hr	0.005725	0.009735	0.005742	0.009906	0.005903	0.010747
Product Composition, mol %						
CO	1.5	0.88	1.8	0.76	0.8	0.43
CO_2	33.0	22.31	38.5	22.54	39.4	21.24
H_2	27.1	15.33	28.0	16.33	27.5	14.89
CH_4	30	17.65	29.6	17.11	30.0	16.20
C_2H_6*	0.4	0.24	0.4	0.23	0.4	0.21
N_2	1.2	0.71	1.2	0.70	1.2	0.65
H_2S	0.7	0.41	0.7	0.40	0.7	0.38
NH_3	--	--	--	--	--	--
C_6H_6	--	--	--	--	--	--
C_6H_5OH	--	--	--	--	--	--
H_2O	--	41.19	--	41.85	--	46.00
Total	100.0	100.0	100.0	100.0	100.0	100.0
CO Consumed, lb-mol./hr	0.001027	--	0.001127	--	0.001059	--
CO_2 Produced, lb-mol./hr	0.001285	--	0.001014	--	0.001037	--
H_2 Produced, lb-mol./hr	0.000358	--	0.001156	--	0.001020	--
H_2O Used, lb-mol./hr	0.001007	--	0.001057	--	0.001274	--
Space Velocity, SCF/hr-cu ft	2303	3917	2310	3946	2335	4324

* The feed gas contains about 1.5 ppm propyl mercaptan, 0.5 ppm thiophene, and 52 ppm carbonyl sulfide

B-64-1065c

Table A-11, Part 4. LIFE TESTS (Union Carbide UC-1870-46-1 Shift Catalyst, 1/16-Inch Extrudates, 21.0 g)

Run No.	21-10		21-11		21-12	
Time, hr	340		366		414	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	800	800	1000	1000	1000	1000
Temperature, Furnace, °F	580	580	580	580	580	580
Temperature, Reactor Entrance, °F	642	642	660	660	660	660
Temperature, Quarter Bed, °F	648	648	642	642	643	643
Temperature, Middle Bed, °F	623	623	624	624	623	623
Temperature, Exit, °F	609	609	605	605	607	607
Flow Rate, H_2S, lb-mol./hr	0.000069	0.000069	0.000079	0.000079	0.000079	0.000079
Flow Rate, Feed, lb-mol./hr	0.004958	0.011694	0.005249	0.012454	0.005280	0.011477
Flow Rate, H_2O, lb-mol./hr	--	0.006736	--	0.007205	--	0.006192
Flow Rate, C_6H_6, lb-mol./hr	--	--	--	--	--	--
Temperature, Steam, °F	900	900	900	900	900	900
Temperature, Benzene, °F	280	280	280	280	280	280
Feed Composition, mol %*						
CO	21.4	9.07	21.1	8.90	21.2	9.75
CO_2	23.1	9.79	23.0	9.68	23.0	10.58
H_2	19.2	8.14	19.9	8.39	19.8	9.16
CH_4	33.3	14.13	32.9	13.87	32.9	15.13
C_2H_4†	0.5	0.21	0.5	0.21	0.5	0.23
N_2	1.1	0.47	1.1	0.47	1.1	0.51
H_2S	1.4	0.59	1.5	0.63	1.5	0.69
NH_3	--	--	--	--	--	--
C_6H_6	--	--	--	--	--	--
C_6H_5OH	--	--	--	--	--	--
H_2O	--	57.60	--	57.85	--	53.95
Total	100.0	100.0	100.0	100.0	100.0	100.0
Product Flow Rate, lb-mol./hr	0.005846	0.011653	0.006164	0.011995	0.005657	0.010522
Product Composition, mol %						
CO†	0.2	0.10	0.1	0.05	--	--
CO_2	36.7	18.41	36.9	18.97	36.7	19.73
H_2	32.6	16.36	32.4	16.65	33.6	17.52
CH_4	28.1	14.10	28.2	14.48	27.3	15.22
C_2H_4†	0.4	0.20	0.4	0.21	0.4	0.22
N_2	0.9	0.45	0.9	0.46	0.9	0.48
H_2S	1.1	0.55	1.1	0.57	1.1	0.59
NH_3	--	--	--	--	--	--
C_6H_6	--	--	--	--	--	--
C_6H_5OH	--	--	--	--	--	--
H_2O	--	49.83	--	48.61	--	46.24
Total	100.0	100.00	100.0	100.00	100.0	100.00
CO Consumed, lb-mol./hr	0.001049	--	0.001102	--	0.001113	--
CO_2 Produced, lb-mol./hr	0.001000	--	0.001068	--	0.000862	--
H_2 Produced, lb-mol./hr	0.000954	--	0.000952	--	0.000850	--
H_2O Used, lb-mol./hr	0.000929	--	0.001085	--	0.001055	--
Space Velocity, SCF/hr-cu ft	2352	4689	2480	4826	2276	4233

* The feed gas contains about 1.3 ppm propyl mercaptan, 0.8 ppm thiophene, and 52 ppm carbonyl sulfide.

† Concentrations of carbon monoxide less than 0.1% cannot be accurately detected by the present instruments; they are not reported, and equilibrium conversion is assumed.

B-64-1065d

Table A-11, Part 5. LIFE TESTS (Union Carbide UC-1870-46-1 Shift Catalyst, 1/16-Inch Extrudates, 21.0 g)

Run No.	21-13		21-14		21-15	
Time, hr	438		607		702	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000	1000	1000
Temperature, Furnace, °F	580	580	580	580	580	580
Temperature, Reactor Entrance, °F	660	660	656	656	651	651
Temperature, Quarter Bed, °F	644	644	643	643	645	645
Temperature, Middle Bed, °F	620	623	618	618	623	623
Temperature, Exit, °F	606	606	606	606	606	606
Flow Rate, H_2S, lb-mol./hr	0.000080	0.000080	0.000082	0.000082	0.000087	0.000087
Flow Rate, Feed, lb-mol./hr	0.005339	0.011656	0.004818	0.012128	0.004842	0.012087
Flow Rate, H_2O, lb-mol./hr	--	0.006312	--	0.007310	--	0.007250
Flow Rate, C_6H_6, lb-mol./hr	--	--	--	--	--	--
Temperature, Steam, °F	900	900	900	900	900	900
Temperature, Benzene, °F	280	280	280	280	280	280
Feed Composition, mol %*						
CO	21.2	9.71	20.2	8.02	19.1	7.65
CO_2	23.0	10.54	23.1	9.18	21.7	8.65
H_2	19.8	9.11	21.0	8.34	24.3	9.74
CH_4	32.9	15.06	32.2	12.79	31.2	12.50
C_2H_4†	0.5	0.23	0.5	0.20	0.5	0.20
N_2	1.1	0.51	1.3	0.52	1.4	0.56
H_2S	1.5	0.69	1.7	0.68	1.8	0.72
NH_3	--	--	--	--	--	--
C_6H_6	--	--	--	--	--	--
C_6H_5OH	--	--	--	--	--	--
H_2O	--	54.15	--	60.27	--	59.98
Total	100.0	100.00	100.0	100.00	100.0	100.00
Product Flow Rate, lb-mol./hr	0.005860	0.010812	0.005724	0.012013	0.005623	0.011795
Product Composition, mol %						
CO†	--	--	--	--	--	--
CO_2	36.6	19.86	37.7	17.96	34.6	16.50
H_2	33.6	17.69	31.8	14.68	36.3	17.30
CH_4	27.4	15.39	27.6	13.63	26.1	12.44
C_2H_4†	0.4	0.21	0.4	0.19	0.4	0.19
N_2	0.9	0.49	1.2	0.57	1.2	0.57
H_2S	1.1	0.59	1.3	0.62	1.4	0.67
NH_3	--	--	--	--	--	--
C_6H_6	--	--	--	--	--	--
C_6H_5OH	--	--	--	--	--	--
H_2O	--	45.77	--	52.35	--	52.33
Total	100.0	100.00	100.0	100.00	100.0	100.00
CO Consumed, lb-mol./hr	0.001126	--	0.000967	--	0.000925	--
CO_2 Produced, lb-mol./hr	0.000917	--	0.001045	--	0.000995	--
H_2 Produced, lb-mol./hr	0.000907	--	0.000838	--	0.000804	--
H_2O Used, lb-mol./hr	0.001225	--	0.001021	--	0.001078	--
Space Velocity, SCF/hr-cu ft	2358	4350	2303	4833	2262	4746

* The feed gas contains about 1.3 ppm propyl mercaptan, 0.8 ppm thiophene, and 52 ppm carbonyl sulfide.

† Concentrations of carbon monoxide less than 0.1% cannot be accurately detected by the present instruments; they are not reported, and equilibrium conversion is assumed.

B-64-1065e

Table A-11, Part 6. LIFE TESTS (Union Carbide UC-1870-46-1 Shift Catalyst, 1/16-Inch Extrudates, 21.0 g)

Run No.	21-16		21-17#		21-18	
Time, hr	726		750		774	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000	1000	1000
Temperature, Furnace, °F	580	580	580	580	580	580
Temperature, Reactor Entrance, °F	651	651	649	649	649	649
Temperature, Quarter Bed, °F	646	646	645	645	648	648
Temperature, Middle Bed, °F	624	624	624	624	625	625
Temperature, Exit, °F	606	606	606	606	609	609
Flow Rate, H_2S, lb-mol./hr	0.000087	0.000087	0.000086	0.000086	0.000087	0.000087
Flow Rate, Feed, lb-mol./hr	0.004837	0.012067	0.004800	0.012590	0.004825	0.012782
Flow Rate, H_2O, lb-mol./hr	--	0.007230	--	0.007196	--	0.007349
Flow Rate, C_6H_6, lb-mol./hr	--	--	--	0.000594	--	0.000608
Temperature, Steam, °F	900	900	900	900	900	900
Temperature, Benzene, °F	280	280	280	280	280	280
Feed Composition, mol %*						
CO	19.2	7.70	19.2	7.32	19.2	7.24
CO_2	21.6	8.66	21.6	8.16	21.6	8.15
H_2	24.3	9.74	24.3	9.24	24.3	9.20
CH_4	31.2	12.50	31.2	11.90	31.2	11.76
C_2H_6+	0.5	0.20	0.5	0.19	0.5	0.19
N_2	1.4	0.56	1.4	0.53	1.4	0.52
H_2S	1.8	0.72	1.8	0.68	1.8	0.68
NH_3	--	--	--	--	--	--
C_6H_6	--	--	--	4.72	--	4.76
C_6H_5OH	--	--	--	--	--	--
H_2O	--	59.92	--	57.26	--	57.50
Total	100.0	100.00	100.0	100.00	100.0	100.00
Product Flow Rate, lb-mol./hr	0.006069	0.012347	0.005744	0.012319	0.005781	0.012540
Product Composition, mol %						
CO+	--	--	--	--	--	--
CO_2	34.3	16.43	33.8	15.76	34.0	15.67
H_2	36.5	17.84	38.0	17.72	38.0	17.51
CH_4	26.2	12.83	24.9	11.61	24.7	11.38
C_2H_6+	0.4	0.19	0.4	0.19	0.4	0.18
N_2	1.2	0.59	1.2	0.56	1.2	0.55
H_2S	1.4	0.69	1.3	0.61	1.3	0.60
NH_3	--	--	--	--	--	--
C_6H_6	--	--	0.4	4.29	0.4	4.69
C_6H_5OH	--	--	--	--	--	--
H_2O	--	51.43	--	49.26	--	49.42
Total	100.0	100.00	100.0	100.00	100.0	100.00
CO Consumed, lb-mol./hr	0.000929	--	0.000922	--	0.000926	--
CO_2 Produced, lb-mol./hr	0.001037	--	0.000904	--	0.000924	--
H_2 Produced, lb-mol./hr	0.001040	--	0.001017	--	0.001025	--
H_2O Used, lb-mol./hr	0.000961	--	0.001126	--	0.001149	--
Space Velocity, SCF/hr-cu ft	2442	4968	2311	4956	2326	5045

* The feed gas contains about 1.3 ppm propyl mercaptan, 0.8 ppm thiophene, and 52 ppm carbonyl sulfide

+ Concentrations of carbon monoxide less than 0.1% cannot be accurately detected by the present instruments; they are not reported, and equilibrium conversion is assumed

Benzene was added at the start of this run

B-64-1065f

Table A-11, Part 7. LIFE TESTS (Union Carbide UC-1870-46-1 Shift Catalyst, 1/16-Inch Extrudates, 21.0 g)

Run No.	21-19		21-20		21-21	
Time, hr	846		870		894	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000	1000	1000
Temperature, Furnace, °F	580	580	580	580	580	580
Temperature, Reactor Entrance, °F	648	648	649	649	647	647
Temperature, Quarter Bed, °F	648	648	648	648	646	646
Temperature, Middle Bed, °F	625	625	625	625	625	625
Temperature, Exit, °F	608	608	609	609	609	609
Flow Rate, H_2S, lb-mol./hr	0.000087	0.000087	0.000088	0.000088	0.000087	0.000087
Flow Rate, Feed, lb-mol./hr	0.004841	0.012740	0.004870	0.012751	0.004839	0.012795
Flow Rate, H_2O, lb-mol./hr	--	0.007349	--	0.007349	--	0.007386
Flow Rate, C_6H_6, lb-mol./hr	--	0.000618	--	0.000600	--	0.000570
Temperature, Steam, °F	900	900	900	900	900	900
Temperature, Benzene, °F	280	280	280	280	280	280
Feed Composition, mol %*						
CO	19.2	7.29	19.2	7.33	19.2	7.26
CO_2	21.6	8.21	21.6	8.35	21.6	8.18
H_2	24.3	9.23	24.3	9.28	24.3	9.19
CH_4	31.2	11.85	31.2	11.91	31.2	11.80
C_2H_6*	0.5	0.19	0.5	0.19	0.5	0.19
N_2	1.4	0.53	1.4	0.53	1.4	0.53
H_2S	1.8	0.68	1.8	0.69	1.8	0.68
NH_3	--	--	--	--	--	--
C_6H_6	--	4.85	--	4.71	--	4.45
C_6H_5OH	--	--	--	--	--	--
H_2O	--	57.17	--	57.01	--	57.72
Total	100.0	100.00	100.0	100.00	100.0	100.00
Product Flow Rate, lb-mol./hr	0.005790	0.012617	0.005818	0.012407	0.005806	0.01249
Product Composition, mol %						
CO*	--	--	--	--	--	--
CO_2	33.4	15.33	33.7	15.81	33.7	15.66
H_2	38.2	17.53	38.1	17.87	37.7	17.51
CH_4	24.9	11.43	24.8	11.63	25.0	11.53
C_2H_6*	0.4	0.18	0.4	0.19	0.5	0.23
N_2	1.3	0.59	1.3	0.61	1.3	0.60
H_2S	1.4	0.64	1.3	0.60	1.4	0.65
NH_3	--	--	--	--	--	--
C_6H_6	0.4	4.48	0.4	4.74	0.4	4.28
C_6H_5OH	--	--	--	--	--	--
H_2O	--	49.82	--	48.55	--	49.54
Total	100.0	100.00	100.0	100.00	100.0	100.00
CO Consumed, lb-mol./hr	0.000929	--	0.00935	--	0.000929	--
CO_2 Produced, lb-mol./hr	0.000896	--	0.00909	--	0.000917	--
H_2 Produced, lb-mol./hr	0.001036	--	0.001034	--	0.001024	--
H_2O Used, lb-mol./hr	0.001064	--	0.001325	--	0.001149	--
Space Velocity, SCF/hr-cu ft	2329	5076	2341	4992	2336	5025

* The feed gas contains about 1.3 ppm propyl mercaptan, 0.8 ppm thiophene, and 52 ppm carbonyl sulfide

† Concentrations of carbon monoxide less than 0.1% cannot be accurately detected by the present instruments; they are not reported, and equilibrium conversion is assumed.

B-64-1065g

Table A-11, Part 8. LIFE TESTS (Union Carbide UC-1870-46-1 Shift Catalyst, 1/16-Inch Extrudates, 21.0 g)

Run No.	21-22		21-23		21-24	
Time, hr	918		942		1058	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000	1000	1000
Temperature, Furnace, °F	580	580	580	580	580	580
Temperature, Reactor Entrance, °F	649	649	648	648	649	669
Temperature, Quarter Bed, °F	648	648	648	648	650	650
Temperature, Middle Bed, °F	625	625	625	625	624	624
Temperature, Exit, °F	608	608	608	608	606	606
Flow Rate, H_2S, lb-mol./hr	0.000088	0.000088	0.000088	0.000088	0.000081	0.000081
Flow Rate, Feed, lb-mol./hr	0.004879	0.012666	0.004897	0.012598	0.004775	0.012705
Flow Rate, H_2O, lb-mol./hr	--	0.007144	--	0.007226	--	0.007349
Flow Rate, C_6H_6, lb-mol./hr	--	0.000617	--	0.000537	--	0.000577
Temperature, Steam, °F	900	900	900	900	900	900
Temperature, Benzene, °F	280	280	280	280	280	280
Feed Composition, mol %*						
CO	19.2	7.40	19.2	7.40	21.2	7.97
CO_2	21.6	8.32	21.6	8.34	24.5	9.21
H_2	24.3	9.36	24.3	9.37	31.1	11.68
CH_4	31.2	12.02	31.2	12.13	19.6	7.37
C_2H_6	0.5	0.19	0.5	0.19	0.5	0.19
N_2	1.4	0.54	1.4	0.54	1.4	0.53
H_2S	1.8	0.69	1.8	0.69	1.7	0.64
NH_3	--	0.21	--	0.20	--	--
C_6H_6	--	4.87	--	4.23	--	4.54
C_6H_5OH	--	--	--	--	--	0.03
H_2O	--	56.40	--	56.91	--	57.84
Total	100.0	100.0	100.0	100.0	100.0	100.0
Product Flow Rate, lb-mol./hr	0.005806	0.012415	0.005794	0.012521	0.005794	0.012385
Product Composition, mol %						
CO†	--	--	--	--	--	--
CO_2	33.6	15.61	33.6	15.55	39.2	18.34
H_2	37.7	17.53	37.7	17.44	40.3	18.85
CH_4	25.1	11.64	25.1	11.61	17.1	8.00
C_2H_6	0.5	0.23	0.5	0.23	0.4	0.19
N_2	1.3	0.60	1.3	0.60	1.2	0.57
H_2S	1.4	0.65	1.4	0.65	1.4	0.65
NH_3	--	0.14	--	0.14	--	--
C_6H_6	0.4	4.55	0.4	3.88	0.4	3.93
C_6H_5OH	--	--	--	--	--	0.02
H_2O	--	49.05	--	49.90	--	49.45
Total	100.0	100.0	100.0	100.0	100.0	100.0
CO Consumed, lb-mol./hr	0.000937	--	0.000940	--	0.001012	--
CO_2 Produced, lb-mol./hr	0.000897	--	0.000889	--	0.001165	--
H_2 Produced, lb-mol./hr	0.001003	--	0.000994	--	0.000950	--
H_2O Used, lb-mol./hr	0.001020	--	0.000980	--	0.001225	--
Space Velocity, SCF/hr-cu ft	2336	4995	2331	5038	2331	4983

*The feed gas contains about 1.3 ppm propyl mercaptan, 0.8 ppm thiophene, and 52 ppm carbonyl sulfide.

† Where values are not given, concentrations are below 0.1%.

B-94-1769a

Table A-11, Part 9. LIFE TESTS (Union Carbide UC-1870-46-1 Shift Catalyst, 1/16-Inch Extrudates, 21.0 g)

Run No.	21-25		21-26		21-27	
Time, hr	1082		1152		1176	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000	1000	1000
Temperature, Furnace, °F	580	580	580	580	580	580
Temperature, Reactor Entrance, °F	646	646	646	646	649	649
Temperature, Quarter Bed, °F	650	650	651	651	650	650
Temperature, Middle Bed, °F	625	625	625	625	626	626
Temperature, Exit, °F	606	606	610	610	606	606
Flow Rate, H_2S, lb-mol./hr	0.000082	0.000082	0.000083	0.000083	0.000082	0.000082
Flow Rate, Feed, lb-mol./hr	0.004843	0.012597	0.004864	0.0129614	0.004815	0.0128462
Flow Rate, H_2O, lb-mol./hr	--	0.007140	--	0.007488	--	0.007419
Flow Rate, C_6H_6, lb-mol./hr	--	0.000610	--	0.000604	--	0.000581
Temperature, Steam, °F	900	900	900	900	900	900
Temperature, Benzene, °F	280	280	280	280	280	280
Feed Composition, mol %*						
CO	21.2	8.15	21.2	7.96	21.2	7.95
CO_2	24.5	9.42	24.5	9.20	24.5	9.18
H_2	31.1	11.96	31.1	11.67	31.1	11.66
CH_4	19.6	7.53	19.6	7.36	19.6	7.35
C_2H_6*	0.5	0.19	0.5	0.19	0.5	0.19
N_2	1.4	0.54	1.4	0.53	0.4	0.52
H_2S	1.7	0.65	1.7	0.64	1.7	0.64
NH_3	--	--	--	--	--	0.21
C_6H_6	--	4.84	--	4.66	--	4.53
C_6H_5OH	--	0.04	--	0.03	--	0.03
H_2O	--	56.68	--	57.76	--	57.74
Total	100.0	100.0	100.0	100.0	100.0	100.0
Product Flow Rate, lb-mol./hr	0.00585	0.012215	0.005647	0.012636	0.005804	0.012499
Product Composition, mol %						
CO†	--	--	--	--	--	--
CO_2	39.3	18.82	39.9	18.48	39.8	18.48
H_2	40.3	19.30	39.8	18.43	39.9	18.53
CH_4	17.0	8.19	16.8	7.78	16.8	7.80
C_2H_6*	0.4	0.19	0.4	0.19	0.4	0.19
N_2	1.2	0.57	1.2	0.56	1.2	0.56
H_2S	1.4	0.67	1.5	0.69	1.5	0.70
NH_3	--	--	--	--	--	0.15
C_6H_6	0.4	4.14	0.4	3.80	0.4	3.80
C_6H_5OH	--	0.03	--	0.03	--	0.03
H_2O	--	48.09	--	50.04	--	49.76
Total	100.0	100.0	100.0	100.0	100.0	100.0
CO Consumed, lb-mol./hr	0.001027	--	0.001031	--	0.001021	--
CO_2 Produced, lb-mol./hr	0.001113	--	0.001141	--	0.001130	--
H_2 Produced, lb-mol./hr	0.000852	--	0.000814	--	0.000818	--
H_2O Used, lb-mol./hr	0.001267	--	0.001169	--	0.001199	--
Space Velocity, SCF/hr-cu ft	2354	4914	2352	5084	2335	5029

*The feed gas contains about 1.3 ppm propyl mercaptan, 0.8 ppm thiophene, and 52 ppm carbonyl sulfide.
† Where values are not given, concentrations are below 0.1 %.

B-94-1769b

Table A-11, Part 10. LIFE TESTS (Union Carbide UC-1870-46-1 Shift Catalyst, 1/16-Inch Extrudates, 21.0 g)

Run No.	21-28		21-29		21-30	
Time, hr	1200		1248		1320	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	510	510	510	510
Temperature, Furnace, °F	580	580	580	580	580	580
Temperature, Reactor Entrance, °F	646	646	641	641	652	652
Temperature, Quarter Bed, °F	650	650	652	652	660	660
Temperature, Middle Bed, °F	625	625	627	627	641	641
Temperature, Exit, °F	609	609	610	610	614	614
Flow Rate, H_2S, lb-mol./hr	0.000083	0.000083	0.000073	0.000073	0.000073	0.000073
Flow Rate, Feed, lb-mol./hr	0.004905	0.0129823	0.004864	0.0128002	0.004854	0.012755
Flow Rate, H_2O, lb-mol./hr	--	0.007456	--	0.007349	--	0.007321
Flow Rate, C_6H_6, lb-mol./hr	--	0.000590	--	0.000576	--	0.000550
Temperature, Steam, °F	900	900	900	900	900	900
Temperature, Benzene, °F	280	280	280	280	280	280
Feed Composition, mol %*						
CO	21.2	8.01	24.3	9.22	24.3	9.25
CO_2	24.5	9.26	22.4	8.50	22.4	8.52
H_2	31.1	11.75	19.9	7.55	19.9	7.57
CH_4	19.6	7.41	30.1	11.42	30.1	11.45
C_2H_6†	0.5	0.19	0.5	0.19	0.5	0.19
N_2	1.4	0.53	1.3	0.49	1.3	0.49
H_2S	1.7	0.64	1.5	0.57	1.5	0.57
NH_3	--	0.21	--	0.21	--	0.21
C_6H_6	--	4.54	--	4.49	--	4.31
C_6H_5OH	--	0.03	--	0.03	--	0.03
H_2O	--	57.43	--	57.33	--	57.41
Total	100.0	100.0	100.0	100.0	100.0	100.0
Product Flow Rate, lb-mol./hr	0.005830	0.012641	0.005863	0.012632	0.005883	0.012259
Product Composition, mol %						
CO†	--	--	0.3	0.14	0.3	0.14
CO_2	39.8	18.13	34.8	16.15	34.7	16.65
H_2	40.0	18.59	36.5	16.94	36.6	17.52
CH_4	16.8	7.89	25.3	11.74	25.3	12.14
C_2H_6†	0.4	0.18	0.4	0.19	0.4	0.19
N_2	1.2	0.55	1.2	0.56	1.2	0.58
H_2S	1.4	0.65	1.1	0.51	1.1	0.53
NH_3	--	0.15	--	0.15	--	0.14
C_6H_6	0.4	3.82	0.4	3.65	0.4	3.68
C_6H_5OH	--	0.03	--	0.03	--	0.03
H_2O	--	50.01	--	49.94	--	48.40
Total	100.0	100.0	100.0	100.0	100.0	100.0
CO Consumed, lb-mol./hr	0.001040	--	0.001164	--	0.001161	--
CO_2 Produced, lb-mol./hr	0.001089	--	0.000950	--	0.000954	--
H_2 Produced, lb-mol./hr	0.000825	--	0.001172	--	0.001180	--
H_2O Used, lb-mol./hr	0.001133	--	0.001041	--	0.001388	--
Space Velocity, SCF/hr-cu ft	2346	5014	2359	5077	2367	4932

* The feed gas contains about 1.3 ppm propyl mercaptan, 0.8 ppm thiophene, and 52 ppm carbonyl sulfide

† Where values are not given, concentrations are below 0.1%.

B-94-1769c

Table A-11, Part 11. LIFE TESTS
(Union Carbide UC-1870-46-1 Shift Catalyst,
1/16-Inch Extrudates, 21.0 g)

Run No.	21-31		21-32	
Time, hr	1344		1368	
Basis for Analysis	Dry	Wet	Dry	Wet
Pressure, psig	510	510	510	510
Temperature, Furnace, °F	730	730	750	750
Temperature, Reactor Entrance, °F	765	765	794	794
Temperature, Quarter Bed, °F	775	775	803	803
Temperature, Middle Bed, °F	751	751	783	783
Temperature, Exit, °F	736	736	764	764
Flow Rate, H_2S, lb-mol./hr	0.000073	0.000073	0.000073	0.000073
Flow Rate, Feed, lb-mol./hr	0.004858	0.013071	0.004849	0.012808
Flow Rate, H_2O, lb-mol./hr	--	0.007496	--	0.007352
Flow Rate, C_6H_6, lb-mol./hr	--	0.008685	--	0.000577
Temperature, Steam, °F	900	900	900	900
Temperature, Benzene, °F	280	280	280	280
Feed Composition, mol %*				
CO	24.3	9.03	24.3	9.20
CO_2	22.4	8.33	22.4	8.48
H_2	19.9	7.40	19.9	7.53
CH_4	30.1	11.19	30.1	11.40
C_2H_4	0.5	0.19	0.5	0.19
N_2	1.3	0.48	1.3	0.49
H_2S	1.5	0.56	1.5	0.57
NH_3	--	0.21	--	0.21
C_6H_6	--	5.24	--	4.50
C_6H_5OH	--	0.04	--	0.03
H_2O	--	57.33	--	57.40
Total	100.0	100.0	100.0	100.0
Product Flow Rate, lb-mol./hr	0.005879	0.012715	0.005819	0.012338
Product Composition, mol %				
CO	0.2	0.09	0.3	0.14
CO_2	35.0	16.18	34.9	16.46
H_2	36.3	16.79	36.2	17.07
CH_4	25.3	11.70	25.4	11.98
C_2H_4	0.4	0.18	0.4	0.19
N_2	1.2	0.55	1.2	0.57
H_2S	1.2	0.55	1.2	0.57
NH_3	--	0.15	--	0.15
C_6H_6	0.4	4.60	0.4	3.87
C_6H_5OH	--	0.04	--	0.03
H_2O	--	49.17	--	48.97
Total	100.0	100.0	100.0	100.0
CO Consumed, lb-mol./hr	0.001168	--	0.001161	--
CO_2 Produced, lb-mol./hr	0.000970	--	0.000945	--
H_2 Produced, lb-mol./hr	0.001167	--	0.001140	--
H_2O Used, lb-mol./hr	0.001244	--	0.001308	--
Space Velocity, SCF/hr-cu ft	2365	5116	2341	4964

*The feed gas contains about 1.3 ppm propyl mercaptan, 0.8 ppm thiophene, and 52 ppm carbonyl sulfide.

B-94-1769d

Table A-11, Part 12. LIFE TESTS (Union Carbide UC-1870-46-1 Shift Catalyst, 1/16-Inch Extrudates, 21.0 g)

Run No.	21-33		21-34		21-35	
Time, hr	1416		1486		1510	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	510	510	510	510	500	500
Temperature, Furnace, °F	750	750	750	750	750	750
Temperature, Reactor Entrance, °F	793	793	775	775	781	781
Temperature, Quarter Bed, °F	802	802	791	791	787	787
Temperature, Middle Bed, °F	780	780	775	775	781	781
Temperature, Exit, °F	766	766	761	761	772	772
Flow Rate, H_2S, lb-mol./hr	0.000074	0.000074	0.000073	0.000073	0.000130	0.000130
Flow Rate, Feed, lb-mol./hr	0.004952	0.013496	0.004843	0.012983	0.009250	0.072416
Flow Rate, H_2O, lb-mol./hr	--	0.007816	--	0.007512	--	0.012003
Flow Rate, C_6H_6, lb-mol./hr	--	0.000694	--	0.000597	--	0.001149
Temperature, Steam, °F	900	900	900	900	900	900
Temperature, Benzene, °F	280	280	280	280	280	280
Feed Composition, mol %*						
CO	24.3	8.92	24.3	9.06	26.3	10.86
CO_2	22.4	8.22	22.4	8.36	27.4	11.23
H_2	19.9	7.30	19.9	7.42	17.5	7.19
CH_4	30.1	11.05	30.1	11.23	25.6	10.49
C_2H_6*	0.5	0.18	0.5	0.19	0.6	0.25
N_2	1.3	0.48	1.3	0.48	1.2	0.50
H_2S	1.5	0.55	1.5	0.56	1.4	0.58
NH_3	--	0.21	--	0.21	--	0.19
C_6H_6	--	5.14	--	4.60	--	5.13
C_6H_5OH	--	0.04	--	0.03	--	0.04
H_2O	--	57.91	--	57.86	--	53.54
Total	100.0	100.0	100.0	100.0	100.0	100.0
Product Flow Rate, lb-mol./hr	0.005973	0.013091	0.005821	0.012367	0.010179	0.021075
Product Composition, mol %						
CO	0.3	0.14	0.4	0.19	6.2	2.99
CO_2	35.1	16.02	34.6	16.29	42.1	20.33
H_2	36.1	16.47	36.1	16.99	26.0	12.56
CH_4	25.3	11.54	25.7	12.10	22.2	10.72
C_2H_6*	0.4	0.18	0.4	0.19	0.5	0.24
N_2	1.2	0.55	1.2	0.56	1.1	0.53
H_2S	1.2	0.55	1.2	0.56	1.3	0.63
NH_3	--	0.15	--	0.14	--	0.14
C_6H_6	0.4	4.70	0.4	4.30	0.6	4.94
C_6H_5OH	--	0.04	--	0.03	--	0.04
H_2O	--	49.66	--	48.65	--	46.88
Total	100.0	100.0	100.0	100.0	100.0	100.0
CO Consumed, lb-mol./hr	0.001185	--	0.001154	--	0.001804	--
CO_2 Produced, lb-mol./hr	0.000988	--	0.000933	--	0.001767	--
H_2 Produced, lb-mol./hr	0.001170	--	0.001137	--	0.001036	--
H_2O Used, lb-mol./hr	0.001313	--	0.001497	--	0.002123	--
Space Velocity, SCF/hr-cu ft	2400	5667	2124	4977	4095	8480

*The feed gas contains about 1.3 ppm propyl mercaptan, 0.8 ppm thiophene, and 52 ppm carbonyl sulfide.

B-94-1769e

Table A-11, Part 13. LIFE TESTS (Union Carbide UC-1870-46-1 Shift Catalyst, 1/16-Inch Extrudates, 21.0 g)

Run No.	21-36		21-37		21-38	
Time, hr	1554		1578		1626	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000	1000	1000
Temperature, Furnace, °F	580	580	490	490	500	500
Temperature, Reactor Entrance, °F	640	640	561	561	568	568
Temperature, Quarter Bed, °F	650	650	564	564	567	567
Temperature, Middle Bed, °F	626	626	476	476	480	480
Temperature, Exit, °F	611	611	479	479	476	476
Flow Rate, H_2S, lb-mol./hr	0.000084	0.000084	0.000082	0.000082	0.000082	0.000082
Flow Rate, Feed, lb-mol./hr	0.004952	0.012982	0.004834	0.012581	0.004834	0.012781
Flow Rate, H_2O, lb-mol./hr	--	0.007409	--	0.007159	--	0.007349
Flow Rate, C_6H_6, lb-mol./hr	--	0.000590	--	0.000558	--	0.000568
Temperature, Steam, °F	900	900	900	900	900	900
Temperature, Benzene, °F	280	280	280	280	280	280
Feed Composition, mol %*						
CO	24.6	9.38	24.6	9.45	24.6	9.30
CO_2	25.4	9.69	25.4	9.76	25.4	9.61
H_2	22.7	8.66	22.7	8.72	22.7	8.59
CH_4	23.8	9.08	23.8	9.15	23.8	9.00
C_2H_6+	0.6	0.23	0.6	0.23	0.6	0.23
N_2	1.2	0.46	1.2	0.46	1.2	0.45
H_2S	1.7	0.65	1.7	0.65	1.7	0.64
NH_3	--	0.21	--	0.20	--	0.21
C_6H_6	--	4.54	--	4.44	--	4.44
C_6H_5OH	--	0.03	--	0.03	--	0.03
H_2O	--	57.07	--	56.91	--	57.50
Total	100.0	100.0	100.0	100.0	100.0	100.0
Product Flow Rate, lb-mol./hr	0.005759	0.012453	0.005312	0.011907	0.005316	0.011953
Product Composition, mol %						
CO†	--	--	5.8	2.59	5.8	2.58
CO_2	37.6	17.39	37.2	16.60	37.0	16.46
H_2	38.3	17.71	31.8	14.19	32.2	14.32
CH_4	20.9	9.67	21.9	9.77	21.6	9.61
C_2H_6+	0.4	0.18	0.5	0.22	0.5	0.22
N_2	1.0	0.46	1.0	0.45	1.1	0.49
H_2S	1.4	0.65	1.4	0.62	1.4	0.62
NH_3	--	0.15	--	0.15	--	0.15
C_6H_6	0.4	4.33	0.4	4.19	0.4	4.29
C_6H_5OH	--	0.03	--	0.03	--	0.03
H_2O	--	49.43	--	51.19	--	51.23
Total	100.0	100.0	100.0	100.0	100.0	100.0
CO Consumed, lb-mol./hr	0.001218	--	0.000881	--	0.000881	--
CO_2 Produced, lb-mol./hr	0.000907	--	0.000748	--	0.000739	--
H_2 Produced, lb-mol./hr	0.001082	--	0.000692	--	0.000615	--
H_2O Used, lb-mol./hr	0.001252		0.001083	--	0.001125	--
Space Velocity, SCF/hr-cu ft	2317	5010	2137	4790	2139	4809

* The feed gas contains about 1.3 ppm propyl mercaptan, 0.8 ppm thiophene, and 52 ppm carbonyl sulfide
† Where values are not given, concentrations are below 0.1%.

B-94-1769f

Table A-11, Part 14. LIFE TESTS (Union Carbide UC-1870-46-1 Shift Catalyst, 1/16-Inch Extrudates, 21.0 g)

Run No.	21-39		21-40		21-41	
Time, hr	1646		1650		1674	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000	990	990
Temperature, Furnace, °F	490	490	580	580	580	580
Temperature, Reactor Entrance, °F	567	567	641	641	653	653
Temperature, Quarter Bed, °F	565	565	647	647	663	663
Temperature, Middle Bed, °F	476	476	627	627	649	649
Temperature, Exit, °F	475	475	610	610	624	624
Flow Rate, H_2S, lb-mol./hr	0.000083	0.000083	0.000083	0.000083	0.001370	0.001370
Flow Rate, Feed, lb-mol./hr	0.004851	0.012796	0.004851	0.012796	0.008554	0.024709
Flow Rate, H_2O, lb-mol./hr	--	0.007349	--	0.007349	--	0.015065
Flow Rate, C_6H_6, lb-mol./hr	--	0.000565	--	0.000565	--	0.001028
Temperature, Steam, °F	900	900	900	900	900	900
Temperature, Benzene, °F	280	280	280	280	280	280
Feed Composition, mol %*						
CO	24.6	9.33	24.6	9.33	24.7	8.55
CO_2	25.4	9.63	25.4	9.63	25.0	8.65
H_2	22.7	8.61	22.7	8.61	23.3	8.07
CH_4	23.8	9.02	23.8	9.02	23.6	8.17
C_2H_6+	0.6	0.23	0.6	0.23	0.6	0.21
N_2	1.2	0.45	1.2	0.45	1.2	0.42
H_2S	1.7	0.64	1.7	0.64	1.6	0.55
NH_3	--	0.21	--	0.21	--	0.22
C_6H_6	--	4.42	--	4.42	--	4.16
C_6H_5OH	--	0.03	--	0.03	--	0.03
H_2O	--	57.43	--	57.43	--	60.97
Total	100.0	100.0	100.0	100.0	100.0	100.0
Product Flow Rate, lb-mol./hr	0.005254	0.012306	0.005883	0.012486	0.010845	0.023315
Product Composition, mol %						
CO†	5.1	2.18	--	--	0.3	0.13
CO_2	37.0	15.80	33.9	15.50	37.5	15.13
H_2	36.0	15.37	44.5	21.06	36.1	13.93
CH_4	18.2	7.77	18.0	8.48	22.7	9.18
C_2H_6+	0.5	0.21	0.4	0.19	0.4	0.18
N_2	1.4	0.60	1.4	0.66	1.0	0.44
H_2S	1.4	0.60	1.4	0.66	1.4	0.62
NH_3	--	0.16	--	0.15	--	0.17
C_6H_6	0.4	4.53	0.4	3.98	0.6	4.39
C_6H_5OH	--	0.03	--	0.03	--	0.03
H_2O	--	52.75	--	42.29	--	55.80
Total	100.0	100.0	100.0	100.0	100.0	100.0
CO Consumed, lb-mol./hr	0.000925	--	0.001193	--	0.002082	--
CO_2 Produced, lb-mol./hr	0.000712	--	0.000703	--	0.001390	--
H_2 Produced, lb-mol./hr	0.000791	--		--	0.001255	--
H_2O Used, lb-mol./hr	0.000857	--	0.001194	--	0.002058	--
Space Velocity, SCF/hr-cu ft	2114	4951	2367	5023	4363	9381

*This feed gas contains about 1.3 ppm propyl mercaptan, 0.8 ppm thiophene, and 52 ppm carbonyl sulfide.
† Where values are not given, concentrations are below 0.1%.

B-94-1769g

Table A-11, Part 15. LIFE TESTS (Union Carbide UC-1870-46-1 Shift Catalyst, 1/16-Inch Extrudates, 21.0 g)

Run No.	21-42		21-43	
Time, hr	1698		1732	
Basis for Analysis	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000
Temperature, Furnace, °F	580	580	500	500
Temperature, Reactor Entrance, °F	662	662	610	610
Temperature, Quarter Bed, °F	675	675	617	617
Temperature, Middle Bed, °F	664	664	605	605
Temperature, Exit, °F	641	641	574	574
Flow Rate, H_2S, lb-mol./hr	0.000215	0.000215	0.000216	0.000216
Flow Rate, Feed, lb-mol./hr	0.013458	0.033162	0.013523	0.034269
Flow Rate, H_2O, lb-mol./hr	--	0.018167	--	0.019031
Flow Rate, C_6H_6, lb-mol./hr	--	0.001460	--	0.001635
Temperature, Steam, °F	900	900	900	900
Temperature, Benzene, °F	280	280	280	280
Feed Composition, mol % *				
CO	15.7	63.7	15.7	6.20
CO_2	25.2	10.23	25.2	9.94
H_2	32.5	13.19	32.5	12.82
CH_4	23.2	9.42	23.2	9.15
C_2H_6*	0.6	0.24	0.6	0.24
N_2	1.2	0.49	1.2	0.47
H_2S	1.6	0.65	1.6	0.63
NH_3	--	0.20	--	0.20
C_6H_6	--	4.40	--	4.77
C_6H_5OH	--	0.03	--	0.03
H_2O	--	54.78	--	55.55
Total	100.0	100.0	100.0	100.0
Product Flow Rate, lb-mol./hr	0.015741	0.031396	0.015696	0.033275
Product Composition, mol %				
CO	0.4	0.20	4.0	2.00
CO_2	36.5	18.31	34.5	16.11
H_2	39.0	19.56	37.5	17.71
CH_4	20.7	10.33	20.6	9.71
C_2H_6*	0.4	0.20	0.4	0.19
N_2	1.0	0.50	1.0	0.47
H_2S	1.4	0.70	1.4	0.66
NH_3	--	0.13	--	0.14
C_6H_6	0.6	4.45	0.6	4.78
C_6H_5OH	--	0.03	--	0.04
H_2O	--	45.59	--	49.19
Total	100.0	100.0	100.0	100.0
CO Consumed, lb-mol./hr	0.002050	--	0.001463	--
CO_2 Produced, lb-mol./hr	0.002355	--	0.001790	--
H_2 Produced, lb-mol./hr	0.001865	--	0.001476	--
H_2O Used, lb-mol./hr	0.003837	--	0.003015	--
Space Velocity, SCF/hr-cu ft	6333	12,632	6315	13,388

*The feed gas contains about 1.3 ppm propyl mercaptan, 0.8 ppm thiophene, and 52 ppm carbonyl sulfide.

B-94-1769h

Table A-11, Part 16. LIFE TESTS (Union Carbide UC-1870-46-1 Shift Catalyst, 1/16-Inch Extrudates, 21.0 g)

Run No.	21-44		21-45	
Time, hr	1842		1866	
Basis for Analysis	Dry	Wet	Dry	Wet
Pressure, psig	510	510	210	210
Temperature, Furnace, °F	500	500	500	500
Temperature, Reactor Entrance, °F	576	576	560	560
Temperature, Quarter Bed, °F	576	576	565	565
Temperature, Middle Bed, °F	560	560	553	553
Temperature, Exit, °F	534	534	538	538
Flow Rate, H_2S, lb-mol./hr	0.000076	0.000076	0.000079	0.000079
Flow Rate, Feed, lb-mol./hr	0.004898		0.004908	0.012940
Flow Rate, H_2O, lb-mol./hr	--	0.007620	--	0.007471
Flow Rate, C_6H_6, lb-mol./hr	--		--	0.000530
Temperature, Steam, °F	900	900	900	900
Temperature, Benzene, °F	280	280	280	280
Feed Composition, mol %*				
CO	15.6	5.86	16.4	6.22
CO_2	25.2	9.47	25.7	9.75
H_2	32.7	12.29	31.1	11.80
CH_4	23.1	8.68	23.4	8.88
C_2H_6*	0.6	0.23	0.6	0.23
N_2	1.2	0.45	1.2	0.46
H_2S	1.6	0.60	1.6	0.61
NH_3	--	0.21	--	0.21
C_6H_6	--	3.74	--	4.10
C_6H_5OH	--	0.03	--	0.03
H_2O	--	58.44	--	57.71
Total	100.0	100.0	100.0	100.0
Product Flow Rate, lb-mol./hr	0.005973	0.012918	0.005700	0.012911
Product Composition, mol %				
CO	3.0	1.40	4.1	1.77
CO_2	33.5	16.51	32.7	14.39
H_2	37.0	17.31	37.7	16.60
CH_4	20.7	9.58	22.3	9.80
C_2H_6*	0.4	0.19	0.4	0.18
N_2	1.0	0.46	1.0	0.44
H_2S	1.4	0.65	1.4	0.62
NH_3	--	0.15	--	0.15
C_6H_6	0.4	3.37	0.4	3.84
C_6H_5OH	--	0.03	--	0.03
H_2O	--	50.35	--	52.18
Total	100.0	100.0	100.0	100.0
CO Consumed, lb-mol./hr	0.000728	--	0.000577	--
CO_2 Produced, lb-mol./hr	0.000946	--	0.000597	--
H_2 Produced, lb-mol./hr	0.00072	--	0.000617	--
H_2O Used, lb-mol./hr	0.000729	--	0.000735	--
Space Velocity, SCF/hr-cu ft	2403	5200	2293	5195

* The feed gas contains about 1.3 ppm propyl mercaptan, 0.8 ppm thiophene, and 52 ppm carbonyl sulfide.

B-96-1769i

Table A-11, Part 17. LIFE TESTS (Union Carbide UC-1870-46-1 Shift Catalyst, 1/16-Inch Extrudates, 21.0 g)

Run No.	21-46		21-47		21-48	
Time, hr	1890		1914		1934	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	210	210	200	200	200	200
Temperature, Furnace, °F	580	580	500	500	580	580
Temperature, Reactor Entrance, °F	630	630	565	565	628	628
Temperature, Quarter Bed, °F	637	637	561	561	631	631
Temperature, Middle Bed, °F	630	630	556	556	626	626
Temperature, Exit, °F	615	615	540	540	614	614
Flow Rate, H_2S, lb-mol./hr	0.000078	0.000078	0.000134	0.000134	0.000134	0.000134
Flow Rate, Feed, lb-mol./hr	0.004880	0.012825	0.008361	0.021697	0.008353	0.021656
Flow Rate, H_2O, lb-mol./hr	--	0.007349	--	0.012248	--	0.012248
Flow Rate, C_6H_6, lb-mol./hr	--	0.000565	--	0.001036	--	0.001003
Temperature, Steam, °F	900	900	900	900	900	900
Temperature, Benzene, °F	280	280	280	280	280	280
Feed Composition, mol %*						
CO	16.4	6.24	15.7	6.05	15.7	6.06
CO_2	25.7	9.78	25.1	9.67	25.1	9.68
H_2	31.1	11.83	32.6	12.56	32.6	12.57
CH_4	23.4	8.90	23.2	8.94	23.2	8.95
C_2H_6*	0.6	0.23	0.6	0.23	0.6	0.23
N_2	1.2	0.46	1.2	0.46	1.2	0.46
H_2S	1.6	0.61	1.6	0.62	1.6	0.62
NH_3	--	0.21	--	0.20	--	0.20
C_6H_6	--	4.41	--	4.78	--	4.63
C_6H_5OH	--	0.03	--	0.03	--	0.03
H_2O	--	57.30	--	56.46	--	56.57
Total	100.0	100.0	100.0	100.0	100.0	100.0
Product Flow Rate, lb-mol./hr	0.005837	0.013204	0.009097	0.022063	0.009089	0.021135
Product Composition, mol %						
CO	2.9	1.28	11.6	4.78	8.4	3.61
CO_2	33.7	14.90	28.5	11.75	30.2	12.99
H_2	38.4	16.97	34.3	14.14	36.9	15.87
CH_4	21.8	9.64	22.1	9.11	21.0	9.03
C_2H_6*	0.4	0.18	0.4	0.16	0.4	0.17
N_2	1.0	0.44	1.1	0.45	1.1	0.47
H_2S	1.4	0.62	1.4	0.58	1.4	0.60
NH_3	--	0.15	--	0.16	--	0.16
C_6H_6	0.4	4.19	0.6	4.6	0.6	4.04
C_6H_5OH	--	0.03	--	0.03	--	0.03
H_2O	--	51.60	--	54.24	--	53.03
Total	100.0	100.0	100.0	100.0	100.0	100.0
CO Consumed, lb-mol./hr	0.000631	--	0.000258	--	0.000548	--
CO_2 Produced, lb-mol./hr	0.000713	--	0.000494	--	0.000648	--
H_2 Produced, lb-mol./hr	0.000723	--	0.000394	--	0.000631	--
H_2O Used, lb-mol./hr	0.000536	--	0.000285	--	0.001041	--
Space Velocity, SCF/hr-cu ft	2348	5312	3660	8877	3657	8504

*The feed gas contains about 1.3 ppm propyl mercaptan, 0.8 ppm thiophene, and 52 ppm carbonyl sulfide.

B-94-1769j

Table A-11, Part 18. LIFE TESTS (Union Carbide UC-1870-46-1 Shift Catalyst, 1/16-Inch Extrudates, 21.0 g)

Run No.	21-49		21-50		21-51	
Time, hr	1978		2005		2029	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	200	200	1000	1000	990	990
Temperature, Furnace, °F	750	750	750	750	750	750
Temperature, Reactor Entrance, °F	753	753	782	782	776	776
Temperature, Quarter Bed, °F	764	764	775	775	781	781
Temperature, Middle Bed, °F	762	762	757	757	770	770
Temperature, Exit, °F	750	750	743	743	753	753
Flow Rate, H_2S, lb-mol./hr	0.000134	0.000134	0.000063	0.000063	0.000114	0.000114
Flow Rate, Feed, lb-mol./hr	0.008371	0.021277	0.004814	0.014191	0.008753	0.024142
Flow Rate, H_2O, lb-mol./hr	--	0.011683	--	0.008804	--	0.014586
Flow Rate, C_6H_6, lb-mol./hr	--	0.001172	--	0.000537	--	0.000745
Temperature, Steam, °F	900	900	900	900	900	900
Temperature, Benzene, °F	280	280	280	280	280	280
Feed Composition, mol %*						
CO	15.7	6.19	17.0	5.76	17.0	6.16
CO_2	25.1	9.88	20.7	7.03	20.7	7.51
H_2	32.6	12.81	26.7	9.06	26.7	9.68
CH_4	23.2	9.13	30.0	10.18	30.0	10.88
C_2H_6	0.6	0.24	0.8	0.27	0.8	0.29
N_2	1.2	0.47	3.5	1.18	3.5	1.27
H_2S	1.6	0.63	1.3	0.44	1.3	0.47
NH_3	--	0.20	--	0.23	--	0.22
C_6H_6	--	5.51	--	3.78	--	3.09
C_6H_5OH	--	0.04	--	0.03	--	0.02
H_2O	--	54.91	--	62.04	--	60.41
Total	100.0	100.0	100.0	100.0	100.0	100.0
Product Flow Rate, lb-mol./hr	0.009502	0.021038	0.005789	0.014096	0.010178	0.023725
Product Composition, mol %*						
CO†	5.3	2.39	--	--	0.8	0.34
CO_2	31.4	14.18	31.9	13.17	31.0	13.30
H_2	39.7	17.93	36.4	14.95	36.3	15.57
CH_4	20.2	9.12	26.5	10.88	26.6	11.41
C_2H_6	0.4	0.18	0.7	0.23	0.7	0.30
N_2	1.0	0.45	3.1	1.27	3.1	1.33
H_2S	1.4	0.63	1.0	0.41	0.9	0.39
NH_3	--	0.15	--	0.16	--	0.16
C_6H_6	0.6	4.48	0.4	3.17	0.6	2.73
C_6H_5OH	--	0.04	--	0.03	--	0.02
H_2O	--	50.45	--	55.73	--	54.45
Total	100.0	100.0	100.0	100.0	100.0	100.0
CO Consumed, lb-mol./hr	0.000810	--	0.000818	--	0.001407	--
CO_2 Produced, lb-mol./hr	0.000813	--	0.000850	--	0.001343	--
H_2 Produced, lb-mol./hr	0.001044	--	0.000822	--	0.001357	--
H_2O Used, lb-mol./hr	0.001072	--	0.000948	--	0.001670	--
Space Velocity, SCF/hr-cu ft	3823	8465	2329	5671	4095	9546

† The feed gas contains about 1.3 ppm propyl mercaptan, 0.8 ppm thiophene, and 52 ppm carbonyl sulfide.
* Where values are not given, concentrations are below 0.1%.

B-94-1769k

Table A-11, Part 19. LIFE TESTS (Union Carbide UC-1870-46-1 Shift Catalyst, 1/16-Inch Extrudates, 21.0 g)

Run No.	21-52		21-53	
Time, hr	2077		2221	
Basis for Analysis	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000
Temperature, Furnace, °F	750	750	750	750
Temperature, Reactor Entrance, °F	790	790	736	736
Temperature, Quarter Bed, °F	790	790	776	776
Temperature, Middle Bed, °F	786	786	758	758
Temperature, Exit, °F	765	765	746	746
Flow Rate, H_2S, lb-mol./hr	0.000175	0.000175	0.000064	0.000064
Flow Rate, Feed, lb-mol./hr	0.014579	0.036226	0.004894	0.012883
Flow Rate, H_2O, lb-mol./hr	--	0.020277	--	0.007471
Flow Rate, C_6H_6, lb-mol./hr	--	0.001288	--	0.000537
Temperature, Steam, °F	900	900	900	900
Temperature, Benzene, °F	280	280	280	280
Feed Composition, mol %*				
CO	17.0	6.84	17.0	6.46
CO_2	21.0	8.45	20.7	7.86
H_2	26.5	10.67	26.7	10.15
CH_4	30.0	12.07	30.0	11.39
C_2H_6*	0.8	0.32	0.8	0.30
N_2	3.5	1.41	3.5	1.33
H_2S	1.2	0.48	1.3	0.50
NH_3	--	0.20	--	0.21
C_6H_6	--	3.55	--	4.17
C_6H_5OH	--	0.03	--	0.03
H_2O	--	55.98	--	57.60
Total	100.0	100.0	100.0	100.0
Product Flow Rate, lb-mol./hr	0.017295	0.035311	0.005912	0.012761
Product Composition, mol %				
CO	1.9	0.93	0.1	0.05
CO_2	31.3	15.33	31.7	14.68
H_2	34.7	17.00	36.4	16.86
CH_4	26.7	13.08	26.6	12.33
C_2H_6*	0.7	0.34	0.7	0.32
N_2	3.1	1.52	3.1	1.43
H_2S	0.9	0.44	1.0	0.46
NH_3	--	0.14	--	0.14
C_6H_6	0.7	3.40	0.4	3.78
C_6H_5OH	--	0.03	--	0.03
H_2O	--	47.79	--	49.92
Total	100.0	100.0	100.0	100.0
CO Consumed, lb-mol./hr	0.002150	--	0.000826	--
CO_2 Produced, lb-mol./hr	0.002351	--	0.000861	--
H_2 Produced, lb-mol./hr	0.002140	--	0.000845	
H_2O Used, lb-mol./hr	0.003402	--	0.001102	--
Space Velocity, SCF/hr-cu ft	6959	14,208	2378	5135

*The feed gas contains about 1.3 ppm propyl mercaptan, 0.8 ppm thiophene, and 52 ppm carbonyl sulfide.

B-94-17691

Table A-12, Part 1. LIFE TESTS (Laporte-Davison Comox 207 Shift Catalyst, 3/16-Inch Pellets, 21.0 g)

Run No.	22-1		22-2		22-3	
Time, hr	2		5		7	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000	1000	1000
Temperature, Furnace, °F	580	580	580	580	580	580
Temperature, Reactor Entrance, °F	615	615	615	615	615	615
Temperature, Quarter Bed, °F	630	630	630	630	630	630
Temperature, Middle Bed, °F	620	620	620	620	620	620
Temperature, Exit, °F	590	590	590	590	590	590
Flow Rate, H_2S, lb-mol./hr	0.000054	0.000054	0.000054	0.000054	0.000054	0.000054
Flow Rate, Feed, lb-mol./hr	0.004860	0.012680	0.004860	0.012680	0.004860	0.012680
Flow Rate, H_2O, lb-mol./hr	--	0.007820	--	0.007820	--	0.007820
Flow Rate, C_6H_6, lb-mol./hr	--	--	--	--	--	--
Temperature, Steam, °F	900	900	900	900	900	900
Temperature, Benzene, °F	280	280	280	280	280	280
Feed Composition, mol %*						
CO	20.2	7.74	20.2	7.74	20.2	7.74
CO_2	22.3	8.55	22.3	8.55	22.3	8.55
H_2	23.9	9.16	23.9	9.16	23.9	9.16
CH_4	29.5	11.31	29.5	11.31	29.5	11.31
C_2H_6*	0.8	0.31	0.8	0.31	0.8	0.31
N_2	2.2	0.84	2.2	0.84	2.2	0.84
H_2S	1.1	0.42	1.1	0.42	1.1	0.42
NH_3	--	--	--	--	--	--
C_6H_6	--	--	--	--	--	--
C_6H_5OH	--	--	--	--	--	--
H_2O	--	61.67	--	61.67	--	61.67
Total	100.0	100.00	100.0	100.00	100.0	100.00
Product Flow Rate, lb-mol./hr	0.005832	0.012635	0.005832	0.012635	0.005891	0.012694
Product Composition, mol %						
CO	3.2	1.48	0.8	0.37	0.1	0.05
CO_2	32.9	15.19	34.2	15.79	34.9	16.20
H_2	34.3	15.83	36.1	16.66	36.6	16.99
CH_4	25.9	11.96	25.5	11.77	25.0	11.60
C_2H_6*	0.7	0.32	0.6	0.28	0.6	0.28
N_2	2.0	0.92	1.9	0.88	1.9	0.88
H_2S	1.0	0.46	0.9	0.42	0.9	0.42
NH_3	--	--	--	--	--	--
C_6H_6	--	--	--	--	--	--
C_6H_5OH	--	--	--	--	--	--
H_2O	--	53.84	--	53.83	--	53.58
Total	100.0	100.00	100.0	100.00	100.0	100.00
CO Consumed, lb-mol./hr	0.000795	--	0.000934	--	0.000976	--
CO_2 Produced, lb-mol./hr	0.000835	--	0.000911	--	0.000972	--
H_2 Produced, lb-mol./hr	0.000839	--	0.000944	--	0.000994	--
H_2O Used, lb-mol./hr	0.001018	--	0.001018	--	0.001018	
Space Velocity, SCF/hr-cu ft	2797	6060	2797	6060	2825	6088

* The feed gas contains about 1.3 ppm propyl mercaptan, 0.8 ppm thiophene, and 52 ppm carbonyl sulfide.

B-15-36a

Table A-12, Part 2. LIFE TESTS (Laporte-Davison Comox 207 Shift Catalyst, 3/16-Inch Pellets, 21.0 g)

Run No.	22-4		22-5		22-6	
Time, hr	26		74		151	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000	1000	1000
Temperature, Furnace, °F	580	580	580	580	580	580
Temperature, Reactor Entrance, °F	615	615	615	615	616	616
Temperature, Quarter Bed, °F	630	630	622	622	625	625
Temperature, Middle Bed, °F	620	620	619	619	620	620
Temperature, Exit, °F	592	592	592	592	591	591
Flow Rate, H_2S, lb-mol./hr	0.000054	0.000054	0.000053	0.000053	0.000053	0.000053
Flow Rate, Feed, lb-mol./hr	0.004862	0.011628	0.004855	0.011921	0.004782	0.012437
Flow Rate, H_2O, lb-mol./hr	--	0.006765	--	0.007066	--	0.007042
Flow Rate, C_6H_6, lb-mol./hr	--	--	--	--	--	0.000612
Temperature, Steam, °F	900	900	900	900	900	900
Temperature, Benzene, °F	280	280	280	280	280	280
Feed Composition, mol %*						
CO	20.2	8.45	20.2	8.23	20.0	7.69
CO_2	22.3	9.33	22.3	9.08	21.2	8.15
H_2	23.9	9.99	23.9	9.73	29.6	11.38
CH_4	29.5	12.34	29.5	12.01	25.6	9.84
C_2H_6†	0.8	0.33	0.8	0.33	0.7	0.27
N_2	2.2	0.92	2.2	0.90	1.8	0.69
H_2S	1.1	0.46	1.1	0.45	1.1	0.42
NH_3	--	--	--	--	--	--
C_6H_6	--	--	--	--	--	4.92
C_6H_5OH	--	--	--	--	--	--
H_2O	--	58.18	--	59.27	--	56.64
Total	100.0	100.00	100.0	100.00	100.0	100.00
Product Flow Rate, lb-mol./hr	0.005858	0.011690	0.005761	0.011790	0.005632	0.012169
Product Composition, mol %						
CO†	--	--	--	--	--	--
CO_2	34.4	17.24	34.5	16.86	33.4	15.46
H_2	36.8	18.44	36.8	17.98	41.6	19.25
CH_4	25.4	12.73	25.3	12.36	21.6	10.00
C_2H_6†	0.6	0.30	0.6	0.29	0.6	0.28
N_2	1.9	0.95	1.8	0.88	1.6	0.74
H_2S	0.9	0.45	1.0	0.49	0.9	0.42
NH_3	--	--	--	--	--	--
C_6H_6	--	--	--	--	0.3	4.7
C_6H_5OH	--	--	--	--	--	--
H_2O	--	49.89	--	51.14	--	49.15
Total	100.0	100.00	100.0	100.00	100.0	100.00
CO Consumed, lb-mol./hr	0.000981	--	0.000981	--	0.000956	--
CO_2 Produced, lb-mol./hr	0.000930	--	0.000905	--	0.000867	--
H_2 Produced, lb-mol./hr	0.000994	--	0.000960	--	0.000928	--
H_2O Used, lb-mol./hr	0.000933	--	0.001036	--	0.001062	--
Space Velocity, SCF/hr-cu ft	2809	5607	2763	5654	2701	5836

* The feed gas contains about 1.3 ppm propyl mercaptan, 0.8 ppm thiophene, and 52 ppm carbonyl sulfide.

† Where values are not given, concentrations are below 0.1%.

B-15-36b

Table A-12, Part 3. LIFE TESTS (Laporte-Davison Comox 207 Shift Catalyst, 3/16-Inch Pellets, 21.0 g)

Run No.	22-7		22-8		22-9	
Time, hr	170		193		217	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000	1000	1000
Temperature, Furnace, °F	580	580	580	580	580	580
Temperature, Reactor Entrance, °F	616	616	616	616	615	615
Temperature, Quarter Bed, °F	628	628	626	626	624	624
Temperature, Middle Bed, °F	620	620	620	620	621	621
Temperature, Exit, °F	590	590	594	594	591	591
Flow Rate, H_2S, lb-mol./hr	0.000053	0.000053	0.000057	0.000057	0.000057	0.000057
Flow Rate, Feed, lb-mol./hr	0.004801	0.011670	0.004741	0.011297	0.004740	0.011950
Flow Rate, H_2O, lb-mol./hr	--	0.006124	--	0.005841	--	0.006624
Flow Rate, C_6H_6, lb-mol./hr	--	0.000745	--	0.000696	--	0.000565
Temperature, Steam, °F	900	900	900	900	900	900
Temperature, Benzene, °F	280	280	280	280	280	280
Feed Composition, mol %*						
CO	20.0	8.23	20.1	8.44	20.1	7.97
CO_2	21.2	8.72	20.8	8.73	20.8	8.25
H_2	29.6	12.19	30.2	12.68	30.2	11.98
CH_4	25.6	10.53	25.3	10.62	25.3	11.04
C_2H_6+	0.7	0.29	0.7	0.29	0.7	0.28
N_2	1.8	0.74	1.7	0.71	1.7	0.67
H_2S	1.1	0.45	1.2	0.50	1.2	0.48
NH_3	--	--	--	0.16	--	0.18
C_6H_6	--	6.38	--	6.16	--	4.73
C_6H_5OH	--	--	--	--	--	--
H_2O	--	52.47	--	51.71	--	55.42
Total	100.0	100.00	100.0	100.00	100.0	100.00
Product Flow Rate, lb-mol./hr	0.005737	0.011681	0.005659	0.011142	0.005643	0.011717
Product Composition, mol %						
CO	0.1	0.05	0.1	0.05	0.1	0.05
CO_2	33.6	16.50	32.9	16.71	32.9	15.84
H_2	41.5	20.39	41.3	20.98	41.1	19.79
CH_4	21.5	10.56	22.4	11.38	22.6	10.88
C_2H_6+	0.6	0.29	0.6	0.30	0.6	0.29
N_2	1.5	0.74	1.6	0.81	1.6	0.77
H_2S	0.9	0.44	0.8	0.41	0.8	0.39
NH_3	--	--	--	--	--	--
C_6H_6	0.3	6.04	0.3	5.62	0.3	4.20
C_6H_5OH	--	--	--	0.11	--	0.12
H_2O	--	44.99	--	43.63	--	47.67
Total	100.0	100.00	100.0	100.00	100.0	100.00
CO Consumed, lb-mol./hr	0.000954	--	0.000947	--	0.000947	--
CO_2 Produced, lb-mol./hr	0.000910	--	0.000876	--	0.000871	--
H_2 Produced, lb-mol./hr	0.000960	--	0.000905	--	0.000888	--
H_2O Used, lb-mol./hr	0.000869	--	0.000980	--	0.001039	--
Space Velocity, SCF/hr-cu ft	2752	5602	2714	5344	2706	5620

* The feed gas contains about 1.3 ppm propyl mercaptan, 0.8 ppm thiophene, and 52 ppm carbonyl sulfide.

B-15-36c

Table A-12, Part 4. LIFE TESTS
(Laporte-Davison Comox 207 Shift Catalyst,
3/16-Inch Pellets, 21.0 g)

Run No.	22-10		22-11		22-12	
Time, hr	241		337		357	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000	1000	1000
Temperature, Furnace, °F	580	580	580	580	580	580
Temperature, Reactor Entrance, °F	615	615	615	615	615	615
Temperature, Quarter Bed, °F	625	624	625	625	625	625
Temperature, Middle Bed, °F	620	620	620	620	621	621
Temperature, Exit, °F	590	590	590	590	590	590
Flow Rate, H_2S, lb-mol./hr	0.000057	0.000057	0.000057	0.000057	0.000058	0.000058
Flow Rate, Feed, lb-mol./hr	0.004751	0.011898	0.004736	0.012429	0.004846	0.013627
Flow Rate, H_2O, lb-mol./hr	--	0.006556	--	0.007101	--	0.008114
Flow Rate, C_6H_6, lb-mol./hr	--	0.000565	--	0.000565	--	0.000636
Temperature, Steam, °F	900	900	900	900	900	900
Temperature, Benzene, °F	280	280	280	280	280	280
Feed Composition, mol %*						
CO	20.1	8.03	20.1	7.66	20.1	7.15
CO_2	20.8	8.31	20.8	7.93	20.8	7.40
H_2	30.2	12.05	30.2	11.51	30.2	10.74
CH_4	25.3	10.10	25.3	9.64	25.3	9.00
C_2H_4*	0.7	0.28	0.7	0.27	0.7	0.25
N_2	1.7	0.68	1.7	0.46	1.7	0.60
H_2S	1.2	0.48	1.2	0.65	1.2	0.43
NH_3	--	0.18	--	0.18	--	0.19
C_6H_6	--	4.75	--	4.55	--	4.67
C_6H_5OH	--	0.04	--	0.03	--	0.03
H_2O	--	55.10	--	57.12	--	59.54
Total	100.0	100.00	100.0	100.00	100.0	100.00
Product Flow Rate, lb-mol./hr	0.005672	0.011758	0.005646	0.012320	0.005832	0.01347
Product Composition, mol %						
CO	0.1	0.05	0.1	0.05	0.2	0.09
CO_2	33.0	15.92	33.2	15.22	33.0	14.29
H_2	41.0	19.78	40.8	18.70	40.8	17.67
CH_4	22.6	10.90	22.5	10.31	22.6	9.78
C_2H_4*	0.6	0.29	0.6	0.27	0.6	0.26
N_2	1.6	0.77	1.6	0.73	1.6	0.69
H_2S	0.8	0.39	0.9	0.41	0.9	0.39
NH_3	--	0.02	--	0.13	--	0.13
C_6H_6	0.3	4.22	0.3	4.11	0.3	4.17
C_6H_5OH	--	0.12	--	0.02	--	0.02
H_2O	--	47.54	--	50.05	--	52.51
Total	100.0	100.00	100.0	100.00	100.0	100.00
CO Consumed, lb-mol./hr	0.000949	--	0.000946	--	0.000963	--
CO_2 Produced, lb-mol./hr	0.000883	--	0.000889	--	0.000916	--
H_2 Produced, lb-mol./hr	0.000890	--	0.000874	--	0.000916	--
H_2O Used, lb-mol./hr	0.000965	--	0.000937	--	0.001041	--
Space Velocity, SCF/hr-cu ft	2720	5639	2708	5909	2797	6461

* The feed gas contains about 1.3 ppm propyl mercaptan, 0.8 ppm thiophene, and 52 ppm carbonyl sulfide.

B-15-36d

Table A-12, Part 5. LIFE TESTS (Laporte-Davison Comox 207 Shift Catalyst, 3/16-Inch Pellets, 21.0 g)

Run No.	22-13		22-14		22-15	
Time, hr	380		476		498	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000	1000	1000
Temperature, Furnace, °F	580	580	580	580	580	580
Temperature, Reactor Entrance, °F	615	615	616	616	614	614
Temperature, Quarter Bed, °F	623	623	623	623	620	620
Temperature, Middle Bed, °F	621	621	620	620	618	618
Temperature, Exit, °F	591	591	590	590	590	590
Flow Rate, H_2S, lb-mol./hr	0.000058	0.000058	0.000058	0.000058	0.000058	0.000058
Flow Rate, Feed, lb-mol./hr	0.004869	0.012855	0.004846	0.011545	0.004862	0.012534
Flow Rate, H_2O, lb-mol./hr	--	0.007430	--	0.006211	--	0.007083
Flow Rate, C_6H_6, lb-mol./hr	--	0.000528	--	0.000464	--	0.000562
Temperature, Steam, °F	900	900	900	900	900	900
Temperature, Benzene, °F	280	280	280	280	280	280
Feed Composition, mol %*						
CO	17.2	6.52	17.2	7.22	17.2	6.67
CO_2	21.3	8.07	21.3	8.94	21.3	8.26
H_2	32.3	12.23	32.3	13.56	32.3	12.54
CH_4	25.6	9.70	25.6	10.76	25.6	9.93
C_2H_6*	0.7	0.27	0.7	0.29	0.7	0.27
N_2	1.7	0.64	1.7	0.71	1.7	0.66
H_2S	1.2	0.45	1.2	0.50	1.2	0.47
NH_3	--	0.18	--	0.17	--	0.18
C_6H_6	--	4.10	--	4.02	--	4.48
C_6H_5OH	--	0.03	--	0.03	--	0.03
H_2O	--	57.81	--	53.80	--	56.51
Total	100.0	100.00	100.0	100.00	100.0	100.00
Product Flow Rate, lb-mol./hr	0.005817	0.012670	0.005832	0.011597	0.005731	0.012303
Product Composition, mol %						
CO	0.4	0.18	0.5	0.25	0.4	0.19
CO_2	32.3	14.65	32.3	16.14	32.3	15.05
H_2	42.3	19.61	42.2	21.32	42.3	19.70
CH_4	21.6	9.92	21.6	10.86	21.6	10.06
C_2H_6*	0.6	0.28	0.6	0.30	0.6	0.28
N_2	1.5	0.69	1.5	0.75	1.5	0.70
H_2S	1.0	0.46	1.0	0.50	1.0	0.47
NH_3	--	0.13	--	0.12	--	0.12
C_6H_6	0.3	3.68	0.3	3.56	0.3	4.24
C_6H_5OH	--	0.02	--	0.02	--	0.02
H_2O	--	50.38	--	46.18	--	49.17
Total	100.0	100.00	100.0	100.00	100.0	100.00
CO Consumed, lb-mol./hr	0.000853	--	0.000844	--	0.000852	--
CO_2 Produced, lb-mol./hr	0.000861	--	0.000870	--	0.000846	--
H_2 Produced, lb-mol./hr	0.000908	--	0.000916	--	0.000860	--
H_2O Used, lb-mol./hr	0.001045	--	0.000857	--	0.001033	--
Space Velocity, SCF/hr-cu ft	2790	6077	2797	5562	2749	5900

* The feed gas contains about 1.3 ppm propyl mercaptan, 0.8 ppm thiophene, and 52 ppm carbonyl sulfide.

B-15-36e

Table A-12, Part 6. LIFE TESTS (Laporte-Davison Comox 207 Shift Catalyst, 3/16-Inch Pellets, 21.0 g)

Run No.	22-16		22-17		22-18	
Time, hr	522		546		570	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000	1000	1000
Temperature, Furnace, °F	580	580	580	580	580	580
Temperature, Reactor Entrance, °F	615	615	613	613	614	614
Temperature, Quarter Bed, °F	620	620	618	618	621	621
Temperature, Middle Bed, °F	617	617	618	618	617	617
Temperature, Exit, °F	592	592	594	594	592	592
Flow Rate, H_2S, lb-mol./hr	0.000058	0.000058	0.000058	0.000058	0.000058	0.000058
Flow Rate, Feed, lb-mol./hr	0.004869	0.012714	0.004862	0.012822	0.004863	0.012994
Flow Rate, H_2O, lb-mol./hr	--	0.007234	--	0.007349	--	0.007502
Flow Rate, C_6H_6, lb-mol./hr	--	0.000584	--	0.000584	--	0.000601
Temperature, Steam, °F	900	900	900	900	900	900
Temperature, Benzene, °F	280	280	280	280	280	280
Feed Composition, mol %*						
CO	17.2	6.59	17.6	6.67	17.6	6.59
CO_2	21.3	8.16	21.7	8.23	21.7	8.13
H_2	32.3	12.37	32.0	12.13	32.0	11.98
CH_4	25.6	9.80	25.3	9.59	25.3	9.47
C_2H_6*	0.7	0.27	0.7	0.27	0.7	0.26
N_2	1.7	0.65	1.5	0.57	1.5	0.56
H_2S	1.2	0.46	1.2	0.46	1.2	0.45
NH_3	--	0.18	--	0.18	--	0.18
C_6H_6	--	4.59	--	4.56	--	4.62
C_6H_5OH	--	0.03	--	0.03	--	0.03
H_2O	--	56.90	--	57.31	--	57.73
Total	100.0	100.00	100.0	100.00	100.0	100.00
Product Flow Rate, lb-mol./hr	0.005804	0.012545	0.005755	0.012830	0.005785	0.012814
Product Composition, mol %						
CO	0.5	0.23	0.6	0.27	0.6	0.27
CO_2	32.2	14.80	32.7	14.67	33.0	14.90
H_2	42.2	19.61	42.0	18.84	41.6	18.78
CH_4	21.7	10.04	21.5	9.64	21.6	9.75
C_2H_6*	0.6	0.28	0.6	0.27	0.6	0.27
N_2	1.5	0.69	1.3	0.58	1.3	0.59
H_2S	1.0	0.46	1.0	0.45	1.0	0.45
NH_3	--	0.13	--	0.13	--	0.13
C_6H_6	0.3	4.13	0.3	4.00	0.3	4.30
C_6H_5OH	--	0.02	--	0.02	--	0.02
H_2O	--	49.61	--	51.13	--	50.54
Total	100.0	100.00	100.0	100.00	100.0	100.00
CO Consumed, lb-mol./hr	0.00847	--	0.000821	--	0.000821	--
CO_2 Produced, lb-mol./hr	0.00851	--	0.000827	--	0.000854	--
H_2 Produced, lb-mol./hr	0.00896	--	0.000861	--	0.000850	--
H_2O Used, lb-mol./hr	0.01013	--	0.000790	--	0.001026	--
Space Velocity, SCF/hr-cu ft	2784	6016	2760	6153	2775	6145

* The feed gas contains about 1.3 ppm propyl mercaptan, 0.8 ppm thiophene, and 52 ppm carbonyl sulfide.

B-15-36f

Table A-12, Part 7. LIFE TESTS (Laporte-Davison Comox 207 Shift Catalyst, 3/16-Inch Pellets, 21.0 g)

Run No.	22-19		22-20		22-21	
Time, hr	660		682		706	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000	1000	1000
Temperature, Furnace, °F	580	580	580	580	580	580
Temperature, Reactor Entrance, °F	620	620	622	622	625	625
Temperature, Quarter Bed, °F	637	637	637	637	647	647
Temperature, Middle Bed, °F	625	625	626	626	630	630
Temperature, Exit, °F	610	610	612	612	625	625
Flow Rate, H_2S, lb-mol./hr	0.000058	0.000058	0.000058	0.000058	0.000104	0.000104
Flow Rate, Feed, lb-mol./hr	0.008051	0.023376	0.008139	0.023454	0.013037	0.034242
Flow Rate, H_2O, lb-mol./hr	--	0.014244	--	0.014238	--	0.019719
Flow Rate, C_6H_6, lb-mol./hr	--	0.001028	--	0.001025	--	0.001431
Temperature, Steam, °F	900	900	900	900	900	900
Temperature, Benzene, °F	280	280	280	280	280	280
Feed Composition, mol %*						
CO	18.0	6.20	18.0	6.25	18.4	7.01
CO_2	22.2	7.65	22.2	7.70	22.7	8.64
H_2	30.7	10.57	3.07	10.65	29.4	11.19
CH_4	25.9	8.92	25.9	8.99	26.5	10.09
C_2H_6+	0.7	0.24	0.7	0.24	0.7	0.27
N_2	1.5	0.52	1.5	0.52	0.8	0.57
H_2S	1.0	0.34	1.0	0.35	1.5	0.30
NH_3	--	0.19	--	0.19	--	0.18
C_6H_6	--	4.40	--	4.37	--	4.13
C_6H_5OH	--	0.03	--	0.03	--	0.03
H_2O	--	60.94	--	60.71	--	57.59
Total	100.0	100.00	100.0	100.00	100.0	100.00
Product Flow Rate, lb-mol./hr	0.009360	0.023127	0.009539	0.023126	0.015172	0.033926
Product Composition, mol %						
CO	1.3	0.53	1.2	0.49	2.2	0.98
CO_2	33.1	13.44	33.2	13.76	33.0	14.76
H_2	40.1	16.39	40.1	16.68	38.9	17.40
CH_4	22.2	9.07	22.2	9.15	22.7	10.15
C_2H_6+	0.6	0.24	0.6	0.25	0.6	0.27
N_2	1.3	0.53	1.3	0.54	1.3	0.58
H_2S	0.9	0.36	0.9	0.37	0.7	0.31
NH_3	--	0.19	--	0.14	--	0.13
C_6H_6	0.5	4.14	0.5	4.12	0.6	3.98
C_6H_5OH	--	0.03	--	0.02	--	0.02
H_2O	--	55.08	--	54.48	--	51.42
Total	100.0	100.00	100.0	100.00	100.0	100.00
CO Consumed, lb-mol./hr	0.001327	--	0.001351	--	0.002065	--
CO_2 Produced, lb-mol./hr	0.01321	--	0.001398	--	0.002048	--
H_2 Produced, lb-mol./hr	0.001319	--	0.001383	--	0.002069	--
H_2O Used, lb-mol./hr	0.001506	--	0.001592	--	0.002278	--
Space Velocity, SCF/hr-cu ft	4488	11090	4574	11,088	6930	15,490

* The feed gas contains about 1.3 ppm propyl mercaptan, 0.8 ppm thiophene, and 52 ppm carbonyl sulfide.

B-15-36g

Table A-12, Part 8. LIFE TESTS (Laporte-Davison Comox 207 Shift Catalyst, 3/16-Inch Pellets, 21.0 g)

Run No.	22-22		22-23		22-24	
Time, hr	730		755		778	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000	1000	1000
Temperature, Furnace, °F	750	750	750	750	750	750
Temperature, Reactor Entrance, °F	750	750	750	750	754	755
Temperature, Quarter Bed, °F	785	785	770	770	775	775
Temperature, Middle Bed, °F	770	770	759	759	763	763
Temperature, Exit, °F	765	765	750	750	750	750
Flow Rate, H_2S, lb-mol./hr	0.000106	0.000106	0.000057	0.000057	0.000080	0.000080
Flow Rate, Feed, lb-mol./hr	0.013187	0.034023	0.004754	0.012551	0.007981	0.023139
Flow Rate, H_2O, lb-mol./hr	--	0.019351	--	0.007205	--	0.013881
Flow Rate, C_6H_6, lb-mol./hr	--	0.001413	--	0.000565	--	0.001225
Temperature, Steam, °F	900	900	900	900	900	900
Temperature, Benzene, °F	280	280	280	280	280	280
Feed Composition, mol %*						
CO	18.4	7.13	17.6	6.67	18.0	6.21
CO_2	22.7	8.80	21.7	8.22	22.2	7.66
H_2	29.4	11.39	32.0	12.12	30.7	10.59
CH_4	26.5	10.27	25.3	9.58	25.9	8.93
C_2H_6+	0.7	0.27	0.7	0.27	0.7	0.24
N_2	0.8	0.58	1.5	0.57	1.5	0.52
H_2S	1.5	0.31	1.2	0.45	1.0	0.34
NH_3	--	0.18	--	0.18	--	0.19
C_6H_6	--	4.15	--	4.50	--	5.29
C_6H_5OH	--	0.03	--	0.03	--	0.04
H_2O	--	56.89	--	57.41	--	59.99
Total	100.0	100.00	100.0	100.00	100.0	100.00
Product Flow Rate, lb-mol./hr	0.015659	0.033983	0.005584	0.012219	0.009647	0.022738
Product Composition, mol %						
CO	1.2	0.55	0.3	0.14	0.5	0.21
CO_2	33.9	15.62	33.0	15.08	33.4	14.17
H_2	39.2	18.06	42.0	19.19	40.9	17.35
CH_4	22.5	10.37	21.5	9.82	21.9	9.29
C_2H_6+	0.6	0.28	0.6	0.27	0.6	0.25
N_2	1.3	0.60	1.3	0.59	1.3	0.55
H_2S	0.7	0.32	1.0	0.46	0.9	0.38
NH_3	--	0.13	--	0.13	--	0.13
C_6H_6	0.6	3.95	0.3	4.06	0.5	5.02
C_6H_5OH	--	0.02	--	0.02	--	0.03
H_2O	--	50.10	--	50.24	--	52.62
Total	100.0	100.00	100.0	100.00	100.0	100.00
CO Consumed, lb-mol./hr	0.002238	--	0.000820	--	0.001338	--
CO_2 Produced, lb-mol./hr	0.002315	--	0.000811	--	0.001450	--
H_2 Produced, lb-mol./hr	0.002262	--	0.000824	--	0.001496	--
H_2O Used, lb-mol./hr	0.002327	--	0.001066	--	0.001919	--
Space Velocity, SCF/hr-cu ft	7150	15,500	2550	5581	4406	10,386

* The feed gas contains about 1.3 ppm propyl mercaptan, 0.8 ppm thiophene, and 52 ppm carbonyl sulfide.

B-15-36h

Table A-12, Part 9. LIFE TESTS (Laporte-Davison Comox 207 Shift Catalyst, 3/16-Inch Pellets, 21.0 g)

Run No.	22-25		22-26		22-27	
Time, hr	803		827		851	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	500	500	500	500	200	200
Temperature, Furnace, °F	750	750	750	750	750	750
Temperature, Reactor Entrance, °F	740	740	740	740	746	746
Temperature, Quarter Bed, °F	755	755	768	768	755	755
Temperature, Middle Bed, °F	750	750	756	756	750	750
Temperature, Exit, °F	736	736	745	745	737	737
Flow Rate, H_2S, lb-mol./hr	0.000044	0.000044	0.000092	0.000092	0.000049	0.000049
Flow Rate, Feed, lb-mol./hr	0.004859	0.013609	0.009193	0.023934	0.004857	0.014120
Flow Rate, H_2O, lb-mol./hr	--	0.008128	--	0.013740	--	0.008647
Flow Rate, C_6H_6, lb-mol./hr	--	0.000591	--	0.000951	--	0.000584
Temperature, Steam, °F	900	900	900	900	900	900
Temperature, Benzene, °F	280	280	280	280	280	280
Feed Composition, mol %*						
CO	18.2	6.50	18.1	6.95	18.1	6.23
CO_2	22.4	8.00	22.3	8.57	22.3	7.67
H_2	30.1	10.75	30.4	11.68	30.4	10.45
CH_4	26.2	9.36	26.0	9.99	26.0	8.94
C_2H_6	0.7	0.25	0.7	0.27	0.7	0.24
N_2	1.5	0.54	1.5	0.58	1.5	0.52
H_2S	0.9	0.32	1.0	0.38	1.0	0.35
NH_3	--	0.19	--	0.18	--	0.20
C_6H_6	--	4.34	--	3.97	--	4.14
C_6H_5OH	--	0.03	--	0.03	--	0.03
H_2O	--	59.72	--	57.40	--	61.23
Total	100.0	100.00	100.0	100.00	100.0	100.00
Product Flow Rate, lb-mol./hr	0.005720	0.013350	0.010716	0.023590	0.00564	0.013472
Product Composition, mol %						
CO	0.6	0.26	1.3	0.59	1.3	0.54
CO_2	34.0	14.57	33.1	15.04	33.1	13.86
H_2	40.2	17.22	40.1	18.22	40.2	16.83
CH_4	22.2	9.51	22.2	10.08	22.3	9.34
C_2H_6	0.6	0.26	0.6	0.27	0.6	0.25
N_2	1.3	0.56	1.3	0.59	1.3	0.54
H_2S	0.8	0.34	0.9	0.41	0.9	0.38
NH_3	--	0.14	--	0.13	--	0.13
C_6H_6	0.3	3.75	0.5	3.87	0.3	3.56
C_6H_5OH	--	0.02	--	0.02	--	0.02
H_2O	--	53.37	--	50.78	--	54.55
Total	100.0	100.00	100.0	100.00	100.0	100.00
CO Consumed, lb-mol./hr	0.000850	--	0.001525	--	0.000806	--
CO_2 Produced, lb-mol./hr	0.000856	--	0.001495	--	0.000784	--
H_2 Produced, lb-mol./hr	0.000836	--	0.001502	--	0.000790	--
H_2O Used, lb-mol./hr	0.001002	--	0.001759	--	0.001299	--
Space Velocity, SCF/hr-cu ft	2613	6098	4894	10,775	2576	6153

* The feed gas contains about 1.3 ppm propyl mercaptan, 0.8 ppm thiophene, and 52 ppm carbonyl sulfide.

B-15-361

Table A-12, Part 10. LIFE TESTS (Laporte-Davison Comox 207 Shift Catalyst, 3/16-Inch Pellets, 21.0 g)

Run No.	22-28		22-29		22-30	
Time, hr	876		900		950	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	200	200	500	500	500	500
Temperature, Furnace, °F	580	580	580	580	580	580
Temperature, Reactor Entrance, °F	609	609	615	615	630	630
Temperature, Quarter Bed, °F	613	613	623	623	640	640
Temperature, Middle Bed, °F	610	610	618	618	633	633
Temperature, Exit, °F	590	590	597	597	614	614
Flow Rate, H_2S, lb-mol./hr	0.000049	0.000049	0.000054	0.000054	0.000082	0.000082
Flow Rate, Feed, lb-mol./hr	0.004866	0.013085	0.004874	0.012815	0.008148	0.022122
Flow Rate, H_2O, lb-mol./hr	--	0.007724	--	0.007349	--	0.012738
Flow Rate, C_6H_6, lb-mol./hr	--	0.000467	--	0.000565	--	0.001187
Temperature, Steam, °F	900	900	900	900	900	900
Temperature, Benzene, °F	280	280	280	280	280	280
Feed Composition, mol %*						
CO	18.1	6.73	17.8	6.77	18.0	6.63
CO_2	22.3	8.29	22.0	8.37	22.2	8.18
H_2	30.4	11.31	31.4	11.94	30.7	11.31
CH_4	26.0	9.67	25.5	9.70	25.9	9.54
C_2H_6*	0.7	0.26	0.7	0.27	0.7	0.26
N_2	1.5	0.56	1.5	0.57	1.5	0.55
H_2S	1.0	0.37	1.1	0.42	1.0	0.37
NH_3	--	0.19	--	0.18	--	0.18
C_6H_6	--	3.57	--	4.41	--	5.37
C_6H_5OH	--	0.03	--	0.03	--	0.04
H_2O	--	59.02	--	57.34	--	57.57
Total	100.0	100.00	100.0	100.00	100.0	100.00
Product Flow Rate, lb-mol./hr	0.005561	0.012566	0.005660	0.012468	0.009469	0.021244
Product Composition, mol %						
CO	3.2	1.42	1.2	0.54	1.5	0.67
CO_2	32.1	14.21	33.0	14.98	33.0	14.71
H_2	38.9	17.22	40.8	18.52	40.1	17.87
CH_4	22.7	10.05	21.9	9.94	22.1	9.85
C_2H_6*	0.6	0.27	0.6	0.27	0.6	0.27
N_2	1.3	0.58	1.3	0.59	1.3	0.58
H_2S	0.9	0.40	0.9	0.41	0.9	0.40
NH_3	--	0.13	--	0.13	--	0.13
C_6H_6	0.3	3.04	0.3	3.84	0.5	5.22
C_6H_5OH	--	0.02	--	0.02	--	0.03
H_2O	--	52.66	--	50.76	--	50.27
Total	100.0	100.00	100.0	100.00	100.0	100.00
CO Consumed, lb-mol./hr	0.000703	--	0.000800	--	0.001325	--
CO_2 Produced, lb-mol./hr	0.000698	--	0.000795	--	0.001316	--
H_2 Produced, lb-mol./hr	0.000684	--	0.000778	--	0.001296	--
H_2O Used, lb-mol./hr	0.001103	--	0.001020	--	0.002057	--
Space Velocity, SCF/hr-cu ft	2540	5739	2585	5695	4325	5592

* The feed gas contains about 1.3 ppm propyl mercaptan, 0.8 ppm thiophene, and 52 ppm carbonyl sulfide.

B-15-36j

Table A-13, Part 1. LIFE TESTS
(Shell Oil 538 Shift Catalyst, 4 x 6 Mesh Spheres, 21.0 g)

Run No.	23-1		23-2		23-3	
Time, hr	2		5		8	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000	1000	1000
Temperature, Furnace, °F	580	580	580	580	580	580
Temperature, Reactor Entrance, °F	626	626	626	626	626	626
Temperature, Quarter Bed, °F	610	610	610	610	610	610
Temperature, Middle Bed, °F	615	615	615	615	615	615
Temperature, Exit, °F	593	593	593	593	593	593
Flow Rate, H_2S, lb-mol./hr	0.000069	0.000069	0.000069	0.000069	0.000069	0.000069
Flow Rate, Feed, lb-mol./hr	0.004924	0.012426	0.004924	0.012426	0.004924	0.012426
Flow Rate, H_2O, lb-mol./hr	--	0.00750Z	--	0.00750Z	--	0.00750Z
Flow Rate, C_6H_6, lb-mol./hr	--	--	--	--	--	--
Temperature, Steam, °F	900	900	900	900	900	900
Temperature, Benzene, °F	280	280	280	280	280	280
Feed Composition, mol %*						
CO	17.2	6.82	17.2	6.82	17.2	6.82
CO_2	21.2	8.40	21.2	8.40	21.2	8.40
H_2	33.4	13.24	33.4	13.24	33.4	13.24
CH_4	24.7	9.79	24.7	9.79	24.7	7.97
C_2H_4*	0.7	0.27	0.7	0.27	0.7	0.27
N_2	1.4	0.56	1.4	0.56	1.4	0.56
H_2S	1.4	0.56	1.4	0.56	1.4	0.56
NH_3	--	--	--	--	--	--
C_6H_6	--	--	--	--	--	--
C_6H_5OH	--	--	--	--	--	--
H_2O	--	60.36	--	60.36	--	60.36
Total	100.0	100.00	100.0	100.00	100.0	100.00
Product Flow Rate, lb-mol./hr	0.005929	0.012436	0.005796	0.012303	0.005790	0.012297
Product Composition, mol %						
CO	2.4	1.42	0.5	0.24	0.2	0.10
CO_2	31.3	14.82	32.5	15.31	32.7	15.39
H_2	42.0	20.00	42.8	20.17	43.1	20.29
CH_4	21.3	10.13	21.2	9.99	21.0	9.89
C_2H_4*	0.6	0.29	0.6	0.28	0.6	0.28
N_2	1.2	0.57	1.2	0.57	1.2	0.56
H_2S	1.2	0.57	1.2	0.57	1.2	0.56
NH_3	--	--	--	--	--	--
C_6H_6	--	--	--	--	--	--
C_6H_5OH	--	--	--	--	--	--
H_2O	--	52.20	--	57.87	--	52.93
Total	100.0	100.00	100.0	100.00	100.0	100.00
CO Consumed, lb-mol./hr	0.000705	--	0.000818	--	0.000835	--
CO_2 Produced, lb-mol./hr	0.000812	--	0.000840	--	0.000849	--
H_2 Produced, lb-mol./hr	0.000745	--	0.000831	--	0.000850	--
H_2O Used, lb-mol./hr	0.000995	--	0.000995	--	0.000995	--
Space Velocity, SCF/hr-cu ft	2525	5297	2468	5240	2466	5327

* The feed gas contains about 1.3 ppm propyl mercaptan, 0.8 ppm thiophene, and 52 ppm carbonyl sulfide.

B-15-35a

Table A-13, Part 2. LIFE TESTS
(Shell Oil 538 Shift Catalyst, 4 x 6 Mesh Spheres, 21.0 g)

Run No.	23-4		23-5		23-6	
Time, hr	73		95		114	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	200	200	500	500	500	500
Temperature, Furnace, °F	580	580	580	580	580	580
Temperature, Reactor Entrance, °F	624	624	625	625	625	625
Temperature, Quarter Bed, °F	611	611	610	610	611	611
Temperature, Middle Bed, °F	624	624	621	621	621	621
Temperature, Exit, °F	576	576	560	560	560	560
Flow Rate, H_2S, lb-mol./hr	0.000044	0.000044	0.000043	0.000043	0.000044	0.000044
Flow Rate, Feed, lb-mol./hr	0.004906	0.012867	0.004786	0.012485	0.004857	0.012871
Flow Rate, H_2O, lb-mol./hr	--	0.007961	--	0.007699	--	0.007486
Flow Rate, C_6H_6, lb-mol./hr	--	--	--	--	--	0.000525
Temperature, Steam, °F	900	900	900	900	900	900
Temperature, Benzene, °F	280	280	280	280	280	280
Feed Composition, mol %*						
CO	18.3	6.98	18.3	7.02	18.3	6.91
CO_2	22.4	8.54	22.4	8.59	22.4	8.45
H_2	30.0	11.44	30.0	11.50	30.0	11.32
CH_4	26.2	9.99	26.2	10.04	26.2	9.89
$C_2H_6^+$	0.7	0.26	0.7	0.27	0.7	0.26
N_2	1.5	0.58	1.5	0.58	1.5	0.34
H_2S	0.9	0.34	0.9	0.34	0.9	0.57
NH_3	--	--	--	--	--	--
C_6H_6	--	--	--	--	--	4.08
C_6H_5OH	--	--	--	--	--	--
H_2O	--	61.87	--	61.66	--	58.18
Total	100.0	100.00	100.0	100.00	100.0	100.00
Product Flow Rate, lb-mol./hr	0.005762	0.012607	0.005645	0.012346	0.005687	0.012465
Product Composition, mol %						
CO	0.9	0.41	0.4	0.19	0.4	0.18
CO_2	33.7	15.30	34.0	15.54	34.1	15.56
H_2	40.3	18.33	40.8	18.65	40.6	18.52
CH_4	22.4	10.14	22.1	10.11	22.0	10.04
$C_2H_6^+$	0.6	0.28	0.6	0.28	0.6	0.27
N_2	1.3	0.59	1.3	0.59	1.3	0.59
H_2S	0.8	0.36	0.8	0.36	0.8	0.36
NH_3	--	--	--	--	--	--
C_6H_6	--	--	--	--	0.2	3.86
C_6H_5OH	--	--	--	--	--	--
H_2O	--	54.69	--	54.28	--	50.62
Total	100.0	100.00	100.0	100.00	100.0	100.00
CO Consumed, lb-mol./hr	0.000846	--	0.000853	--	0.000866	--
CO_2 Produced, lb-mol./hr	0.000830	--	0.000837	--	0.000839	--
H_2 Produced, lb-mol./hr	0.000819	--	0.000867	--	0.000850	--
H_2O Used, lb-mol./hr	0.001041	--	0.000998	--	0.001181	--
Space Velocity, SCF/hr-cu ft	2454	5369	2404	5258	2422	5309

* The feed gas contains about 1.3 ppm propyl mercaptan, 0.8 ppm thiophene, and 52 ppm carbonyl sulfide.

B-15-35b

Table A-13, Part 3. LIFE TESTS
(Shell Oil 538 Shift Catalyst, 4 x 6 Mesh Spheres, 21.0 g)

Run No.	23-7		23-8		23-9	
Time, hr	140		162		234	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000	1000	1000
Temperature, Furnace, °F	580	580	580	580	580	580
Temperature, Reactor Entrance, °F	630	630	625	625	626	626
Temperature, Quarter Bed, °F	609	609	608	608	609	609
Temperature, Middle Bed, °F	620	620	620	620	622	622
Temperature, Exit, °F	483	483	490	490	485	485
Flow Rate, H_2S, lb-mol./hr	0.000068	0.000068	0.000083	0.000083	0.000083	0.000083
Flow Rate, Feed, lb-mol./hr	0.004849	0.013087	0.004910	0.012834	0.004909	0.01304
Flow Rate, H_2O, lb-mol./hr	--	0.007642	--	0.007349	--	0.007424
Flow Rate, C_6H_6, lb-mol./hr	--	0.000596	--	0.000575	--	0.000683
Temperature, Steam, °F	900	900	900	900	900	900
Temperature, Benzene, °F	280	280	280	280	280	280
Feed Composition, mol %*						
CO	17.1	6.33	16.5	6.31	16.5	6.21
CO_2	21.4	7.93	20.6	7.88	20.6	7.75
H_2	33.3	12.34	35.4	13.54	35.4	13.32
CH_4	24.7	9.15	23.8	9.11	23.8	8.95
$C_2H_6^+$	0.7	0.26	0.7	0.26	0.7	0.26
N_2	1.4	0.52	1.3	0.50	1.3	0.49
H_2S	1.4	0.52	1.7	0.65	1.7	0.64
NH_3	--	--	--	--	--	0.18
C_6H_6	--	4.55	--	4.48	--	5.24
C_6H_5OH	--	--	--	--	--	0.04
H_2O	--	58.40	--	52.27	--	56.92
Total	100.0	100.00	100.0	100.00	100.0	100.00
Product Flow Rate, lb-mol./hr	0.005791	0.012769	0.005778	0.012753	0.005619	0.01279
Product Composition, mol %						
CO	0.2	0.09	0.4	0.18	0.4	0.17
CO_2	32.7	14.83	31.5	14.27	31.5	13.84
H_2	42.7	19.41	44.2	20.03	44.3	19.46
CH_4	21.1	9.57	20.5	9.28	20.4	8.96
$C_2H_6^+$	0.6	0.27	0.6	0.27	0.6	0.27
N_2	1.2	0.54	1.1	0.50	1.1	0.48
H_2S	1.2	0.54	1.5	0.68	1.5	0.66
NH_3	--	--	--	--	--	0.14
C_6H_6	0.2	4.22	0.2	4.05	0.2	4.12
C_6H_5OH	--	--	--	--	--	0.03
H_2O	--	50.53	--	50.74	--	51.07
Total	100.0	100.00	100.0	100.00	100.0	100.00
CO Consumed, lb-mol./hr	0.000817	--	0.000787	--	0.000788	--
CO_2 Produced, lb-mol./hr	0.000856	--	0.000809	--	0.000759	--
H_2 Produced, lb-mol./hr	0.000864	--	0.000816	--	0.000751	--
H_2O Used, lb-mol./hr	0.001191	--	0.000978	--	0.000893	--
Space Velocity, SCF/hr-cu ft	2466	5438	2461	5431	2393	5447

* The feed gas contains about 1.3 ppm propyl mercaptan, 0.8 ppm thiophene, and 52 ppm carbonyl sulfide.

B-15-35c

Table A-13, Part 4. LIFE TESTS
(Shell Oil 538 Shift Catalyst, 4 x 6 Mesh Spheres, 21.0 g)

Run No.	23-10		23-11		23-12	
Time, hr	256		277		400	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000	1000	1000
Temperature, Furnace, °F	580	580	580	580	580	580
Temperature, Reactor Entrance, °F	627	627	630	630	627	627
Temperature, Quarter Bed, °F	609	609	610	610	609	609
Temperature, Middle Bed, °F	620	620	620	620	619	619
Temperature, Exit, °F	485	485	485	485	485	485
Flow Rate, H_2S, lb-mol./hr	0.000084	0.000084	0.000083	0.000083	0.000083	0.000083
Flow Rate, Feed, lb-mol./hr	0.004914	0.012955	0.004887	0.012317	0.004896	0.012877
Flow Rate, H_2O, lb-mol./hr	--	0.007387	--	0.006859	--	0.007277
Flow Rate, C_6H_6, lb-mol./hr	--	0.000645	--	0.000565	--	0.000676
Temperature, Steam, °F	900	900	900	900	900	900
Temperature, Benzene, °F	280	280	280	280	280	280
Feed Composition, mol %*						
CO	16.5	6.26	16.5	6.54	16.5	6.27
CO_2	20.6	7.81	20.6	8.18	20.6	7.84
H_2	35.4	13.33	35.4	14.03	35.4	13.46
CH_4	23.8	9.00	23.8	9.42	23.8	9.05
C_2H_6*	0.7	0.26	0.7	0.28	0.7	0.26
N_2	1.3	0.49	1.3	0.52	1.3	0.50
H_2S	1.7	0.65	1.7	0.67	1.7	0.64
NH_3	--	0.19	--	0.18	--	0.18
C_6H_6	--	4.95	--	4.58	--	5.25
C_6H_5OH	--	0.04	--	0.03	--	0.04
H_2O	--	57.02	--	55.57	--	56.51
Total	100.0	100.00	100.0	100.00	100.0	100.00
Product Flow Rate, lb-mol./hr	0.005685	0.012612	0.005668	0.012233	0.005694	0.012841
Product Composition, mol %						
CO	0.3	0.13	0.3	0.14	0.3	0.13
CO_2	31.4	14.15	31.4	14.55	31.6	14.01
H_2	44.4	20.01	44.5	20.62	44.3	19.64
CH_4	20.5	9.24	20.4	9.45	20.4	9.05
C_2H_6*	0.6	0.27	0.6	0.28	0.6	0.26
N_2	1.1	0.50	1.1	0.51	1.1	0.49
H_2S	1.5	0.67	1.5	0.69	1.5	0.66
NH_3	--	0.13	--	0.13	--	0.13
C_6H_6	0.2	4.84	0.2	4.34	0.2	4.95
C_6H_5OH	--	0.03	--	0.02	--	0.03
H_2O	--	50.03	--	49.27	--	50.65
Total	100.0	100.00	100.0	100.00	100.0	100.00
CO Consumed, lb-mol./hr	0.000794	--	0.000789	--	0.000791	--
CO_2 Produced, lb-mol./hr	0.000773	--	0.000773	--	0.000802	--
H_2 Produced, lb-mol./hr	0.000784	--	0.000792	--	0.000763	--
H_2O Used, lb-mol./hr	0.001080	--	0.000833	--	0.000775	--
Space Velocity, SCF/hr-cu ft	2421	5372	2414	5210	2425	5469

* The feed gas contains about 1.3 ppm propyl mercaptan, 0.8 ppm thiophene, and 52 ppm carbonyl sulfide.

B-15-35d

Table A-13, Part 5. LIFE TESTS
(Snell Oil 538 Shift Catalyst, 4 x 6 Mesh Spheres, 21.0 g)

Run No.	23-13		23-14		23-15	
Time, hr	520		600		660	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000	1000	1000
Temperature, Furnace, °F	580	580	580	580	580	580
Temperature, Reactor Entrance, °F	629	629	640	640	645	645
Temperature, Quarter Bed, °F	610	610	610	610	610	610
Temperature, Middle Bed, °F	621	621	621	621	620	620
Temperature, Exit, °F	495	495	490	490	490	490
Flow Rate, H_2S, lb-mol./hr	0.000083	0.000083	0.000084	0.000084	0.000083	0.000083
Flow Rate, Feed, lb-mol./hr	0.004897	0.012976	0.004915	0.013154	0.004867	0.012798
Flow Rate, H_2O, lb-mol./hr	--	0.007460	--	0.007594	--	0.007373
Flow Rate, C_6H_6, lb-mol./hr	--	0.000591	--	0.000616	--	0.000531
Temperature, Steam, °F	900	900	900	900	900	900
Temperature, Benzene, °F	280	280	80	80	80	80
Feed Composition, mol %*						
CO	16.5	6.23	16.5	6.16	16.5	6.27
CO_2	20.6	7.78	20.6	7.69	20.6	7.84
H_2	35.4	13.36	35.4	13.23	35.4	13.46
CH_4	23.8	8.98	23.8	8.89	23.8	9.05
C_2H_6*	0.7	0.26	0.7	0.26	0.7	0.26
N_2	1.3	0.49	1.3	0.49	1.3	0.49
H_2S	1.7	0.64	1.7	0.64	1.7	0.65
NH_3	--	0.18	--	0.18	--	0.18
C_6H_6	--	4.56	--	4.68	--	4.15
C_6H_5OH	--	0.03	--	0.04	--	0.03
H_2O	--	57.49	--	57.74	--	57.62
Total	100.0	100.00	100.0	100.00	100.0	100.00
Product Flow Rate, lb-mol./hr	0.005700	0.012797	0.005684	0.012951	0.005645	0.012713
Product Composition, mol %						
CO	0.3	0.13	0.4	0.18	0.4	0.18
CO_2	31.8	14.17	31.9	14.00	31.2	13.85
H_2	43.8	19 51	44.1	19.36	44.6	19.81
CH_4	20.7	9.22	20.2	8.86	20.4	9.06
C_2H_6*	0.6	0.27	0.6	0.26	0.6	0.27
N_2	1.1	0.49	1.1	0.49	1.1	0.49
H_2S	1.5	0.67	1.5	0.66	1.5	0.67
NH_3	--	0.14	--	0.14	--	0.14
C_6H_6	0.2	4.22	0.2	4.58	0.2	4.28
C_6H_5OH	--	0.02	--	0.03	--	0.02
H_2O	--	51.16	--	51.44	--	51.25
Total	100.0	100.00	100.0	100.00	100.0	100.00
CO Consumed, lb-mol./hr	0.000784	--	0.000788	--	0.000770	--
CO_2 Produced, lb-mol./hr	0.000804	--	0.000801	--	0.000758	--
H_2 Produced, lb-mol./hr	0.000763	--	0.000767	--	0.000793	--
H_2O Used, lb-mol./hr	0.000913	--	0.000913	--	0.000857	--
Space Velocity, SCF/hr-cu ft	2427	5450	2421	5515	2404	5414

* The feed gas contains about 1.3 ppm propyl mercaptan, 0.8 ppm thiophene, and 52 ppm carbonyl sulfide.

B-15-35e

Table A-13, Part 6. LIFE TESTS
(Shell Oil 538 Shift Catalyst, 4 x 6 Mesh Spheres, 21.0 g)

Run No.	23-16		23-17		23-18	
Time, hr	684		724		728	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000	1000	1000
Temperature, Furnace, °F	580	580	580	580	580	580
Temperature, Reactor Entrance, °F	645	645	653	653	653	653
Temperature, Quarter Bed, °F	610	610	625	625	625	625
Temperature, Middle Bed, °F	620	620	628	628	628	628
Temperature, Exit, °F	--	--	510	510	513	513
Flow Rate, H_2S, lb-mol./hr	0.000084	0.000084	0.000119	0.000119	0.000119	0.000119
Flow Rate, Feed, lb-mol./hr	0.005163	0.013157	0.007958	0.022745	0.007941	0.022726
Flow Rate, H_2O, lb-mol./hr	--	0.007441	--	0.013717	--	0.013684
Flow Rate, C_6H_6, lb-mol./hr	--	0.000525	--	0.001018	--	0.001010
Temperature, Steam, °F	900	900	900	900	900	900
Temperature, Benzene, °F	80	80	80	80	80	80
Feed Composition, mol %*						
CO	16.5	6.47	17.1	5.98	17.1	6.03
CO_2	20.6	8.09	21.0	7.35	21.0	7.32
H_2	35.4	13.89	35.1	12.28	35.1	12.30
CH_4	23.8	9.37	23.3	8.17	23.3	8.24
C_2H_6+	0.7	0.27	0.7	0.25	0.7	0.25
N_2	1.3	0.51	1.3	0.45	1.3	0.46
H_2S	1.7	0.64	1.5	0.52	1.5	0.53
NH_3	--	0.18	--	0.19	--	0.19
C_6H_6	--	3.99	--	4.48	--	4.43
C_6H_5OH	--	0.03	--	0.03	--	0.03
H_2O	--	56.56	--	60.30	--	60.22
Total	100.0	100.00	100.0	100.00	100.0	100.00
Product Flow Rate, lb-mol./hr	0.005833	0.012659	0.009413	0.022471	0.009425	0.022493
Product Composition, mol %						
CO	0.4	0.18	0.8	0.33	0.8	0.33
CO_2	31.1	14.26	31.2	13.07	31.1	13.00
H_2	44.9	20.49	44.8	18.79	44.8	18.80
CH_4	20.2	9.31	19.8	8.29	19.9	8.35
C_2H_6+	0.6	0.28	0.6	0.25	0.6	0.25
N_2	1.1	0.51	1.1	0.46	1.1	0.46
H_2S	1.5	0.69	1.3	0.54	1.3	0.54
NH_3	--	0.13	--	0.14	--	0.14
C_6H_6	0.2	3.95	0.4	4.19	0.4	4.16
C_6H_5OH	--	0.02	--	0.02	--	0.02
H_2O	--	50.18	--	53.92	--	53.95
Total	100.0	100.00	100.0	100.00	100.0	100.00
CO Consumed, lb-mol./hr	0.000829	--	0.001286	--	0.001280	--
CO_2 Produced, lb-mol./hr	0.000750	--	0.001266	--	0.001251	--
H_2 Produced, lb-mol./hr	0.000791	--	0.001424	--	0.001449	--
H_2O Used, lb-mol./hr	0.000924	--	0.001600	--	0.001544	--
Space Velocity, SCF/hr-cu ft	2484	5391	4009	9570	4014	9579

* The feed gas contains about 1.3 ppm propyl mercaptan, 0.8 ppm thiophene, and 52 ppm carbonyl sulfide.

B75030431a

Table A-13, Part 7. LIFE TESTS
(Shell Oil 538 Shift Catalyst, 4 x 6 Mesh Spheres, 21.0 g)

Run No.	23-19		23-20		23-21	
Time, hr	732		748		752	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000	1000	1000
Temperature, Furnace, °F	580	580	580	580	580	580
Temperature, Reactor Entrance, °F	652	652	652	652	652	652
Temperature, Quarter Bed, °F	626	626	627	627	627	627
Temperature, Middle Bed, °F	629	629	630	630	630	630
Temperature, Exit, °F	515	515	515	515	515	515
Flow Rate, H_2S, lb-mol./hr	0.000118	0.000118	0.000118	0.000118	0.000118	0.000118
Flow Rate, Feed, lb-mol./hr	0.007950	0.022731	0.007964	0.022760	0.007943	0.022611
Flow Rate, H_2O, lb-mol./hr	--	0.013651	--	0.013690	--	0.013609
Flow Rate, C_6H_6, lb-mol./hr	--	0.001018	--	0.001018	--	0.001005
Temperature, Steam, °F	900	900	900	900	900	900
Temperature, Benzene, °F	80	80	80	80	80	80
Feed Composition, mol %*						
CO	17.1	6.04	17.1	6.04	17.1	6.01
CO_2	21.0	7.34	21.0	7.36	21.0	7.39
H_2	35.1	12.35	35.1	12.28	35.1	12.36
CH_4	23.3	8.31	23.3	8.25	23.3	8.18
C_2H_6	0.7	0.25	0.7	0.25	0.7	0.24
N_2	1.3	0.47	1.3	0.46	1.3	0.46
H_2S	1.5	0.54	1.5	0.53	1.5	0.52
NH_3	--	0.19	--	0.19	--	0.19
C_6H_6	--	4.50	--	4.45	--	4.44
C_2H_5OH	--	0.03	--	0.03	--	0.03
H_2O	--	59.98	--	60.16	--	60.18
Total	100.0	100.00	100.0	100.00	100.0	100.00
Product Flow Rate, lb-mol./hr	0.009416	0.022481	0.009441	0.022438	0.009446	0.022444
Product Composition, mol %						
CO	0.8	0.34	0.8	0.33	0.8	0.34
CO_2	31.2	13.05	31.1	13.03	31.0	13.05
H_2	44.7	18.70	44.9	18.90	45.0	18.94
CH_4	19.9	8.37	19.8	8.37	19.8	8.33
C_2H_6	0.6	0.25	0.6	0.25	0.6	0.25
N_2	1.1	0.46	1.1	0.46	1.1	0.46
H_2S	1.3	0.54	1.3	0.55	1.3	0.55
NH_3	--	0.14	--	0.14	--	0.14
C_6H_6	0.4	4.25	0.4	4.21	0.4	4.20
C_2H_5OH	--	0.02	--	0.02	--	0.02
H_2O	--	53.88	--	53.74	--	53.72
Total	100.0	100.00	100.0	100.00	100.0	100.00
CO Consumed, lb-mol./hr	0.001284	--	0.001279	--	0.001283	--
CO_2 Produced, lb-mol./hr	0.001265	--	0.001250	--	0.001258	--
H_2 Produced, lb-mol./hr	0.001451	--	0.001443	--	0.001463	--
H_2O Used, lb-mol./hr	0.001547	--	0.001539	--	0.001552	--
Space Velocity, SCF/hr-cu ft	4010	9574	4021	9556	4023	9558

* The feed gas contains about 1.3 ppm propyl mercaptan, 0.8 ppm thiophene, and 52 ppm carbonyl sulfide.

B75030431b

Table A-13, Part 8. LIFE TESTS
(Shell Oil 538 Shift Catalyst, 4 x 6 Mesh Spheres, 21.0 g)

Run No.	23-22		23-23		23-24	
Time, hr	872		880		890	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000	1000	1000
Temperature, Furnace, °F	580	580	580	580	580	580
Temperature, Reactor Entrance, °F	653	653	653	653	654	654
Temperature, Quarter Bed, °F	635	635	634	634	635	635
Temperature, Middle Bed, °F	637	637	637	637	637	637
Temperature, Exit, °F	520	520	520	520	520	520
Flow Rate, H_2S, lb-mol./hr	0.000224	0.000224	0.000224	0.000224	0.000223	0.000223
Flow Rate, Feed, lb-mol./hr	0.013180	0.034782	0.013186	0.034778	0.013178	0.034765
Flow Rate, H_2O, lb-mol./hr	--	0.020209	--	0.020206	--	0.020212
Flow Rate, C_6H_6, lb-mol./hr	--	0.001319	--	0.001324	--	0.001316
Temperature, Steam, °F	900	900	900	900	900	900
Temperature, Benzene, °F	80	80	80	80	80	80
Feed Composition, mol %*						
CO	16.3	6.18	16.3	6.16	16.3	6.16
CO_2	21.0	7.96	21.0	7.95	21.0	7.91
H_2	37.0	14.03	37.0	14.05	37.0	13.96
CH_4	22.0	8.34	22.0	8.35	22.0	8.41
$C_2H_6^+$	0.7	0.26	0.7	0.26	0.7	0.26
N_2	1.3	0.49	1.3	0.49	1.3	0.49
H_2S	1.7	0.64	1.7	0.64	1.7	0.64
NH_3	--	0.18	--	0.18	--	0.18
C_6H_6	--	3.79	--	3.74	--	3.72
C_6H_5OH	--	0.03	--	0.03	--	0.03
H_2O	--	58.10	--	58.15	--	58.24
Total	100.0	100.00	100.0	100.00	100.0	100.00
Product Flow Rate, lb-mol./hr	0.015512	0.034491	0.015506	0.034481	0.015520	0.034489
Product Composition, mol %						
CO	1.3	0.58	1.3	0.58	1.3	0.58
CO_2	29.9	13.45	29.8	13.39	29.9	13.48
H_2	45.9	20.64	45.9	20.67	45.9	20.65
CH_4	19.0	8.54	19.1	8.60	19.0	8.56
$C_2H_6^+$	0.6	0.27	0.6	0.27	0.6	0.27
N_2	1.1	0.50	1.1	0.50	1.1	0.50
H_2S	1.6	0.72	1.6	0.72	1.6	0.72
NH_3	--	0.13	--	0.13	--	0.13
C_6H_6	0.6	3.66	0.6	3.68	0.6	3.65
C_6H_5OH	--	0.02	--	0.02	--	0.02
H_2O	--	51.49	--	51.44	--	51.44
Total	100.0	100.00	100.0	100.00	100.0	100.00
CO Consumed, lb-mol./hr	0.001947	--	0.001939	--	0.001923	--
CO_2 Produced, lb-mol./hr	0.001870	--	0.001859	--	0.001846	--
H_2 Produced, lb-mol./hr	0.002243	--	0.002236	--	0.002228	--
H_2O Used, lb-mol./hr	0.002450	--	0.002444	--	0.002425	--
Space Velocity, SCF/hr-cu ft	6606	14689	6604	14685	6610	14688

* The feed gas contains about 1.3 ppm propyl mercaptan, 0.8 ppm thiophene, and 52 ppm carbonyl sulfide.

B75030431c

Table A-13, Part 9. LIFE TESTS
(Shell Oil 538 Shift Catalyst, 4 x 6 Mesh Spheres, 21.0 g)

Run No.	23-25		23-26		23-27	
Time, hr	894		896		925	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000	1000	1000
Temperature, Furnace, °F	580	580	580	580	750	750
Temperature, Reactor Entrance, °F	653	653	653	653	760	760
Temperature, Quarter Bed, °F	635	635	635	635	775	775
Temperature, Middle Bed, °F	637	637	637	637	773	773
Temperature, Exit, °F	520	520	520	520	524	524
Flow Rate, H_2S, lb-mol./hr	0.000224	0.000224	0.000224	0.000224	0.000223	0.000223
Flow Rate, Feed, lb-mol./hr	0.013169	0.013172	0.013180	0.034782	0.013166	0.034342
Flow Rate, H_2O, lb-mol./hr	--	0.020208	--	0.007441	--	0.019596
Flow Rate, C_6H_6, lb-mol./hr	--	0.001314	--	0.000525	--	0.001507
Temperature, Steam, °F	900	900	900	900	900	900
Temperature, Benzene, °F	80	80	80	80	80	80
Feed Composition, mol %*						
CO	16.3	6.12	16.3	6.14	16.3	6.10
CO_2	21.0	7.86	21.0	7.86	21.0	7.78
H_2	37.0	13.97	37.0	13.92	37.0	13.84
CH_4	22.0	8.46	22.0	8.44	22.0	8.46
$C_2H_6^+$	0.7	0.26	0.7	0.26	0.7	0.26
N_2	1.3	0.49	1.3	0.49	1.3	0.49
H_2S	1.7	0.64	1.7	0.64	1.7	0.64
NH_3	--	0.18	--	0.18	--	0.18
C_6H_6	--	3.77	--	3.74	--	3.80
C_6H_5OH	--	0.03	--	0.03	--	0.03
H_2O	--	58.22	--	58.30	--	58.42
Total	100.0	100.00	100.0	100.00	100.0	100.00
Product Flow Rate, lb-mol./hr	0.015534	0.034496	0.015531	0.034506	0.015634	0.034116
Product Composition, mol %						
CO	1.3	0.58	1.3	0.58	1.1	0.50
CO_2	30.1	13.61	29.8	13.41	30.1	13.79
H_2	45.8	20.44	45.9	20.65	46.1	21.13
CH_4	18.9	8.47	19.1	8.60	18.9	8.66
$C_2H_6^+$	0.6	0.27	0.6	0.26	0.6	0.28
N_2	1.1	0.50	1.1	0.50	1.1	0.50
H_2S	1.6	0.72	1.6	0.72	1.5	0.69
NH_3	--	0.13	--	0.13	--	0.13
C_6H_6	0.6	3.74	0.6	3.67	0.6	4.28
C_6H_5OH	--	0.02	--	0.02	--	0.02
H_2O	--	51.62	--	51.46	--	50.02
Total	100.0	100.00	100.0	100.00	100.0	100.00
CO Consumed, lb-mol./hr	0.001941	--	0.001940	--	0.001974	--
CO_2 Produced, lb-mol./hr	0.001852	--	0.001872	--	0.001942	--
H_2 Produced, lb-mol./hr	0.002236	--	0.002234	--	0.002335	--
H_2O Used, lb-mol./hr	0.002438	--	0.002441	--	0.002351	--
Space Velocity, SCF/hr-cu ft	6615	14691	2484	5391	6650	14530

* The feed gas contains about 1.3 ppm propyl mercaptan, 0.8 ppm thiophene, and 52 ppm carbonyl sulfide.

B750304311d

Table A-13, Part 10. LIFE TESTS
(Shell Oil 538 Shift Catalyst, 4 x 6 Mesh Spheres, 21.0 g)

Run No.	23-28		23-29		23-30	
Time, hr	929		931		1088	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000	1000	1000
Temperature, Furnace, °F	750	750	750	750	750	750
Temperature, Reactor Entrance, °F	760	760	760	760	757	757
Temperature, Quarter Bed, °F	775	775	775	775	768	768
Temperature, Middle Bed, °F	774	774	774	774	767	767
Temperature, Exit, °F	524	524	524	524	520	520
Flow Rate, H_2S, lb-mol./hr	0.000223	0.000223	0.000223	0.000223	0.000127	0.000127
Flow Rate, Feed, lb-mol./hr	0.013162	0.034336	0.013151	0.034317	0.007952	0.022873
Flow Rate, H_2O, lb-mol./hr	--	0.019592	--	0.019588	--	0.013881
Flow Rate, C_6H_6, lb-mol./hr	--	0.001503	--	0.001508	--	0.000989
Temperature, Steam, °F	900	900	900	900	900	900
Temperature, Benzene, °F	80	80	80	80	80	80
Feed Composition, mol %*						
CO	16.3	6.13	16.3	6.13	17.0	5.92
CO_2	21.0	7.74	21.0	7.78	21.3	7.40
H_2	37.0	13.80	37.0	13.74	36.5	12.69
CH_4	22.0	8.46	22.0	8.44	21.6	7.52
$C_2H_6^+$	0.7	0.26	0.7	0.26	0.7	0.24
N_2	1.3	0.49	1.3	0.49	1.3	0.45
H_2S	1.7	0.64	1.7	0.64	1.6	0.56
NH_3	--	0.18	--	0.18	--	0.19
C_6H_6	--	3.82	--	3.76	--	4.32
C_6H_5OH	--	0.03	--	0.03	--	0.03
H_2O	--	58.45	--	58.55	--	60.68
Total	100.0	100.00	100.0	100.00	100.0	100.00
Product Flow Rate, lb-mol./hr	0.015648	0.034127	0.015642	0.034140	0.009560	0.022720
Product Composition, mol %						
CO	1.1	0.50	1.1	0.50	0.9	0.38
CO_2	30.2	13.86	30.1	13.72	30.5	12.87
H_2	46.0	20.98	46.0	21.03	46.5	19.53
CH_4	18.9	8.69	19.0	8.77	18.5	7.79
$C_2H_6^+$	0.6	0.28	0.6	0.28	0.6	0.26
N_2	1.1	0.50	1.1	0.50	1.1	0.47
H_2S	1.5	0.69	1.5	0.69	1.5	0.64
NH_3	--	0.13	--	0.13	--	0.13
C_6H_6	0.6	4.24	0.6	4.19	0.4	4.07
C_6H_5OH	--	0.02	--	0.02	--	0.02
H_2O	--	50.11	--	50.17	--	53.84
Total	100.0	100.00	100.0	100.00	100.0	100.00
CO Consumed, lb-mol./hr	0.001981	--	0.001969	--	0.001266	--
CO_2 Produced, lb-mol./hr	0.001947	--	0.001952	--	0.001231	--
H_2 Produced, lb-mol./hr	0.002326	--	0.002332	--	0.001434	--
H_2O Used, lb-mol./hr	0.002344	--	0.002339	--	0.001642	--
Space Velocity, SCF/hr-cu ft	6588	14534	6646	14521	4071	9506

* The feed gas contains about 1.3 ppm propyl mercaptan, 0.8 ppm thiophene, and 52 ppm carbonyl sulfide.

B75030431e

Table A-13, Part 11. LIFE TESTS
(Shell Oil 538 Shift Catalyst, 4 x 6 Mesh Spheres, 21.0 g)

Run No.	23-31		23-32		23-33	
Time, hr	1092		1096		1099	
Basis for Analysis	Dry	Wet	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000	1000	1000
Temperature, Furnace, °F	750	750	750	750	750	750
Temperature, Reactor Entrance, °F	757	757	756	756	757	757
Temperature, Quarter Bed, °F	768	768	768	768	768	768
Temperature, Middle Bed, °F	767	767	767	767	767	767
Temperature, Exit, °F	520	520	520	520	520	520
Flow Rate, H_2S, lb-mol./hr	0.000127	0.000127	0.000126	0.000126	0.000127	0.000127
Flow Rate, Feed, lb-mol./hr	0.007946	0.022868	0.007957	0.0022877	0.007947	0.022869
Flow Rate, H_2O, lb-mol./hr	--	0.013889	--	0.013886	--	0.013876
Flow Rate, C_6H_6, lb-mol./hr	--	0.000976	--	0.000987	--	0.000982
Temperature, Steam, °F	900	900	900	900	900	900
Temperature, Benzene, °F	80	80	80	80	80	80
Feed Composition, mol %*						
CO	17.0	5.89	17.0	5.93	17.0	5.95
CO_2	21.3	7.39	21.3	7.41	21.3	7.40
H_2	36.5	12.62	36.5	12.65	36.5	12.71
CH_4	21.6	7.54	21.6	7.58	21.6	7.53
$C_2H_6^+$	0.7	0.24	0.7	0.24	0.7	0.24
N_2	1.3	0.45	1.3	0.45	1.3	0.45
H_2S	1.6	0.56	1.6	0.56	1.6	0.56
NH_3	--	0.19	--	0.19	--	0.19
C_6H_6	--	4.34	--	4.35	--	4.35
C_6H_5OH	--	0.03	--	0.03	--	0.03
H_2O	--	60.75	--	60.61	--	60.59
Total	100.0	100.00	100.0	100.00	100.0	100.00
Product Flow Rate, lb-mol./hr	0.009571	0.022790	0.009562	0.022740	0.009564	0.022740
Product Composition, mol %						
CO	0.9	0.37	0.9	0.38	0.9	0.38
CO_2	30.5	12.82	30.6	12.82	30.6	12.70
H_2	46.6	19.74	46.5	19.70	46.4	19.64
CH_4	18.4	7.69	18.4	7.65	18.5	7.88
$C_2H_6^+$	0.6	0.26	0.6	0.26	0.6	0.26
N_2	1.1	0.47	1.1	0.47	1.1	0.47
H_2S	1.5	0.63	1.5	0.64	1.5	0.64
NH_3	--	0.13	--	0.13	--	0.13
C_6H_6	0.4	4.09	0.4	4.05	0.4	4.04
C_6H_5OH	--	0.02	--	0.02	--	0.02
H_2O	--	53.78	--	53.88	--	53.84
Total	100.0	100.00	100.0	100.00	100.0	100.00
CO Consumed, lb-mol./hr	0.001271	--	0.001262	--	0.001263	--
CO_2 Produced, lb-mol./hr	0.001234	--	0.001230	--	0.001225	--
H_2 Produced, lb-mol./hr	0.001429	--	0.001427	--	0.001437	--
H_2O Used, lb-mol./hr	0.001638	--	0.001632	--	0.001640	--
Space Velocity, SCF/hr-cu ft	4076	9535	4072	9514	4070	9514

* The feed gas contains about 1.3 ppm propyl mercaptan, 0.8 ppm thiophene, and 52 ppm carbonyl sulfide.

B750304311

Table A-13, Part 12. LIFE TESTS
(Shell Oil 538 Shift Catalyst, 4 x 6 Mesh Spheres, 21.0 g)

Run No.	23-34		23-35	
Time, hr	1168		1171	
Basis for Analysis	Dry	Wet	Dry	Wet
Pressure, psig	1000	1000	1000	1000
Temperature, Furnace, °F	750	750	750	750
Temperature, Reactor Entrance, °F	755	755	755	755
Temperature, Quarter Bed, °F	765	765	765	765
Temperature, Middle Bed, °F	765	765	765	765
Temperature, Exit, °F	520	520	520	520
Flow Rate, H_2S, lb-mol./hr	0.000083	0.000083	0.000083	0.000083
Flow Rate, Feed, lb-mol./hr	0.004869	0.012748	0.004872	0.012760
Flow Rate, H_2O, lb-mol./hr	--	0.007279	--	0.007290
Flow Rate, C_6H_6, lb-mol./hr	--	0.000573	--	0.000575
Temperature, Steam, °F	900	900	900	900
Temperature, Benzene, °F	80	80	80	80
Feed Composition, mol %*				
CO	16.7	6.36	16.7	6.38
CO_2	21.0	8.03	21.0	8.02
H_2	37.2	14.24	37.2	14.24
CH_4	21.4	8.24	21.4	8.19
$C_2H_6^+$	0.7	0.27	0.7	0.27
N_2	1.3	0.49	1.3	0.49
H_2S	1.7	0.65	1.7	0.65
NH_3	--	0.18	--	0.18
C_6H_6	--	4.49	--	4.49
C_6H_5OH	--	0.03	--	0.03
H_2O	--	57.02	--	57.06
Total	100.0	100.00	100.0	100.00
Product Flow Rate, lb-mol./hr	0.005856	0.012710	0.005852	0.012701
Product Composition, mol %				
CO	0.3	0.14	0.3	0.14
CO_2	31.1	14.33	31.2	14.40
H_2	47.0	21.66	46.9	21.56
CH_4	18.2	8.39	18.2	8.41
$C_2H_6^+$	0.6	0.28	0.6	0.28
N_2	1.1	0.50	1.1	0.50
H_2S	1.5	0.69	1.5	0.69
NH_3	--	0.12	--	0.12
C_6H_6	0.2	4.04	0.2	4.08
C_6H_5OH	--	0.02	--	0.02
H_2O	--	49.83	--	49.80
Total	100.0	100.00	100.0	100.00
CO Consumed, lb-mol./hr	0.000795	--	0.000780	--
CO_2 Produced, lb-mol./hr	0.000799	--	0.000798	--
H_2 Produced, lb-mol./hr	0.000941	--	0.000952	--
H_2O Used, lb-mol./hr	0.000945	--	0.000961	--
Space Velocity, SCF/hr-cu ft	2494	5413	2494	5413

* The feed gas contains about 1.3 ppm propyl mercaptan, 0.8 ppm thiophene, and 52 ppm carbonyl sulfide.

B75030431g