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APPENDIX D

Coal and Coal Ash Analysis Details

Two main groupings of analysis reports are included in Appendix D. The first grouping includes those more commonly used determinations and procedures for which there are ASTM Standard methods available. These include, as subgroupings, the following tests:

a. Proximate/Ultimate Analysis.

b. Equilibrium Moisture.

c. Gross Calorific Value.

d. Sulfur Forms.

e. Tumbler Test for Coal.

f. Free Swelling Index.

g. Hardgrove Grindability Index.

h. Mineral Analysis of Ash.

i. Fusion Temperature of Ash.

The second main grouping includes the procedures for which ASTM Standard methods are either unavailable or, if available, require special instrumental analysis methods, namely:

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j. Caking Index (Damm's Method).

k. Water-Soluble Alkalies.

l. Spark Source Mass Spectrography.

m. Atomic Absorption Spectroscopy.

n. AA (Fluorine and Mercury Only).

o. Fischer Assay.

Analysis reports are indicated (*) for each of the three products tested frome ach of the following mines sampled:

1. Old Ben Mine #1 - West Pit - Indiana V Seam.
2. Lynnville (Eby Pit) - Indiana V Seam.
3. Lynnville Mine No. 1 - Indiana VI Seam.
4. Camp 11 Mine - Kentucky No. 11 Seam.
5. Hamilton Mine #1 - Kentucky No. 9 Seam.
6. Providence #1 - Kentucky No. 9 Seam.
7. No. 9 - Kentucky No. 9 Seam.
8. Marissa Mine - Illinois No. 6 Seam.
9. Wabash Mine - Illinois No. 5 Seam.
10. Delta Mine - Illinois No. 6 Seam.

<u>Note:</u>

(*) Example: OB-1 (a-d, f-n), i.e. (e) Tumbler Test not run.

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APPENDIX D-1

Old Ben Mine #1 - West Pit - Indiana V Seam

	Page
OB-1 - Total Product: a-d, f-O	D- 4
OB-2 - 2" Rd. x 1/4" Rd.: a-k, n-o	D-11
OB-3 - 1/4" Rd. x O: a-d, f-k, n-o	D-17

:-457

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COMMERCIAL TESTING & ENGINEERING CO.

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PLEASE ADDRESS ALL CORRESPONDENCE TO:
P.O. BOX 752, HENDERSON, KY 42420
OFFICE TEL. (502) 827-1187

TEXAS EASTERN SYNFUELS
Houston, TX 77001

August 17, 1981

Kind of sample reported to us: Coal

Sample taken at: Old Ben #1 Mine, Spurgeon, Indiana

Sample taken by: CT&E

Date sampled: June 23, 1981

Date received: June 23, 1981

Analysis report no. 63-136156

Sample identification by CT&E Company

Tri-State Synfuels Project
Old Ben Coal Company
Old Ben #1 Mine
Crushed Raw Coal - Total Product
OB1

PROXIMATE ANALYSIS	% Weight As received	% Weight Dry basis
Moisture	11.28	XXXXX
Ash	18.06	20.36
Volatile	34.16	38.50
Fixed Carbon	36.50	41.14
	100.00	100.00
Btu/lb.	10031	11306
Sulfur	4.42	4.98
Alk. as Na_2O	0.41	0.46
SULFUR FORMS		
Pyritic Sulfur	2.76	3.11
Sulfate Sulfur	0.00	0.00
Organic Sulfur	1.60	1.87
	4.42	4.98
WATER SOLUBLE ALKALIES		
Na_2O	XXXX	XXXX
K_2O	XXXX	XXXX

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2020 °F	2370 °F
Softening (H=W)	2080 °F	2420 °F
Softening (H=½W)	2110 °F	2470 °F
Fluid	2290 °F	2500 °F

H is Cone Height
W is Cone Width

% EQUILIBRIUM MOISTURE 9.09
HARDGROVE GRINDABILITY INDEX 54.0 at 7.37% Moisture
FREE SWELLING INDEX 2 1/2

Silica Value 65.00
Base: Acid Ratio 0.43
T_{250} Temperature 2381

ESTIMATED VISCOSITY at critical viscosity temperature of 2310°F = 600 poises

ULTIMATE ANALYSIS	% Weight As received	% Weight Dry basis
Moisture	11.28	XXXXX
Carbon	55.14	62.15
Hydrogen	3.81	4.29
Nitrogen	1.05	1.18
Chlorine	0.04	0.05
Sulfur	4.41	4.98
Ash	18.06	20.36
Oxygen (diff)	6.20	6.99
	100.00	100.00

MAF 14196

MINERAL ANALYSIS OF ASH	% Weight Ignited Basis
Silica, SiO_2	47.49
Alumina, Al_2O_3	18.98
Titania, TiO_2	0.87
Ferric oxide, Fe_2O_3	21.18
Lime, CaO	3.30
Magnesia, MgO	1.09
Potassium oxide, K_2O	2.39
Sodium oxide, Na_2O	0.70
Sulfur trioxide, SO_3	2.01
Phos. pentoxide, P_2O_5	0.17
Strontium Oxide, SrO	0.00
Barium Oxide, BaO	0.04
Manganese Oxide, Mn_3O_4	0.05
Undetermined	1.73
	100.00

Fouling Index 0.3
Slagging Index 2.1

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

L. W. TAYLOR III, Manager, Central Division

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January 2, 1982

TEXAS EASTERN SYNFUELS, INC.
Houston, TX 77001

Sample identification by
CT&E Company

Kind of sample reported to us	Coal	Tri-State Synfuels Project
Sample taken at	Old Ben #1 Mine Spurgeon, Indiana	Old Ben Coal Company Old Ben #1 Mine
Sample taken by	CT&E	Crushed Raw Coal - Total Product OB1
Date sampled	June 23, 1981	
Date received	June 23, 1981	

Analysis report no. 63-136156

Caking Index (Damm's Method) = 14 - 15

	As Received	Dry Basis
Moisture, %	11.28	XXXX
Fluorine (F)[1], µg/g	130	150
Mercury (Hg)[2], µg/g	0.12	0.14

1. Preparation by oxygen bomb combustion; analysis by ion selective electrode. ASTM, Part 26, D3761-79

2. Preparation by oxygen train combustion; analysis by flameless cold vapor atomic absorption spectroscopy. ASTM, Part 26, D3684-78

Respectfully submitted,
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LT/mc

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OFFICE TEL. (502) 827-1187

TEXAS EASTERN SYNFUELS
Houston, TX 77001

August 17, 1981

Sample identification by CT&E Company

Kind of sample reported to us: Coal

Sample taken at: Old Ben #1 Mine, Spurgeon, Indiana

Sample taken by: CT&E

Date sampled: June 23, 1981

Date received: June 23, 1981

Tri-State Synfuels Project
Old Ben Coal Company
Old Ben #1 Mine
Crushed Raw Coal - Total Product
OB1

Analysis report no. 63-136156

Alkalies, dry coal basis

	Water Soluble	Non Water Soluble
Sodium oxide, Na_2O, ppm	444	755
Potassium oxide, K_2O, ppm	97	4300

% Ash in non water soluble coal = 17.55

% Ash in original sample = 20.36

Alkalies calculated to ignited basis from above:

	Ignited basis
% Sodium oxide, Na_2O	0.65
% Potassium oxide, K_2O	2.50

LT/kmc

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

L. W. TAYLOR III, Manager, Central Division

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CENTRAL DIVISION MANAGER
L. W. TAYLOR III

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January 2, 1981

TEXAS EASTERN SYNFUELS, INC.
Houston, TX 77001

Lab No. 63-136156

Tri-State Synfuels Project
Old Ben Coal Company
Old Ben #1 Mine
Crushed Raw Coal - Total Product
OB1

SPARK SOURCE MASS SPECTROGRAPHIC ANALYSIS

CONCENTRATION IN PPM WEIGHT

ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.
Uranium	5 (2.4)	Terbium		Ruthenium		Vanadium	50
Thorium	6	Gadolinium		Molybdenum	4	Titanium	MC
Bismuth	12	Europium	0.2	Niobium	8	Scandium	2
Lead		Samarium	3	Zirconium	43	Calcium	MC
Thallium	NR	Neodymium	4	Yttrium	22	Potassium	MC
Mercury		Praseodymium	3	Strontium	54	Chlorine	21
Gold		Cerium	22	Rubidium	58	Sulfur	MC
tinum		Lanthanum	16	Bromine	2	Phosphorus	MC
Iridium		Barium	160	Selenium	8	Silicon	MC
Osmium		Cesium	2	Arsenic	14	Aluminum	MC
Rhenium		Iodine	0.2	Germanium	8	Magnesium	MC
Tungsten		Tellurium		Gallium	22	Sodium	MC
Tantalum		Antimony	0.3	Zinc	25	Fluorine	NR
Hafnium		Tin	1	Copper	27	Oxygen	NR
Lutetium		Indium	STD	Nickel	28	Nitrogen	NR
Ytterbium		Cadmium	1	Cobalt	1	Carbon	NR
Thulium		Silver		Iron	MC	Boron	35
Erbium		Palladium		Manganese	76	Beryllium	1
Holmium		Rhodium		Chromium	17	Lithium	21
Dysprosium				Neptunium	< 0.1ppm	Hydrogen	NR

STD - Internal Standard
NR - Not Reported
All elements not detected < 0.2ppm
MC - Major Component
INT - Interference

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Lloyd W. Taylor, III
Manager, Central Division

D-7. Charter Member

TABLE NO. I
Trace Elements by Atomic Absorption
(concentration in ug/g)

Parameter	OB-1 As Rec'd	OB-1 Dry	PB-28 As Rec'd	PB-28 Dry	HB-31 As Rec'd	HB-31 Dry	TG-19 As Rec'd	TG-19 Dry	IC-35 As Rec'd	IC-35 Dry
Moisture (%)[1]	11.28	XXXX	11.67	XXXX	9.49	XXXX	11.11	XXXX	7.49	XXXX
Antimony	0.3	0.3	0.5	0.6	0.1	0.1	0.2	0.2	0.4	0.4
Arsenic	11.0	12.4	22.5	25.5	4.3	4.8	3.0	3.4	4.6	5
Beryllium	2	2	2	2	2	2	1	1	1	1
Boron[2]	140	160.00	140	160	160	180	160	180	150	160
Cadmium	0.8	0.9	0.2	0.2	0.2	0.2	0.4	0.4	0.6	0.6
Chromium	25	28	14	16	21	23	43	48	25	27
Copper	25	28	13	15	17	19	28	31	20	22
Fluorine[3]	130	150	95	110	130	140	440	500	150	160
Lead	4	4	20	23	4	4	4	4	37	40
Lithium	19	21	11	13	25	28	23	26	17	18
Manganese	64	72	57	65	66	73	84	94	113	122
Mercury	0.12	0.14	0.09	0.10	0.10	0.11	0.07	0.08	0.15	0.16
Nickel	18	20	24	27	21	23	29	33	15	16
Selenium	2.4	2.7	1.1	1.3	1.4	1.5	2.8	3.2	3.1	3.4
Uranium[4]	2.1	2.4	1.3	1.5	1.9	2.1	6.3	7.1	3.3	3.6
Vanadium	37	42	24	27	52	58	77	87	59	64
Zinc	121	136	87	98	63	70	85	96	92	99

1 Determination by ASTM Method D3173
2 Determination by curcumin colorimetric technique
3 Determination by ASTM Method D3761
4 Determination by delayed neutron activation

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[illegible]	NT 3-0010
SAMPLE [illegible]	CT&E Lab No. 63-136156, OB1
TERMINAL TEMP	941 DEG. F
FISHER ASSAY NO.	FB 2337

FISCHER ASSAY YIELDS	AS ANALYZED	NORMALIZED
OIL (LB/TON)	261.5	263.0
(GAL/TON)	29.6	29.8
API GRAVITY	2.4	2.4
GAS (LB/TON)	116.3	117.0
(SCF/TON)	1820.8	1831.1
WATER (LB/TON)	87.4	87.9
(GAL/TON)	10.5	10.5
SS (LB/TON)	1523.5	1532.2
TOTAL (LB/TON)	1988.8	2000.0
VARIANCE (PC)	-0.6	

GAS (NORMALIZED)	(LB/TON)	(LB/100 LB) (FA OIL)
H2	1.19	0.45
CO	6.27	2.38
CO2	18.50	7.04
H2S	33.08	12.58
C1	29.95	11.39
C2	11.23	4.27
C2-	2.47	0.94
C3	5.09	1.93
C3-	3.14	1.19
I-C4	0.39	0.15
N-C4	1.18	0.45
C4-	2.28	0.87
C5	1.45	0.55
C6	0.58	0.22
C7	0.20	0.08
C8	0.00	0.00
C9	0.00	0.00

ADJUSTED YIELDS (NORMALIZED)	LB/TON	SCF/TON	LB/100 LB F A OIL
C3 & LIGHTER	110.9	1794.4	42.4
SCRUBBED C3&LIGHTER [LESS CO2 & H2S]	59.3	1267.4	22.7
C4 & HEAVIER	269.0		102.9
TOTAL HYDROCARBONS INCL. H2 & CO, LB/TON	328.4		125.6
C4 & HEAVIER (GAL/TON)		31.0	
API GRAVITY		4.5	

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SAMPLE NUMBER	RF3-0010
SAMPLE DESCRIPTION	CT&E Lab No. 63-136156, OB1
FISCHER ASSAY NO.	FR 2337

COMPONENT	MOLE PERCENT
H2	12.35
CO	4.63
CO2	8.70
H2S	20.08
C1	38.75
C2	7.72
C2-	1.83
C3	2.39
C3-	1.54
I-C4	0.14
N-C4	0.42
C4-	0.84
C5	0.42
C6	0.14
C7	0.04
C8	0.00
C9	0.00
SUM	100.00

AVERAGE MOLE WT	24.22
LBS C IN GAS/TON SHALE	53.24
WT. PERCENT TOTAL CARBON	45.51
WT. PERCENT SULFUR	26.60

BTU VALUE OF GAS (CALC.)		GROSS	NET
C3 & LIGHTER*	(BTU/SCF)	852.51	775.80
SCRUBBED C3 & LIGHTER	(BTU/SCF)	1021.71	927.45
WHOLE GAS*	(BTU/SCF)	905.10	824.95
SCRUBBED WHOLE GAS	(BTU/SCF)	1090.78	992.19

*[INCL. H2S & CO2]

Identification:

Tri-State Synfuels Project
Old Ben Coal Company
Old Ben #1 Mine
Crushed Raw Coal - Total Product
OB1

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OFFICE TEL. (502) 827-1187

TEXAS EASTERN SYNFUELS
Houston, TX 77001

August 17, 1981

Kind of sample reported to us: Coal

Sample taken at: Old Ben #1 Mine, Spurgeon, Indiana

Sample taken by: CT&E

Date sampled: June 23, 1981

Date received: June 23, 1981

Sample identification by CT&E Company:
Tri-State Synfuels Project
Old Ben Coal Company
Old Ben #1
Plus 1/4" Screen Fraction
OB2

Analysis report no. 63-136157

PROXIMATE ANALYSIS	% Weight As received	% Weight Dry basis
Moisture	11.30	XXXXX
Ash	14.33	16.15
Volatile	35.96	40.54
Fixed Carbon	38.41	43.31
	100.00	100.00
Btu/lb.	10632	11986
Sulfur	4.51	5.09
Alk. as Na_2O	0.35	0.39
SULFUR FORMS		
Pyritic Sulfur	2.90	3.27
Sulfate Sulfur	0.01	0.01
Organic Sulfur	1.60	1.81
	4.51	5.09
WATER SOLUBLE ALKALIES		
Na_2O	XXXX	XXXX
K_2O	XXXX	XXXX

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	1980 °F	2485 °F
H is Cone Height — Softening (H=W)	2030 °F	2520 °F
W is Cone Width — Softening (H=½W)	2070 °F	2560 °F
Fluid	2300 °F	2590 °F

% EQUILIBRIUM MOISTURE 9.47

HARDGROVE GRINDABILITY INDEX 53.0 at 8.28% Moisture

FREE SWELLING INDEX 2 1/2

Silica Value 61.79

Base: Acid Ratio 0.48

T_{250} Temperature 2324

ULTIMATE ANALYSIS	% Weight As received	% Weight Dry basis
Moisture	11.30	XXXXX
Carbon	57.80	65.16
Hydrogen	4.07	4.59
Nitrogen	0.93	1.05
Chlorine	0.03	0.03
MAF 14295 Sulfur	4.51	5.09
Ash	14.33	16.15
Oxygen (diff)	7.03	7.93
	100.00	100.00

MINERAL ANALYSIS OF ASH	% Weight Ignited Basis
Silica, SiO_2	46.64
Alumina, Al_2O_3	18.81
Titania, TiO_2	0.84
Ferric oxide, Fe_2O_3	26.27
Lime, CaO	1.55
Magnesia, MgO	1.02
Potassium oxide, K_2O	2.37
Sodium oxide, Na_2O	0.84
Sulfur trioxide, SO_3	1.35
Phos. pentoxide, P_2O_5	0.24
Strontium Oxide, SrO	0.00
Barium Oxide, BaO	0.04
Manganese Oxide, Mn_3O_4	0.03
Undetermined	0.00
	100.00

Fouling Index 0.4

Slagging Index 2.4

ESTIMATED VISCOSITY at critical viscosity temperature of 2270°F = 370 poises

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

L. W. TAYLOR III, Manager, Central Division

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September 18, 1981

TEXAS EASTERN SYNFUELS
Houston, TX 77001

Sample identification by CT&E Company

Kind of sample reported to us	Coal
Sample taken at	Old Ben #1 Mine Spurgeon, Indiana
Sample taken by	CT&E
Date sampled	June 23, 1981
Date received	June 23, 1981

Tri-State Synfuels Project
Old Ben Coal Company
Old Ben #1
Plus 1/4" Rd. Screen Fraction
OB2

Analysis report no. 63-136157

TUMBLER TEST FOR COAL - ASTM D 441-45 (1975)

Retained on	Passing	Weight Percent (1)	Average of Sieve Openings Inches (2)	Factor (3)	Product of (1) x (3)
1.06 in.	1.50 in.	100.0	1.280	1	100.00 = S
1.06 in.	1.50 in.	62.2	1.280	1	62.2
0.750 in.	1.06 in.	15.6	0.905	0.7	10.92
0.530 in.	0.750 in.	7.7	0.640	0.5	3.85
0.375 in.	0.530 in.	1.7	0.452	0.35	.595
0.0469 in.	0.375 in.	2.1	0.211	0.16	.336
0.0117 in.	0.0469 in.	1.3	0.029	0.023	.0299
	0.0117 in.	9.4	0.006	0.005	.0470
Total (Sum of products (1) x (3)					77.98 = s

Friability, 22.0 percent: with dust index of 9

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO

L. W. TAYLOR III, Manager, Central Division

LT/mc

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TEXAS EASTERN SYNFUELS, INC.
Houston, TX 77001

January 4, 1982

Sample identification by CT&E Company

Kind of sample reported to us	Coal
Sample taken at	Old Ben #1 Mine Spurgeon, Indiana
Sample taken by	CT&E
Date sampled	June 23, 1981
Date received	June 23, 1981

Tri-State Synfuels Project
Old Ben Coal Company
Old Ben #1
Plus 1/4" Rd. Screen Fraction
OB2

Analysis report no. 63-136157

Caking Index (Damm's Method) = 16 - 17

	As Received	Dry Basis
Moisture, %	11.30	XXXX
Fluorine (F)[1], µg/g	180	200
Mercury (Hg)[2], µg/g	0.09	0.10

1. Preparation by oxygen bomb combustion; analysis by ion selective electrode. ASTM, Part 26, D3761-79

2. Preparation by oxygen train combustion; analysis by flameless cold vapor atomic absorption spectroscopy. ASTM, Part 26, D3684-78

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

L.W. TAYLOR III, Manager, Central Division

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OVER 40 BRANCH LABORATORIES STRATEGICALLY LOCATED IN PRINCIPAL COAL MINING AREAS, TIDEWATER AND GREAT LAKES PORTS, AND RIVER LOADING FACILITIES

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TEXAS EASTERN SYNFUELS
Houston, TX 77001

August 18, 1981

Sample identification by CT&E Company

Kind of sample reported to us Coal

Sample taken at Old Ben #1 Mine, Spurgeon, Indiana

Sample taken by CT&E

Date sampled June 23, 1981

Date received June 23, 1981

Tri-State Synfuels Project
Old Ben Coal Company
Old Ben #1
Plus 1/4" Rd. Screen Fraction
OB2

Analysis report no. 63-136157

Alkalies, dry coal basis

	Water Soluble	Non Water Soluble
Sodium oxide, Na_2O, ppm	378	730
Potassium oxide, K_2O, ppm	89	3353

% Ash in non water soluble coal = 14.90

% Ash in original sample = 16.15

Alkalies calculated to ignited basis from above:

	Ignited basis
% Sodium oxide, Na_2O	0.72
% Potassium oxide, K_2O	2.31

LT/kmc

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

L. W. TAYLOR III, Manager, Central Division

D-14.

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DATE : 11/4/81

SAMPLE NUMBER	RF 2-6968
SAMPLE DESCRIPTION	CT&E Lab No. 63-136157, OB2
TERMINAL TEMP	932 DEG. F
FISHER ASSAY NO.	PB 2322

FISCHER ASSAY YIELDS	AS ANALYZED	NORMALIZED
OIL (LB/TON)	292.0	295.4
(GAL/TON)	32.9	33.3
API GRAVITY	1.5	1.5
GAS (LB/TON)	96.7	97.8
(SCF/TON)	1430.8	1447.5
WATER (LB/TON)	83.4	84.4
(GAL/TON)	10.0	10.1
SS (LB/TON)	1504.9	1522.5
TOTAL (LB/TON)	1976.9	2000.0
VARIANCE (PC)	-1.2	

GAS (NORMALIZED)	(LB/TON)	(LB/100 LB) (FA OIL)
H2	0.73	0.25
CO	5.72	1.94
CO2	14.44	4.89
H2S	25.05	8.48
C1	22.89	7.75
C2	10.98	3.72
C2-	2.33	0.79
C3	5.48	1.85
C3-	3.16	1.07
I-C4	0.38	0.13
N-C4	1.42	0.48
C4-	2.29	0.77
C5	1.28	0.43
C6	0.97	0.33
C7	0.65	0.22
C8	0.00	0.00
C9	0.00	0.00

ADJUSTED YIELDS (NORMALIZED)	LB/TON	SCF/TON	LB/100 LB F A OIL
C3 & LIGHTER	90.8	1406.6	31.1
SCRUBBED C3&LIGHTER [LESS CO2 & H2S]	51.3	1003.8	17.6
C4 & HEAVIER	302.4		103.6
TOTAL HYDROCARBONS INCL. H2 & CO, LB/TON	353.7		121.1
C4 & HEAVIER (GAL/TON)		34.6	
API GRAVITY		3.6	

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GAS ANALYSIS

SAMPLE NUMBER	RF 2-6968
SAMPLE DESCRIPTION	CT&E Lab No. 63-136157, OB2
FISCHER ASSAY NO.	PB 2322

COMPONENT	MOLE PERCENT
H2	9.58
CO	5.35
CO2	8.59
H2S	19.24
C1	37.46
C2	9.55
C2-	2.18
C3	3.25
C3-	1.97
I-C4	0.17
N-C4	0.64
C4-	1.07
C5	0.47
C6	0.30
C7	0.17
C8	0.00
C9	0.00
SUM	100.00

AVERAGE MOLE WT	25.60
LBS C IN GAS/TON SHALE	47.39
WT. PERCENT TOTAL CARBON	48.47
WT. PERCENT SULFUR	24.11

BTU VALUE OF GAS (CALC.)		GROSS	NET
C3 & LIGHTER*	(BTU/SCF)	905.89	826.08
SCRUBBED C3 & LIGHTER	(BTU/SCF)	1092.21	994.11
WHOLE GAS*	(BTU/SCF)	981.50	896.70
SCRUBBED WHOLE GAS	(BTU/SCF)	1189.69	1085.39

*[INCL. H2S & CO2]

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Identification:

Tri-State Synfuels Project
Old Ben Coal Company
Old Ben #1
Plus 1/4" Rd. Screen Fraction
OB2

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P.O. BOX 752, HENDERSON, KY 42420
OFFICE TEL. (502) 827-1187

TEXAS EASTERN SYNFUELS
Houston, TX 77001

August 17, 1981

Kind of sample reported to us: Coal

Sample taken at: Old Ben #1 Mine, Spurgeon, Indiana

Sample taken by: CT&E

Date sampled: June 23, 1981

Sample identification by: CT&E Company

Tri-State Synfuels Project
Old Ben Coal Company
Old Ben #1
Minus 1/4" Rd. Screen Fraction
OB3

Date received: June 23, 1981 Analysis report no. 63-136158

PROXIMATE ANALYSIS	% Weight As received	% Weight Dry basis
Moisture	11.01	XXXXX
Ash	22.75	25.56
Volatile	31.32	35.20
Fixed Carbon	34.92	39.24
	100.00	100.00
Btu/lb.	9299	10450
Sulfur	4.08	4.59
Alk. as Na_2O	0.53	0.60
SULFUR FORMS		
Pyritic Sulfur	2.50	2.81
Sulfate Sulfur	0.04	0.04
Organic Sulfur	1.54	1.74
	4.08	4.59
WATER SOLUBLE ALKALIES		
Na_2O	XXXX	XXXX
K_2O	XXXX	XXXX

ULTIMATE ANALYSIS	% Weight As received	% Weight Dry basis
Moisture	11.01	XXXXX
Carbon	51.16	57.49
Hydrogen	3.69	4.15
Nitrogen	1.01	1.14
Chlorine	0.06	0.07
MAF 14038 Sulfur	4.08	4.59
Ash	22.75	25.56
Oxygen (diff)	6.24	7.00
	100.00	100.00

MINERAL ANALYSIS OF ASH	% Weight Ignited Basis
Silica, SiO_2	49.80
Alumina, Al_2O_3	19.22
Titania, TiO_2	0.85
Ferric oxide, Fe_2O_3	17.71
Lime, CaO	5.41
Magnesia, MgO	1.06
Potassium oxide, K_2O	2.49
Sodium oxide, Na_2O	0.71
Sulfur trioxide, SO_3	1.81
Phos. pentoxide, P_2O_5	0.19
Strontium Oxide, SrO	0.00
Barium Oxide, BaO	0.05
Manganese Oxide, Mn_3O_4	0.04
Undetermined	0.66
	100.00

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2120 °F	2400 °F
Softening (H=W)	2190 °F	2460 °F
Softening (H=½W)	2230 °F	2500 °F
Fluid	2360 °F	2550 °F

H is Cone Height
W is Cone Width

% EQUILIBRIUM MOISTURE 8.72
HARDGROVE GRINDABILITY INDEX 57.0 at 8.50 % Moisture
FREE SWELLING INDEX 2 1/2

Silica Value 67.32
Base: Acid Ratio 0.39
T_{250} Temperature 2420

Fouling Index 0.3
Slagging Index 1.8

ESTIMATED VISCOSITY at critical viscosity temperature of 2430°F = 1000 poises

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

L. W. TAYLOR III, Manager, Central Division

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D-17.

Charter Member

OVER 40 BRANCH LABORATORIES STRATEGICALLY LOCATED IN PRINCIPAL COAL MINING AREAS, TIDEWATER AND GREAT LAKES PORTS, AND RIVER LOADING FACILITIES

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OFFICE TEL. (502) 827-1187

January 4, 1982

TEXAS EASTERN SYNFUELS, INC.
Houston, TX 77001

Sample identification by CT&E Company

Kind of sample reported to us	Coal	Tri-State Synfuels Project
Sample taken at	Old Ben #1 Mine Spurgeon, Indiana	Old Ben Coal Company Old Ben #1
Sample taken by	CT&E	Minus 1/4" Rd. Screen Fraction OB3
Date sampled	June 23, 1981	
Date received	June 23, 1981	

Analysis report no. 63-136158

Caking Index (Damm's Method) = 12 - 13

	As Received	Dry Basis
Moisture, %	11.01	XXXX
Fluorine (F)[1], ug/g	140	160
Mercury (Hg)[2], ug/g	0.04	0.04

1. Preparation by oxygen bomb combustion; analysis by ion selective electrode. ASTM, Part 26, D3761-79

2. Preparation by oxygen train combustion; analysis by flameless cold vapor atomic absorption spectroscopy. ASTM, Part 26, D3684-78.

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

L. W. TAYLOR III, Manager, Central Division

Charter Member

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LT/mc

OVER 40 BRANCH LABORATORIES STRATEGICALLY LOCATED IN PRINCIPAL COAL MINING AREAS, TIDEWATER AND GREAT LAKES PORTS, AND RIVER LOADING FACILITIES

F-464

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OFFICE TEL. (502) 827-1187

TEXAS EASTERN SYNFUELS
Houston, TX 77001

August 17, 1981

Sample identification by CT&E Company

Kind of sample reported to us	Coal	Tri-State Synfuels Project
Sample taken at	Old Ben #1 Mine Spurgeon, Indiana	Old Ben Coal Company Old Ben #1 Minus 1/4" Rd. Screen Fraction OB3
Sample taken by	CT&E	
Date sampled	June 23, 1981	
Date received	June 23, 1981	

Analysis report no. 63-136158

Alkalies, dry coal basis

	Water Soluble	Non Water Soluble
Sodium oxide, Na_2O, ppm	536	1005
Potassium oxide, K_2O, ppm	91	5598

% Ash in non water soluble coal = 22.85

% Ash in original sample = 25.56

Alkalies calculated to ignited basis from above:

	Ignited basis
% Sodium oxide, Na_2O	0.65
% Potassiun oxide, K_2O	2.49

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

L. W. TAYLOR III, Manager, Central Division

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D-19

Charter Member

RF2-694
CT&E Lab No. 63-136158, OB3
TEMP 932 DEG. F
FISHER NO. PB2319

FISCHER ASSAY YIELDS	AS ANALYZED	NORMALIZED
OIL (LB/TON)	233.6	234.7
(GAL/TON)	26.4	26.5
API GRAVITY	2.1	2.1
GAS (LB/TON)	107.4	108.0
(SCF/TON)	1687.1	1695.3
WATER (LB/TON)	86.1	86.5
(GAL/TON)	10.3	10.4
SS (LB/TON)	1563.1	1570.7
TOTAL (LB/TON)	1990.3	2000.0
VARIANCE (PC)	-0.5	

GAS (NORMALIZED)	(LB/TON)	(LB/100 LB) (FA OIL)
H2	1.11	0.47
CO	6.30	2.68
CO2	18.49	7.87
H2S	20.72	8.83
C1	29.65	12.63
C2	11.52	4.91
C2-	2.52	1.07
C3	5.96	2.54
C3-	3.16	1.35
I-C4	0.87	0.37
N-C4	1.74	0.74
C4-	2.10	0.90
C5	1.60	0.68
C6	1.28	0.54
C7	0.74	0.32
C8	0.21	0.09
C9	0.00	0.00

ADJUSTED YIELDS (NORMALIZED)	LB/TON	SCF/TON	LB/100 LB F A OIL
C3 & LIGHTER	99.4	1646.3	42.6
SCRUBBED C3&LIGHTER [LESS CO2 & H2S]	60.2	1256.7	25.8
C4 & HEAVIER	243.3		104.2
TOTAL HYDROCARBONS INCL. H2 & CO, LB/TON	303.5		129.9
C4 & HEAVIER (GAL/TON)		28.2	
API GRAVITY		5.3	

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SAMPLE : [illegible] RF2-896T
SAMPLE DESCRIPTION CT&E Lab No. 63-136158, OB3
FISCHER ASSAY NO. FB2319

COMPONENT	MOLE PERCENT
H2	12.41
CO	5.03
CO2	9.39
H2S	13.58
C1	41.43
C2	8.55
C2-	2.01
C3	3.02
C3-	1.68
I-C4	0.34
N-C4	0.67
C4-	0.84
C5	0.50
C6	0.34
C7	0.17
C8	0.04
C9	0.00
SUM	100.00

AVERAGE MOLE WT 24.14

LBS C IN GAS/TON SHALE 56.09

WT. PERCENT TOTAL CARBON 51.95
WT. PERCENT SULFUR 18.06

BTU VALUE OF GAS (CALC.)		GROSS	NET
C3 & LIGHTER*	(BTU/SCF)	884.73	804.87
SCRUBBED C3 & LIGHTER	(BTU/SCF)	1041.89	946.34
WHOLE GAS*	(BTU/SCF)	964.96	879.73
SCRUBBED WHOLE GAS	(BTU/SCF)	1140.14	1038.22

*[INCL. H2S & CO2]

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Identification:

Tri-State Synfuels Project
Old Ben Coal Company
Old Ben #1
Minus 1/4" Rd. Screen Fraction
OB3

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APPENDIX D-2

Lynnville (Eby Pit) - Indiana V Seam

	Page
PB-28 - Total Product: a-o	D-23
PB-29 - 2" Rd. x 1/4" Rd.: a-d, f-k, n	D-31
PB-30 - 1/4" Rd. x 0: a-d, f-k, n-o	D-34

-457

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OFFICE TEL. (502) 827-1187

TEXAS EASTERN SYNFUELS
HOUSTON, TX 77001

February 5, 1982

Kind of sample reported to us: Coal, Indiana No. V Seam

Sample identification by C. T. & E. CO.

Sample taken at: Lynnville Mine, Warrick County, Indiana

Tri-State Synfuels Project
Peabody Coal Company
Lynnville Mine
Crushed Raw Coal. Total Product.
PB-28

Sample taken by: CT&E

Date sampled: June 15, 1981

Date received: June 15, 1981 Analysis report no. 71-74330

PROXIMATE ANALYSIS	% Weight As received	% Weight Dry basis
Moisture	11.67	XXXXX
Ash	11.93	13.51
Volatile	30.99	35.08
Fixed Carbon	45.41	51.41
	100.00	100.00
Btu/lb.	10829	12260
Sulfur	3.55	4.02
Alk. as Na_2O	0.20	0.23
SULFUR FORMS		
Pyritic Sulfur	1.99	2.25
Sulfate Sulfur	0.23	0.26
Organic Sulfur	1.33	1.51
WATER SOLUBLE ALKALIES		
Na_2O	XXXX	XXXX
K_2O	XXXX	XXXX

MAF 14175

ULTIMATE ANALYSIS	% Weight As received	% Weight Dry basis
Moisture	11.67	XXXXX
Carbon	60.00	67.93
Hydrogen	4.22	4.78
Nitrogen	1.15	1.30
Chlorine	0.03	0.03
Sulfur	3.55	4.02
Ash	11.93	13.51
Oxygen (diff)	7.45	8.43
	100.00	100.00

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	1920 °F	2465 °F
Softening (H=W)	2030 °F	2500 °F
Softening (H=½W)	2145 °F	2535 °F
Fluid	2260 °F	2575 °F

H is Cone Height
W is Cone Width

% EQUILIBRIUM MOISTURE	10.82
HARDGROVE GRINDABILITY INDEX	56 @7.20% moisture
FREE SWELLING INDEX	2
Silica Value	60.74
Base: Acid Ratio	0.50
T_{250} Temperature	2310

MINERAL ANALYSIS OF ASH	% Weight Ignited Basis
Silica, SiO_2	46.47
Alumina, Al_2O_3	17.49
Titania, TiO_2	0.87
Ferric oxide, Fe_2O_3	27.93
Lime, CaO	1.11
Magnesia, MgO	1.00
Potassium oxide, K_2O	2.01
Sodium oxide, Na_2O	0.36
Sulfur trioxide, SO_3	1.12
Phos. pentoxide, P_2O_5	0.49
Strontium Oxide, SrO	0.00
Barium Oxide, BaO	0.13
Manganese Oxide, Mn_3O_4	0.11
Undetermined	0.91
	100.00
Fouling Index	0.18
Slagging Index	2.01

= (.TED VISCOSITY at critical viscosity emperature of 2345°F = 180 poises

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

L. W. TAYLOR III, Manager, Central Division

D-23.

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SOUTH HOLLAND, IL 60473
OFFICE TEL. (312) 264-1173

TEXAS EASTERN Synfuels, Inc.
Houston, TX 77001

February 5, 1982

Sample identification by CT&E COMPANY

Kind of sample reported to us	Coal, Indiana No. V Seam	Tri-State Synfuels Project Peabody Coal Company Lynnville Mine
Sample taken at	Lynnville Mine Warrick County, Indiana	Crushed Raw Coal. Total Product. PB-28
Sample taken by	CT&E	
Date sampled	June 15, 1981	
Date received	June 15, 1981	

Analysis report no. 71-74330

TUMBLER TEST FOR COAL - ASTM D 441-45 (1975)

etained on	Passing	Weight percent (1)	Average of Sieve Openings Inches (2)	Factor (3)	Product of (1) x (3)
.06 in.	1.50 in.	100.0	1.280	1	100.00 = S
.06 in.	1.50 in.	27.4	1.280	1	27.4
.750 in.	1.06 in.	42.5	0.905	0.7	29.75
.530 in.	0.750 in.	11.7	0.640	0.5	5.85
.375 in.	0.530 in.	2.6	0.452	0.35	.910
.0469 in.	0.375 in.	3.4	0.211	0.16	.544
.0117 in.	0.0469 in.	1.5	0.029	0.023	.0345
	0.0117 in.	10.9	0.006	0.005	.0545
otal (Sum of products (1) x (3)					64.54 = s

Friability, 35.5 percent: with dust index of 11

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

R. A. HOUSER, Manager, Midwest Division

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Charter Member

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SOUTH HOLLAND, IL 60473
OFFICE TEL. (312) 264-1173

TEXAS EASTERN SYNFUELS
Houston, TX 77001

February 5, 1982

Sample identification by CT&E Company

Kind of sample reported to us	Coal, Indiana No. V Seam	Tri-State Synfuels Project Peabody Coal Company Lynnville Mine Crushed Raw Coal. Total Product. PB-28
Sample taken at	Lynnville, Mine Warrick County, Indiana	
Sample taken by	CT&E	
Date sampled	June 15, 1981	
Date received	June 15, 1981	

Analysis report no. 71-74330

Caking Index (Damm's Method) = 12 - 13

	As Received	Dry Basis
Moisture, %	11.67	XXXXX
Fluorine, (F)[1], ug/g	93	105
Mercury (Hg)[2], ug/g	0.09	0.10

1. Preparation by oxygen bomb combustion; analysis by ion selective electrode. ASTM, Part 26, D3761-79.

2. Preparation by oxygen train combustion; analysis by flameless cold vapor atomic absorption spectroscopy. ASTM, Part 26, D3684-78

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

R. A. HOUSER, Manager, Midwest Division D-25.

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SOUTH HOLLAND, IL 60473
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TEXAS EASTERN SYNFUELS
Houston, TX 77001

February 5, 1982

Sample identification by CT&E Company

Kind of sample reported to us	Coal, Indiana No. V Seam	Tri-State Synfuels Project Peabody Coal Company Lynnville Mine Crushed Raw Coal. Total Product. PB-28
Sample taken at	Lynnville Mine Warrick County, Indiana	
Sample taken by	CT&E	
Date sampled	June 15, 1981	
Date received	June 15, 1981	

Analysis report no. 71-74330

Alkalies, dry coal basis

	Water soluble	Non Water Soluble
Sodium oxide, Na_2O, ppm	54	450
Potassium oxide, K_2O, ppm	64	2369

% Ash in non water soluble coal = 12.15

% Ash in original sample = 13.51

Alkalies calculated to ignited basis from above:

	Ignited basis
% Sodium oxide, Na_2O	0.41
% Potassium oxide, K_2O	2.00

Respectfully submitted.
COMMERCIAL TESTING & ENGINEERING CO.

R. A. HOUSER, Manager, Midwest Division D-26.

Charter Member

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16130 VAN DRUNEN RD., SOUTH HOLLAND, IL 60473
OFFICE TEL. (312) 264-1173

February 5, 1982

TEXAS EASTERN SYNFUELS, INC.
Houston, tX 77001

Lab. No. 71-74330

Tri-State Synfuels Project
Peadody Coal Company
Lynnville Mine, No. V Seam
Crushed Raw Coal. Total Product.
PB-28

SPARK SOURCE MASS SPECTROGRAPHIC ANALYSIS
CONCENTRATION IN PPM WEIGHT

ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.
Uranium	5 (5)	Terbium	≤0.2	Ruthenium		Vanadium	50
Thorium	6	Gadolinium	≤0.4	Molybdenum	17	Titanium	MC
Bismuth		Europium	0.4	Niobium	6	Scandium	9
Lead	27	Samarium	3	Zirconium	43	Calcium	MC
Thallium		Neodymium	7	Yttrium	22	Potassium	MC
Mercury	NR	Praseodymium	3	Strontium	60	Chlorine	21
Gold		Cerium	88	Rubidium	13	Sulfur	MC
imum		Lanthanum	39	Bromine	3	Phosphorus	MC
Iridium		Barium	160	Selenium	5	Silicon	MC
Osmium		Cesium	0.9	Arsenic	31	Aluminum	MC
Rhenium		Iodine	0.3	Germanium	8	Magnesium	MC
Tungsten	13	Tellurium	0.3	Gallium	10	Sodium	MC
Tantalum		Antimony	7	Zinc	44	Fluorine	NR
Hafnium		Tin	0.6	Copper	20	Oxygen	NR
Lutetium		Indium	STD	Nickel	16	Nitrogen	NR
Ytterbium		Cadmium	0.5	Cobalt	11	Carbon	NR
Thulium		Silver		Iron	MC	Boron	19
Erbium	≤0.3	Palladium		Manganese	76	Beryllium	1
Holmium	≤0.5	Rhodium		Chromium	17	Lithium	9
Dysprosium	≤0.7	Neptunium	<0.1			Hydrogen	NR

STD - Internal Standard
NR - Not Reported
All elements not detected<0.2ppm
MC - Major Component
INT - Interference

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

R. A. HOUSER, Manager, Midwest Division D-27.

Chemist Member

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TABLE NO. I
Trace Elements by Atomic Absorption
(concentration in ug/g)

Parameter	OB-1 As Rec'd	OB-1 Dry	PB-28 As Rec'd	PB-28 Dry	PB-31 As Rec'd	PB-31 Dry	TG-19 As Rec'd	TG-19 Dry	IC-35 As Rec'd	IC-35 Dry
Moisture (%)[1]	11.28	XXXX	11.67	XXXX	9.49	XXXX	11.11	XXXX	7.49	XXXX
Antimony	0.3	0.3	0.5	0.6	0.1	0.1	0.2	0.2	0.4	0.4
Arsenic	11.0	12.4	22.5	25.5	4.3	4.8	3.0	3.4	4.6	5
Beryllium	2	2	2	2	2	2	1	1	1	1
Boron[2]	140	160.00	140	160	160	180	160	180	150	160
Cadmium	0.8	0.9	0.2	0.2	0.2	0.2	0.4	0.4	0.6	0.6
Chromium	25	28	14	16	21	23	43	48	25	27
Copper	25	28	13	15	17	19	28	31	20	22
Fluorine[3]	130	150	95	110	130	140	440	500	150	160
Lead	4	4	20	23	4	4	4	4	37	40
Lithium	19	21	11	13	25	28	23	26	17	18
Manganese	64	72	57	65	66	73	84	94	113	122
Mercury	0.12	0.14	0.09	0.10	0.10	0.11	0.07	0.08	0.15	0.16
Nickel	18	20	24	27	21	23	29	33	15	16
Selenium	2.4	2.7	1.1	1.3	1.4	1.5	2.8	3.2	3.1	3.4
Uranium[4]	2.1	2.4	1.3	1.5	1.9	2.1	6.3	7.1	3.3	3.6
Vanadium	37	42	24	27	52	58	77	87	59	64
Zinc	121	136	87	98	63	70	85	96	92	99

1 Determination by ASTM Method D3173
2 Determination by curcumin colorimetric technique
3 Determination by ASTM Method D3761
4 Determination by delayed neutron activation

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COMMERCIAL TESTING & ENGINEERING CO.

TEXAS EASTERN SYNFUELS, INC.

PAUL WEIR CO. JOB NO. 2753-B

Analysis report No. 71-74330
Date: 10/06/81
Sample No. PB 28
TERMINAL TEMP 932 DEG. F

FISCHER ASSAY YIELDS	AS ANALYZED	NORMALIZED
OIL (LB/TON)	229.3	231.7
(GAL/TON)	25.8	26.1
API GRAVITY	1.5	1.5
GAS (LB/TON)	90.8	91.8
(SCF/TON)	1445.1	1460.7
WATER (LB/TON)	100.6	101.6
(GAL/TON)	12.0	12.2
SS (LB/TON)	1558.0	1574.8
TOTAL (LB/TON)	1978.6	2000.0
VARIANCE (PC)	-1.1	

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GAS (NORMALIZED)	(LB/TON)	(LB/100 LB) (FA OIL)
H2	1.26	0.54
CO	6.84	2.95
CO2	17.60	7.60
H2S	17.49	7.55
C1	21.91	9.45
C2	9.96	4.30
C2-	2.49	1.07
C3	4.61	1.99
C3-	2.99	1.29
I-C4	0.34	0.15
N-C4	1.31	0.57
C4-	2.20	0.95
C5	1.18	0.51
C6	1.32	0.57
C7	0.25	0.11
C8	0.00	0.00
C9	0.00	0.00

ADJUSTED YIELDS (NORMALIZED)	LB/TON	SCF/TON	LB/100 LB F A OIL
C3 & LIGHTER	85.2	1421.9	37.1
SCRUBBED C3 & LIGHTER [LESS CO2 & H2S]	50.1	1075.8	21.8
C4 & HEAVIER	238.4		104.0
TOTAL HYDROCARBONS INCL. H2 & CO, LB/TON	288.4		125.8
C4 & HEAVIER (GAL/TON)		27.4	
API GRAVITY		4.1	

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SAMPLE NO. PB 28

COMPONENT MOLE PERCENT

H2	16.33
CO	6.34
CO2	10.38
H2S	13.31
C1	35.53
C2	8.59
C2-	2.31
C3	2.71
C3-	1.85
I-C4	0.15
N-C4	0.59
C4-	1.02
C5	0.43
C6	0.40
C7	0.07
C8	0.00
C9	0.00
SUM	100.00

AVERAGE MOLE WT 23.81

LBS C IN GAS/TON SHALE 46.15

WT. PERCENT TOTAL CARBON 50.29
WT. PERCENT SULFUR 17.93

BTU VALUE OF GAS (CALC.)		GROSS	NET
C3 & LIGHTER*	(BTU/SCF)	838.57	763.08
SCRUBBED C3 & LIGHTER	(BTU/SCF)	992.85	902.02
WHOLE GAS*	(BTU/SCF)	911.20	830.91
SCRUBBED WHOLE GAS	(BTU/SCF)	1082.64	986.07

*[INCL. H2S & CO2]

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COMMERCIAL TESTING & ENGINEERING CO.

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PLEASE ADDRESS ALL CORRESPONDENCE TO
P.O. BOX 752, HENDERSON, KY 42420
OFFICE TEL. (502) 827-1187

TEXAS EASTERN SYNFUELS
HOUSTON, TX 77001

February 5, 1982

Kind of sample reported to us: Coal, Indiana No. V Seam

Sample identification by C. T. & E. CO.

Tri-State Synfuels Project
Peabody Coal Company
Lynnville Mine
Plus 1/4" Rd. screen fraction.
PB-29

Sample taken at: Lynnville Mine
Warrick County, Indiana

Sample taken by: CT&E

Date sampled: June 15, 1981

Date received: June 15, 1981 Analysis report no. 71-74331

PROXIMATE ANALYSIS	% Weight As received	% Weight Dry basis
Moisture	11.62	XXXXX
Ash	10.84	12.26
Volatile	31.83	36.02
Fixed Carbon	45.71	51.72
	100.00	100.00
Btu/lb.	11138	12602
Sulfur	3.76	4.26
Alk. as Na_2O	0.17	0.19

MAF 14363

SULFUR FORMS		
Pyritic Sulfur	2.69	3.05
Sulfate Sulfur	0.08	0.09
Organic Sulfur	0.99	1.12

WATER SOLUBLE ALKALIES		
Na_2O	XXXX	XXXX
K_2O	XXXX	XXXX

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	1930 °F	2460 °F
Softening (H=W)	2040 °F	2510 °F
Softening (H=½W)	2145 °F	2545 °F
Fluid	2250 °F	2570 °F

H = Cone Height
W = Cone Width

% EQUILIBRIUM MOISTURE 10.76
HARDGROVE GRINDABILITY INDEX 57 @6.20% moisture
FREE SWELLING INDEX 3-1/2

Silica Value 51.75
Base: Acid Ratio 0.70
T_{250} Temperature 2205

ESTIMATED VISCOSITY at critical viscosity temperature of 2245°F = 62 poises

ULTIMATE ANALYSIS	% Weight As received	% Weight Dry basis
Moisture	11.62	XXXXX
Carbon	61.60	69.70
Hydrogen	4.28	4.84
Nitrogen	1.22	1.38
Chlorine	0.03	0.03
Sulfur	3.76	4.26
Ash	10.84	12.26
Oxygen (diff)	6.65	7.53
	100.00	100.00

MINERAL ANALYSIS OF ASH	% Weight Ignited Basis
Silica, SiO_2	41.16
Alumina, Al_2O_3	16.16
Titania, TiO_2	0.86
Ferric oxide, Fe_2O_3	36.70
Lime, CaO	0.82
Magnesia, MgO	0.85
Potassium oxide, K_2O	1.90
Sodium oxide, Na_2O	0.33
Sulfur trioxide, SO_3	0.63
Phos. pentoxide, P_2O_5	0.52
Strontium Oxide, SrO	0.00
Barium Oxide, BaO	0.02
Manganese Oxide, Mn_3O_4	0.05
Undetermined	0.00
	100.00
Fouling Index	0.23
Slagging Index	2.98

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO

L. W. TAYLOR III, Manager, Central Division

D-31.

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SOUTH HOLLAND, IL 60473
OFFICE TEL. (312) 264-1173

TEXAS EASTERN SYNFUELS
Houston, TX 77001

February 5, 1982

Sample identification by CT&E Company

Kind of sample reported to us	Coal, Indiana No. V Seam	Tri-State Synfuels Project Peabody Coal Company Lynnville Mine
Sample taken at	Lynnville, Mine Warrick County, Indiana	Plus 1/4" Rd. screen fraction. PB-29
Sample taken by	CT&E	
Date sampled	June 15, 1981	
Date received	June 15, 1981	

Analysis report no. 71-74331

Caking Index (Damm's Method) = 14 - 15

	As Received	Dry Basis
Moisture, %	11.62	XXXXX
Fluorine, (F)[1], ug/g	74	84
Mercury (Hg)[2], ug/g	0.21	0.24

1. Preparation by oxygen bomb combustion; analysis by ion selective electrode. ASTM, Part 26, D3761-79.

2. Preparation by oxygen train combustion; analysis by flameless cold vapor atomic absorption spectroscopy. ASTM, Part 26, D3684-78

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

R. A. HOUSER, Manager, Midwest Division

D-32.

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OFFICE TEL. (312) 264-1173

TEXAS EASTERN SYNFUELS
Houston, TX 77001

February 5, 1982

Sample identification by CT&E Company

Kind of sample reported to us	Coal, Indiana No. V Seam	Tri-State Synfuels Project Peabody Coal Company Lynnville Mine Plus 1/4" Rd. screen fraction. PB-29
Sample taken at	Lynnville Mine Warrick County, Indiana	
Sample taken by	CT&E	
Date sampled	June 15, 1981	
Date received	June 15, 1981	

Analysis report no. 71-74331

Alkalies, dry coal basis

	Water soluble	Non Water Soluble
Sodium oxide, Na_2O, ppm	51	355
Potassium oxide, K_2O, ppm	42	2054

% Ash in non water soluble coal = 11.10

% Ash in original sample = 12.26

Alkalies calculated to ignited basis from above:

	Ignited basis
% Sodium oxide, Na_2O	0.36
% Potassium oxide, K_2O	1.88

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

R. A. HOUSER, Manager, Midwest Division

Charter Member

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TEXAS EASTERN SYNFUELS
HOUSTON, TX 77001

February 5, 1982

Kind of sample reported to us: Coal, Indiana No. V Seam

Sample identification by C. T. & E. CO.

Tri-State Synfuels Project
Peabody Coal Company
Lynnville Mine
Minus 1/4" Rd. screen fraction.
PB-30

Sample taken at: Lynnville Mine
Warrick County, Indiana

Sample taken by: CT&E

Date sampled: June 15, 1981

Date received: June 15, 1981 Analysis report no. 71-74332

PROXIMATE ANALYSIS	% Weight As received	% Weight Dry basis
Moisture	11.20	XXXXX
Ash	14.87	16.75
Volatile	29.22	32.90
Fixed Carbon	44.71	50.35
	100.00	100.00
Btu/lb.	10312	11613
Sulfur	3.62	4.08
Alk. as Na_2O	0.26	0.29
SULFUR FORMS		
Pyritic Sulfur	2.34	2.63
Sulfate Sulfur	0.39	0.43
Organic Sulfur	0.89	1.00
WATER SOLUBLE ALKALIES		
Na_2O	XXXX	XXXX
K_2O	XXXX	XXXX

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	1950 °F	2470 °F
H is Cone Height: Softening (H=W)	2060 °F	2505 °F
W is Cone Width: Softening (H=½W)	2170 °F	2525 °F
Fluid	2280 °F	2560 °F
% EQUILIBRIUM MOISTURE	10.89	
HARDGROVE GRINDABILITY INDEX	64 @6.80% moisture	
FREE SWELLING INDEX	1	
Silica Value	62.46	
Base: Acid Ratio	0.47	
T_{250} Temperature	2335	

ULTIMATE ANALYSIS	% Weight As received	% Weight Dry basis
Moisture	11.20	XXXXX
Carbon	57.54	64.80
Hydrogen	4.11	4.63
Nitrogen	1.01	1.14
Chlorine	0.03	0.03
MAF 13950 Sulfur	3.62	4.08
Ash	14.87	16.75
Oxygen (diff)	7.62	8.57
	100.00	100.00

MINERAL ANALYSIS OF ASH	% Weight Ignited Basis
Silica, SiO_2	47.61
Alumina, Al_2O_3	17.21
Titania, TiO_2	0.85
Ferric oxide, Fe_2O_3	26.69
Lime, CaO	1.15
Magnesia, MgO	0.77
Potassium oxide, K_2O	1.95
Sodium oxide, Na_2O	0.43
Sulfur trioxide, SO_3	1.33
Phos. pentoxide, P_2O_5	0.40
Strontium Oxide, SrO	0.00
Barium Oxide, BaO	0.17
Manganese Oxide, Mn_3O_4	0.10
Undetermined	1.34
	100.00
Fouling Index	0.20
Slagging Index	1.92

ESTIMATED VISCOSITY at critical viscosity temperature of 2370°F = 200 poises

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

L. W. TAYLOR III, Manager, Central Division

D-34.

Charter Member

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TEXAS EASTERN SYNFUELS
Houston, TX 77001

February 5, 1982

Sample identification by CT&E Company

Kind of sample reported to us	Coal, Indiana No. V Seam	Tri-State Synfuels Project Peabody Coal Company Lynnville Mine Minus 1/4" Rd. screen fraction. PB-30
Sample taken at	Lynnville, Mine Warrick County, Indiana	
Sample taken by	CT&E	
Date sampled	June 15, 1981	
Date received	June 15, 1981	

Analysis report no. 71-74332

Caking Index (Damm's Method) = 9 - 10

	As Received	Dry Basis
Moisture, %	11.20	XXXXX
Fluorine, (F)[1], ug/g	93	105
Mercury (Hg)[2], ug/g	0.19	0.21

1. Preparation by oxygen bomb combustion; analysis by ion selective electrode. ASTM, Part 26, D3761-79.

2. Preparation by oxygen train combustion; analysis by flameless cold vapor atomic absorption spectroscopy. ASTM, Part 26, D3684-78

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

R. A. HOUSER, Manager, Midwest Division

D-35.

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TEXAS EASTERN SYNFUELS
Houston, TX 77001

February 5, 1982

Sample identification by CT&E Company

Kind of sample reported to us	Coal, Indiana No. V Seam	Tri-State Synfuels Project Peabody Coal Company Lynnville Mine Minus 1/4" Rd. screen fraction. PB-30
Sample taken at	Lynnville Mine Warrick County, Indiana	
Sample taken by	CT&E	
Date sampled	June 15, 1981	
Date received	June 15, 1981	

Analysis report no. 71-74332

Alkalies, dry coal basis

	Water soluble	Non Water Soluble
Sodium oxide, Na_2O, ppm	51	622
Potassium oxide, K_2O, ppm	70	2886

% Ash in non water soluble coal = 14.80

% Ash in original sample = 16.75

Alkalies calculated to ignited basis from above:

	Ignited basis
% Sodium oxide, Na_2O	0.45
% Potassium oxide, K_2O	1.99

Respectfully submitted.
COMMERCIAL TESTING & ENGINEERING CO.

R. A. HOUSER, Manager, Midwest Division

Charter Member

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TEXAS EASTERN SYNFUELS, INC.

PAUL WEIR CO. JOB NO. 2753-B

Analysis report No. 71-74332
Date: 10/06/81
Sample No. PB 30
TERMINAL TEMP 932 DEG. F

FISCHER ASSAY YIELDS	AS ANALYZED	NORMALIZED
OIL (LB/TON)	170.8	170.4
(GAL/TON)	19.3	19.3
API GRAVITY	2.2	2.2
GAS (LB/TON)	112.2	111.9
(SCF/TON)	1942.8	1937.7
WATER (LB/TON)	105.4	105.1
(GAL/TON)	12.6	12.6
SS (LB/TON)	1616.8	1612.6
TOTAL (LB/TON)	2005.2	2000.0
VARIANCE (PC)	0.3	

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GAS (NORMALIZED)	(LB/TON)	(LB/100 LB) (FA OIL)
H2	2.47	1.45
CO	8.20	4.81
CO2	27.31	16.03
H2S	23.14	13.58
C1	25.87	15.19
C2	9.72	5.71
C2-	2.80	1.64
C3	4.52	2.65
C3-	2.75	1.61
I-C4	0.34	0.20
N-C4	1.02	0.60
C4-	1.64	0.96
C5	0.83	0.49
C6	0.50	0.29
C7	0.58	0.34
C8	0.20	0.12
C9	0.00	0.00

ADJUSTED YIELDS (NORMALIZED)	LB/TON	SCF/TON	LB/100 LB F A OIL
C3 & LIGHTER	106.8	1908.3	62.5
SCRUBBED C3 & LIGHTER [LESS CO2 & H2S]	56.3	1415.9	33.0
C4 & HEAVIER	175.5		102.7
TOTAL HYDROCARBONS INCL. H2 & CO, LB/TON	231.8		135.7
C4 & HEAVIER (GAL/TON)		20.3	
API GRAVITY		4.9	

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SAMPLE NO. PB 30

COMPONENT MOLE PERCENT

H2	24.16
CO	5.73
CO2	12.14
H2S	13.27
C1	31.63
C2	6.32
C2-	1.96
C3	2.01
C3-	1.28
I-C4	0.11
N-C4	0.34
C4-	0.57
C5	0.23
C6	0.11
C7	0.11
C8	0.03
C9	0.00
SUM	100.00

AVERAGE MOLE WT 21.88

LBS C IN GAS/TON SHALE 50.87

WT. PERCENT TOTAL CARBON 45.46
WT. PERCENT SULFUR 19.46

BTU VALUE OF GAS (CALC.)		GROSS	NET
C3 & LIGHTER*	(BTU/SCF)	734.37	665.82
SCRUBBED C3 & LIGHTER	(BTU/SCF)	873.73	790.33
WHOLE GAS*	(BTU/SCF)	778.34	706.88
SCRUBBED WHOLE GAS	(BTU/SCF)	929.84	842.85

*[INCL. H2S & CO2]

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APPENDIX D-3

Lynnville Mine No. 1 - Indiana VI Seam

	Page
PB-31 - Total Product: a-o	D-40
PB-32 - 2" Rd. x 1/4" Rd.: a-d, f-k, n-o	D-48
PB-33 - 1/4" Rd. x 0: a-d, f-k, n-o	D-53

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GENERAL OFFICES 228 NORTH LA SALLE STREET, CHICAGO, ILLINOIS 60601 · AREA CODE 312 726-8434

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P.O. BOX 752, HENDERSON, KY 42420
OFFICE TEL. (502) 827-1187

TEXAS EASTERN SYNFUELS
HOUSTON, TX 77001

February 5, 1982

Kind of sample reported to us	Coal, Indiana No. VI Seam	Sample identification by	C. T. & E. CO.
Sample taken at	Lynnville Mine Warrick County, Indiana		Tri-State Synfuels Project Peabody Coal Company Lynnville Mine
Sample taken by	CT&E		Crushed Raw Coal. Total Product. PB-31
Date sampled	June 16, 1981		
Date received	June 16, 1981	Analysis report no.	71-74301

PROXIMATE ANALYSIS	% Weight As received	% Weight Dry basis
Moisture	9.49	XXXXX
Ash	24.81	27.41
Volatile	30.30	33.48
Fixed Carbon	35.40	39.11
	100.00	100.00
Btu/lb.	9198	10162
Sulfur	3.32	3.67
Alk. as Na_2O	0.55	0.61
SULFUR FORMS		
Pyritic Sulfur	2.28	2.52
Sulfate Sulfur	0.08	0.09
Organic Sulfur	0.96	1.06
WATER SOLUBLE ALKALIES		
Na_2O	XXXX	XXXX
K_2O	XXXX	XXXX

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2120 °F	2220 °F
H is Cone Height Softening (H=W)	2270 °F	2310 °F
W is Cone Width Softening (H=½W)	2310 °F	2405 °F
Fluid	2450 °F	2500 °F
% EQUILIBRIUM MOISTURE	9.72	
HARDGROVE GRINDABILITY INDEX	54 @7.20% moisture	
FREE SWELLING INDEX	2-1/2	
Silica Value	69.45	
Base: Acid Ratio	0.35	
T_{250} Temperature	2480	

ULTIMATE ANALYSIS	% Weight As received	% Weight Dry basis
Moisture	9.49	XXXXX
Carbon	50.93	56.27
Hydrogen	3.74	4.13
Nitrogen	0.77	0.85
Chlorine	0.05	0.06
MAF 13999 Sulfur	3.32	3.67
Ash	24.81	27.41
Oxygen (diff)	6.89	7.61
	100.00	100.00

MINERAL ANALYSIS OF ASH	% Weight Ignited Basis
Silica, SiO_2	49.14
Alumina, Al_2O_3	19.75
Titania, TiO_2	0.83
Ferric oxide, Fe_2O_3	13.96
Lime, CaO	6.68
Magnesia, MgO	0.98
Potassium oxide, K_2O	2.16
Sodium oxide, Na_2O	0.80
Sulfur trioxide, SO_3	5.03
Phos. pentoxide, P_2O_5	0.50
Strontium Oxide, SrO	0.03
Barium Oxide, BaO	0.06
Manganese Oxide, Mn_3O_4	0.08
Undetermined	0.00
	100.00
Fouling Index	0.28
Slagging Index	1.28

ESTIMATED VISCOSITY at critical viscosity temperature of 2510°F = 245 poises

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO

L. W. TAYLOR III, Manager, Central Division

D-40. Charter Member

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SOUTH HOLLAND, IL 60473
OFFICE TEL. (312) 264-1173

TEXAS EASTERN Synfuels, Inc.
Houston, TX 77001

February 5, 1982

Sample identification
by CT&E COMPANY

Kind of sample reported to us	Coal, Indiana No. VI Seam	Tri-State Synfuels Project Peabody Coal Company Lynnville Mine
Sample taken at	Lynnville Mine Warrick County, Indiana	Crushed Raw Coal. Total Product. PB-31
Sample taken by	CT&E	
Date sampled	June 16, 1981	
Date received	June 16, 1981	

Analysis report no. 71-74301

TUMBLER TEST FOR COAL - ASTM D 441-45 (1975)

etained on	Passing	Weight percent (1)	Average of Sieve Openings Inches (2)	Factor (3)	Product of (1) x (3)
.06 in.	1.50 in.	100.0	1.280	1	100.00 = s
.06 in.	1.50 in.	26.8	1.280	1	26.8
.750 in.	1.06 in.	44.8	0.905	0.7	31.36
.530 in.	0.750 in.	10.7	0.640	0.5	5.35
375 in.	0.530 in.	2.3	0.452	0.35	.805
0469 in.	0.375 in.	3.3	0.211	0.16	.528
0117 in.	0.0469 in.	1.2	0.029	0.023	.0276
	0.0117 in.	10.9	0.006	0.005	.0545
otal (Sum of products (1) x (3)					64.93 = s

Friability, 35.0 percent: with dust index of 11

Respectfully submitted.
COMMERCIAL TESTING & ENGINEERING CO.

R. A. HOUSER, Manager, Midwest Division

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TEXAS EASTERN SYNFUELS
Houston, TX 77001

February 5, 1982

Sample identification by CT&E Company

Kind of sample reported to us	Coal, Indiana No. VI Seam	Tri-State Synfuels Project Peabody Coal Company Lynnville Mine Crushed Raw Coal. Total Product. PB-31
Sample taken at	Lynnville, Mine Warrick County, Indiana	
Sample taken by	CT&E	
Date sampled	June 16, 1981	
Date received	June 16, 1981	

Analysis report no. 71-74301

Caking Index (Damm's Method) = 13 - 14

	As Received	Dry Basis
Moisture, %	9.49	XXXXX
Fluorine, (F)[1], ug/g	127	140
Mercury (Hg)[2], ug/g	0.10	0.11

1. Preparation by oxygen bomb combustion; analysis by ion selective electrode. ASTM, Part 26, D3761-79.

2. Preparation by oxygen train combustion; analysis by flameless cold vapor atomic absorption spectroscopy. ASTM, Part 26, D3684-78

Respectfully submitted,
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SOUTH HOLLAND, IL 60473
OFFICE TEL. (312) 254-1173

TEXAS EASTERN SYNFUELS
Houston, TX 77001

February 5, 1982

Sample identification by CT&E Company

Kind of sample reported to us	Coal, Indiana No. VI Seam	Tri-State Synfuels Project Peabody Coal Company Lynnville Mine Crushed Raw Coal. Total Product. PB-31
Sample taken at	Lynnville Mine Warrick County, Indiana	
Sample taken by	CT&E	
Date sampled	June 16, 1981	
Date received	June 16, 1981	

Analysis report no. 71-74301

Alkalies, dry coal basis

	Water soluble	Non Water Soluble
Sodium oxide, Na_2O, ppm	673	1409
Potassium oxide, K_2O, ppm	106	5315

% Ash in non water soluble coal = 24.72

% Ash in original sample = 27.41

Alkalies calculated to ignited basis from above:

	Ignited basis
% Sodium oxide, Na_2O	0.82
% Potassium oxide, K_2O	2.19

Respectfully submitted.
COMMERCIAL TESTING & ENGINEERING CO.

R. A. HOUSER, Manager, Midwest Division

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February 5, 1982

TEXAS EASTERN SYNFUELS, INC.
Houston, TX 77001

Lab. No. 71-74301

Tri-State Synfuels Project
Peadody Coal Company
Lynnville Mine, No. VI Seam
Crushed Raw Coal. Total Product.
PB-31

SPARK SOURCE MASS SPECTROGRAPHIC ANALYSIS
CONCENTRATION IN PPM WEIGHT

ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.
Uranium	5 (2.1)	Terbium	0.1	Ruthenium		Vanadium	120
Thorium	12	Gadolinium	0.3	Molybdenum	7	Titanium	MC
Bismuth		Europium	0.4	Niobium	8	Scandium	4
Lead	11	Samarium	6	Zirconium	40	Calcium	MC
Thallium		Neodymium	7	Yttrium	*21	Potassium	MC
Mercury	NR	Praseodymium	3	Strontium	100	Chlorine	9
Gold		Cerium	36	Rubidium	24	Sulfur	MC
inum		Lanthanum	65	Bromine	5	Phosphorus	720
Iridium		Barium	170	Selenium	19	Silicon	MC
Osmium		Cesium	0.9	Arsenic	13	Aluminum	MC
Rhenium		Iodine	0.3	Germanium	4	Magnesium	MC
Tungsten	6	Tellurium	0.1	Gallium	21	Sodium	MC
Tantalum		Antimony		Zinc	18	Fluorine	NR
Hafnium		Tin	0.6	Copper	21	Oxygen	NR
Lutetium		Indium	STD	Nickel	11	Nitrogen	NR
Ytterbium		Cadmium	0.5	Cobalt	21	Carbon	NR
Thulium	≤0.7	Silver		Iron	MC	Boron	26
Erbium	0.6	Palladium		Manganese	210	Beryllium	0.5
Holmium	0.3	Rhodium		Chromium	7	Lithium	22
Dysprosium	0.5	Neptunium	<0.1			Hydrogen	NR

STD - Internal Standard
NR - Not Reported
All elements not detected<0.1ppm
MC - Major Component
INT - Interference
'eterogeneous

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COMMERCIAL TESTING & ENGINEERING CO.

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TABLE NO. I
Trace Elements by Atomic Absorption
(concentration in ug/g)

Parameter	OB-1 As Rec'd	OB-1 Dry	PB-28 As Rec'd	PB-28 Dry	PB-31 As Rec'd	PB-31 Dry	TG-19 As Rec'd	TG-19 Dry	IC-35 As Rec'd	IC-35 Dry
Moisture (%)[1]	11.28	XXXX	11.67	XXXX	9.49	XXXX	11.11	XXXX	7.49	XXXX
Antimony	0.3	0.3	0.5	0.6	0.1	0.1	0.2	0.2	0.4	0.4
Arsenic	11.0	12.4	22.5	25.5	4.3	4.8	3.0	3.4	4.6	5
Beryllium	2	2	2	2	2	2	1	1	1	1
Boron[2]	140	160.00	140	160	160	180	160	180	150	160
Cadmium	0.8	0.9	0.2	0.2	0.2	0.2	0.4	0.4	0.6	0.6
Chromium	25	28	14	16	21	23	43	48	25	27
Copper	25	28	13	15	17	19	28	31	20	22
Fluorine[3]	130	150	95	110	130	140	440	500	150	160
Lead	4	4	20	23	4	4	4	4	37	40
Lithium	19	21	11	13	25	28	23	26	17	18
Manganese	64	72	57	65	66	73	84	94	113	122
Mercury	0.12	0.14	0.09	0.10	0.10	0.11	0.07	0.08	0.15	0.16
Nickel	18	20	24	27	21	23	29	33	15	16
Selenium	2.4	2.7	1.1	1.3	1.4	1.5	2.8	3.2	3.1	3.4
Uranium[4]	2.1	2.4	1.3	1.5	1.9	2.1	6.3	7.1	3.3	3.6
Vanadium	37	42	24	27	52	58	77	87	59	64
Zinc	121	136	87	98	63	70	85	96	92	99

1 Determination by ASTM Method D3173
2 Determination by curcumin colorimetric technique
3 Determination by ASTM Method D3761
4 Determination by delayed neutron activation

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TEXAS EASTERN SYNFUELS, INC.

PAUL WEIR CO. JOB NO. 2753-B

Analysis report No. 71-74301
Date: 09/09/81
Sample No. PB 31
TERMINAL TEMP 932 DEG. F

FISCHER ASSAY YIELDS	AS ANALYZED	NORMALIZED
OIL (LB/TON)	205.0	205.4
(GAL/TON)	23.9	24.0
API GRAVITY	6.2	6.2
GAS (LB/TON)	112.7	112.9
(SCF/TON)	1687.7	1690.5
WATER (LB/TON)	114.6	114.8
(GAL/TON)	13.7	13.8
SS (LB/TON)	1564.3	1567.0
TOTAL (LB/TON)	1996.6	2000.0
VARIANCE (PC)	-0.2	

GAS (NORMALIZED)	(LB/TON)	(LB/100 LB) (FA OIL)
H2	1.17	0.57
CO	5.19	2.53
CO2	19.01	9.26
H2S	41.33	20.12
C1	22.83	11.12
C2	8.42	4.10
C2-	2.52	1.23
C3	4.15	2.02
C3-	2.90	1.41
I-C4	0.28	0.14
N-C4	1.14	0.55
C4-	1.92	0.93
C5	1.04	0.51
C6	0.83	0.41
C7	0.15	0.07
C8	0.00	0.00
C9	0.00	0.00

ADJUSTED YIELDS (NORMALIZED)	LB/TON	SCF/TON	LB/100 LB F A OIL
C3 & LIGHTER	107.5	1658.5	52.4
SCRUBBED C3 & LIGHTER [LESS CO2 & H2S]	47.2	1035.4	23.0
C4 & HEAVIER	210.7		102.8
TOTAL HYDROCARBONS INCL. H2 & CO, LB/TON	257.9		125.8
C4 & HEAVIER (GAL/TON)		25.0	
API GRAVITY		8.5	

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SAMPLE NO. PB 31

COMPONENT MOLE PERCENT

H2	13.17
CO	4.15
CO2	9.68
H2S	27.17
C1	31.98
C2	6.27
C2-	2.02
C3	2.11
C3-	1.54
I-C4	0.11
N-C4	0.44
C4-	0.77
C5	0.33
C6	0.22
C7	0.03
C8	0.00
C9	0.00
SUM	100.00

AVERAGE MOLE WT 25.30

LBS C IN GAS/TON SHALE 43.79

WT. PERCENT TOTAL CARBON 38.80
WT. PERCENT SULFUR 34.45

BTU VALUE OF GAS (CALC.)		GROSS	NET
C3 & LIGHTER*	(BTU/SCF)	799.20	728.03
SCRUBBED C3 & LIGHTER	(BTU/SCF)	996.73	904.68
WHOLE GAS*	(BTU/SCF)	850.53	775.95
SCRUBBED WHOLE GAS	(BTU/SCF)	1072.08	975.27

*[INCL. H2S & CO2]

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TEXAS EASTERN SYNFUELS
HOUSTON, TX 77001

February 5, 1982

Kind of sample reported to us: Coal, Indiana No. VI Seam

Sample identification by C. T. & E. CO.

Sample taken at: Lynnville Mine
Warrick County, Indiana

Tri-State Synfuels Project
Peabody Coal Company
Lynnville Mine
Plus 1/4" Rd. screen fraction.
PB-32

Sample taken by: CT&E

Date sampled: June 16, 1981

Date received: June 16, 1981 Analysis report no. 71-74302

PROXIMATE ANALYSIS	% Weight As received	% Weight Dry basis
Moisture	10.15	XXXXX
Ash	20.01	22.27
Volatile	31.91	35.52
Fixed Carbon	37.93	42.21
	100.00	100.00
Btu/lb.	9927	11048
Sulfur	3.41	3.79
Alk. as Na_2O	0.47	0.52

MAF 14213

ULTIMATE ANALYSIS	% Weight As received	% Weight Dry basis
Moisture	10.15	XXXXX
Carbon	55.02	61.24
Hydrogen	3.86	4.30
Nitrogen	0.96	1.07
Chlorine	0.04	0.05
Sulfur	3.41	3.79
Ash	20.01	22.27
Oxygen (diff)	6.55	7.28
	100.00	100.00

SULFUR FORMS		
Pyritic Sulfur	2.37	2.64
Sulfate Sulfur	0.08	0.09
Organic Sulfur	0.96	1.06

WATER SOLUBLE ALKALIES		
Na_2O	XXXX	XXXX
K_2O	XXXX	XXXX

MINERAL ANALYSIS OF ASH	% Weight Ignited Basis
Silica, SiO_2	50.40
Alumina, Al_2O_3	20.54
Titania, TiO_2	0.86
Ferric oxide, Fe_2O_3	16.91
Lime, CaO	3.66
Magnesia, MgO	1.02
Potassium oxide, K_2O	2.31
Sodium oxide, Na_2O	0.80
Sulfur trioxide, SO_3	2.96
Phos. pentoxide, P_2O_5	0.38
Strontium Oxide, SrO	0.05
Barium Oxide, BaO	0.05
Manganese Oxide, Mn_3O_4	0.06
Undetermined	0.00
	100.00

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2030 °F	2160 °F
H is Cone Height: Softening (H=W)	2260 °F	2300 °F
W is Cone Width: Softening (H=½W)	2300 °F	2420 °F
Fluid	2500 °F	2535 °F

% EQUILIBRIUM MOISTURE	9.77
HARDGROVE GRINDABILITY INDEX	52 @8.20% moisture
FREE SWELLING INDEX	3
Silica Value	70.01
Base: Acid Ratio	0.34
T_{cv}: Temperature	2495
Fouling Index	0.27
Slagging Index	1.29

ATED VISCOSITY at critical viscosity emperature of 2500°F = 305 poises

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO

L. W. TAYLOR III, Manager, Central Division

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TEXAS EASTERN SYNFUELS
Houston, TX 77001

February 5, 1982

Sample identification by CT&E Company

Kind of sample reported to us	Coal, Indiana No. VI Seam	Tri-State Synfuels Project Peabody Coal Company Lynnville Mine Plus 1/4" Rd. screen fraction. PB-32
Sample taken at	Lynnville, Mine Warrick County, Indiana	
Sample taken by	CT&E	
Date sampled	June 16, 1981	
Date received	June 16, 1981	

Analysis report no. 71-74302

Caking Index (Damm's Method) = 14 - 15

	As Received	Dry Basis
Moisture, %	10.15	XXXXX
Fluorine, (F)[1], ug/g	171	190
Mercury (Hg)[2], ug/g	0.12	0.13

1. Preparation by oxygen bomb combustion; analysis by ion selective electrode. ASTM, Part 26, D3761-79.

2. Preparation by oxygen train combustion; analysis by flameless cold vapor atomic absorption spectroscopy. ASTM, Part 26, D3684-78

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

R. A. HOUSER, Manager, Midwest Division

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TEXAS EASTERN SYNFUELS
Houston, TX 77001

February 5, 1982

Sample identification by CT&E Company

Kind of sample reported to us	Coal, Indiana No. VI Seam	Tri-State Synfuels Project Peabody Coal Company Lynnville Mine
Sample taken at	Lynnville Mine Warrick County, Indiana	Plus 1/4" Rd. screen fraction. PB-32
Sample taken by	CT&E	
Date sampled	June 16, 1981	
Date received	June 16, 1981	

Analysis report no. 71-74302

Alkalies, dry coal basis

	Water soluble	Non Water Soluble
Sodium oxide, Na_2O, ppm	653	996
Potassium oxide, K_2O, ppm	112	4500

% Ash in non water soluble coal = 19.15

% Ash in original sample = 22.27

Alkalies calculated to ignited basis from above:

	Ignited basis
% Sodium oxide, Na_2O	0.81
% Potassium oxide, K_2O	2.40

Respectfully submitted.
COMMERCIAL TESTING & ENGINEERING CO.

R. A. HOUSER, Manager, Midwest Division

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TEXAS EASTERN SYNFUELS, INC.

PAUL WEIR CO. JOB NO. 2753-B

Analysis report No. 71-74302
Date: 10/09/81
Sample No. PB 32
TERMINAL TEMP 932 DEG. F

FISCHER ASSAY YIELDS	AS ANALYZED	NORMALIZED
OIL (LB/TON)	207.4	208.1
(GAL/TON)	23.5	23.6
API GRAVITY	2.4	2.4
GAS (LB/TON)	111.5	111.9
(SCF/TON)	1632.4	1637.9
WATER (LB/TON)	105.2	105.5
(GAL/TON)	12.6	12.6
SS (LB/TON)	1569.2	1574.4
TOTAL (LB/TON)	1993.3	2000.0
VARIANCE (PC)	-0.3	

GAS (NORMALIZED)	(LB/TON)	(LB/100 LB) (FA OIL)
H2	0.86	0.42
CO	5.36	2.57
CO2	19.76	9.49
H2S	37.72	18.12
C1	23.69	11.38
C2	9.51	4.57
C2-	2.56	1.23
C3	4.77	2.29
C3-	3.15	1.51
I-C4	0.14	0.07
N-C4	0.97	0.46
C4-	1.87	0.90
C5	0.59	0.28
C6	0.71	0.34
C7	0.25	0.12
C8	0.00	0.00
C9	0.00	0.00

ADJUSTED YIELDS (NORMALIZED)	LB/TON	SCF/TON	LB/100 LB F A OIL
C3 & LIGHTER	107.4	1610.8	51.8
SCRUBBED C3 & LIGHTER [LESS CO2 & H2S]	49.9	1021.3	24.1
C4 & HEAVIER	212.7		102.5
TOTAL HYDROCARBONS INCL. H2 & CO, LB/TON	262.6		126.6
C4 & HEAVIER (GAL/TON)		24.5	
API GRAVITY		4.3	

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SAMPLE NO. PB 32

COMPONENT MOLE PERCENT

H2	10.01
CO	4.43
CO2	10.39
H2S	25.60
C1	34.26
C2	7.31
C2-	2.12
C3	2.50
C3-	1.73
I-C4	0.06
N-C4	0.38
C4-	0.77
C5	0.19
C6	0.19
C7	0.06
C8	0.00
C9	0.00
SUM	100.00

AVERAGE MOLE WT 25.90

LBS C IN GAS/TON SHALE 45.64

WT. PERCENT TOTAL CARBON 40.79
WT. PERCENT SULFUR 31.72

BTU VALUE OF GAS (CALC.)		GROSS	NET
C3 & LIGHTER*	(BTU/SCF)	835.77	762.10
SCRUBBED C3 & LIGHTER	(BTU/SCF)	1055.91	960.04
WHOLE GAS*	(BTU/SCF)	879.77	803.22
SCRUBBED WHOLE GAS	(BTU/SCF)	1118.96	1019.16

*[INCL. H2S & CO2]

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GENERAL OFFICES 220 NORTH LA SALLE STREET, CHICAGO, ILLINOIS 60601 · AREA CODE 312 726-8434

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P.O. BOX 752, HENDERSON, KY 42420
OFFICE TEL. (502) 827-1187

TEXAS EASTERN SYNFUELS
HOUSTON, TX 77001

February 5, 1982

Kind of sample reported to us: Coal, Indiana No. VI Seam

Sample identification by C. T. & E. CO.

Sample taken at: Lynnville Mine
Warrick County, Indiana

Sample taken by: CT&E

Date sampled: June 16, 1981

Tri-State Synfuels Project
Peabody Coal Company
Lynnville Mine
Minus 1/4" Rd. screen fraction.
PB-33

Date received: June 16, 1981 Analysis report no. 71-74303

PROXIMATE ANALYSIS	% Weight As received	% Weight Dry basis
Moisture	10.23	XXXXX
Ash	27.85	31.02
Volatile	28.35	31.58
Fixed Carbon	33.57	37.40
	100.00	100.00
Btu/lb.	8551	9526
Sulfur	3.62	4.03
Alk. as Na_2O	0.62	0.69
SULFUR FORMS		
Pyritic Sulfur	2.64	2.94
Sulfate Sulfur	0.11	0.12
Organic Sulfur	0.87	0.97
WATER SOLUBLE ALKALIES		
Na_2O	XXXX	XXXX
K_2O	XXXX	XXXX

MAF 13810

ULTIMATE ANALYSIS	% Weight As received	% Weight Dry basis
Moisture	10.23	XXXXX
Carbon	47.68	53.11
Hydrogen	3.26	3.63
Nitrogen	0.47	0.52
Chlorine	0.06	0.07
Sulfur	3.62	4.03
Ash	27.85	31.02
Oxygen (diff)	6.83	7.62
	100.00	100.00

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2140 °F	2230 °F
H is Cone Height — Softening (H=W)	2270 °F	2330 °F
W is Cone Width — Softening (H=½W)	2310 °F	2430 °F
Fluid	2480 °F	2530 °F
% EQUILIBRIUM MOISTURE	9.54	
HARDGROVE GRINDABILITY INDEX	68 @7.50% moisture	
FREE SWELLING INDEX	1	
Silica Value	64.86	
Base. Acid Ratio	0.43	
T_{250} Temperature	2375	

MINERAL ANALYSIS OF ASH	% Weight Ignited Basis
Silica, SiO_2	47.39
Alumina, Al_2O_3	18.74
Titania, TiO_2	0.81
Ferric oxide, Fe_2O_3	15.99
Lime, CaO	8.71
Magnesia, MgO	0.97
Potassium oxide, K_2O	2.13
Sodium oxide, Na_2O	0.83
Sulfur trioxide, SO_3	3.23
Phos. pentoxide, P_2O_5	0.28
Strontium Oxide, SrO	0.03
Barium Oxide, BaO	0.06
Manganese Oxide, Mn_3O_4	0.07
Undetermined	0.76
	100.00
Fouling Index	0.36
Slagging Index	1.73

:: ATED VISCOSITY at critical viscosity
emperature of 2510°F = 115 poises

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO

L. W. TAYLOR III, Manager, Central Division

D-55

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16130 VAN DRUNEN RD., P.O. BOX 127
SOUTH HOLLAND, IL 60473
OFFICE TEL. (312) 264-1173

TEXAS EASTERN SYNFUELS
Houston, TX 77001

February 5, 1982

Sample identification by CT&E Company

Kind of sample reported to us	Coal, Indiana No. VI Seam	Tri-State Synfuels Project Peabody Coal Company Lynnville Mine
Sample taken at	Lynnville, Mine Warrick County, Indiana	Minus 1/4" Rd. screen fraction. PB-33
Sample taken by	CT&E	
Date sampled	June 16, 1981	
Date received	June 16, 1981	

Analysis report no. 71-74303

Caking Index (Damm's Method) = 11 - 12

	As Received	Dry Basis
Moisture, %	10.23	XXXXX
Fluorine, (F)[1], ug/g	215	240
Mercury (Hg)[2], ug/g	0.11	0.12

1. Preparation by oxygen bomb combustion; analysis by ion selective electrode. ASTM, Part 26, D3761-79.

2. Preparation by oxygen train combustion; analysis by flameless cold vapor atomic absorption spectroscopy. ASTM, Part 26, D3684-78

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

R. A. HOUSER, Manager, Midwest Division

D-54.

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F-454

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SOUTH HOLLAND, IL 60473
OFFICE TEL. (312) 264-1173

TEXAS EASTERN SYNFUELS
Houston, TX 77001

February 5, 1982

Sample identification by CT&E Company

Kind of sample reported to us	Coal, Indiana No. VI Seam	Tri-State Synfuels Project Peabody Coal Company Lynnville Mine Minus 1/4" Rd. screen fraction. PB-33
Sample taken at	Lynnville Mine Warrick County, Indiana	
Sample taken by	CT&E	
Date sampled	June 16, 1981	
Date received	June 16, 1981	

Analysis report no. 71-74303

Alkalies, dry coal basis

	Water soluble	Non Water Soluble
Sodium oxide, Na_2O, ppm	910	1682
Potassium oxide, K_2O, ppm	136	6195

% Ash in non water soluble coal = 29.50

% Ash in original sample = 31.02

Alkalies calculated to ignited basis from above:

	Ignited basis
% Sodium oxide, Na_2O	0.86
% Potassium oxide, K_2O	2.14

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

R. A. HOUSER, Manager, Midwest Division

Charter Member

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dh

TEXAS EASTERN SYNFUELS, INC.

PAUL WEIR CO. JOB NO. 2753-B

Analysis report No. 71-74303
Date: 09/03/81
Sample No. PB 33
TERMINAL TEMP 932 DEG. F

FISCHER ASSAY YIELDS	AS ANALYZED	NORMALIZED
OIL (LB/TON)	248.5	247.8
(GAL/TON)	28.1	28.0
API GRAVITY	1.8	1.8
GAS (LB/TON)	93.0	92.8
(SCF/TON)	7.9	1394.1
WATER (LB/TON)	64.1	63.9
(GAL/TON)	7.7	7.7
SS (LB/TON)	1599.7	1595.4
TOTAL (LB/TON)	2005.4	2000.0
VARIANCE (PC)	0.3	

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GAS (NORMALIZED)	(LB/TON)	(LB/100 LB) (FA OIL)
H2	0.93	0.38
CO	5.01	2.02
CO2	18.62	7.51
H2S	22.80	9.20
C1	20.48	8.26
C2	9.73	3.92
C2-	2.24	0.90
C3	4.60	1.85
C3-	3.16	1.27
I-C4	0.26	0.10
N-C4	1.06	0.43
C4-	1.77	0.72
C5	0.95	0.38
C6	0.76	0.31
C7	0.44	0.18
C8	0.00	0.00
C9	0.00	0.00

ADJUSTED YIELDS (NORMALIZED)	LB/TON	SCF/TON	LB/100 LB F A OIL
C3 & LIGHTER	87.5	1363.4	35.2
SCRUBBED C3 & LIGHTER [LESS CO2 & H2S]	46.1	949.7	18.6
C4 & HEAVIER	253.1		101.8
TOTAL HYDROCARBONS INCL. H2 & CO, LB/TON	299.2		120.4
C4 & HEAVIER (GAL/TON)		29.0	
API GRAVITY		3.7	

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SAMPLE NO. PB 33

COMPONENT MOLE PERCENT

H2	12.64
CO	4.86
CO2	11.50
H2S	18.17
C1	34.29
C2	8.78
C2-	2.17
C3	2.83
C3-	2.04
I-C4	0.12
N-C4	0.50
C4-	0.86
C5	0.36
C6	0.24
C7	0.12
C8	0.00
C9	0.00
SUM	100.00

AVERAGE MOLE WT	25.22
LBS C IN GAS/TON SHALE	43.13
WT. PERCENT TOTAL CARBON	46.49
WT. PERCENT SULFUR	23.12

BTU VALUE OF GAS (CALC.)		GROSS	NET
C3 & LIGHTER*	(BTU/SCF)	850.98	775.31
SCRUBBED C3 & LIGHTER	(BTU/SCF)	1051.27	955.84
WHOLE GAS*	(BTU/SCF)	911.03	831.39
SCRUBBED WHOLE GAS	(BTU/SCF)	1130.39	1029.92

*[INCL. H2S & CO2]

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APPENDIX D-4

Camp 11 Mine - Kentucky No. 11 Seam

	Page
TG-19 - Total Product: a-d, f-o	D-59
TG-20 - 2" Rd. x 1/4" Rd.: a-k, n-o	D-66
TG-21 - 1/4" Rd. x 0: a-d, f-k, n-o	D-72

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PLEASE ADDRESS ALL CORRESPONDENCE TO
P.O. BOX 752, HENDERSON, KY 42420
OFFICE TEL. (502) 827-1187

TEXAS EASTERN SYNFUELS
Houston, TX 77001

August 18, 1981

Kind of sample reported to us	Coal	Sample identification by	CT&E Company
Sample taken at	Peabody Camp #11 Uniontown, Kentucky		Tri-State Synfuels Project Peabody Coal Company Camp #11
Sample taken by	CT&E		Crushed Raw Coal - Total Product TG19
Date sampled	June 19, 1981		
Date received	June 19, 1981	Analysis report no.	63-135924

PROXIMATE ANALYSIS	% Weight As received	% Weight Dry basis
Moisture	11.11	XXXXX
Ash	25.27	28.43
Volatile	30.33	34.12
Fixed Carbon	33.29	37.45
	100.00	100.00
Btu/lb.	8886	9997
Sulfur	3.41	3.84
Alk. as Na_2O	0.77	0.87
SULFUR FORMS		
Pyritic Sulfur	2.03	2.28
Sulfate Sulfur	0.02	0.02
Organic Sulfur	1.36	1.54
	3.41	3.84
WATER SOLUBLE ALKALIES		
Na_2O	XXXX	XXXX
K_2O	XXXX	XXXX

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2050 °F	2320 °F
H is Cone Height — Softening (H=W)	2160 °F	2390 °F
W is Cone Width — Softening (H=½W)	2200 °F	2430 °F
Fluid	2350 °F	2470 °F

% EQUILIBRIUM MOISTURE 8.10
HARDGROVE GRINDABILITY INDEX 52.3 at 7.35% Moisture
FREE SWELLING INDEX 2 1/2

Silica Value 74.04
Base: Acid Ratio 0.30
T_{250} Temperature 2543

ESTIMATED VISCOSITY at critical viscosity temperature of 2400°F = GT2000

ULTIMATE ANALYSIS		% Weight As received	% Weight Dry basis
Moisture		11.11	XXXXX
Carbon		48.81	54.91
Hydrogen		3.50	3.94
Nitrogen		0.69	0.78
Chlorine		0.04	0.05
Sulfur	MAF 13968	3.41	3.84
Ash		25.27	28.43
Oxygen (diff)		7.17	8.05
		100.00	100.00

MINERAL ANALYSIS OF ASH	% Weight Ignited Basis
Silica, SiO_2	52.08
Alumina, Al_2O_3	20.29
Titania, TiO_2	0.91
Ferric oxide, Fe_2O_3	12.75
Lime, CaO	4.37
Magnesia, MgO	1.14
Potassium oxide, K_2O	3.01
Sodium oxide, Na_2O	1.08
Sulfur trioxide, SO_3	2.64
Phos. pentoxide, P_2O_5	1.07
Strontium Oxide, SrO	0.00
Barium Oxide, BaO	0.08
Manganese Oxide, Mn_3O_4	0.06
Undetermined	0.52
	100.00

Fouling Index 0.3
Slagging Index 1.2

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO

L. W. TAYLOR III, Manager, Central Division

D-59.

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December 17, 1981

TEXAS EASTERN SYNFUELS, INC.
Houston, TX 77001

Sample identification by CT&E Company

Kind of sample reported to us	Coal	Tri-State Synfuels Project Peabody Coal Company Camp No. 11 Crushed Raw Coal - Total Product TG19
Sample taken at	Peabody Camp #11 Uniontown, Kentucky	
Sample taken by	CT&E	
Date sampled	June 19, 1981	
Date received	June 19, 1981	

Analysis report no. 63-135924

Caking Index (Damm's Method) = 10-11

	As Received	Dry Basis
Moisture, %	11.11	XXXX
Fluorine (F)[1], µg/g	440	500
Mercury (Hg)[2], µg/g	0.07	0.08

1. Preparation by oxygen bomb combustion; analysis by ion selective electrode. ASTM, Part 26, D3761-79
2. Preparation by oxygen train combustion; analysis by flameless cold vapor atomic absorption spectroscopy. ASTM, Part 26, D3684-78

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

L. W. TAYLOR III, Manager, Central Division

D-60.

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LT/mc

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OFFICE TEL. (502) 827-1187

TEXAS EASTERN SYNFUELS
Houston, TX 77001

August 18, 1981

Sample Identification
by CT&E Company

Tri-State Synfuels Project
Peabody Coal Company
Camp #11
Crushed Raw Coal - Total Product
TG19

Kind of sample reported to us Coal

Sample taken at Peabody Camp #11
Uniontown, Kentucky

Sample taken by CT&E

Date sampled June 19, 1981

Date received June 19, 1981

Analysis report no. 63-135924

Alkalies, dry coal basis

	Water Soluble	Non Water Soluble
Sodium oxide, Na_2O, ppm	1460	1189
Potassium oxide, K_2O, ppm	183	7966

% Ash in non water soluble coal = 25.29

% Ash in original sample = 28.43

Alkalies calculated to ignited basis from above:

	Ignited basis
% Sodium oxide, Na_2O	0.98
% Potassium oxide, K_2O	3.12

LT/kmc

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

L. W. TAYLOR III, Manager, Central Division

D-61.

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CENTRAL DIVISION MANAGER
L.W. TAYLOR III

PLEASE ADDRESS ALL CORRESPONDENCE TO:
P.O. BOX 752, HENDERSON, KY 42420
OFFICE TEL. (502) 827-1157

December 15, 1981

TEXAS EASTERN SYNFUELS, INC.
Houston, TX 77001

Lab No. 63-135924

Tri-State Synfuels Project
Peabody Coal Company
Camp No. 11
Crushed Raw Coal - Total Product
TG19

SPARK SOURCE MASS SPECTROGRAPHIC ANALYSIS
CONCENTRATION IN PPM WEIGHT

ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.
Uranium	8 (7.1)	Terbium	0.4	Ruthenium		Vanadium	68
Thorium	5	Gadolinium	1	Molybdenum	3	Titanium	MC
Bismuth		Europium	0.2	Niobium	12	Scandium	2
Lead	17	Samarium	3	Zirconium	59	Calcium	MC
Thallium		Neodymium	4	Yttrium	7	Potassium	MC
Mercury	NR	Praseodymium	4	Strontium	36	Chlorine	130
Gold		Cerium	42	Rubidium	63	Sulfur	MC
Platinum		Lanthanum	24	Bromine	3	Phosphorus	MC
Iridium		Barium	240	Selenium	3	Silicon	MC
Osmium		Cesium	3	Arsenic	8	Aluminum	MC
Rhenium		Iodine	0.3	Germanium	2	Magnesium	MC
Tungsten		Tellurium	0.3	Gallium	13	Sodium	MC
Tantalum		Antimony	0.2	Zinc	*27	Fluorine	NR
Hafnium	0.5	Tin	0.8	Copper	31	Oxygen	NR
Lutetium		Indium	STD	Nickel	17	Nitrogen	NR
Ytterbium		Cadmium	0.3	Cobalt	7	Carbon	NR
Thulium	< 0.1	Silver		Iron	MC	Boron	21
Erbium	0.8	Palladium		Manganese	46	Beryllium	0.2
Holmium	1	Rhodium		Chromium	10	Lithium	< 0.1
Dysprosium	2	*Heterogeneous		Neptunium	<0.1ppm	Hydrogen	NR

STD - Internal Standard
NR - Not Reported
All elements not detected < 0.1ppm
MC - Major Component
INT - Interference

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Lloyd W. Taylor, III
Manager, Central Division

D-62.

OVER 40 BRANCH LABORATORIES STRATEGICALLY LOCATED IN PRINCIPAL COAL MINING AREAS, TIDEWATER AND GREAT LAKES PORTS, AND RIVER LOADING FACILITIES

TABLE NO. I
Trace Elements by Atomic Absorption
(concentration in ug/g)

Parameter	OB-1 As Rec'd	OB-1 Dry	PB-28 As Rec'd	PB-28 Dry	PB-31 As Rec'd	PB-31 Dry	TG-19 As Rec'd	TG-19 Dry	IC-35 As Rec'd	IC-35 Dry
Moisture (%)[1]	11.28	XXXX	11.67	XXXX	9.49	XXXX	11.11	XXXX	7.49	XXXX
Antimony	0.3	0.3	0.5	0.6	0.1	0.1	0.2	0.2	0.4	0.4
Arsenic	11.0	12.4	22.5	25.5	4.3	4.8	3.0	3.4	4.6	5
Beryllium	2	2	2	2	2	2	1	1	1	1
Boron[2]	140	160.00	140	160	160	180	160	180	150	160
Cadmium	0.8	0.9	0.2	0.2	0.2	0.2	0.4	0.4	0.6	0.6
Chromium	25	28	14	16	21	23	43	48	25	27
Copper	25	28	13	15	17	19	20	31	20	22
Fluorine[3]	130	150	95	110	130	140	440	500	150	160
Lead	4	4	20	23	4	4	4	4	37	40
Lithium	19	21	11	13	25	28	23	26	17	18
Manganese	64	72	57	65	66	73	84	94	113	122
Mercury	0.12	0.14	0.09	0.10	0.10	0.11	0.07	0.08	0.15	0.16
Nickel	18	20	24	27	21	23	29	33	15	16
Selenium	2.4	2.7	1.1	1.3	1.4	1.5	2.8	3.2	3.1	3.4
Uranium[4]	2.1	2.4	1.3	1.5	1.9	2.1	6.3	7.1	3.3	3.6
Vanadium	37	42	24	27	52	58	77	87	59	64
Zinc	121	136	87	98	63	70	85	96	92	99

1 Determination by ASTM Method D3173
2 Determination by curcumin colorimetric technique
3 Determination by ASTM Method D3761
4 Determination by delayed neutron activation

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DATE : 10/2[illegible]/81

SAMPLE NUMBER RF2-6963
SAMPLE DESCRIPTION CT&E Lab No. 63-135924, TG19
TERMINAL TEMP 932 DEG. F
FISHER ASSAY NO. PB 2306

FISCHER ASSAY YIELDS	AS ANALYZED	NORMALIZED
OIL (LB/TON)	225.0	226.7
(GAL/TON)	25.3	25.5
API GRAVITY	1.5	1.5
GAS (LB/TON)	90.1	90.8
(SCF/TON)	1397.0	1407.5
WATER (LB/TON)	70.7	71.2
(GAL/TON)	8.5	8.5
SS (LB/TON)	1599.2	1611.3
TOTAL (LB/TON)	1985.1	2000.0
VARIANCE (PC)	-0.7	

GAS (NORMALIZED)	(LB/TON)	(LB/100 LB) (FA OIL)
H2	0.81	0.36
CO	5.52	2.43
CO2	15.07	6.65
H2S	21.03	9.28
C1	23.85	10.52
C2	10.05	4.43
C2-	2.40	1.06
C3	4.53	2.00
C3-	2.88	1.27
I-C4	0.15	0.07
N-C4	1.00	0.44
C4-	1.92	0.85
C5	0.61	0.27
C6	0.73	0.32
C7	0.25	0.11
C8	0.00	0.00
C9	0.00	0.00

ADJUSTED YIELDS (NORMALIZED)	LB/TON	SCF/TON	LB/100 LB F A OIL
C3 & LIGHTER	86.1	1379.6	38.3
SCRUBBED C3&LIGHTER [LESS CO2 & H2S]	50.0	1016.1	22.2
C4 & HEAVIER	231.4		102.8
TOTAL HYDROCARBONS INCL. H2 & CO, LB/TON	281.4		125.1
C4 & HEAVIER (GAL/TON)		26.4	
API GRAVITY		3.4	

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GAS ANALYSIS

SAMPLE NUMBER	RF2-6963
SAMPLE DESCRIPTION	CT&E Lab No. 63-135924, TG19
FISCHER ASSAY NO.	PB 2306

COMPONENT	MOLE PERCENT
H2	10.84
CO	5.30
CO2	9.23
H2S	16.61
C1	40.13
C2	8.99
C2-	2.31
C3	2.77
C3-	1.85
I-C4	0.07
N-C4	0.46
C4-	0.92
C5	0.23
C6	0.23
C7	0.07
C8	0.00
C9	0.00
SUM	100.00

AVERAGE MOLE WT	24.45
LBS C IN GAS/TON SHALE	44.54
WT. PERCENT TOTAL CARBON	49.05
WT. PERCENT SULFUR	21.79

BTU VALUE OF GAS (CALC.)		GROSS	NET
C3 & LIGHTER*	(BTU/SCF)	888.90	809.67
SCRUBBED C3 & LIGHTER	(BTU/SCF)	1060.03	963.82
WHOLE GAS*	(BTU/SCF)	940.58	858.00
SCRUBBED WHOLE GAS	(BTU/SCF)	1125.12	1024.86

*[INCL. H2S & CO2]

Identification:

Tri-State Synfuels Project
Peabody Coal Company
Camp No. 11
Crushed Raw Coal - Total Product
TG19

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PLEASE ADDRESS ALL CORRESPONDENCE TO.
P.O. BOX 752, HENDERSON, KY 42420
OFFICE TEL. (502) 827-1187

TEXAS EASTERN SYNFUELS
Houston, TX 77001

August 18, 1981

Kind of sample reported to us: Coal

Sample taken at: Peabody Camp #11, Uniontown, Kentucky

Sample taken by: CT&E

Date sampled: June 19, 1981

Date received: June 19, 1981

Analysis report no. 63-136315

Sample identification by CT&E Company

Tri-State Synfuels Project
Peabody Coal Company
Peabody Camp #11
Plus 1/4" Rd. Screen Fraction
TG20

PROXIMATE ANALYSIS	% Weight As received	% Weight Dry basis
Moisture	10.94	XXXXX
Ash	25.65	28.80
Volatile	30.33	34.06
Fixed Carbon	33.08	37.14
	100.00	100.00
Btu/lb.	8822	9906
Sulfur	3.74	4.20
Alk. as Na_2O	0.76	0.85

SULFUR FORMS		
Pyritic Sulfur	2.21	2.48
Sulfate Sulfur	0.03	0.03
Organic Sulfur	1.50	1.69
	3.74	4.20

WATER SOLUBLE ALKALIES		
Na_2O	XX	XXXX
K_2O	XXXX	XXXX

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	°F	°F
Softening (H=W)	2080 °F	2400 °F
Softening (H=½W)	2200 °F	2450 °F
Fluid	2240 °F	2500 °F
% EQUILIBRIUM MOISTURE	2340	2540
HARDGROVE GRINDABILITY INDEX	7.64	
FREE SWELLING INDEX	52.0 at 4.95% Moisture	
	2 1/2	
Silica Value	72.48	
Base: Acid Ratio	0.33	
T_{250} Temperature	2515	

ULTIMATE ANALYSIS	% Weight As received	% Weight Dry basis
Moisture	10.94	XXXXX
Carbon	48.87	54.87
Hydrogen	3.62	4.06
Nitrogen	0.87	0.93
Chlorine	0.04	0.05
Sulfur	3.74	4.20
Ash	25.65	28.80
Oxygen (diff)	6.31	7.04
	100.00	100.00

MAF 13913

MINERAL ANALYSIS OF ASH	% Weight Ignited Basis
Silica, SiO_2	51.77
Alumina, Al_2O_3	19.89
Titania, TiO_2	0.89
Ferric oxide, Fe_2O_3	14.12
Lime, CaO	4.21
Magnesia, MgO	1.33
Potassium oxide, K_2O	2.88
Sodium oxide Na_2O	1.09
Sulfur trioxide, SO_3	2.32
Phos. pentoxide, P_2O_5	1.37
Strontium Oxide, SrO	0.00
Barium Oxide BaO	0.09
Manganese Oxide, Mn_3O_4	0.04
Undetermined	0.00
	100.00

Fouling Index 0.4
Slagging Index 1.4

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

L. W. TAYLOR III, Manager, Central Division

D-66.

Charter Member

...ATED VISCOSITY at critical viscosity temperature of 2440°F = 920 poises

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OFFICE TEL. (502) 827-1187

September 18, 1981

TEXAS EASTERN SYNFUELS
Houston, TX 77001

Sample identification by CT&E Company

Kind of sample reported to us: Coal

Sample taken at: Peabody Camp #11
Uniontown, Kentucky

Sample taken by: CT&E

Date sampled: June 19, 1981

Date received: June 19, 1981

Tri-State Synfuels Project
Peabody Coal Company
Peabody Camp #11
Plus 1/4" Rd. Screen Fraction
TG20

Analysis report no. 63-136315

TUMBLER TEST FOR COAL - ASTM D 441-45 (1975)

Retained on	Passing	Weight Percent (1)	Average of Sieve Openings Inches (2)	Factor (3)	Product of (1) x (3)
1.06 in.	1.50 in.	100.0	1.280	1	100.00 = S
1.06 in.	1.50 in.	43.0	1.280	1	43.0
0.750 in.	1.06 in.	25.0	0.905	0.7	17.50
0.530 in.	0.750 in.	9.0	0.640	0.5	4.50
0.375 in.	0.530 in.	3.2	0.452	0.35	1.12
0.0469 in.	0.375 in.	5.0	0.211	0.16	.80
0.0117 in.	0.0469 in.	3.6	0.029	0.023	.0828
	0.0117 in.	11.2	0.006	0.005	.0560
Total (Sum of Products (1) x (3)					67.06 = s

Friability, 33.0 percent: with dust index of 11

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

L. W. TAYLOR III, Manager, Central Division

D-67.

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OVER 40 BRANCH LABORATORIES STRATEGICALLY LOCATED IN PRINCIPAL COAL MINING AREAS, TIDEWATER AND GREAT LAKES PORTS, AND RIVER LOADING FACILITIES

-464

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P.O. BOX 752, HENDERSON, KY 42420
OFFICE TEL. (502) 827-1187

January 4, 1982

TEXAS EASTERN SYNFUELS, INC.
Houston, TX 77001

Sample identification by CT&E Company

Kind of sample reported to us	Coal	Tri-State Synfuels Project
Sample taken at	Peabody Camp #11 Uniontown, Kentucky	Peabody Coal Company Peabody Camp #11
Sample taken by	CT&E	Plus 1/4" Rd. Screen Fraction TG20
Date sampled	June 19, 1981	
Date received	June 19, 1981	

Analysis report no. 63-136315

Caking Index (Damm's Method) = 12 - 13

	As Received	Dry Basis
Moisture, %	10.94	XXXX
Fluorine (F)[1], µg/g	500	560
Mercury (Hg)[2], µg/g	0.02	0.02

1. Preparation by oxygen bomb combustion; analysis by ion selective electrode. ASTM, Part 26, D3761-79

2. Preparation by oxygen train combustion; analysis by flameless cold vapor atomic absorption spectroscopy. ASTM, Part 26, D3684-78

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

L. W. TAYLOR III, Manager, Central Division

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D-68.

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OFFICE TEL. (502) 827-1187

TEXAS EASTERN SYNFUELS
Houston, TX 77001

August 19, 1981

Sample identification by CT&E Company

Kind of sample reported to us: Coal

Sample taken at: Peabody Camp #11, Uniontown, Kentucky

Sample taken by: CT&E

Date sampled: June 19, 1981

Date received: June 19, 1981

Tri-State Synfuels Project
Peabody Coal Company
Peabody Camp #11
Plus 1/4" Rd. Screen Fraction
TG20

Analysis report no. F3-136315

Alkalies, dry coal basis

	Water Soluble	Non Water Soluble
Sodium oxide, Na_2O, ppm	1400	1175
Potassium oxide, K_2O, ppm	175	7550

% Ash in non water soluble coal = 25.00

% Ash in original sample = 28.80

Alkalies calculated to ignited basis from above:

	Ignited basis
% Sodium oxide, Na_2O	0.96
% Potassium oxide, K_2O	3.08

LT/kmc

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

L. W. TAYLOR III, Manager, Central Division D-69.

Charter Member

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DATE : 10/29/81

SAMPLE NUMBER RF2-6964
SAMPLE DESCRIPTION CT&E Lab No. 63-136315, TG20
TERMINAL TEMP 932 DEG. F
FISHER ASSAY NO. FB 2307

USE OR DISCLOSURE OF REPORT DATA IS SUBJECT TO THE RESTRICTION ON THE NOTICE PAGE AT THE FRONT OF THIS REPORT

FISCHER ASSAY YIELDS	AS ANALYZED	NORMALIZED
OIL (LB/TON)	249.7	251.6
(GAL/TON)	28.1	28.3
API GRAVITY	1.3	1.3
GAS (LB/TON)	88.0	88.7
(SCF/TON)	1343.4	1353.7
WATER (LB/TON)	63.3	63.8
(GAL/TON)	7.6	7.6
SS (LB/TON)	1583.6	1595.9
TOTAL (LB/TON)	1984.7	2000.0
VARIANCE (PC)	-0.8	

GAS (NORMALIZED)	(LB/TON)	(LB/100 LB) (FA OIL)
H2	0.66	0.26
CO	5.32	2.12
CO2	13.46	5.35
H2S	21.43	8.52
C1	23.15	9.20
C2	10.20	4.06
C2-	2.32	0.92
C3	4.74	1.88
C3-	2.78	1.11
I-C4	0.48	0.19
N-C4	0.96	0.38
C4-	1.86	0.74
C5	0.59	0.23
C6	0.70	0.28
C7	0.00	0.00
C8	0.00	0.00
C9	0.00	0.00

ADJUSTED YIELDS (NORMALIZED)	LB/TON	SCF/TON	LB/100 LB F A OIL
C3 & LIGHTER	84.1	1325.5	33.7
SCRUBBED C3&LIGHTER [LESS CO2 & H2S]	49.2	971.4	19.7
C4 & HEAVIER	256.2		102.6
TOTAL HYDROCARBONS INCL. H2 & CO, LB/TON	305.4		122.3
C4 & HEAVIER (GAL/TON)		29.2	
API GRAVITY		3.0	

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GAS ANALYSIS

USE OR DISCLOSURE OF REPORT DATA IS SUBJECT TO THE RESTRICTION ON THE NOTICE PAGE AT THE FRONT OF THIS REPORT

SAMPLE NUMBER RF2-6964
SAMPLE DESCRIPTION CT&E Lab No. 63-136315, TG20
FISCHER ASSAY NO. FR 2307

COMPONENT	MOLE PERCENT
H2	9.26
CO	5.32
CO2	8.56
H2S	17.59
C1	40.51
C2	9.49
C2-	2.31
C3	3.01
C3-	1.85
I-C4	0.23
N-C4	0.46
C4-	0.93
C5	0.23
C6	0.23
C7	0.00
C8	0.00
C9	0.00
SUM	100.00

AVERAGE MOLE WT 24.82

LBS C IN GAS/TON SHALE 43.56

WT. PERCENT TOTAL CARBON 49.13
WT. PERCENT SULFUR 22.74

BTU VALUE OF GAS (CALC.)		GROSS	NET
C3 & LIGHTER*	(BTU/SCF)	910.52	829.86
SCRUBBED C3 & LIGHTER	(BTU/SCF)	1085.81	987.87
WHOLE GAS*	(BTU/SCF)	962.63	878.58
SCRUBBED WHOLE GAS	(BTU/SCF)	1151.43	1049.40

*[INCL. H2S & CO2]

Identification:

Tri-State Synfuels Project
Peabody Coal Company
Peabody Camp #11
Plus 1/4" Rd. Screen Fraction
TG20

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OFFICE TEL. (502) 827-1187

August 17, 1981

TEXAS EASTERN SYNFUELS
Houston, TX 77001

Kind of sample reported to us	Coal	Sample identification by	CT&E Company
Sample taken at	Peabody Camp #11 Uniontown, Kentucky		Tri-State Synfuels Project Peabody Coal Company Peabody Camp #11 Minus 1/4" Rd. Screen Fraction TG21
Sample taken by	CT&E		
Date sampled	June 19, 1981		
Date received	June 19, 1981	Analysis report no.	63-136316

PROXIMATE ANALYSIS	% Weight As received	% Weight Dry basis
Moisture	12.36	XXXXX
Ash	28.80	32.86
Volatile	27.90	31.83
Fixed Carbon	30.94	35.31
	100.00	100.00
Btu/lb.	8092	9233 MAF 13752
Sulfur	3.14	3.58
Alk. as Na_2O	0.94	1.07

ULTIMATE ANALYSIS	% Weight As received	% Weight Dry basis
Moisture	12.36	XXXXX
Carbon	45.47	51.88
Hydrogen	3.27	3.73
Nitrogen	0.79	0.95
Chlorine	0.06	0.07
Sulfur	3.14	3.58
Ash	28.80	32.86
Oxygen (diff)	6.11	6.93
	100.00	100.00

SULFUR FORMS		
Pyritic Sulfur	1.79	2.04
Sulfate Sulfur	0.04	0.04
Organic Sulfur	1.31	1.50
	3.14	3.58

WATER SOLUBLE ALKALIES		
Na_2O	XXXX	XXXX
K_2O	XXXX	XXXX

MINERAL ANALYSIS OF ASH	% Weight Ignited Basis
Silica, SiO_2	52.72
Alumina, Al_2O_3	20.18
Titania, TiO_2	0.92
Ferric oxide, Fe_2O_3	11.49
Lime, CaO	4.58
Magnesia, MgO	1.48
Potassium oxide, K_2O	3.18
Sodium oxide, Na_2O	1.15
Sulfur trioxide, SO_3	2.45
Phos. pentoxide, P_2O_5	0.80
Strontium Oxide, SrO	0.00
Barium Oxide, BaO	0.11
Manganese Oxide, Mn_3O_4	0.05
Undetermined	0.89
	100.00

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2090 °F	2360 °F
H is Cone Height: Softening (H=W)	2170 °F	2410 °F
W is Cone Width: Softening (H=½W)	2200 °F	2450 °F
Fluid	2360 °F	2500 °F

% EQUILIBRIUM MOISTURE	8.40
HARDGROVE GRINDABILITY INDEX	59.8 at 7.38% Moisture
FREE SWELLING INDEX	2 1/2
Silica Value	75.02
Base: Acid Ratio	0.30
T_{250} Temperature	2558
Fouling Index	0.3
Slagging Index	1.1

ESTIMATED VISCOSITY at critical viscosity temperature of 2400°F = GT 2000 poises

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

L.W. TAYLOR III, Manager, Central Division

D-72.

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OFFICE TEL. (502) 827-1187

January 4, 1982

TEXAS EASTERN SYNFUELS, INC.
Houston, TX 77001

Sample identification by CT&E Company

Kind of sample reported to us	Coal	Tri-State Synfuels Project
Sample taken at	Peabody Camp #11 Uniontown, Kentucky	Peabody Coal Company Peabody Camp #11
Sample taken by	CT&E	Minus 1/4" Rd. Screen Fraction
Date sampled	June 19, 1981	TG21
Date received	June 19, 1981	

Analysis report no. 63-136316

Caking Index (Damm's Method) = 10 - 11

	As Received	Dry Basis
Moisture, %	12.36	XXXX
Fluorine (F)[1], µg/g	390	440
Mercury (Hg)[2], µg/g	0.03	0.03

1. Preparation by oxygen bomb combustion; analysis by ion selective electrode. ASTM, Part 26, D3761-79

2. Preparation by oxygen train combustion; analysis by flameless cold vapor atomic absorption spectroscopy. ASTM, Part 26, D3684-78

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

L. W. TAYLOR III, Manager, Central Division

Charter Member

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D-73.

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August 17, 1981

TEXAS EASTERN SYNFUELS
Houston, TX 77001

Sample identification by CT&E Company

Kind of sample reported to us	Coal	Tri-State Synfuels Project
Sample taken at	Peabody Camp #11 Uniontown, Kentucky	Peabody Coal Company Peabody Camp #11 Minus 1/4" Rd. Screen Fraction TG21
Sample taken by	CT&E	
Date sampled	June 19, 1981	
Date received	June 19, 1981	

Analysis report no. 63-136316

Alkalies, dry coal basis

	Water Soluble	Non Water Soluble
Sodium oxide, Na_2O	1615	1183
Potassium oxide, K_2O, ppm	191	8806

% Ash in non water soluble coal = 27.52

% Ash in original sample = 32.86

Alkalies calculated to ignited basis from above:

	Ignited basis
% Sodium oxide, Na_2O	0.92
% Potassium oxide, K_2O	3.26

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

L. W. TAYLOR III, Manager, Central Division

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D-74.

Charter Member

DATE : 11

SAMPLE NUMBER	RF 2-6965
SAMPLE DESCRIPTION	CT&E Lab No. 63-136316, TG21
TERMINAL TEMP	932 DEG. F
FISHER ASSAY NO.	PB 2323

USE OR DISCLOSURE OF REPORT DATA IS SUBJECT TO THE RESTRICTION ON THE NOTICE PAGE AT THE FRONT OF THIS REPORT

FISCHER ASSAY YIELDS	AS ANALYZED	NORMALIZED
OIL (LB/TON)	204.8	205.8
(GAL/TON)	23.1	23.2
API GRAVITY	1.8	1.8
GAS (LB/TON)	76.1	76.5
(SCF/TON)	1185.4	1191.1
WATER (LB/TON)	71.4	71.8
(GAL/TON)	8.6	8.6
SS (LB/TON)	1638.2	1646.0
TOTAL (LB/TON)	1990.6	2000.0
VARIANCE (PC)	-0.5	

GAS (NORMALIZED)	(LB/TON)	(LB/100 LB) (FA OIL)
H2	0.65	0.32
CO	4.95	2.41
CO2	12.00	5.83
H2S	15.59	7.57
C1	21.11	10.26
C2	8.88	4.31
C2-	2.06	1.00
C3	3.90	1.90
C3-	2.48	1.21
I-C4	0.43	0.21
N-C4	0.86	0.42
C4-	1.65	0.80
C5	1.05	0.51
C6	0.63	0.30
C7	0.22	0.11
C8	0.00	0.00
C9	0.00	0.00

ADJUSTED YIELDS (NORMALIZED)	LB/TON	SCF/TON	LB/100 LB F A OIL
C3 & LIGHTER	71.6	1162.3	35.0
SCRUBBED C3&LIGHTER [LESS CO2 & H2S]	44.0	885.7	21.5
C4 & HEAVIER	210.6		102.8
TOTAL HYDROCARBONS INCL. H2 & CO, LB/TON	254.7		124.3
C4 & HEAVIER (GAL/TON)		24.2	
API GRAVITY		4.0	

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GAS ANALYSIS

SAMPLE NUMBER	RF 2-6965
SAMPLE DESCRIPTION	CT&E Lab No. 63-136316, TG21
FISCHER ASSAY NO.	FB 2323

COMPONENT	MOLE PERCENT
H2	10.32
CO	5.63
CO2	8.68
H2S	14.54
C1	41.99
C2	9.38
C2-	2.35
C3	2.81
C3-	1.88
I-C4	0.23
N-C4	0.47
C4-	0.94
C5	0.47
C6	0.23
C7	0.07
C8	0.00
C9	0.00
SUM	100.00
AVERAGE MOLE WT	24.33

LBS C IN GAS/TON SHALE	39.47
WT. PERCENT TOTAL CARBON	51.62
WT. PERCENT SULFUR	19.18

BTU VALUE OF GAS (CALC.)		GROSS	NET
C3 & LIGHTER*	(BTU/SCF)	907.59	826.63
SCRUBBED C3 & LIGHTER	(BTU/SCF)	1066.09	969.53
WHOLE GAS*	(BTU/SCF)	970.77	885.67
SCRUBBED WHOLE GAS	(BTU/SCF)	1143.39	1041.93

*[INCL. H2S & CO2]

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Identification:

Tri-State Synfuels Project
Peabody Coal Company
Peabody Camp #11
Minus 1/4" Rd. Screen Fraction
TG21

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APPENDIX D-5

Hamilton Mine #1 - Kentucky No. 9 Seam

	Page
IC-35 - Total Product: a-d, f-o	D-78
IC-36 - 2" Rd. x 1/4" Rd.: a-k, n-o	D-85
IC-37 - 1/4" Rd. x 0: a-d, f-k, n-o	D-91

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COMMERCIAL TESTING & ENGINEERING CO.

GENERAL OFFICES: 228 NORTH LA SALLE STREET, CHICAGO, ILLINOIS 60601 · AREA CODE 312 726-9434

PLEASE ADDRESS ALL CORRESPONDENCE TO.
P.O. BOX 752, HENDERSON, KY 42420
OFFICE TEL. (502) 827-1187

TEXAS EASTERN SYNFUELS
Houston, TX 77001

August 17, 1981

Kind of sample reported to us: Coal

Sample taken at: Hamilton #1 Mine, Morganfield, Kentucky

Sample taken by: CT&E

Date sampled: June 22, 1981

Date received: June 22, 1981

Analysis report no. 63-136327

Sample identification by CT&E Company

Tri-State Synfuels Project
Island Creek Coal Company
Hamilton No. 1 Mine
Crushed Raw Coal - Total Product
IC35

PROXIMATE ANALYSIS	% Weight As received	% Weight Dry basis
Moisture	7.49	XXXXX
Ash	20.72	22.40
Volatile	33.15	35.83
Fixed Carbon	38.64	41.77
	100.00	100.00
Btu/lb.	10209	11036
Sulfur	3.91	4.23
Alk. as Na_2O	0.63	0.68
SULFUR FORMS		
Pyritic Sulfur	2.32	2.51
Sulfate Sulfur	0.01	0.01
Organic Sulfur	1.58	1.71
	3.91	4.23
WATER SOLUBLE ALKALIES		
Na_2O	XXXX	XXXX
K_2O	XXXX	XXXX

ULTIMATE ANALYSIS	% Weight As received	% Weight Dry basis
Moisture	7.49	XXXXX
Carbon	56.03	60.57
Hydrogen	3.94	4.26
Nitrogen	1.21	1.31
Chlorine	0.22	0.24
MAF 14222 Sulfur	3.91	4.23
Ash	20.72	22.40
Oxygen (diff)	6.48	6.99
	100.00	100.00

MINERAL ANALYSIS OF ASH	% Weight Ignited Basis
Silica, SiO_2	48.88
Alumina, Al_2O_3	17.93
Titania, TiO_2	0.82
Ferric oxide, Fe_2O_3	17.57
Lime, CaO	5.12
Magnesia, MgO	1.39
Potassium oxide, K_2O	2.80
Sodium oxide, Na_2O	1.21
Sulfur trioxide, SO_3	3.72
Phos. pentoxide, P_2O_5	0.22
Strontium Oxide, SrO	0.00
Barium Oxide BaO	0.27
Manganese Oxide Mn_3O_4	0.07
Undetermined	0.00
	100.00

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2030 °F	2460 °F
H = Core Height: Softening (H = W)	2080 °F	2500 °F
W = Core Width: Softening (H = ½W)	2120 °F	2520 °F
Fluid	2350 °F	2600 °F

% EQUILIBRIUM MOISTURE 7.00
HARDGROVE GRINDABILITY INDEX 54.3 at 5.97% Moisture
FREE SWELLING INDEX 3

Silica Value 67.01
Base: Acid Ratio 0.42
T_{250} Temperature 2392

Fouling Index 0.5
Slagging Index 1.8

ESTIMATED VISCOSITY at critical viscosity temperature of 2320°F = 860 poises

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

L. W. TAYLOR III, Manager, Central Division

D-78.

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OFFICE TEL. (502) 827-1187

January 4, 1982

TEXAS EASTERN SYNFUELS, INC.
Houston, TX 77001

Sample identification by CT&E Company

Kind of sample reported to us	Coal	Tri-State Synfuels Project
Sample taken at	Hamilton #1 Mine Morganfield, Kentucky	Island Creek Coal Company Hamilton #1 Mine
Sample taken by	CT&E	Crushed Raw Coal - Total Product IC35
Date sampled	June 22, 1981	
Date received	June 22, 1981	

Analysis report no. 63-136327

Caking Index (Damm's Method) = 14 - 15

	As Received	Dry Basis
Moisture, %	7.49	XXXX
Fluorine (F)[1], µg/g	150	160
Mercury (Hg)[2], µg/g	0.15	0.16

1. Preparation by oxygen bomb combustion; analysis by ion selective electrode. ASTM, Part 26, D3761-79

2. Preparation by oxygen train combustion; analysis by flameless cold vapor atomic absorption spectroscopy. ASTM, Part 26, D3684-78

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

L. W. TAYLOR III, Manager, Central Division

LT/mc

D-79.

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OVER 40 BRANCH LABORATORIES STRATEGICALLY LOCATED IN PRINCIPAL COAL MINING AREAS.
TIDEWATER AND GREAT LAKES PORTS, AND RIVER LOADING FACILITIES

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TEXAS EASTERN SYNFUELS
Houston, TX 77001

August 17, 1981

Sample identification by CT&E Company

Kind of sample reported to us	Coal
Sample taken at	Hamilton #1 Mine Morganfield, Kentucky
Sample taken by	CT&E
Date sampled	June 22, 1981
Date received	June 22, 1981

Tri-State Synfuels Project
Island Creek Coal Company
Hamilton No. 1 Mine
Crushed Raw Coal - Total Product
IC 35

Analysis report no. 63-136327

Alkalies, dry coal basis

	Water Soluble	Non Water Soluble
Sodium oxide, Na_2O, ppm	1188	997
Potassium, K_2O, ppm	133	5559

% Ash in non water soluble coal = 19.17

% Ash in original sample = 22.40

Alkalies calculated to ignited basis from above:

	Ignited Basis
% Sodium oxide, Na_2O	1.05
% Potassium oxide, K_2O	2.96

LT/kmc

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO

L. W. TAYLOR III, Manager, Central Division

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CENTRAL DIVISION MANAGER
L. W. TAYLOR III

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January 4, 1982

TEXAS EASTERN SYNFUELS, INC.
Houston, TX 77001

Lab No. 63-136327

Tri-State Synfuels Project
Island Creek Coal Company
Hamilton #1 Mine
Crushed Raw Coal - Total Product
IC35

SPARK SOURCE MASS SPECTROGRAPHIC ANALYSIS
CONCENTRATION IN PPM WEIGHT

ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.	ELEMENT	CONC.
Uranium	4 (3.6)	Terbium	0.2	Ruthenium		Vanadium	*240
Thorium	5	Gadolinium	0.2	Molybdenum	5	Titanium	MC
Bismuth		Europium	<0.1	Niobium	6	Scandium	0.7
Lead	22	Samarium	1	Zirconium	31	Calcium	MC
Thallium		Neodymium	1	Yttrium	4	Potassium	MC
Mercury	NR	Praseodymium	1	Strontium	19	Chlorine	270
Gold		Cerium	12	Rubidium	41	Sulfur	MC
Platinum		Lanthanum	22	Bromine	4	Phosphorus	550
Iridium		Barium	510	Selenium	3	Silicon	MC
Osmium		Cesium	2	Arsenic	10	Aluminum	MC
Rhenium		Iodine	0.5	Germanium	2	Magnesium	MC
Tungsten		Tellurium	0.1	Gallium	16	Sodium	MC
Tantalum		Antimony	0.9	Zinc	*310	Fluorine	NR
Hafnium	0.3	Tin	0.4	Copper	29	Oxygen	NR
Lutetium		Indium	STD	Nickel	5	Nitrogen	NR
Ytterbium		Cadmium	0.2	Cobalt	0.9	Carbon	NR
Thulium		Silver		Iron	MC	Boron	18
Erbium	0.1	Palladium		Manganese	160	Beryllium	0.2
Holmium	0.3	Rhodium		Chromium	24	Lithium	3
Dysprosium	0.4	* Heterogeneous		Neptunium	<0.1ppm	Hydrogen	NR

STD - Internal Standard
NR - Not Reported
All elements not detected <0.1ppm
MC - Major Component
INT - Interference

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Lloyd W. Taylor, III
Manager, Central Division

D-81.

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TABLE NO. I
Trace Elements by Atomic Absorption
(concentration in ug/g)

Parameter	OB-1 As Rec'd	OB-1 Dry	PB-28 As Rec'd	PB-28 Dry	PB-31 As Rec'd	PB-31 Dry	TG-19 As Rec'd	TG-19 Dry	IC-35 As Rec'd	IC-35 Dry
Moisture (%)[1]	11.28	XXXX	11.67	XXXX	9.49	XXXX	11.11	XXXX	7.49	XXXX
Antimony	0.3	0.3	0.5	0.6	0.1	0.1	0.2	0.2	0.4	0.4
Arsenic	11.0	12.4	22.5	25.5	4.3	4.8	3.0	3.4	4.6	5
Beryllium	2	2	2	2	2	2	1	1	1	1
Boron[2]	140	160.00	140	160	160	180	160	180	150	160
Cadmium	0.8	0.9	0.2	0.2	0.2	0.2	0.4	0.4	0.6	0.6
Chromium	25	28	14	16	21	23	43	48	25	27
Copper	25	28	13	15	17	19	28	31	20	22
Fluorine[3]	130	150	95	110	130	140	440	500	150	160
Lead	4	4	20	23	4	4	4	4	37	40
Lithium	19	21	11	13	25	28	23	26	17	18
Manganese	64	72	57	65	66	73	84	94	113	122
Mercury	0.12	0.14	0.09	0.10	0.10	0.11	0.07	0.08	0.15	0.16
Nickel	18	20	24	27	21	23	29	33	15	16
Selenium	2.4	2.7	1.1	1.3	1.4	1.5	2.8	3.2	3.1	3.4
Uranium[4]	2.1	2.4	1.3	1.5	1.9	2.1	6.3	7.1	3.3	3.6
Vanadium	37	42	24	27	52	58	77	87	59	64
Zinc	121	136	87	98	63	70	85	96	92	99

1 Determination by ASTM Method D3173
2 Determination by curcumin colorimetric technique
3 Determination by ASTM Method D3761
4 Determination by delayed neutron activation

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DATE : 11/.

SAMPLE NUMBER RF3-0008
SAMPLE DESCRIPTION CT&E Lab No. 63-136327, IC35
TERMINAL TEMP 941 DEG. F
FISHER ASSAY NO. PB 2334

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FISCHER ASSAY YIELDS	AS ANALYZED	NORMALIZED
OIL (LB/TON)	253.6	256.5
(GAL/TON)	28.8	29.2
API GRAVITY	2.8	2.8
GAS (LB/TON)	96.7	97.8
(SCF/TON)	1508.0	1525.5
WATER (LB/TON)	70.1	71.0
(GAL/TON)	8.4	8.5
SS (LB/TON)	1556.5	1574.7
TOTAL (LB/TON)	1977.0	2000.0
VARIANCE (PC)	-1.2	

GAS (NORMALIZED)	(LB/TON)	(LB/100 LB) (FA OIL)
H2	0.85	0.33
CO	5.29	2.06
CO2	13.65	5.32
H2S	20.92	8.16
C1	27.72	10.81
C2	10.96	4.27
C2-	2.08	0.81
C3	5.65	2.20
C3-	2.84	1.11
I-C4	0.78	0.31
N-C4	1.96	0.76
C4-	1.89	0.74
C5	1.44	0.56
C6	1.15	0.45
C7	0.67	0.26
C8	0.00	0.00
C9	0.00	0.00

ADJUSTED YIELDS (NORMALIZED)	LB/TON	SCF/TON	LB/100 LB F A OIL
C3 & LIGHTER	90.0	1479.5	35.5
SCRUBBED C3&LIGHTER [LESS CO2 & H2S]	55.4	1129.5	21.8
C4 & HEAVIER	264.4		104.3
TOTAL HYDROCARBONS INCL. H2 & CO, LB/TON	319.8		126.1
C4 & HEAVIER (GAL/TON)		30.7	
API GRAVITY		5.5	

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ANALYSIS

SAMPLE NUMBER	RF3-0008
SAMPLE DESCRIPTION	CT&E Lab No. 63-136327, IC35
FISCHER ASSAY NO.	FE 2334

COMPONENT	MOLE PERCENT
H2	10.55
CO	4.69
CO2	7.71
H2S	15.24
C1	43.05
C2	9.05
C2-	1.84
C3	3.18
C3-	1.68
I-C4	0.34
N-C4	0.84
C4-	0.84
C5	0.50
C6	0.34
C7	0.17
C8	0.00
C9	0.00
SUM	100.00

AVERAGE MOLE WT	24.31
LBS C IN GAS/TON SHALE	50.98
WT. PERCENT TOTAL CARBON	52.10
WT. PERCENT SULFUR	20.12

BTU VALUE OF GAS (CALC.)		GROSS	NET
C3 & LIGHTER*	(BTU/SCF)	916.69	834.26
SCRUBBED C3 & LIGHTER	(BTU/SCF)	1069.30	971.51
WHOLE GAS*	(BTU/SCF)	997.61	909.77
SCRUBBED WHOLE GAS	(BTU/SCF)	1168.35	1064.14

*[INCL. H2S & CO2]

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Identification:

Tri-State Synfuels Project
Island Creek Coal Company
Hamilton #1 Mine
Crushed Raw Coal - Total Product
IC35

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-457

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OFFICE TEL. (502) 827-1187

TEXAS EASTERN SYNFUELS
Houston, TX 77001

August 17, 1981

Kind of sample reported to us: Coal

Sample taken at: Hamilton #1 Mine
Morganfield, Kentucky

Sample taken by: CT&E

Date sampled: June 22, 1981

Date received: June 22, 1981

Sample identification by CT&E Company

Tri-State Synfuels Project
Island Creek Coal Company
Hamilton No. 1 Mine
Plus 1/4" Rd. Screen Fraction
IC36

Analysis report no. 63-136329

PROXIMATE ANALYSIS	% Weight As received	% Weight Dry basis
Moisture	6.84	XXXXX
Ash	19.27	20.68
Volatile	33.83	36.31
Fixed Carbon	40.06	43.01
	100.00	100.00
Btu/lb.	10517	11289
Sulfur	4.03	4.33
Alk. as Na_2O	0.58	0.62

SULFUR FORMS		
Pyritic Sulfur	2.40	2.58
Sulfate Sulfur	0.01	0.01
Organic Sulfur	1.62	1.74
	4.03	4.33

WATER SOLUBLE ALKALIES		
Na_2O	XXXXX	XXXXX
K_2O	XXXXX	XXXXX

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2060 °F	2580 °F
H is Cone Height Softening (H=W)	2130 °F	2630 °F
W is Cone Width Softening (H=½W)	2170 °F	2660 °F
Fluid	2380 °F	2720 °F

% EQUILIBRIUM MOISTURE 7.03
HARDGROVE GRINDABILITY INDEX 52.4 at 5.95% Moisture
FREE SWELLING INDEX 3

Silica Value 67.81
Base: Acid Ratio 0.40
T_{250} Temperature 2410

ESTIMATED VISCOSITY at critical viscosity temperature of 2370°F = 620 poises

ULTIMATE ANALYSIS		% Weight As received	% Weight Dry basis
Moisture		6.84	XXXXX
Carbon		57.64	61.87
Hydrogen		3.97	4.26
Nitrogen		1.25	1.34
Chlorine		0.20	0.21
Sulfur	MAF 14232	4.03	4.33
Ash		19.27	20.68
Oxygen (diff)		6.80	7.31
		100.00	100.00

MINERAL ANALYSIS OF ASH	% Weight Ignited Basis
Silica, SiO_2	49.77
Alumina, Al_2O_3	18.37
Titania, TiO_2	0.86
Ferric oxide, Fe_2O_3	19.34
Lime, CaO	3.02
Magnesia, MgO	1.27
Potassium oxide, K_2O	2.84
Sodium oxide, Na_2O	1.13
Sulfur trioxide, SO_3	2.70
Phos. pentoxide, P_2O_5	0.18
Strontium Oxide, SrO	0.00
Barium Oxide, BaO	0.21
Manganese Oxide, Mn_3O_4	0.04
Undetermined	0.27
	100.00

Fouling Index 0.5
Slagging Index 1.7

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

L. W. TAYLOR III, Manager, Central Division D-85.

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OFFICE TEL. (502) 827-1187

September 18, 1981

TEXAS EASTERN SYNFUELS
Houston, TX 77001

Sample identification by CT&E Company

Kind of sample reported to us	Coal
Sample taken at:	Hamilton #1 Mine Morganfield, Kentucky
Sample taken by	CT&E
Date sampled	June 22, 1981
Date received	June 22, 1981

Tri-State Synfuels Project
Island Creek Coal Company
Hamilton No. 1 Mine
Plus 1/4" Rd. Screen Fraction
IC36

Analysis report no. 63-136329

TUMBLER TEST FOR COAL - ASTM D 441-45 (1975)

Retained on	Passing	Weight Percent (1)	Average of Sieve Openings Inches (2)	Factor (3)	Product of (1) x (3)
1.06 in.	1.50 in.	100.0	1.280	1	100.00 = S
1.06 in.	1.50 in.	64.1	1.280	1	64.1
0.750 in.	1.06 in.	15.5	0.905	0.7	10.85
0.530 in.	0.750 in.	4.2	0.640	0.5	2.10
0.375 in.	0.530 in.	1.3	0.452	0.35	.455
0.0469 in.	0.375 in.	2.9	0.211	0.16	.464
0.0117 in.	0.0469 in.	1.8	0.029	0.023	.0414
	0.0117 in.	10.2	0.006	0.005	.0510
Total (Sum of products (1) x (3)					78.06 = s

Friability, 22.0 percent: with dust index of 10

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

L. W. TAYLOR III, Manager, Central Division

LT/mc

D-86

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January 4, 1982

TEXAS EASTERN SYNFUELS, INC.
Houston, TX 77001

Sample identification by CT&E Company

Kind of sample reported to us	Coal	Tri-State Synfuels Project
Sample taken at	Hamilton #1 Mine Morganfield, Kentucky	Island Creek Coal Company Hamilton #1 Mine
Sample taken by	CT&E	Plus 1/4" Rd. Screen Fraction IC36
Date sampled	June 22, 1981	
Date received	June 22, 1981	

Analysis report no. 63-136329

Caking Index (Damm's Method) = 14 ~ 15

	As Received	Dry Basis
Moisture, %	6.84	XXXX
Fluorine (F)[1], µg/g	130	140
Mercury (Hg)[2], µg/g	0.05	0.05

1. Preparation by oxygen bomb combustion; analysis by ion selective electrode. ASTM, Part 26, D3761-79

2. Preparation by oxygen train combustion; analysis by flameless cold vapor atomic absorption spectroscopy. ASTM, Part 26, D3684-78

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

L. W. TAYLOR III, Manager, Central Division

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TEXAS EASTERN SYNFUELS
Houston, TX 77001

August 17, 1981

Sample Identification by CT&E Company

Kind of sample reported to us: Coal

Sample taken at: Hamilton #1 Mine, Morganfield, Kentucky

Sample taken by: CT&E

Date sampled: June 22, 1981

Date received: June 22, 1981

Tri-State Synfuels Project
Island Creek Coal Company
Hamilton No. 1 Mine
Plus 1/4" Rd. Screen Fraction
IC36

Analysis report no. 63-136329

Alkalies, dry coal basis

	Water Soluble	Non Water Soluble
Sodium oxide, Na_2O, ppm	912	923
Potassium oxide, K_2O, ppm	141	5236

% Ash in non water soluble coal = 17.75

% Ash in original sample = 20.68

Alkalies calculated to ignited basis from above:

	Ignited basis
% Sodium oxide, Na_2O	0.96
% Potassium oxide, K_2O	3.02

LT/kmc

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

L. W. TAYLOR III, Manager, Central Division

D-88.

Charter Member

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DATE : 11/19/81

SAMPLE NUMBER RF3-0005
SAMPLE DESCRIPTION CT&E Lab No. 63-136329, IC36
TERMINAL TEMP 932 DEG. F
FISHER ASSAY NO. PR2330

FISCHER ASSAY YIELDS	AS ANALYZED	NORMALIZED
OIL (LB/TON)	253.8	257.3
(GAL/TON)	29.0	29.4
API GRAVITY	3.2	3.2
GAS (LB/TON)	111.5	113.1
(SCF/TON)	1696.0	1719.4
WATER (LB/TON)	78.2	79.3
(GAL/TON)	9.4	9.5
SS (LB/TON)	1529.2	1550.3
TOTAL (LB/TON)	1972.7	2000.0
VARIANCE (PC)	-1.4	

GAS (NORMALIZED)	(LB/TON)	(LB/100 LB) (FA OIL)
H2	0.98	0.38
CO	5.89	2.29
CO2	14.50	5.64
H2S	27.26	10.59
C1	29.73	11.55
C2	11.82	4.59
C2-	2.55	0.99
C3	6.18	2.40
C3-	2.95	1.15
I-C4	0.81	0.32
N-C4	2.04	0.79
C4-	1.97	0.76
C5	1.50	0.58
C6	1.79	0.70
C7	0.70	0.27
C8	2.40	0.93
C9	0.00	0.00

ADJUSTED YIELDS (NORMALIZED)	LB/TON	SCF/TON	LB/100 LB F A OIL
C3 & LIGHTER	101.9	1661.0	40.1
SCRUBBED C3&LIGHTER [LESS CO2 & H2S]	60.1	1233.1	23.7
C4 & HEAVIER	268.5		105.8
TOTAL HYDROCARBONS INCL. H2 & CO, LB/TON	328.6		129.5
C4 & HEAVIER (GAL/TON)		31.5	
API GRAVITY		6.9	

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GAS ANALYSIS

SAMPLE NUMBER	RF3-0005
SAMPLE DESCRIPTION	CT&E Lab No. 63-136329, IC36
FISCHER ASSAY NO.	FB2330

COMPONENT	MOLE PERCENT
H2	10.82
CO	4.64
CO2	7.26
H2S	17.62
C1	40.96
C2	8.66
C2-	2.01
C3	3.09
C3-	1.55
I-C4	0.31
N-C4	0.77
C4-	0.77
C5	0.46
C6	0.46
C7	0.15
C8	0.46
C9	0.00
SUM	100.00

AVERAGE MOLE WT	24.92
LBS C IN GAS/TON SHALE	57.39
WT. PERCENT TOTAL CARBON	50.76
WT. PERCENT SULFUR	22.68

BTU VALUE OF GAS (CALC.)		GROSS	NET
C3 & LIGHTER*	(BTU/SCF)	905.08	823.93
SCRUBBED C3 & LIGHTER	(BTU/SCF)	1062.17	965.03
WHOLE GAS*	(BTU/SCF)	1010.45	922.17
SCRUBBED WHOLE GAS	(BTU/SCF)	1195.34	1089.43

*[INCL. H2S & CO2]

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Identification:

Tri-State Synfuels Project
Island Creek Coal Company
Hamilton #1 Mine
Plus 1/4" Rd. Screen Fraction
IC36

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COMMERCIAL TESTING & ENGINEERING CO.

GENERAL OFFICES: 228 NORTH LA SALLE STREET, CHICAGO, ILLINOIS 60601 - AREA CODE 312 726-8434

PLEASE ADDRESS ALL CORRESPONDENCE TO:
P.O. BOX 752, HENDERSON, KY 42420
OFFICE TEL. (502) 827-1187

TEXAS EASTERN SYNFUELS
Houston, TX 77001

August 17, 1981

Kind of sample reported to us: Coal

Sample taken at: Hamilton #1 Mine, Morganfield, Kentucky

Sample taken by: CT&E

Date sampled: June 22, 1981

Date received: June 22, 1981

Analysis report no. 63-136330

Sample identification by CT&E Company

Tri-State Synfuels Project
Island Creek Coal Company
Hamilton No. 1 Mine
Minus 1/4" Rd. Screen Fraction
IC37

PROXIMATE ANALYSIS	% Weight As received	% Weight Dry basis
Moisture	7.99	XXXXX
Ash	19.86	21.59
Volatile	32.97	35.83
Fixed Carbon	39.18	42.58
	100.00	100.00
Btu/lb.	10232	11120
Sulfur	3.63	3.94
Alk. as Na_2O	0.57	0.62
SULFUR FORMS		
Pyritic Sulfur	2.10	2.28
Sulfate Sulfur	0.04	0.04
Organic Sulfur	1.49	1.62
	3.63	3.94
WATER SOLUBLE ALKALIES		
Na_2O	XXXX	XXXX
K_2O	XXXX	XXXX

ULTIMATE ANALYSIS	% Weight As received	% Weight Dry basis
Moisture	7.99	XXXXX
Carbon	56.66	61.58
Hydrogen	3.90	4.24
Nitrogen	0.09	0.98
Chlorine	0.23	0.25
MAF 14182 Sulfur	3.63	3.94
Ash	19.86	21.59
Oxygen (diff)	6.83	7.42
	100.00	100.00

MINERAL ANALYSIS OF ASH	% Weight Ignited Basis
Silica, SiO_2	46.88
Alumina, Al_2O_3	17.58
Titania, TiO_2	0.78
Ferric oxide, Fe_2O_3	17.02
Lime, CaO	7.89
Magnesia, MgO	1.23
Potassium oxide, K_2O	2.65
Sodium oxide, Na_2O	1.15
Sulfur trioxide, SO_3	4.27
Phos. pentoxide, P_2O_5	0.18
Strontium Oxide, SrO	0.00
Barium Oxide, BaO	0.28
Manganese Oxide, Mn_3O_4	0.09
Undetermined	0.00
	100.00

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2030 °F	2470 °F
H is Cone Height: Softening (H=W)	2080 °F	2510 °F
W is Cone Width: Softening (H=½W)	2120 °F	2530 °F
Fluid	2270 °F	2590 °F

°C EQUILIBRIUM MOISTURE	7.28
HARDGROVE GRINDABILITY INDEX	60.9 at 6.62% Moisture
FREE SWELLING INDEX	2 1/2
Silica Value	64.21
Base: Acid Ratio	0.46
T_{250} Temperature	2346
Fouling Index	0.5
Slagging Index	1.8

E. .MATED VISCOSITY at critical viscosity temperature of 2320°F = 440 poises

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

L. W. TAYLOR III, Manager, Central Division

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Charter Member

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COMMERCIAL TESTING & ENGINEERING CO.

GENERAL OFFICES: 228 NORTH LA SALLE STREET, CHICAGO, ILLINOIS 60601 · AREA CODE 312 726-8434

PLEASE ADDRESS ALL CORRESPONDENCE TO
P.O. BOX 752, HENDERSON, KY 42420
OFFICE TEL. (502) 827-1187

January 4, 1982

TEXAS EASTERN SYNFUELS, INC.
Houston, TX 77001

Sample identification by CT&E Company

Kind of sample reported to us	Coal
Sample taken at	Hamilton #1 Mine Morganfield, Kentucky
Sample taken by	CT&E
Date sampled	June 22, 1981
Date received	June 22, 1981

Tri-State Synfuels Project
Island Creek Coal Company
Hamilton #1 Mine
Minus 1/4" Rd. Screen Fraction
IC37

Analysis report no. 63-136330

Caking Index (Damm's Method) = 13 - 14

	As Received	Dry Basis
Moisture, %	7.99	XXXX
Fluorine (F)[1], µg/g	130	140
Mercury (Hg)[2], µg/g	0.01	0.01

1. Preparation by oxygen bomb combustion; analysis by ion selective electrode. ASTM, Part 26, D3761-79

2. Preparation by oxygen train combustion; analysis by flameless cold vapor atomic absorption spectroscopy. ASTM, Part 26, D3684-78

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

L. W. TAYLOR III, Manager Centre Division

D-92.

Chemist Manager

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LT/mc

F-464

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P.O. BOX 752, HENDERSON, KY 42420
OFFICE TEL. (502) 827-1187

TEXAS EASTERN SYNFUELS
Houston, TX 77001

August 17, 1981

Sample identification by CT&E Company

Kind of sample reported to us	Coal	Tri-State Synfuels Project
Sample taken at	Hamilton #1 Mine Morganfield, Kentucky	Island Creek Coal Company Hamilton No. 1 Mine Minus 1/4" Rd. Screen Fraction IC37
Sample taken by	CT&E	
Date sampled	June 22, 1981	
Date received	June 22, 1981	

Analysis report no. 63-136330

Alkalies, dry coal basis

	Water Soluble	Non Water Soluble
Sodium oxide, Na_2O, ppm	1121	924
Potassium oxide, K_2O, ppm	143	5467

% Ash in non water soluble coal = 18.85

% Ash in original sample = 21.59

Alkalies calculated to ignited basis from above:

	Ignited basis
% Sodium oxide, Na_2O	1.01
% Potassium oxide, K_2O	2.97

LT/kmc

Respectfully submitted.
COMMERCIAL TESTING & ENGINEERING CO.

L. W. TAYLOR III, Manager, Central Division

D-93.

Charter Member

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OVER 40 BRANCH LABORATORIES STRATEGICALLY LOCATED IN PRINCIPAL COAL MINING AREAS, TIDEWATER AND GREAT LAKES PORTS AND RIVER LOADING FACILITIES

DATE : 11/4/81

SAMPLE NUMBER: RF2-6966
SAMPLE DESCRIPTION: CT&E Lab No. 63-136330, IC37
TERMINAL TEMP: 932 DEG. F
FISHER ASSAY NO. PB2318

FISCHER ASSAY YIELDS	AS ANALYZED	NORMALIZED
OIL (LB/TON)	240.2	243.4
(GAL/TON)	27.5	27.9
API GRAVITY	4.0	4.0
GAS (LB/TON)	101.7	103.1
(SCF/TON)	1581.0	1602.3
WATER (LB/TON)	76.9	78.0
(GAL/TON)	9.2	9.3
SS (LB/TON)	1554.7	1575.6
TOTAL (LB/TON)	1973.4	2000.0
VARIANCE (PC)	-1.3	

GAS (NORMALIZED)	(LB/TON)	(LB/100 LB) (FA OIL)
H2	1.10	0.45
CO	5.85	2.40
CO2	18.04	7.41
H2S	26.44	10.86
C1	25.53	10.49
C2	10.10	4.15
C2-	2.30	0.94
C3	4.60	1.89
C3-	2.83	1.16
I-C4	0.43	0.18
N-C4	1.30	0.53
C4-	2.09	0.86
C5	1.06	0.44
C6	0.63	0.26
C7	0.74	0.30
C8	0.00	0.00
C9	0.00	0.00

ADJUSTED YIELDS (NORMALIZED)	LB/TON	SCF/TON	LB/100 LB F A OIL
C3 & LIGHTER	96.8	1565.6	40.3
SCRUBBED C3&LIGHTER [LESS CO2 & H2S]	52.3	1116.2	21.8
C4 & HEAVIER	249.7		104.0
TOTAL HYDROCARBONS INCL. H2 & CO: LB/TON	302.0		125.7
C4 & HEAVIER (GAL/TON)		29.1	
API GRAVITY		6.2	

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GAS ANALYSIS

SAMPLE NUMBER	FF2-6966
SAMPLE DESCRIPTION	CT&E Lab No. 63-136330, IC37
FISCHER ASSAY NO.	FE23.8

COMPONENT	MOLE PERCENT
H2	13.05
CO	4.94
CO2	9.70
H2S	18.34
C1	37.74
C2	7.94
C2-	1.94
C3	2.47
C3-	1.59
I-C4	0.18
N-C4	0.53
C4-	0.88
C5	0.35
C6	0.18
C7	0.18
C8	0.00
C9	0.00
SUM	100.00

AVERAGE MOLE WT	24.37
LBS C IN GAS/TON SHALE	48.05
WT. PERCENT TOTAL CARBON	46.63
WT. PERCENT SULFUR	24.15

BTU VALUE OF GAS (CALC.)		GROSS	NET
C3 & LIGHTER*	(BTU/SCF)	845.54	769.47
SCRUBBED C3 & LIGHTER	(BTU/SCF)	1017.70	924.04
WHOLE GAS*	(BTU/SCF)	908.00	827.81
SCRUBBED WHOLE GAS	(BTU/SCF)	1099.02	1000.19

*[INCL. H2S & CO2]

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Identification:

Tri-State Synfuels Project
Island Creek Coal Company
Hamilton #1 Mine
Minus 1/4" Rd. Screen Fraction
IC37

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