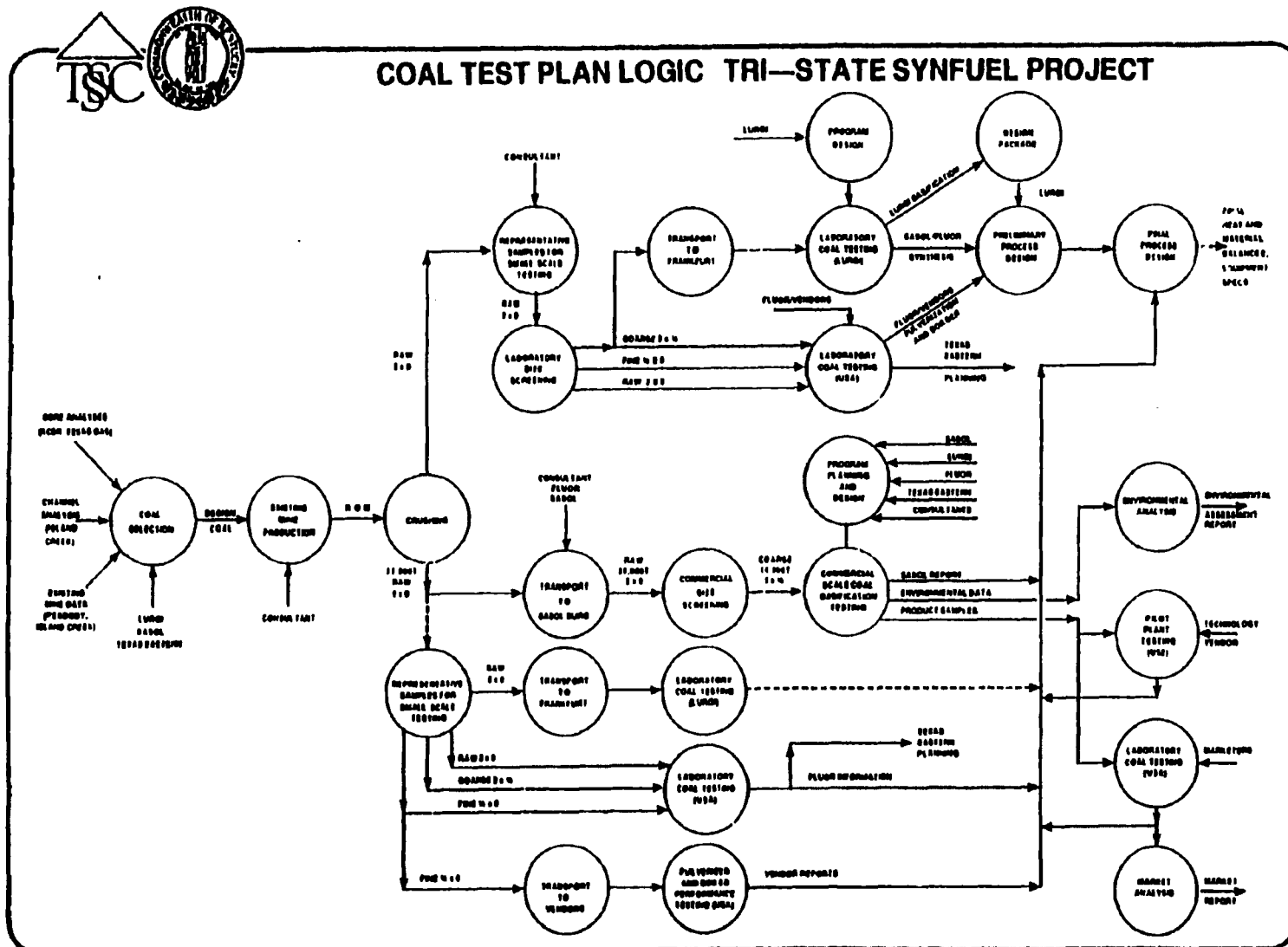


The Phase 1 work effort is complete with the following exceptions: interpretation of export sample analytical testwork and water treatability study which are addressed elsewhere in detail.



# EXHIBIT IX-I



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## 5.0 SUMMARY

### 5.1 HISTORY

#### 5.1.1 Work Plan

The Phase 1 work plan (Exhibit IX-I) for the Tri-State Synfuels Project involved:

- o Selection of a coal suitable for the commercial scale test and design coal based primarily on a literature survey of Illinois Basin coals.
- o Collection and shipment of the selected coal from the Illinois Basin to Sasolburg, Republic of South Africa for the large scale test. Detailed sampling and analysis of the coal was planned at each location to enable coal quality and size data to be obtained at every transfer point.
- o Gasification test at Sasolburg to obtain mass balance data and determine high load levels for the design coal. These data were to be developed by Sasol and supplied to Lurgi to arrive at a design coal heat and material balance and to set the number of gasifiers.

The original gasification test program as planned is shown in Exhibit IX-J. The startup was planned on Sigma--a non caking coal--to be followed by the mechanical checkout and optimization runs on the test coal. The optimization run is required to set the proper steam-oxygen ratio to avoid excessively large clinkers and to set the optimum gas outlet temperature. The mass and heat balance was planned for 2 inch x 1/4 inch dry screened coal over a 48-hour period at reasonable loads. The high load test was to feed 2 inch x 1/4 inch dry screened coal with a step-wise increase in undersize material, in effect, simulating a run-of-mine coal. Finally, a high load test was to be conducted with 2 inch x 1/8 inch wet screened coal.

Cooling tower test to examine the feasibility of using stripped gas liquor for cooling purposes by determining the: (1) extent of corrosion and fouling, (2) degree of passivation on carbon steel, (3) extent of biological activity and control, if needed, and (4) effect of such a tower on the environment.

Environmental data collection during the test to provide design criteria for environmental-related equipment. Samples of solids and liquids were to be taken for export.



EXHIBIT IX-J

COAL GASIFICATION TEST PLAN

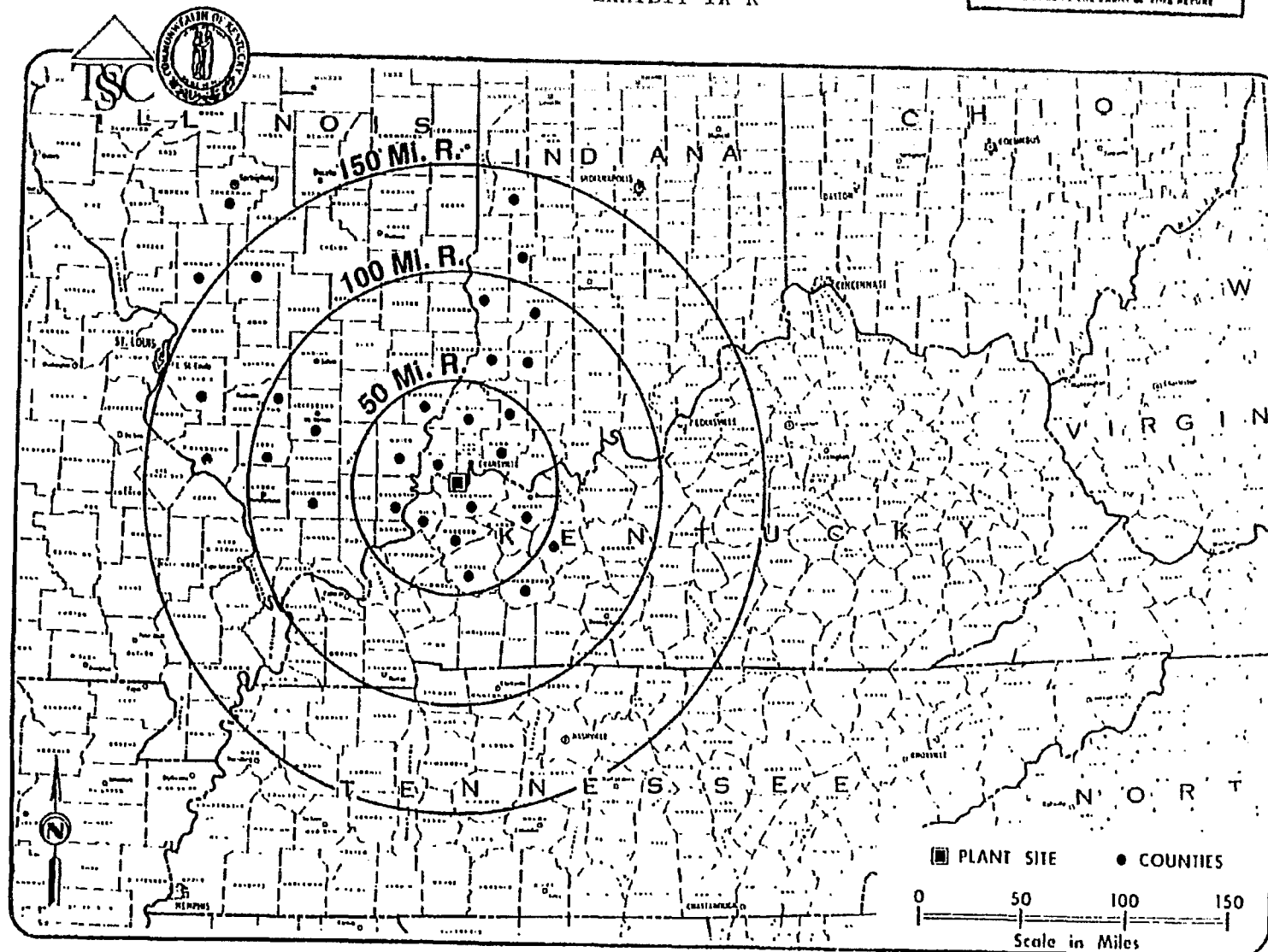
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<u>Run Description</u>	<u>Gasification</u>		<u>Screening</u>	<u>Operation Time Days</u>	<u>Estimated Coal Requirement Metric Tons</u>		
	<u>Coal Size Inch x Inch</u>	<u>Fine Content % W(minus 1/4 in)</u>			<u>Gasification</u>	<u>Fine</u>	<u>Total</u>
Start-up	2 x 1/4	-	Dry	-	Sigma Coal		
Mechanical Checkout	2 x 1/4	-	Dry	-	250	250	500
Optimization	2 x 1/4	-	Dry	3	2,500	2,500	5,000
Mass and Heat Balance	2 x 1/4	-	Dry	2	1,700	1,700	3,400
High Load Test	2 x 0	5%	Dry	1	700	700	1,400
	2 x 0	10%	Dry	1	700	630	1,330
	2 x 0	15%	Dry	1	700	560	1,260
	2 x 0	20%	Dry	1	700	490	1,190
High Load Test	2 x 1/8	-	Wet	<u>1</u>	<u>700</u>	<u>420</u>	<u>1,120</u>
TOTAL PLANNED RUNS				10	7,950	7,250	15,200
Contingency							<u>4,800</u>
TOTAL SHIPMENT							20,000



EXHIBIT IX-K

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ILLINOIS BASIN COUNTIES FOR  
INITIAL COAL QUALITY EVALUATION



- o Technological assessment of fines utilization to require sampling and analytical examination of the selected design coal to provide criteria for coal washing, if needed, and for steam generation in cyclone furnace and pulverized furnace boilers.
- o Construction and sampling and testing of the Kentucky stockpile at periodic intervals over one year for coal quality, size degradation, gasification performance and leaching.
- o Analytical examination of export samples from the gasification test to develop environmental design criteria and support market development efforts.

#### 5.1.2 Work Completed

5.1.2.1 Selection of Camp 1 Coal - The initial coal quality evaluation was accomplished in early 1980 (Exhibit IX-K). It consisted primarily of Pen State coal data from Illinois Basin counties.

In November 1980, a preliminary collection of Illinois Basin coal quality data was developed to support the selection of coals for potential plant supply and full scale commercial testing. Some information was provided by potential suppliers and some was developed from special run-of-mine samples analyzed in the United States. The coal quality data were examined and used as a guide to identify representative candidate mines for the supply of the test coal. Exhibit IX-L summarizes the sample identification while Exhibit IX-M illustrates the geographical location of candidate mines.

In December 1980, the list of mines was narrowed down to three as the potential source of the 22,000 short ton sample of raw coal for the test. The candidate coals were from the Kentucky 9 seam and were mined by the conventional, underground method. The mines were Camp 1, Ken and Providence (Exhibit IX-N).

The three candidate mines were again sampled in December 1980 and representative splits of the run-of-mine samples were flown to Lurgi in Frankfurt, Federal Republic of Germany and Sasol in Sasolburg for examination. Commercial Testing & Engineering Co. (CT&E) in Henderson, Kentucky also analyzed the samples as a referee.

The technical recommendations of Lurgi, Sasol and Paul Weir provided the basis for selecting Camp 1 as the preferred coal for the commercial scale test at Sasolburg.





## EXHIBIT IX-L

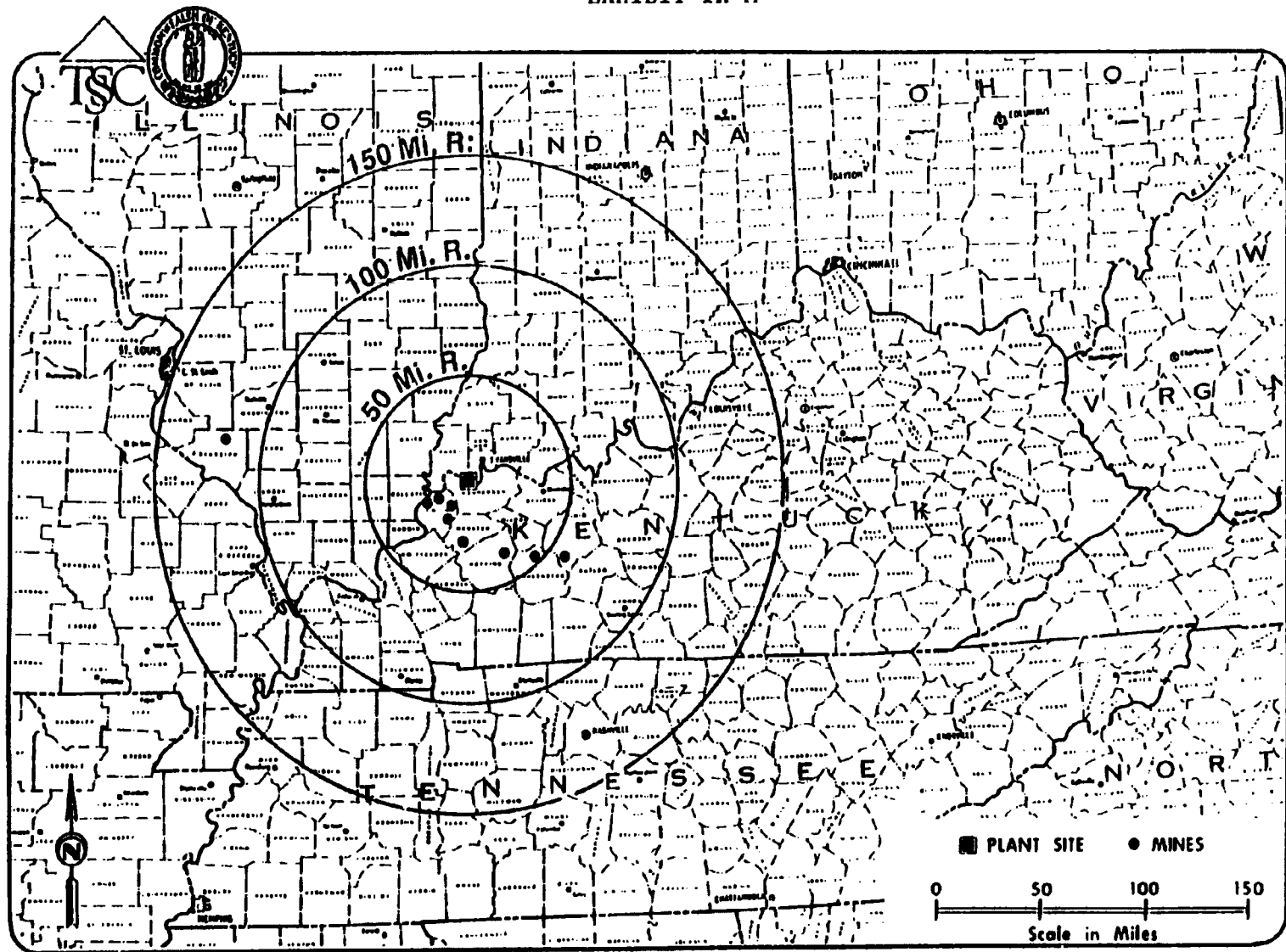
**LURGI GASIFICATION TESTS OF U.S.A. COALS**

<u>LOCATION</u>	<u>DATE</u>	<u>SPONSOR</u>	<u>PROJECT</u>	<u>COAL</u>	<u>TEST GASIFIER</u>
Westfield, Scotland	1973-4	American Gas Association/Office of Coal Research	Trials	Montana Rosebud	Mark II
				Illinois 5	Mark II
				Illinois 6	Mark II
				Pittsburgh 8	Mark II
Sasolburg, Republic of South Africa	1974	ANG Coal Gasification	Great Plains Gasification	North Dakota Lignite	Mark III
	1977	Carter Oil	Exxon East Texas	East Texas Lignite	Mark III
	1981	Panhandle Eastern Pipeline	WyCoal Gas	Wyoming Sub-Bituminous	Mark IV
	1981	Texas Eastern Texas Gas	Tri-State Synfuels	Kentucky 9	Mark IV Modified
	1982	Phillips Coal	Texas Gasification	East Texas Lignite	Mark IV

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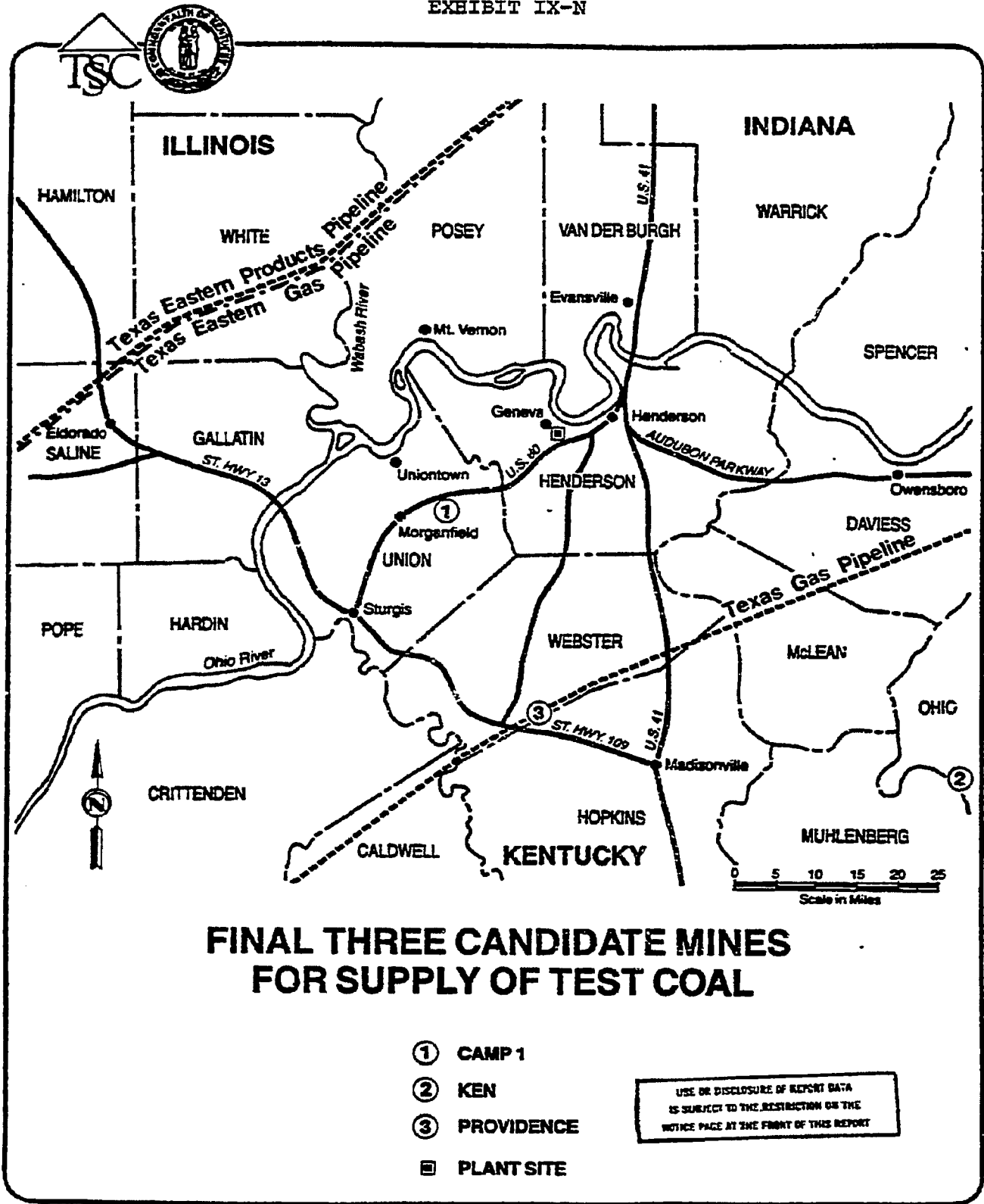
EXHIBIT IX-M



**CANDIDATE MINES FOR SUPPLY OF TEST COAL**

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#### 5.1.2.2 Collection and Shipment - Mine/Barge, Ship and Train Programs

##### Selection and Loading at Uniontown, Kentucky

Camp 1 coal loading commenced February 23 at the Uniontown dock on the Ohio River and lasted over a three-day period. Direct feed from the mine storage was used to enable selection from the nine-mile conveyor belt and allow low loading rates (1300 tons per hour) to limit breakage.

Loading was completed February 25 and the tow left the next morning for the 900-mile trip to Darrow, Louisiana. On the 15-barge tow, 22,558 tons of 2 inch x 0 raw coal were loaded at an average fines content of 37.2%.

Reports were prepared on the coal selection, sampling and loading at the Morganfield and Uniontown locations. The reports include visual inspection, barge draft, screen test, barge composite size and quality and leaching.

Splits of the barge composite sample representing the 22,558 ton shipment were sent to Lurgi, Sasol, University of Kentucky - Institute of Mining and Minerals Research, The Pennsylvania State University by Commercial Testing & Engineering, Henderson for examination and reports.

##### Transloading at Darrow, Louisiana

The tow arrived at Darrow milepost 175 on the Mississippi River on March 2 where the barges were secured and inspected daily until barge-top sampling commenced March 17 and 18.

The M.S. Bonita's holds were inspected for cleanliness just prior to transloading which commenced on March 19 in midstream at milepost 180. Two cranes with 16-cubic yard buckets were used to transload the coal from both sides of the ship. Each bucket was lowered to the top of the pile in the ship's holds so as to minimize breakage.

The loading was completed on March 20 and the bulk carrier left Darrow early the next morning for the Gulf of Mexico and South Africa.

##### Offloading at Port Elizabeth, South Africa

After the 8,600-mile voyage, the M.S. Bonita arrived in the Port Elizabeth harbor on April 15 and berthed later that day.



Offloading commenced on April 17. Up to six small clamshells on shore cranes were used for loading the coal on side dump rail cars of 35-metric ton capacity. Two or three tracks were used simultaneously. The overall unloading took 10 days including the Easter holiday. A total of 587 rail cars were inspected, loaded, sampled and weighed before dispatched in 34-car trains to Sasolburg.

The original sampling plan was modified after one shift to reduce the number of increments drawn for screening tests from two to one per rail car. One quality increment was drawn from every rail car. The samples were taken by modified (stratified) top car sampling, composited and split for analysis.

The McLachlan & Lazar rail car sampling results at Port Elizabeth were compared with the screening and analytical results during the loading operation at Uniontown and barge-top sampling at Darrow. Further, the M&L results on standard coal analysis parameters were compared on a split of the rail car samples taken at Port Elizabeth.

5.1.2.3 Gasification Test at Sasolburg - The commercial scale coal gasification test was conducted at the Sasol One plant between July and November 1981 on the Kentucky 9 coal.

The test consisted of three phases:

- o An optimization run, a 48-hour mass balance run, and a six-hour high load run in July - August which was terminated due to Sasol production priorities. The mass balance operated at 34,000 normal cubic meters per hour of raw gas with 2 inch x 1/4 inch dry screened coal.
- o A continuation of the high load test in September which also demonstrated closed loop tar recycle over 107 hours of operation. The test was terminated in order to make modifications to the distributor-stirrer. The high load tests were operated at between 45,000-48,000 normal cubic meters per hour of raw gas with 2 inch x 1/4 inch wet screened coal.
- o The final high load test in November ran over 42 hours with the modified distributor-stirrer and confirmed the earlier results of 45,000-48,000 normal cubic meters per hour of raw gas with 2 inch x 1/4 inch wet screened coal.



The total run-of-mine coal shipment to Sasolburg was 20,400 metric tons. During the tests, 5,923 metric tons were fed to the gasifier and 6,577 metric tons were rejected as fines. The balance of 7,900 metric tons was not used due to degradation of size consist because Sasol was forced for safety reasons before the November test to move and compact the coal to prevent spontaneous combustion.

A cooling tower test was completed over a three-month period on stripped gas liquor from the Camp 1 coal. The chemical and biological quality of the stripped gas liquor was measured and various corrosion monitoring devices were examined and measured. Environmental tests on the cooling tower inlet and outlet air were conducted.

Sasol prepared a summary report, a full report and test results and analyses only report. The summary report, a copy of which is included in Section 3.3, Work Plan Review, contained an executive summary, test results for mass balance, test run description and log sheets with selective data. The full report contained for both the gasification test and cooling water test, design recommendations, conclusions, major observations, objectives and discussion.

5.1.2.4 Coal Fines Utilization in Furnace Boilers - A representative sample of the fines from the Camp 1 coal shipment to Sasolburg was analyzed by ASTM methods for quality both on a raw and washed basis for various screen size fractions.

These analyses were compared with specifications for both cyclone (wet bottom) and pulverized (dry bottom) furnaces and conclusions drawn.

A survey was made of nearby utilities which could utilize the fines.

Several provisions were identified which should be considered for the design of the storage, handling and transportation systems for fine coal.

5.1.2.5 Kentucky Stockpile - A 200-ton stockpile, representative of the Camp 1 coal shipped to Sasolburg, was constructed at Uniontown during and shortly after the loading in February 1981. The pile was compacted to simulate dead storage. An instrument station was set up to accumulate selected meteorological data and temperature profiles of the stockpile.



A series of nine analytical and size analysis samples were taken over a 12-month period ending February 26, 1982. The analytical samples were split and provided to Lurgi, University of Kentucky - Institute for Mining and Minerals Research and Commercial Testing & Engineering, Henderson, for reports. Texas Gas provided two reports on the interim and final basis for the site observations. Paul Weir provided conclusions on the weatherability and leaching via ASTM analyses, while Lurgi reported expected impact on gasifier performance.

5.1.2.6 Export Sample Program - Various liquid and solid samples were taken during the commercial scale test and shipped to the United States for analysis.

The samples include raw, dephenolized and stripped gas liquor; biological sludge; tar; crude phenol; coal; gasifier ash; Synthol wastewater; cooling tower influent and blowdown; and miscellaneous samples.

Tar-oil samples were taken for possible characterization and pilot plant testing for hydrogen upgrading. However, the samples contained virtually no oil and hence, creosote oil upgrading to diesel fraction was not required for the design. No tests were planned on the partial oxidation of the tar which was planned for the design basis.

Crude phenol samples were characterized by Merichem Corporation. The phenols are typical and represent a valuable raw material for further use in the plastics industry. However, partial oxidation of crude phenols was planned at least for the early operation of the plant.

A preliminary report has been prepared by Radian Corporation which contains a large amount of raw data. The analytical groups that have been examined include water quality, organic, priority pollutants, trace metals, radio nuclides, proximate/ultimate, physical properties and leachate. Due to budgetary restraints, it has not been possible to consolidate this data into a cohesive set of results, analytical method, descriptions, and design implications.

This program will be completed during the demobilization phase activities as discussed more fully in Project Review Report, Volume 6, Environmental, Health, Safety and Socioeconomics.

5.1.2.7 Wastewater Treatability Study - A large amount of stripped gas liquor from the commercial scale coal test was shipped to the United States for characterization and treatability studies. This stripped gas liquor was taken from the same lot as accumulated at Sasolburg for the cooling tower test.



EXHIBIT IX-0

KEY DECISIONS REACHED

<u>Decision</u>	<u>Rank*</u>	<u>Date</u>	<u>Alternatives</u>	<u>Rationale for Decision</u>
Selection of Camp 1 coal	3	January 1981	Other coals	Proximity to Towhead Reserves, barge loading convenience
Confirmation of Camp 1 coal gasification	3	August 5-8, 1981	Other gasification technology than Lurgi	Mass balance test
Use of wet screening to control fines	3	August 7, 1981	Other types of screens	Wet screening reduced undersize in coal feed to allowable level of about 3%
Use of 2 inch screen to remove oversize material	3	August 10, 1981	None	Operation requires more attention (clinkering)
Defer high load test	3	August 12, 1981	None	Sasol production priority
Demonstration of design load conditions to set number of gasifiers	3	Sept. 19-20, 1981	None	High load test with tar recycle conducted at steady state
Use of stripped gas liquor proved infeasible for cooling tower makeup water	3	December 1981	Extra river water for makeup and discharge wastewater to river after usual biological treatment	High chloride levels in test caused excessive corrosion rates and destroyed biological activity
Update design coal flow and heat balances around gasification unit through syngas	3	January 1982	Rely on TG-10 coal sample balances	Sasol coal gasification test results represented confirmation of feasibility study estimate and optimized steam and gas flow rates for design coal

\*3-Absolute

2-Preliminary (pending additional input/information)

1-Operational (little to no support)



Engineering Sciences Company has recently been awarded a contract to do a series of bench scale tests to develop and optimize treatability parameters that will be useful in setting the design. The unit processes cover nitrification, biological treating and activated carbon polishing.

The program is more fully covered in Project Review Report, Volume 6, Environmental, Health, Safety and Socioeconomics.

#### 5.1.3 Key Decisions

The key decisions reached in the overall program are shown in Exhibit IX-O and summarized below:

- o Selection of Camp 1 coal -- the basis for the technical, economic and environmental aspects of the project.
- o Confirmation of coal gasifiability -- a fatal flaw would have required examination of other gasification technology.
- o Use of wet screening for coal preparation -- to maintain less than 3% undersize at 1/4 inch cutoff to provide satisfactory feed quality for gasification.
- o Use of 2-inch screen for coal preparation -- to remove from gasifier feed oversize rock and pyrite which were suspected to have contributed to the clinkering in that they require a somewhat higher steam-to-oxygen ratio compared to what had been determined so far.
- o Delay of high load test -- caused a slip in establishing the number of gasifiers.
- o Use of stripped gas liquor for cooling -- ruled out because of excessive corrosion rates experienced and failure of biological activity due to the high chloride content liquor.
- o Update of design coal material and heat balances -- based on results of commercial scale coal test.

#### 5.1.4 Major Accomplishments/Milestones

The major accomplishments and their milestones are tabulated in Exhibit IX-P. They range from the selection of the coal, collection and shipment, commercial scale gasification tests, fines evaluation and stockpile testing. These testing aspects occurred from June 1980 through February 1982.



EXHIBIT IX-P

MAJOR ACCOMPLISHMENTS/MILESTONES COMPLETED

<u>Description</u>	<u>Initiated</u>	<u>Completed</u>
Selection of Camp 1 Coal	June 1980	January 1981
Collection and Shipment:		
o Barge Loading	February 23, 1981	February 25, 1981
o Ship Transloading	March 19, 1981	March 21, 1981
o Ship Offloading	April 15, 1981	April 25, 1981
o Stockpiling	April 18, 1981	April 30, 1981
Development of heat and material balances for design coal from gasification through syngas based on TG-10 sample and sent to Fluor (LPTH-0013)	May 1981	June 19, 1981
Gasification Test at Sasolburg:		
o First Phase	July 22, 1981	August 14, 1981
o Second Phase	September 14, 1981	September 20, 1981
o Third Phase	November 14, 1981	November 16, 1981
o Reporting		March 18, 1982
Development of coal size degradation formula to predict fines generation during rehandling (WChEH-0012)	April 1981	November 20, 1981
Recommendations for crushing and screening conceptual design to prepare stable gasifier feed coal (WChEH-0012 and Texas Gas letter)	July 1981	November 20, 1981 December 9, 1981
Development of updated heat and material balances for design coal from gasification through syngas based on Sasol coal test data and sent to Fluor (LPTH-0065)	December 1981	January 11, 1982



EXHIBIT IX-P (Continued)

MAJOR ACCOMPLISHMENTS/MILESTONES COMPLETED

<u>Description</u>	<u>Initiated</u>	<u>Completed</u>
Development of updated total, coarse and fine coal quality data for gasification and steam-power generation design (WChEH-0022)	February 1981	February 24, 1981
Kentucky Stockpile Tests	February 23, 1981	February 26, 1982
Assessment of fines utilization in furnace boilers	February 25, 1981	April 19, 1982
Preparation of fines utilization report (WChEH-0025)	April 1981	April 29, 1982
Recommendations and observations for dead pile storage (LFTH-0112, WChEH-0026, Texas Gas reports)	February 1981	June 1, 1982
Summary report on gasification test revised by Sasol to meet US DOE Cooperative Agreement Deliverable Requirements	March 29, 1982	June 1, 1982
Export Sample Program	July 1981	To be completed September 1982
Wastewater Treatability Study	April 1982	To be completed July 1982



The results of these activities were used to confirm or substantiate the preliminary design heat and material balances and develop size degradation, design coal quality and fines assessment for the Camp 1 sample. These activities overlapped with the testing aspects and occurred from December 1981 through June 1982.

The specific recommendations, findings and observations are listed below under each separate program.

5.1.4.1 Selection of Camp 1 Coal - A broad range of Illinois Basin coals was surveyed and the three candidate coals--Camp 1, Ken, and Providence--were examined in some detail for the commercial scale test and certain preferences were provided by:

- o Concluding from Lurgi laboratory tests and Sasol's concurrence that Camp 1 and Ken samples would qualify as suitable gasifier feed coals based on their proximate analysis, carbonization assay, ash melting behavior, reactivity, free swelling and caking indices. However, the Providence sample exhibited strongly swelling properties and was not recommended for the first plant.
- o Concluding from Paul Weir examination that the Camp 1 mine could provide the best sample because it operates in the seams contiguous to the Towhead Island Reserves--one of the potential candidate reserve sites--and has the ability to transport the mine sample by belt to a barge loading facility to limit production of fines.

The ultimate selection of Camp 1 coal for the test coal shipment resulted from the following considerations:

- o Geographical proximity to the plant site since a substantial portion of the coal feedstock would come from nearby Kentucky 9 reserves which are considered similar to the test coal.
- o Ability to limit fines content to about 35% in the run-of-mine coal to compensate for attrition of coarse coal during the several rehandling operations required to transport the coal to Sasolburg. The conveyor belt operation at Camp 1 would allow a selection period of one hour for the rejection of fine slugs before loading the barges.
- o Logistics which avoided rail or small barge movement to the Ohio River to minimize rehandling and attendant fines generation.



5.1.4.2 Collection and Shipment - The collection and shipment program provided the basis for the design of the coal preparation units by:

- o Developing conceptual coal preparation flow diagrams to limit fines generation and yet reject rock and mine gob that will arrive with the coal. The large rock and hard materials have been identified both at Camp 1 mine and Sasolburg locations and may require more attention if sent to the gasifier. These diagrams feature:
  - A 3-inch rotary breaker at the mine to reject large rock and shale pieces.
  - A 2-inch rotary breaker at the plant under Tri-State control to insure rejection of rock and hard material such as "sulfur balls."
  - A wet screening operation at the plant to reject mine gob and allow delivery of coal of rather constant gravity and fines specifications to the gasifier.
- o Developing a design coal analysis for both coarse and fine fractions based on the analytical and size samples from the 15-barge shipment. In addition to standard ASTM type coal analyses, design Fischer assay, trace elements, fluorine and mercury contents are provided.
- o Developing a formula to predict the effect of rehandling on fines generation during coal transport and preparation. For the type handling and the size distribution data collected during this program, the percentage of fines increased by an average of 0.5% at each stage of handling. The measure of fines generation was set as the increase in the cumulative weight percentage passing the 1/4-inch round role screen.
- o Confirming from the Lurgi laboratory results that the Camp 1 coal is a suitable feedstock for the Lurgi pressure gasification process. Lurgi reported that the ash melting characteristics under oxidizing conditions indicated a "short" ash which means that the steam/oxygen ratio will have to be controlled carefully. The reactivity of the coal is typical for the Illinois Basin. The Fischer tar assay is typical but the yield will be lower and the tar recycled will be gasified and not converted to oil. The chlorine content is significantly higher than most coals, and the gasifier but not the downstream equipment must be fitted with protective cladding.



5.1.4.3 Gasification Test at Sasolburg - The commercial scale gasification test on Camp 1 coal provided the basis for the design of the coal preparation and gasification units for the Tri-State Synfuels Project by:

- o Confirming that moderately swelling and strongly caking Illinois Basin coals can be gasified in the Mark IV gasifier fitted with a distributor stirrer when using a non-caking coal for startup from an empty gasifier.
- o Anticipating coke or non-caking coals must be used for startup of an empty gasifier since such a gasifier cannot be started up from "empty" using a swelling and caking coal.
- o Confirming the design and performance of the distributor stirrer was satisfactory for Illinois Basin type coals.
- o Demonstrating the need for two additional gasifiers over the 36 predicted in the April 1980 feasibility study. The 45,000 normal cubic meters per hour rate as recommended by Sasol at 26 bar pressure corresponds to about 49,100 normal cubic meters per hour in the Lurgi design when Tri-State's higher operating pressure of 31 bar is taken into account. Even with a gasifier availability as low as 80%, this yields 38 gasifiers. The coal throughput rate per gasifier corresponds to 720 short tons as received coal per day.
- o Determining the steam requirement of 2.66 tons per ton dry ash-free coal based on the Sasol test results was the same as predicted for the feasibility study. The Lurgi design is 2,85 tons per ton or about 8% higher than the feasibility study.
- o Confirming the oxygen (100% purity basis) requirement of 0.52 ton per ton dry ash-free coal based on the Sasol test results was about 7% lower than predicted for the feasibility study.
- o Determining coal feed to the gasifier should be 2 inch x 1/4 inch with preferably less than 3% fines because the throughput of the gasifier with distributor-stirrer is limited by fines carryover. However, smooth operation was achieved at an average fines content of 2.6% with peaks as high as 5.4%.
- o Determining the gasifier should be fed coal with a rather constant specific gravity to minimize adjustments to steam flow.



- o Anticipating use of wet screening is preferred over dry screening in order to ensure close control of undersize in the gasifier feed and acceptability of wet coal during expected rainfall and snowfall periods. Equipment to dry screen coal with close undersize control may be available although its applicability for the project was not the purpose of the test.
- o Determining the amount of excess fines to be expected from run-of-mine Illinois Basin coals considering the ability of the Lurgi gasifier to handle coal with a cutoff size of 1/4 inch with several percent fines.
- o Determining segregation of coal and fines generation should be minimized or avoided at every step from coal receipt through gasification bunker by proper equipment design since the process is sensitive to fines content on an average and peak basis.
- o Determining large, heavy particles in the coal feed be removed positively by breaking the coal in a Bradford-type breaker with 2 inch openings. The heavy, hard lumps will break very little due to their high mechanical strength in this type of coal breaker and will be rejected entirely for all practical purposes. Loss of good coal should be minimal as it will readily break to 2 inch size.
- o Anticipating recovery of the oversize, hard, heavy material in the nominal 2 inch x 0 coal is not warranted due to its low carbon content and its requirement of more operating attention in the gasifier.
- o Anticipating separate storage for each coal supply is preferred over single combined storage. Intentional blending of several supply coals to smooth out expected variations in certain gasification characteristics such as free swelling and caking indices and ash fusion temperatures is not recommended by Lurgi because of the complexity of equipment, inability to predict interaction of ash quality on fusion temperatures and additional fines generation.
- o Determining gasifiers should be clad to protect against corrosion from high chloride content coal. The design coal has a chlorine content of 0.12% weight compared with 0.06% weight chlorine in the feasibility coal.



- o Confirming dusty tar injection is feasible up to certain limits and all tar injected is gasified. For design purposes, the net make of tar was planned to be partially oxidized.
- o Determining no oil is produced directly from the gasifier since there was no hydrocarbon phase lighter than water in the separator though this may be due to the routing of all condensates into one separator under the conditions of the test. Therefore, creosote upgrading was eliminated from the design.
- o Determining no shift unit is required to adjust the hydrogen-to-carbon monoxide ratio to that required for the input to the Fischer-Tropsch Synthol unit or methanol unit.
- o Determining increase in frequency of monitoring and quality control measures is required over the Sasolburg and Secunda measures due to coal characteristics.
- o Determining direct use of stripped gas liquor for plant cooling purposes is neither practical nor economical due to the excessively high chloride levels and is best handled, after biotreatment, by discharge to large water sources.

5.1.4.4 Coal Fines Utilization in Furnace Boilers - An examination of the fines representative of the Camp 1 coal provided the design criteria for combustion in furnace boilers and certain considerations in fines handling by:

- o Determining Camp 1 raw fines or washed fines are suitable as a potential fuel source in cyclone (wet bottom) and pulverized (dry bottom) furnaces.
- o Identifying:
  - Nearby utilities with proper combustion equipment to handle fines.
  - Several requirements for design of storage, handling and transportation systems for fine coal to overcome problems with retained moisture content.

5.1.4.5 Kentucky Stockpile Tests - The tests conducted on the compacted stockpile of run-of-mine Camp 1 coal at Uniontown provided the following major observations over the one-year period:

- o No spontaneous combustion occurred in the pile as evidenced by a maximum July temperature of 97°F.



- o No serious oxidation occurred, except on the surface, due to successful compacting during the construction.
- o Oxidation of the pile occurred on the surface as evidenced by large pieces of coal and shale tending to break up, iron pyrite becoming more visible, and appearance of white colored hydrate of iron sulfate.
- o No evidence of vegetation being killed by acid runoff in vicinity of pile probably due to neutralization by the limestone base.
- o The pH of the rainwater ranged from 4.1 to 7.0 and averaged 6.0. Some indication exists that lower pH's occurred in months when winds were predominantly southerly to southwesterly.
- o The pH of the leachate ranged from 2.7 to 3.4 and averaged about 3.0. The acidity of the leachate is due to oxidation of the sulfides and arsenides and dissolution of the resultant sulfates. No correlation was found between leachate pH, amount of rainfall and rainfall pH.
- o The sodium chloride content, as measured by the water soluble sodium, decreased as expected, due to rain percolation. About 12% of the chloride and about 50% of the water soluble sodium were leached out.
- o Rainwater leaching of other major elements and trace elements has been calculated by both disappearance from the coal as well as by appearance in the leachate. The results vary considerably due to the method of calculation and the element being leached. The appearance method is more accurate an indication of the extent of leaching.
- o Leaching by rainwater has been compared with leaching by the ASTM and RCRA methods for regulatory purposes.



- o Coal characteristic properties, measured by Commercial Testing & Engineering for Paul Weir on the random samples, which can be expected to have been influenced by weathering such as gross calorific value, moisture, oxygen, caking and grindability indices, tended to be within the allowable limits of reproducibility. Moisture and oxygen contents appeared to increase and the gross calorific value and caking indices appeared to decrease as expected, but the changes may not be statistically significant. Further, no significant oxidation was observed by the Gieseler Plastometer test, a sensitive indication of oxidation, or by the free swelling index, a less sensitive indicator of oxidation.
- o A slight oxidation of the coal was reported by Lurgi based on the following tendencies:
  - Decrease in gasification reactivity from 0.029 to 0.020.
  - Decrease in caking index from 19 to 13.
  - Decrease in volume increase in pressure coke from 15 to 3.

The majority of the observed decrease in characteristic values occurred during the first three to six months. Lurgi reported no change in the free swelling index through the entire program.

- o No significant size degradation occurred due to weathering. The observed degradation from 35% fine to 47% fine occurred due to compacting the coal during stockpile construction.

The stockpile tests also provided the following conclusions and design recommendations by:

- o Determining macrochanges in ASTM physical and chemical properties due to weathering and leaching were minimal with the exception of chloride losses as sodium chloride. For design purposes, the chemical and physical composition of the Camp 1 coal is estimated to remain unchanged with the exception of sodium chloride during long term storage.
- o Determining leaching of salt and trace metals will occur due to rain water leaching and provision should be made in the design to contain and treat the leachate with the identified composition.



- o Determining macrochanges in the gasification characteristics of reactivity, caking and pressure coke expansion for the Camp 1 coal did not impact the test results at Sasolburg because these characteristics showed no significant changes over the corresponding stockpile sampling and test periods. However, in the event that freshly mined coal is fed to the gasifier, several results would be expected:
  - A lower oxygen consumption would result due to the higher reactivity.
  - A higher volume increase in (more brittle) pressure coke would be compensated by the higher caking index.
- o Demonstrating compaction of the coal is successful in preventing spontaneous combustion and should be adequate for construction of a safe dead pile. However, additional fines will be created which represent lost gasification feed.

#### 5.1.5 Major Problems

The commercial scale test program experienced major problems in several areas which were solved:

- o The topsize of the coal as delivered to the screening plant in Sasolburg exceeded the 2 inch size as specified and contributed to clinkering during Phase 1 of the test. The problems were traced to relatively large amounts of larger pieces of heterogeneous coal and rock (high specific gravity) which segregated in the gasifier bed eventually leading to clinkering and shutdown. The solution was to screen out all greater than 2 inch coal. In the report, conceptual designs are offered for the commercial plant to eliminate this test-related problem by rejection of the hard oversize material.
- o The specific gravity of the gasifier feed coal fluctuated considerably due to the rock content and pyrite coal content in Phase 1 until measures were taken to screen out the larger pieces which tended to be of high gravity. The installation of quality control measures are important and must be practiced at all locations from the mine to the gasifier feed if problems are to be anticipated and minimized. Temporary increases in coal feed gravity are compensated for by increases in steam rate.



#### 5.1.6 Assumptions Challenged

The commercial scale test program led to new knowledge which challenged major assumptions in several areas:

- o Size degradation of the run-of-mine coal was less than previously anticipated for all the handling points and long term storage involved in the program. It is concluded that the coal is rugged as long as proper precautions are taken in transfer and handling to limit breakage.
- o The capability of the Lurgi gasifier with distributor-stirrer to handle run-of-mine coals from the Illinois Basin could not be proven but; however, it does not look feasible. This conclusion was reached based on excessive dust carryover containing particles as large as 1/8 inch observed when the gasifier was operating at low loads with about 6% average undersize coal fines in the 2 inch x 1/4 inch coal feed. The test program demonstrated that 2 inch x 1/4 inch wet-screened coal with less than 3% fine coal could be gasified successfully and serves as the design basis.
- o Fines, in excess of those required for in-plant steam and power generation, will exist and must be disposed of by means other than the Lurgi gasifier. The feasibility study assumed that the distribution of coarse-fine material in the run-of-mine coal balanced the gasification-steam generation requirements. This assumption has been determined to be impractical because the typical size consist of Illinois Basin coals at the mine indicates the fine fraction at 1/4 inch cutoff greatly exceeds the in-plant fuel requirements. If the tests showed 1/8 inch cutoff was satisfactory for gasifier feed, then the fines would have balanced the coal requirements for steam generation. Options to utilize these excess fines have been examined by the Project Development staff and reported elsewhere.
- o The capability of the Lurgi gasifier with distributor-stirrer to handle 2 inch x 1/8 inch coal does not appear to be feasible for a commercial plant. The run had been planned but was never attempted because the dust carried over on coal screened at 1/4 inch (with very little material of 1/8 inch size) contained particles of 1/8 inch and even slightly larger indicating that particles as large as 1/8 inch would be carried over. Screening at 1/8 inch would therefore have been impractical.



- o The maximum practical throughput of the Lurgi gasifier on Kentucky 9 coal with distributor-stirrer was limited by the amount of dusty tar injection that the gasifier can handle and not by the bed fluidization characteristics.
- o The capability of producing 2 inch x 1/4 inch dry screened coal suitable for the Lurgi gasifier could not be demonstrated with the available screening equipment. Wet screening had to be used to reduce fines content to acceptable levels in the test equipment.
- o The Lurgi gasifier gross tar yield from Kentucky 9 coal was considerably less than anticipated by Lurgi from laboratory experiments. This reduces the byproduct workup facility size.
- o The Lurgi gasifier oil yield from Kentucky 9 coal was nil and not anticipated by Lurgi from laboratory experiments or by Sasol. This simplifies the byproduct workup facilities.
- o The Lurgi gasifier dusty tar injection is essentially completely gasified. This increases the gas yield.
- o The raw gas hydrogen-to-carbon monoxide ratio was higher than anticipated by Lurgi thus eliminating a need for shifting to produce a proper synthesis gas composition.
- o Use of stripped gas liquor produced from high chloride content coals for plant cooling purposes is not practical or economical due to:
  - Extensive corrosion which occurred throughout the test with no signs of passivation.
  - Failure of biological system which occurred due to buildup of ammonium chloride which exceeded the tolerance of the bacteria.

#### 5.1.7 Consultant/Contractor Review

The several consultants and contractors used during the program were competent and responsive to the schedule. The reviews are presented in Exhibits IX-Q-1 through IX-Q-6.



EXHIBIT IX-Q-1

CONSULTANT/CONTRACTOR REVIEW

Firm: Paul Weir Company

Individual/Positions:

M. P. Corriveau	Senior Engineer and Vice President
M. J. Laurila	Coal Preparation Engineer
A. F. Duzy	Senior Engineer and Vice President
D. W. Pacer	Senior Engineer

Statement of Scope:

- o Provide recommendations for selection of Illinois Basin coals for Sasol test.
- o Plan and coordinate the selection, collection, sampling, preparation and analytical testing of the 22,500 ton shipment of Camp 1 coal.
- o Evaluate Camp 1 fines for furnace boiler use.
- o Plan, sample and test Kentucky stockpile for weatherability and leaching.

Dates of Service:

December 1980 through June 1982

Reports Prepared/Dates:

o Selection of candidate coals	December 3, 1980
o Selection of candidate coals	December 10, 1980
o Instructions for sampling, testing and analysis	February 16, 1981
o Modified instructions on splitting size samples	March 5, 1981
o Sampling program conducted at the Camp 1 mine	March 9, 1981
o Sample patterns for barge-top samples	March 10, 1981



EXHIBIT IX-Q-1 (Continued)

CONSULTANT/CONTRACTOR REVIEW

o Proposal for Weirco supervision in South Africa	March 16, 1981
o Instructions for sample preparation and analysis of barge-top samples	March 23, 1981
o Barge-top sampling program	March 27, 1981
o Meeting with Sasol on South African sampling program (WChEH-0001)	May 15, 1981
o Camp 1 leaching tests (WChEH-0011)	November 18, 1981
o Conceptual crushing and screening plant (WChEH-0012)	November 20, 1981
o Fines generation in handling (WChEH-0012)	November 20, 1981
o Test work on specimens (WChEH-0014)	January 9, 1982
o Summary Camp 1 analytical data (WChEH-0022)	February 24, 1982
o General technological assessment of fines utilization in boilers (WChEH-0025)	April 29, 1982
o Special oxidation study (WChEH-0026)	May 11, 1982 (incomplete draft) June 1, 1982 (final)

Decisions Impacted:

- o Development of the Camp 1 design coal analysis of total, coarse and fine fractions.
- o Development of equation to predict generation of fines from rehandling operations.
- o Development of conceptual and preparation flow diagram.
- o Preliminary criteria for combustion utilization of Camp 1 fines.
- o Weatherability and leaching of Kentucky coal stockpile.



EXHIBIT IX-Q-1 (Continued)

CONSULTANT/CONTRACTOR REVIEW

Budgeted \$ to date:

Actual \$ to date:

Future Budget/Estimate: None

Performance Appraisal: Competent and responsive to schedule

Future Recommendations: Use, when needed



EXHIBIT IX-Q-2

CONSULTANT/CONTRACTOR REVIEW

Firm: Commercial Testing and Engineering Co.

Individual/Positions:

Lloyd W. Taylor, III	Manager, Central Division (Henderson, KY)
M. L. Jacobs	Manager, Instrumental Analysis Division (Golden, CO)

Statement of Scope:

- o Perform analytical services in connection with coal selection for Sasol coal test.
- o Perform inspection, sampling, and analytical services at Camp 1 mine, barge loading terminal and transloading locations under supervision of Paul Weir.
- o Provide coal samples to Lurgi, Sasol, University of Kentucky - Institute for Mining and Minerals Research and Pennsylvania State University.

Dates of Service:

June 1980 through June 1982

Reports Prepared/Dates:

- |   |                            |
|---|----------------------------|
| o Series of analysis reports on Camp 1, Ken and Providence mine samples on total, coarse and fine fractions | June 1980<br>December 1980 |
| o Screen analysis and analytical reports on Camp 1 shipment   | 1981-1982                  |

Decisions Impacted:

- o Refer to Paul Weir Company



EXHIBIT IX-Q-2 (Continued)

CONSULTANT/CONTRACTOR REVIEW

Budgeted \$ to date:

Actual \$ to date:

Future Budget/Estimate:

None

Performance Appraisal:

Competent and responsive to schedule

Future Recommendations:

Use, when needed



EXHIBIT IX-Q-3

CONSULTANT/CONTRACTOR REVIEW

Firm: McLachlan & Lazar (Pty) Ltd.

Individual/Positions:

Brian Casey

Manager, Commodity Sampling

Statement of Scope:

- o Conduct sampling, analytical and sizing of Camp 1 coal at Port Elizabeth during discharge to rail cars under the direction of Paul Weir.

Dates of Service:

April 1981

Reports Prepared/Dates:

- o Report on sampling and sizing analysis during discharge of M.S. Bonita at Port Elizabeth and subsequent further sizing and quality analysis at our Johannesburg Laboratories. 1981

Decisions Impacted:

- o Refer to Paul Weir Company

Budgeted \$ to date:

Actual \$ to date:

Future Budget/Estimate:

None

Performance Appraisal:

Competent and responsive to schedule

Future Recommendations:

Use, if needed



EXHIBIT IX-Q-4

CONSULTANT/CONTRACTOR REVIEW

Firm: Sasol Limited

Individual/Positions:

SASOL TECHNOLOGY (PROPRIETARY) LIMITED

P. Naude General Manager - Technology

Technology Transfer

J. P. Ingram	Technical Manager
A. D. Bosman	Consultant
J. W. Van Zyl	Principal Technical Advisor
C. T. Jooste	Principal Technical Advisor
R. Bettman	Principal Process Engineer
G. G. Lazar	Senior Project Engineer
H. Oosthuizen	Senior Technical Advisor
W. D. Saunders	Senior Technical Advisor
P. A. Van Schalkwyk	Technical Advisor
A. Niemand	Technical Advisor

SASOL ONE - Gasification - Operations

J. Rademeyer	Production Manager
J. Combrinck	Area Head
D. Keyser	Operations Assistant
H. Wagenaar	Operations Assistant
G. Visser	Senior Process Controller
L. Lambrecht	Senior Process Controller

Gasification - Maintenance

J. Fox	Foreman
P. Pottas	Foreman
H. Liebenberg	Foreman

SASOL THREE - Operations

D. Benade	Production Superintendent
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Statement of Scope:

- o Conduct laboratory screening tests for three coal samples to assist in selection for Sasol test.



EXHIBIT IX-Q-4 (Continued)

CONSULTANT/CONTRACTOR REVIEW

- o Conduct laboratory examination of Camp 1 coal shipment to Sasolburg for commercial scale coal test.
- o Conduct coal gasification test at Sasol One plant on Camp 1 coal and prepare reports.

Dates of Service:

December 1980 through June 1982

Reports Prepared/Dates:

- |  |                   |
|--|-------------------|
| o Telex on coal selection  | December 12, 1980 |
| o Laboratory results on three coals  | April 24, 1981    |
| o Coal Analysis - Tri-State coal gasification test   | June 29, 1981     |
| o Coal gasification test for Tri-State Synfuels Company - Summary Report, Full Report and Test Results and Analyses Only | 1981              |
| o Draft copy of new summary report (SJTB-0022)   | May 3, 1982       |
| o Final text of new summary report (SJTB-0026)   | June 1, 1982      |

Decisions Impacted:

- o Confirmation of Camp 1 coal gasification in commercial Lurgi gasifier.
- o Development of data for design heat and material balance.

Budgeted \$ to date:

Actual \$ to date:

Future Budget/Estimate:

None

Performance Appraisal:

Competent and responsive to schedule

Future Recommendations:

Use, when needed



EXHIBIT IX-Q-5

CONSULTANT/CONTRACTOR REVIEW

Firm: Lurgi Kohle und Mineraloeltechnik GmbH

Individual/Positions:

P. K. Herbert	Gasification Manager
K. Cleve	Project Manager
H. Schlepper	Process Engineer
J. Loeffler	Process Engineer
J. Ergezinger	Process Engineer
C. Bafke	Head, Gasification Department
W. Wilcke	Chemical Engineer
J. Krowarz	Mechanical Engineer
W. Sindel	Laboratory
W. Taubert	Laboratory
H. Knepper	Head, Mechanical Design
D. Sauter	Head, Laboratory
H. Raab	Laboratory
K. Zapke	Mechanical Engineer

Statement of Scope:

- o Conduct laboratory screening tests for three coal samples to assist in selection of Sasol test coal.
- o Conduct laboratory examination of Camp 1 coal shipment to Sasolburg for commercial scale test.
- o Prepare heat and material balance on Camp 1 coal for design basis.
- o Conduct laboratory examination of Camp 1 coal and coal liquid samples taken during Phase 1, 2 and 3 of commercial scale test.
- o Act as technical advisor to Sasol and Tri-State at commercial scale test.
- o Review Sasol coal gasification test reports.
- o Conduct laboratory examination of Kentucky stockpile samples and prepare engineering report.

Dates of Service:

December 1980 through June 1982



EXHIBIT IX-Q-5 (Continued)

CONSULTANT/CONTRACTOR REVIEW

Reports Prepared/Dates:

- o Tri-State Coal Sample Test Program (LFTH-0001) April 24, 1981
- o Design Coal Balance - TG-10 Sample (LFTH-0013) June 19, 1981
- o Coal Test Program - Sasol Test Coal (LFTH-0045) October 26, 1981
- o Sasol Draft Test Report (LFSJ-0001) January 7, 1982
- o Updated Design Coal Balances (LFTH-0065) January 11, 1982
- o Comments to Your TELF-0068 (LFTH-0068) January 14, 1982
- o Reports from Sasol Tests (LFTH-0069) January 14, 1982
- o Coal Report - November Test (LFTH-0099) March 15, 1982
- o Sasol's Final Draft Report (LFSJ-0002) March 22, 1982
- o Oxidation Studies on Stockpile (LFTH-0112) April 30, 1982
- o Comments on Sasol Executive Summary Report (LFSJ-0004) May 24, 1982

Decisions Impacted:

- o Confirmation of Camp 1 coal gasification in commercial Lurgi gasifier.
- o Development of design heat and material balances for gasification.

Budgeted \$ to date:

Actual \$ to date:

Future Budget/Estimate:

None

Performance Appraisal:

Competent and responsive to schedule

Future Recommendations:

Use, when needed



EXHIBIT IX-Q-6

CONSULTANT/CONTRACTOR REVIEW

Firm: Entran, Incorporated

Individual/Positions:

James D. Watson, Jr.                      Material Inspector

Statement of Scope:

- o Inspect 15 barges of coal at Darrow, Louisiana

Dates of Service:

March 3-17, 1981

Reports Prepared/Dates:

- o Synfuel Project #2050                      March 24, 1981

Decisions Impacted:

- o Security of 15 barges prior to transloading

Budgeted \$ to date:

Actual \$ to date:

Future Budget/Estimate:                      None

Performance Appraisal:                      Competent and responsive to schedule

Future Recommendations:                      Use, if needed



## 5.2 CURRENT STATUS

### 5.2.1 Current Work Activities

The work activities originally planned for the program are complete with the exception of the export sample program and wastewater treatability study.

The export sample program had been interrupted by the demobilization activities but the effort will be conducted. The current program being conducted by Radian involves a critical review of the test data results from samples taken during the test. The report will discuss the representatives of the results and their meaning to the project. The current work schedule calls for completion of the program by September 1982.

The wastewater treatability study is being conducted on stripped gas liquor obtained specifically from Camp 1 coal during the test program. Since the gas liquor has a limited shelf life, treatability tests are underway to develop data to optimize biological oxidation and other process steps. The Project Review, Volume 7, Section 5.0, Permitting, Environmental Impact Statement and Related Environmental Information, discusses the plans. The current schedule calls for completion of the final report on the study by September 1982.

### 5.2.2 Key Decisions Pending

No key decisions are pending.

### 5.2.3 Major Strengths/Weaknesses

The technical guidance information developed from this program provides a comprehensive study of the physical, chemical and gasification characteristics and design heat and material balances for the Camp 1 coal. In addition, critical environmental design and permitting criteria are being developed from the export sample and wastewater treatability study.

The major concern in the technology is the inability of the Lurgi gasifier to handle fines directly.

### 5.2.4 Demobilization

All work documentation, results and technology transfer activities have been completed concurrently with the demobilization activities with the exception of the export sample program and the wastewater treatability study which is now in progress.



EXHIBIT IX-R

FUTURE MILESTONES/MASTER SCHEDULE

Phase 1

<u>Description</u>	<u>Date</u>	
	<u>Initiate</u>	<u>Deadline</u>
Export Sample Program	August 1981	September 1982



### 5.3 FUTURE

#### 5.3.1 Milestone/Master Schedule

The future work activities involve the export sample program which will complete the technical and environmental knowledge relative to the design coal. The program is estimated to be complete by September 1982 (Exhibit IX-R).

#### 5.3.2 Work Program

The export sample program will involve the following activities:

- o Completion of analytical examination and characterization of liquid and solid samples taken during the commercial scale test of Kentucky 9 coal. The samples include raw, dephenolized and stripped gas liquor, biological sludge, tar, crude phenol, coal, gasifier ash, Synthol wastewater, cooling tower influent and blowdown and miscellaneous samples.

The analytical groups that have been examined include water quality, organic, priority pollutants, trace metals, radionuclides, proximate/ultimate, physical properties and leachate.

- o Interpretation of the significance of the samples through material and elemental balances leading to engineering and environmental design criteria and permitting background information.
- o Description of the analytical test methods used.

#### 5.3.3 State of Readiness

A state of readiness and awareness will be maintained by assessing emerging technologies, changing regulations and availability of key personnel and organizations.

#### 5.3.4 List of Tasks

No specific program oriented tasks can be defined at the present time as being first priority, if the project is reactivated. There is a high probability that technological questions will arise and will have to be answered on an individual need basis which cannot now be identified. Depending on the schedule of the project engineering activities, design coal material and heat balances will have to be fit precisely with the coal quality as developed for this program so as to arrive at an internally consistent basis for the coal from the stockpile to the syngas and steam generation.



#### 5.3.5 Long Lead Time

No long lead activities have been identified.

#### 5.3.6 Staffing

If the project is reactivated, technical support will not be required on the same level as the current program activities since the coal test is complete. However, technical support in coal technology will be required and is discussed in Project Review Report, Volume 13, Coal Sampling and Testing.



X  
COAL SUPPLY

Prepared by: Linda S. Rathbun - Manager, Project  
Development  
William M. Scriber - Resources, Coordinator

1.0 INTRODUCTION

1.1 SCOPE OF WORK

The Coal Supply Program was one of the responsibilities of the Project Development Group in the Tri-State Synfuels Project. The focus of the Coal Supply Program was the evaluation of coal supply options available to the Tri-State Synfuels Project ("the Project") the determination and recommendation of the least-cost, most desirable options available, and the negotiation of contracts for the recommended supply. The Coal Supply Program was also involved in recommending design coals for the gasifier, coal handling and storage, and plant logistic criteria based on the actual coal supplies which were being offered to Tri-State as feedstock. However, the primary focus of the work effort was clearly the determination and acquisition of the most desirable coal supply for the Project.

1.2 OBJECTIVES AND GOALS

During Phase I of the Project, the Coal Supply Program had two primary objectives:

- o Obtain signed contracts for the purchase and transportation of a coal supply which minimizes the total cost to the Project and maximizes the acceptability to the gasifier.
- o Insure that the plant design reflects the coal supplies available to the Project.

1.3 WORK EFFORT

The Coal Supply Program was conducted primarily by a Resource Coordinator and the Manager of Project Development. Strategic roles were played by other Tri-State, Texas Eastern and Texas Gas personnel and are reflected in Exhibit X-A. No consulting work has been completed or contracted for, however a considerable effort was envisioned for the remainder of Phase I. Consulting assistance was planned in the areas of



EXHIBIT X-A  
COAL SUPPLY PROGRAM

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

PROJECT PERSONNEL

Tri-State

<u>Name</u>	<u>Title</u>	<u>Date of Service</u>	<u>Area of Responsibility</u>
H.C. Homeyer	TSSP Executive Com.; Pres., Texas Eastern Synfuels	/ -	Direction to contract negotiations, TE position
P.M. Anderson	Project Director	5/80 - 6/82	Direction to contract negotiations, TE position
M.N. Kelley	Texas Gas Project Rep- resentative		Direction to contract negotiations, TxGas position
M.D. Burke	Deputy Project Dir.	12/80 - 6/82	Direction to contract negotiations, TE position; review of coal supply options
L.S. Rathbun	Mgr., Project Develop- ment	7/20/81- 5/15/82	Management & direction of coal acquisition program
W.M. Scriber	Resource Coordinator	1/81 - 6/82	Implementation of coal acquisition program
W.N. Shoff	Project Analyst	1/1/82- 4/19/82	Analysis of coal quality parameters

Texas Eastern Support

<u>Name</u>	<u>Title</u>	<u>Area/Type Assistance</u>	<u>Role</u>
A. Roeger	Technical Mgr.	Coal sampling & analysis	To assist in assessing technical factors relating to coal supply
J.A. Carson	Attorney	Contract development	To assist in the drafting of TE coal and transportation contracts
R.F. Wornson	Gen. Attorney	Contract development & negotiations	To draft TE coal and transpor- tation contracts & to assist the Project Team in negotiations

Texas Gas Support

Paul Fedde	VP Research and Development	Coal quality, mining condi- tions, etc.	Advise Tri-State staff on as- needed basis.
Jack MacKenzie	VP & General Counsel	Contract development & review	Assist in drafting & reviewing coal & transportation contracts



geologic evaluation, mine engineering and feasibility, and coal transportation costs and alternatives.

#### 1.4 ESTIMATED COSTS

Other than staff time and the affiliated overhead and travel costs, the major direct expenditures were for consulting services. \_\_\_\_\_ dollars were estimated to be spent during Phase I, \_\_\_\_\_ of which was to be spent by June 15, 1982. No contracts for consulting services have been entered into and none of the money has been spent. (See Exhibit X-B).



## 2.0 SUMMARY

### 2.1 HISTORY

#### 2.1.1 Work Plan

The effort of the Coal Supply Program was focused on evaluating the coal supply options available to the Project, choosing the best sources of supply, and contracting for it. The contracts for coal supply and transportation were to be specific, executable contracts but conditioned upon the positive decision on the part of Tri-State to construct the plant. The Coal Supply Program was also responsible for recommending coal design parameters for the Project which reflected the physical and chemical characteristics of the coal offered to Tri-State. Design parameters were required not only for the Lurgi gasifier but also the on-site coal handling and unloading systems being designed by Fluor. (See Section 3.0 for more detail on the Coal Supply work plan.)

#### 2.1.2 Description of Work Completed

Major work tasks completed thus far during Phase I of the Project are summarized as follows:

- o Thirteen major coal supplier companies active in the southern part of the Illinois Basin coal field were contacted and asked to propose mines to supply coal for the Tri-State Project. (See Section 3.0 for the packet sent to suppliers.) Numerous meetings were held with most of these companies during which a total of 34 mines were proposed as potential coal supply to Tri-State. These mines were all within 100 miles of the Geneva plant site and contained reserves sufficient to support over 50 million tons of annual production. (See Section 3.0 for a summary of the characteristics of these 34 properties.) These properties were evaluated for apparent suitability in the Lurgi gasifier, delivered costs, and their owning company's contracting position. Based on this evaluation, fifteen mines were eliminated from consideration by Tri-State as sources of supply. (See Section 3.0 for documentation of this evaluation process.)
- o The railroads which would potentially bring coal to Tri-State were contacted and preliminary discussions were held with them regarding general operating conditions within the region, rates, etc. The American Commercial Barge Line, a subsidiary of Texas Gas, was asked specifically to provide



estimates for barge rates from a number of candidate mines. Discussions were held with the consulting firm of Syntech (a consortium including A. T. Kearney) regarding their providing assistance in estimating transportation costs and specific tariffs. A proposal was prepared but no decision to proceed was made.

- o Design parameters for the Lurgi gasifiers were set based upon a statistical analysis of the characteristics of the 19 remaining candidate coal reserves. (See Section 3.0 for description of this analysis.)
- o An analysis of fines disposition options was conducted and preliminary conclusions were reached. Based on non-binding quotes from the potential coal suppliers, it was estimated that Tri-State could purchase a product which contained the desired level of fines (i.e., roughly 30% on an "as-consumed" basis) for a \$3 premium per total ton of coal purchased. This solution has been assumed for the economic modeling of the Project. However, building larger boilers and power generation facilities with a local utility may provide a more economic and operationally desirable solution. Preliminary discussions have been held with utilities on this matter and Big Rivers Electric Corp. in Henderson appears very interested in exploring the matter further.
- o Preliminary discussions were held with equipment manufacturers, coal consumers, and consultants regarding coal handling and unloading options for the Tri-State Project. No definitive evaluation of the costs and merits of various systems was conducted, and no final decision was reached. For the purpose of Fluor's design work, some preliminary assumptions about the kind of equipment and capability of the systems were made. (See Fluor report for greater detail.)
- o A coal contracting seminar was held for representatives of the Tri-State Project and the Legal departments of both Texas Eastern and Texas Gas. The seminar was led by representatives from the coal brokerage and consulting firm of Zinder-Neris. Also, a review was made of existing coal supply contracts of those coal companies who had proposed supplying coal to Tri-State. (See Section 3.0.)



- o Preliminary evaluations were conducted of the possible options for "starter" coal for the Lurgi gasifiers. Preliminary indications are that coal from the Powder River Basin of Wyoming would be the least-cost solution.

#### 2.1.3 Key Decisions Reached

Following are the key decisions reached in the Coal Supply Program thus far during Phase I of the Tri-State Project. (See Exhibit X-C for ranking, rationale, and alternatives considered for each of these decisions):

- o Buy Illinois Basin coal.
- o Buy all or most of a mine's output.
- o Buy approximately 1 - 1.5 million tons of coal per year from each supplier (mine).
- o Buy coal under long-term contracts (make spot purchases only to build up an adequate stockpile or during periods of interruption or limited volumes from any given supplier).
- o If economically viable, purchase coal which has the correct amount of "fines" (material which is less than 1/4" in size) to be utilized by the on-site boilers.
- o Deliver coal by both rail and conveyor belt.
- o Purchase coal from at least two independently owned mines other than Towhead Island.
- o Purchase run-of-mine (non-washed) coal.
- o Transport coal in railroad owned railcars.
- o Build unit train rail unloading capability at the plant.
- o Buy coal from the western United States (probably from the Powder River Basin of Wyoming) as "starter coal" for the Lurgi gasifiers.
- o Sign "conditional contracts" by the end of Phase I.

#### 2.1.4 Major Accomplishments/Milestones

The major accomplishment of the Coal Supply Program has been the development of a number of coal supply options to be evaluated as sources of feedstock for the Tri-State Project.



EXHIBIT X-B

COAL SUPPLY PROGRAM

ESTIMATED EXPENDITURES FOR WORK AREA

<u>Major Areas</u>	<u>Expenditures 2/6/81 - 6/15/82</u>	<u>To Complete Phase I</u>
	<u>Budget</u>	<u>Estimate</u>

Consulting Agreements

1. Reserve Evaluation

- a) Limited review :  
of 8-10 candi-  
date reserves
- b) More detailed  
review of 2-3  
"finalist"  
reserves, in-  
cluding Towhead  
Island

2. Coal Transportation  
Evaluation

- a) Simplistic esti-  
mate of rail &  
barge rates for  
8-10 candidate  
reserves
- b) Detailed esti-  
mates of rates  
for specific  
coal hauls;  
assistance in  
negotiations of  
transportation  
agreements

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EXHIBIT X-C

COAL SUPPLY PROGRAM

KEY DECISIONS REACHED

<u>Decision</u>	<u>Rank*</u>	<u>Date</u>	<u>Alternatives</u>	<u>Rationale for Decision</u>
1. Buy Illinois Basin coal	3		(1) Western Coals (e.g., Powder River Basin) shipped in	. Local, political pressure . Availability of many coal suppliers
2. Buy all or most of a mine's output	1		(1) Buy a portion of their output	. Better control over the mine's quality . Dedicated reserves . Benefits of "marriage" between supplier and consumer
3. Buy approximately 1-1.5 mmtpy from each supplier	1		--	. Generally the size of the mines proposed as suppliers
4. Buy coal under long term contracts (make spot purchases only during build-up and during periods of problem with a supplier)	3		(1) Buy some percentage on the spot market (2) Buy all on the spot market	. More predictable price . Security of supply . More predictable & consistent quality
5. Purchase coal in "fines balance"	2		(1) Sell excess fines (2) Briquet excess fines & use in gasifier (3) Build a power plant large enough to burn all the fines & sell power	. Coal suppliers are willing to do this for a premium which appears more economic than alternative (1) & (2); alternative (3) could be the best decision after further investigation.
6. Deliver coal by both rail and conveyor	3x		(1) Deliver by only rail or conveyor (2) Deliver by barge also	. Need flexibility of receiving coal by two transportation methods in case of strike, breakdown etc. . Coal mines served by rail or conveyor appear to be the least cost source of supply.

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EXHIBIT X-C (Continued)

<u>Decision</u>	<u>Rank*</u>	<u>Date</u>	<u>Alternatives</u>	<u>Rationale for Decision</u>
7. Purchase coal from at least 2 mines	2		(1) Purchase coal only from one mine	<ul style="list-style-type: none"> <li>Reduced vulnerability to effects of strike, disaster etc.</li> <li>Competitive pressure on alternative suppliers</li> </ul>
8. Purchase run-of-mine (non-washed) coal	2		(1) Buy partially washed coal (2) Buy fully washed coal	<ul style="list-style-type: none"> <li>Preliminary price differential doesn't justify washing coal</li> </ul>
9. Railroad would own rail cars	1		(1) Tri-State own (2) Tri-State lease	<ul style="list-style-type: none"> <li>Costs of alternatives (1) &amp; (2) not yet available</li> </ul>
10. Unit train rail unloading capability	3x		(1) Single-car unloading capability (2) Multiple-car unloading capability	<ul style="list-style-type: none"> <li>Volumes are large enough to require unit trains</li> <li>Cost savings (lower rates &amp; less chance of demurage)</li> </ul>
11. Buy western coal (probably from the Powder River Basin of Wyoming) as "starter coal"	1		(1) Eastern Kentucky coal (2) Coke	<ul style="list-style-type: none"> <li>Appears to be least cost</li> </ul>
12. Sign "conditional contracts"	3		(1) Letter of Intent (2) Binding contract	<ul style="list-style-type: none"> <li>Letters of intent are too loose so a contract is needed</li> <li>Since the Project might not proceed to operation, a condition allowing for such must be contained in the contract</li> </ul>

- \* 3x - Could change depending upon selection of final coal suppliers  
 3 - Absolute  
 2 - Preliminary (pending additional input/information)  
 1 - Operational (little to no support)

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Through numerous meetings with the potential coal suppliers, Tri-State personnel have been able to develop not only excellent working relationships with the suppliers, but also fairly detailed information on the proposed reserves. These meetings and this information enables Tri-State to proceed into the next phase of coal supply evaluation. (Exhibit X-D enumerates the major accomplishments completed thus far during Phase I in the Coal Supply Program.)

#### 2.1.5 Major Problems

There were two major problems which impeded the work effort of the Coal Supply Program. One problem was the confusion over the effect that certain coal quality characteristics would have on the operation of the Lurgi gasifier. Confusion over this issue and lack of clear guidance caused our communications with the potential coal suppliers to often be misleading and indicate more stringent quality requirements than actually were necessary. These same kinds of problems of lack of information and/or cost evaluations were experienced to a lesser degree with issues regarding the design of coal unloading, on-site handling, and storage systems.

The second major problem area was the immature level of information available on the Towhead Island reserves and proposed mine plan. Because many of the other Illinois Basin coal reserves being considered for the Project had been actively marketed by their respective owners for many years, fairly detailed mine plans and quality information was available on most of the reserves. However, similarly detailed information was not yet available from the Towhead Island reserve and this prevented the clear evaluation of the competitiveness of Towhead Island vs. other coal supply options. The problem had not yet had any serious ramifications on the Project to-date; however, prior to entering into serious negotiations with coal suppliers (as envisioned to occur in the latter half of 1982), the lack of such information would have precluded a decision upon how much of the Project's coal supply were to be furnished from Towhead Island and how much were to be purchased from other suppliers.

#### 2.1.6 Challenges to Major Assumptions/Conventional Wisdoms

The major area where the Coal Supply Program uncovered information which challenged major assumptions and/or conventional wisdom was in the area of the impact of coal quality characteristics on the plant's design and operation. After a series of meetings on this topic and subsequent correspondence and phone calls, it was determined that there are very few coal quality characteristics which have a measureable and quantifiable impact upon the design and



EXHIBIT X-D

COAL SUPPLY PROGRAM

MAJOR ACCOMPLISHMENTS/MILESTONES COMPLETED

<u>Description</u>	<u>Date</u>	
	<u>Initiated</u>	<u>Completed</u>
1. Initial discussions with coal suppliers	4/81	11/81
2. Initial discussions with coal transporters	7/81	10/81
3. Narrow down potential coal suppliers to 19 proposed mines	11/81	12/81
4. Specify coal quality characteristics for Lurgi design criteria	12/81	2/82

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operation of the plant (particularly the gasifier). Only the following characteristics were determined to be important enough to set a parameter by which to reject a candidate coal supply:

- o Free swelling index - for only generally specified reasons, Lurgi strongly recommended that no coal with a free swelling index greater than four be considered as a feedstock.
- o Chlorine - because of the corrosive effect of chlorine on the gasifier lining as well as downstream water handling and treatment, a maximum level of acceptable chlorine was set at .3%. Although the gasifiers would have to be clad with a special corrosion-resistant lining in order to utilize any Illinois Basin coal, the cut-off was set at .3% chlorine because of the potential of having to consider additional cladding for any coals with a higher chlorine content.
- o Ash fusion temperature--for more control during operation and a smaller danger of "clinkering" the gasifier, coals which have a wide range between the initial deformation and fluidizing temperatures would be preferred.

It was determined that there are no apparent problems with combining coal from more than one mine into a consistent, "blended" feedstock. Lurgi has some concerns about the advisability of doing this; however, their rationale was not clearly stated and thus their concerns were not considered an obstacle.

## 2.2 CURRENT STATUS

### 2.2.1 Current Work Activities

As of the time of the decision to demobilize the Tri-State Project, the Coal Supply Program had the following activities ongoing:

- o Follow-up meetings were being scheduled with the coal companies owning the nineteen coal reserves Tri-State is still considering as potential sources of feedstock. The companies had been notified by letter as to the status of the reserves that they had proposed as feedstock to the plant and of Tri-State's determination that only nineteen reserves were to be considered for further evaluation.



- o These nineteen coal reserves were to be evaluated further with the help of a cursory geologic and mine engineering review by a consultant or consultants. Their evaluations would assist in the determination of the most desirable of these properties and lead to the reduction of the list of "candidate reserves" to 4-8 properties being considered by Tri-State. The reduction of reserves to be considered for the Project was to be accomplished by June 30 of this year. Following this reduction, more detailed geologic and mine engineering reviews were envisioned for the remaining candidate reserves.
- o Rail and barge companies (L & N, ICG, and ACBL) were contacted and briefed on the status of Tri-State's coal acquisition program. They were told of the nineteen remaining "candidate coal reserves" and were asked to quote preliminary tariffs for the transportation of coal from those mines which were located on their respective transportation systems. These preliminary tariffs would be used in conjunction with the geologic and engineering evaluations mentioned above to determine the 4-8 most viable candidate coal properties.



- o Coal contract language was being collected and reviewed for discussion with the Texas Eastern legal department. A draft contract was to be prepared prior to the series of meetings with coal suppliers mentioned above.
- o A request had been made of PLM, Inc. (a railcar leasing and maintenance company) for a general quote of the lease and maintenance cost for the railcar requirements of the Tri-State Project. They were also asked to provide a comparative analysis of the economics of the various options for railcar ownership: the Project owning and maintaining its own railcars, the Project leasing the railcars, and the Project contracting with the railroads in such a manner that the railroads own and maintain the railcars.

#### 2.2.2 Key Decisions Pending

The major decisions that had not been made prior to the termination of Phase I of the Tri-State Project are:

- o Resolution of the most economic and feasible solution for the disposal of the "excess coal fines".
- o Whether to buy or lease rail and barge equipment.
- o Whether the Project should be equipped with both large scale barge and unit train railroad coal unloading.
- o The 4-8 primary coal supply reserves.
- o

- - -

#### 2.2.3 Major Strengths And Weaknesses Of The Coal Supply Program

Overall the major strength of the Coal Supply Program was the relationship Tri-State established with the coal suppliers in the region. Although competition among coal producers is keen in the Illinois Basin, Tri-State's Coal Supply Program had to convince the coal suppliers that the project was serious, viable, and worthy of the rather significant efforts involved in supplying information to the Project. Close, cooperative relationships were developed with most of the



coal suppliers and the Project was able to acquire the attention and information requested of the coal supplying companies.

#### 2.2.4 Demobilization Program

Demobilization efforts concentrated on the following activities:

- o Notification by phone and letter of coal suppliers, railroad, and barges companies of the status of the Tri-State Project.
- o Notification of utilities in the Tri-State region (with special additional conversations with Big Rivers Electric Corp.) of the status of the Project.
- o Notification of other coal contacts and consultants of the status of the Project.
- o Request that American Commercial Barge Lines continue the preparation of estimates of coal barge rates.
- o Update the estimates of the delivered cost of coal from the nineteen candidate coal supply reserves.
- o Write up notes of the November Lurgi et al. meeting
- o Clean up Coal Supply Program files and transfer into the Central Files of the Synfuels Division.

#### 2.3 FUTURE

##### 2.3.1 Milestones/Master Schedule

Attached as Exhibit X-E are the future milestones for the Coal Supply Program. Only minimal work had begun toward attaining the first milestone of reducing the candidate coal reserves to 4-8 properties. Thus, upon resumption of the Tri-State Project, these milestones and the timing required to complete them should still be considered valid.



EXHIBIT X-E

FUTURE MILESTONES/MASTER SCHEDULE

<u>Description</u>	<u>Phase 1</u>	<u>Date</u>	
		<u>Initiate</u>	<u>Deadline</u>
1. Reduce candidate reserves to 4-8		3/1/82	6/30/82
2. Determine fines disposition alternative		1/1/82	6/30/82
3. Determine coal transportation system requirements		7/1/82	9/30/82
4. Negotiate coal supply contracts		7/1/82	6/30/83
5. Determine rail car and/or barge ownership			
6. Negotiate coal transportation contracts		10/1/82	6/30/83
7. Negotiate fines disposition alternative			
8. Select coal supply		7/1/83	8/31/82
9. Execute coal supply & transportation contracts		9/1/83	10/1/83

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### 2.3.2 Minimal Effort Work Program

As a minimum, Tri-State staff should maintain contact with the coal suppliers, railroad and barge companies, and Big Rivers Electric Corp. to brief them on the status of the Project and the then-current plan for the resumption of full-scale efforts. Project personnel should also monitor the Illinois Basin coal market and price trends, to insure that upon resumption of the Project, negotiations for a coal supply can commence from a position of informed strength.

### 2.3.3 Maintaining a State of Readiness

In order to maintain a state of readiness to be prepared for the resumption of a full-scale effort on the Tri-State Project, the following coal supply activities were considered in addition to the minimal effort described above:

- o Request that Consol complete their mine plans for the Towhead Island reserve and provide Tri-State with a per ton price estimate for various annual volumes of coal output.
- o Attempt to quantify any premiums or penalties that various coal quality characteristics will have on the capital and operating cost of the plant.
- o Work with Texas Eastern's legal department to develop a draft coal supply contract.
- o Continue to meet with Big Rivers Electric Corp. to develop a conceptual business arrangement that would provide for the cogeneration of steam and power and thus the consumption of Tri-State's excess fines.
- o Establish contact with consultants and/or manufacturers who specialize in coal handling and storage systems.
- o Continue to gather information regarding the decision of buying or leasing coal rail and barge equipment.

A decision was made not to undertake these activities at this time due to the inability to justify the resulting expenses.

### 2.3.4 High Priority Tasks After Start-Up

If and when the decision is made to resume full-scale effort on the Tri-State Project, and assuming that the tasks above necessary to maintain a state of readiness were completed, following are the high priority tasks to be quickly focused upon:



- o Make well-defined, well-prepared presentations to the coal suppliers and transportation companies to convince them of the seriousness of the Project and to convey to them the critical information needed by the Project.
- o Determine which of the nineteen candidate coal reserves are still viable candidates.
- o Solicit consultant proposals for quick, limited evaluations of the geologic and mining conditions of the remaining viable coal reserves.
- o Determine whether the gasifiers will use run-of-mine or washed coal (reaffirm the decision already made).
- o Pursue an agreement with and/or other appropriate utilities for the construction of a cogeneration facility which will consume Tri-State's "excess fines".
- o Prepare an analysis of the current market for Illinois Basin coal and develop from this Tri-State's contracting and negotiating posture: modify the draft coal supply contract as necessary.

#### 2.3.5 Long Lead Time Activities

Because the negotiation of the coal supply contracts and transportation contracts will require a great deal of time, the longest lead time activity is the determination of which coal properties are the most viable and economic feedstock options. By quickly assessing this, the more detailed geologic and mine evaluation work required to confidently enter into coal supply contracts can be initiated and completed fairly quickly.

#### 2.3.6 Staffing and Organizational Requirements

The staffing of the Coal Supply Program should be at a level similar to the level thus far in Phase I. The program will require a Manager, Coordinator, and Analyst working on the project team as well as heavy support from an in-house legal staff.

Experience in coal marketing, purchasing and transportation will be critical if the staff is to remobilize the Coal Supply Program quickly.



### 3.0 DISCUSSION OF WORK EFFORT

The following sections document the major work effort completed thus far in Tri-State's Coal Supply Program. The sections contain major work products produced and a discussion of these products if appropriate or if they are not self-explanatory. The following topics are addressed:

- o Section 3.1: Work Plan
- o Section 3.2: Coal Testing Program
- o Section 3.3: Towhead Island Reserves
- o Section 3.4: Coal Acquisition Efforts
- o Section 3.5: Fines Disposition
- o Section 3.6: Coal Quality Parameters
- o Section 3.7: Coal Contracting
- o Section 3.8: Coal Transportation

#### 3.1 WORK PLAN

As discussed in Sections 1 and 2, the major objectives of the Coal Supply Program were to obtain signed contracts for the coal supply of the plant and to insure that the plant design reflects the coal quality which would be purchased. Attached as Exhibit X-F is a more detailed schedule of the tasks planned to meet these objectives during 1982.

#### 3.2 COAL TESTING PROGRAM

In order to better understand the performance of various Illinois Basin coals in the Lurgi Mark IV gasifier, a testing program was developed and implemented. This program consisted generally of: (1) the large-scale testing of 20,000 tons of Kentucky #9 coal by Sasol during the Fall of 1981; and, (2) testing by Lurgi in their Frankfurt laboratory of 19 small samples of various coals from Kentucky, Illinois, and Indiana. The results of the program have provided only general guidance to the acquisition analysis and decisions facing the Coal Supply Program. Complete documentation of the design, implementation and results of coal testing program is presented in Tri-State Synfuels Project Review Report, Volume 14, "Coal Sampling and Testing."



EXHIBIT X-F  
1982  
WORK PLAN

<u>Major Work Area</u>	<u>Work Plan</u>	<u>Completion Date</u>
1. Identify the coal supply needs of the project; coordinated with process design criteria and limitations.	<ul style="list-style-type: none"> <li>- Work with engineering and results of large scale coal test and lab tests to establish preliminary coal quality parameters for coal supply.</li> <li>- Continual review of technical and engineering results from various coal tests and update coal quality parameters as needed.</li> </ul>	<p>4th quarter 1981</p> <p>Ongoing</p>
2. Assess coal market conditions Illinois Basin outlook and evaluate implication in developing supply contracts.	<ul style="list-style-type: none"> <li>- Discussions with consultants, industry personnel and literature reviews.</li> </ul>	1st quarter 1982
3. Determine specific coal supplies best suited for project needs.	<ul style="list-style-type: none"> <li>- Review coal reserves presented and evaluate based upon quality and FOB price; use geologic &amp; engineering consultant for technical evaluation.</li> <li>- Develop transportation costs and rank coals by delivered price.</li> </ul>	<p>4th quarter 1981</p> <p>1st quarter 1982</p>
4. Develop general plan for coal transportation and handling systems.	<ul style="list-style-type: none"> <li>- Estimate costs based on discussions with Texas Gas, transporters and coal suppliers; use consultant to develop definitive costs.</li> <li>- Develop plan from discussions with or work by transportation and coal handling consultants.</li> <li>- As the coal supply agreements are firmed, identify the specific transportation mode and carrier and negotiate contracts.</li> </ul>	<p>4th quarter 1981</p> <p>4th quarter 1982</p>

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EXHIBIT X-F (continued)

<u>Major Work Area</u>	<u>Work Plan</u>
5. Negotiate coal supply contracts, develop terms and draft contract and substantiate and evaluate Tri-State's position.	<ul style="list-style-type: none"><li>- Develop Tri-State's going-in negotiating position, incorporating quality, supply outlook, terms and conditions and other considerations.</li><li>- Develop a general Tri-State coal supply contract suitable to be reviewed by legal for proper terminology.</li><li>- Begin negotiations for selected reserves based upon desirable quality and economically competitive reserves.</li><li>- Continue serious negotiations with those companies agreeing to Tri-State terms and conditions and contract for coal requirements by mid 1983.</li></ul>

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### 3.3 TOWHEAD ISLAND RESERVES

Documentation of the information available on the Towhead Island reserve, the additional information requested, and the status of the effort is presented in the following exhibits and appendices:

- o Exhibit X-G: Memo describing Towhead Island reserves which are dedicated.
- o Appendix, Exhibit XIX-G-1, Towhead Island Section: Towhead Island information provided to Tri-State by Texas Gas.
- o Appendix, Exhibit XIX-G-2, Towhead Island Section: Additional Towhead Island information requested by Tri-State.
- o Appendix, Exhibit XIX-G-3, Towhead Island Section: Status of Texas Gas' and Consol's efforts to develop the requested Towhead Island information.

### 3.4 COAL ACQUISITION EFFORTS

The following exhibits document the coal acquisition work to date:

- o Exhibit X-H: Information requested from potential coal suppliers.
- o Appendix, Exhibit XIX-F-1, Coal Suppliers Section: Summary of quality information on the 34 reserves proposed to Tri-State for consideration as feedstock for the plant. (Detailed information is contained in coal company's files in the Tri-State files.)
- o Exhibit X-I: Memo documenting evaluation of the 34 coal reserves and elimination of all but 19. Map of location of reserves.
- o Exhibit X-J: Table of most recent estimates of delivered coal costs.
- o Appendix, Exhibit XIX-F-2, Coal Suppliers Section: Letters sent to coal suppliers with 19 "candidate coal reserves" outlining the next steps in the coal acquisition program.
- o Exhibit X-K: Letters sent to coal suppliers to notify them of the delay in the Project.



TEXAS   
EASTERN

INTEROFFICE CORRESPONDENCE

TO: Distribution\*  
FROM: L. S. Rathbun *LSR*  
SUBJECT: TEXAS GAS' DEDICATION OF TOWHEAD ISLAND  
RESERVES TO TRI-STATE

CO/DIV: Synfuels  
DATE: March 12, 1982

I have reviewed the Tri-State Synfuels Company General Partnership Agreement and subsequent correspondence from Texas Gas (i.e., May 1, 1981 letter from Paul A. Fedde to Howard Homeyer) and have prepared the following summary description of Texas Gas' dedication of coal reserves from Towhead Island to the Tri-State Project.

Dedicated Reserves

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Memo to Distribution\*  
March 12, 1982  
Page Two

Term of Dedication

Obligation to Sell and Buy

LSR:psj

\*P. M. Anderson  
O. D. Adams  
M. D. Burke  
J. M. Hossack  
W. M. Scriber  
W. N. Shoff

xc: M. N. Kelley

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-CONFIDENTIAL-

TEXAS   
EASTERN

INTEROFFICE CORRESPONDENCE

TO: P. M. Anderson  
FROM: L. S. Rathbun *LSR*  
SUBJECT: Pricing of Towhead Island Coal

CO/DIV: Synfuels

DATE: March 12, 1982

LSR/ca

xc: M. D. Burke  
W. M. Scriber

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Coal Suppliers To Whom The  
Initial Information Request  
Package Was Mailed

AMAX Coal Company  
ARCO Coal Company  
Consolidation Coal Company  
Freeman United Coal Mining Company  
Island Creek Coal Sales Company  
Kerr McGee Coal Corporation

MAPCO Coals Inc.  
Old Ben Coal Company  
Peabody Coal Company  
Pittsburg & Midway Coal  
Mining Company  
Zeigler Coal Company

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The following Potential Coal Suppliers were sent this package on July 10, 1981:

Freeman United Coal Mining Company - Larry S. Hickman, Jr.

Old Ben Coal Company - J. Harley Williams

Zeigler Coal Company - Michael K. Reilly

Peabody Coal Company - Gregg P. Wickstra

Island Creek Coal Sales Company - Jerry T. Booher

AMAX Coal Company - Gary B. Root

ARCO Coal Company - J. C. McAndrew

Consolidation Coal Company - Robert F. Pusateri

Inland Steel Company - N. Terry Burton

**RECEIVED**

**JUL 13 1981**

**CENTRAL FILES**

*Bill*

WMS Distribution: P. M. Anderson  
M. D. Burke  
H. C. Homeyer  
L. S. Rathbun  
J. T. Wooten  
Tri-State File

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## TRI-STATE SYN FUELS COMPANY

July 17, 1981

Mr. B. G. McGrath  
Manager - Operations Support  
Pittsburg & Midway Coal Mining Company  
1720 S. Bellaire Street  
Denver, Colorado 80222

Dear Mr. McGrath:

I enjoyed talking with you yesterday and hope that you have found the Tri-State Synfuels Project Status booklet informative. To supplement the booklet I am enclosing more detailed information for you concerning Tri-State's coal requirements. Enclosed are the following:

- Attachment I - Suggested Outline Coal Supply Presentation
- Attachment II - Tri-State Synfuels Plant Coal Requirements
- Attachment III - Estimated Coal Purchase Schedule
- Attachment IV - Approximate Coal Feedstock Specifications
- Attachment V - Coal Requirements During Testing and Start-up

Hopefully this information will assist you in your evaluation of Pittsburg & Midway's reserve blocks in Henderson and Webster counties and the DeKoven block as a potential candidate supply source for the Tri-State plant.

Please let me know if I can provide further information or assist in scheduling your presentation which we would like to host in our Houston office.

Sincerely,

W. M. Scriber  
Resources Coordinator

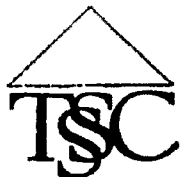
WMS:ca

Enclosures

bcc: P. M. Anderson  
M. D. Burke  
L. S. Rathbun  
Tri-State File

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## TRI-STATE SYN FUELS COMPANY

Attachment I  
Page 1 of 2

### SUGGESTED OUTLINE COAL SUPPLY PRESENTATION

#### I. Corporate Overview

- Brief History
- Corporate Structure
- Management Organization
- Coal Production Growth Objectives
- Coal Reserve Growth Objectives

#### II. Existing Mines in the Tri-State Region

- Remaining Operating Life
- Mining Techniques Employed
- Depth/Seam Thickness
- Labor Force
  - Size
  - Productivity
  - Union Status

#### III. Transportation

- Modes Employed
- Ownership of Rail Cars, Barges, Trucks
- Relationship with Shipper

#### IV. Reserves

- Reserves Nominated for Tri-State Supply
- Recoverable Reserve Tonnage
- Mine Development Plans
- Production Timing Rates
- Proposed Transportation

#### V. Tri-State Synfuels Plant Coal Issues

- Unique Quality Requirements
- Fines Generation
- Selling Excess Fines
- Washed vs. Run-of-Mine Coal
  - Advantages/Disadvantages
  - Economic Trade-offs

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**VI. Letter of Intent**

- Reciprocal Commitments
- Rights of Prior Sale
- Capital Pledge
- Back-out Penalty

**VII. Contracts**

- Supplier Philosophy
- Contract Life
- Commitment Timing
- Cancellation Penalties
- Coal Quality Provisions
- Supply Guarantees
- Coal Pricing
  - Base Pricing
  - Escalation
  - Re-opener Provisions
- Payment Terms

**VIII. Outlook for Synfuels Industry**

- Current Participation in Synfuels Industry
- Future Participation in Synfuels Industry
  - Coal Supplier
  - Project Participation





## TRI-STATE SYN FUELS COMPANY

### Attachment II

#### TRI-STATE SYN FUELS PLANT COAL REQUIREMENTS

Total Consumption: 10.5 Million Tons Per Year

Captive Supply: 3.0-4.0 Million Tons Per Year

Outside Purchase: 6.5-7.5 Million Tons Per Year

Number of Suppliers: 4-7

Minimum Supply Source: 1.0 Million Tons Per Year

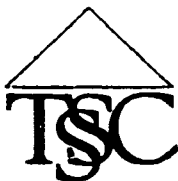
Maximum Supply Source: 4.0 Million Tons Per Year

At least one Supply Source from Kentucky, Illinois and Indiana

Modes of Delivery to Plant Site: Barge, Rail Car, Conveyor Belt

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## TRI-STATE SYN FUELS COMPANY

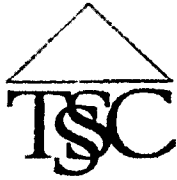
### Attachment III

#### ESTIMATED COAL PURCHASE SCHEDULE

Initiate Discussions with Coal Suppliers ..... May 1981  
Selection of Potential Suppliers ..... September 1981  
Establish Parameters of Agreements ..... October 1981  
Initiate Contract Negotiations ..... November 1981  
Execute Letters of Intent ..... August 1982  
Execute Contract Agreements ..... April 1983  
Commit to Construction ..... April 1983  
Initial Equipment Testing ..... January 1986  
Initial Stockpiling ..... January 1987  
Mechanical Completion ..... March 1987  
Plant Start-up ..... April 1987  
90% Production Rate ..... March 1988  
Full Production ..... September 1988

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# TRI-STATE SYNFUELS COMPANY

Attachment IV  
Page 1 of 3

## TRI-STATE SYNFUELS PLANT APPROXIMATE SPECIFICATIONS for COAL FEEDSTOCK

### Raw Coal Unwashed

Coarse Coal greater than  $\frac{1}{2}$ " round hole 70% minimum  
Fine Coal less than  $\frac{1}{2}$ " round hole 30% maximum  
Top size to be 2" with less than 5% > 2"

	<u>Maximum</u>	<u>Minimum</u>
<u>Proximate Analysis % Weight</u> (as received)		
Moisture	11.00	--
Ash	30.00	--
Volatile Matter	--	28.00
Fixed Carbon	--	31.00
<u>Proximate Analysis % Weight</u> (Dry)		
Ash	34.00	--
Volatile Matter	--	31.00
Fixed Carbon	--	35.00
<u>Higher Heating Value, BTU/Lb.</u>		
As Received	--	8,200
Dry	--	9,200
Moisture - Ash Free	--	13,800
<u>Ultimate Analysis, % Weight</u> (As Received)		
Moisture	11.00	--
Carbon	--	45.00
Hydrogen	--	3.40
Chlorine	0.14	--
Sulfur	4.70	--
Ash	30.00	--

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<u>Ultimate Analysis % Weight</u> (Dry)	<u>Maximum</u>	<u>Minimum</u>
Carbon	--	51.00
Hydrogen	--	3.80
Chlorine	0.16	--
Sulfur	5.10	--
Ash	34.00	--
<u>Sulfur Forms, % Weight</u> (As Received)		
Pyritic	2.80	--
Sulfate	0.20	--
Organic	<u>1.70</u>	<u>--</u>
TOTAL	4.70	--
<u>Sulfur Forms, % Weight</u> (Dry)		
Pyritic	3.15	--
Sulfate	.27	--
Organic	<u>1.92</u>	<u>--</u>
TOTAL	5.30	--
<u>Water Soluble Alkalis, % Weight</u>		
Na <sub>2</sub> O (AR/Dry)	0.23/0.25	--
K <sub>2</sub> O (AR/Dry)	0.020/0.022	--
<u>Alkalis As Na<sub>2</sub>O (AR/Dry)</u>		
% Weight	0.78/0.86	--
<u>Equilibrium Moisture</u>		
% Weight	8.55	--
<u>Ash Fusion (Reducing) °F</u>		
Initial Deformation	--	2,000
Softening	--	2,090
Hemispherical	--	2,130
Fluid	--	2,280
<u>Ash Fusion (Oxidizing) °F</u>		
Initial Deformation	--	2,190
Softening	--	2,260
Hemispherical	--	2,325
Fluid	--	2,420

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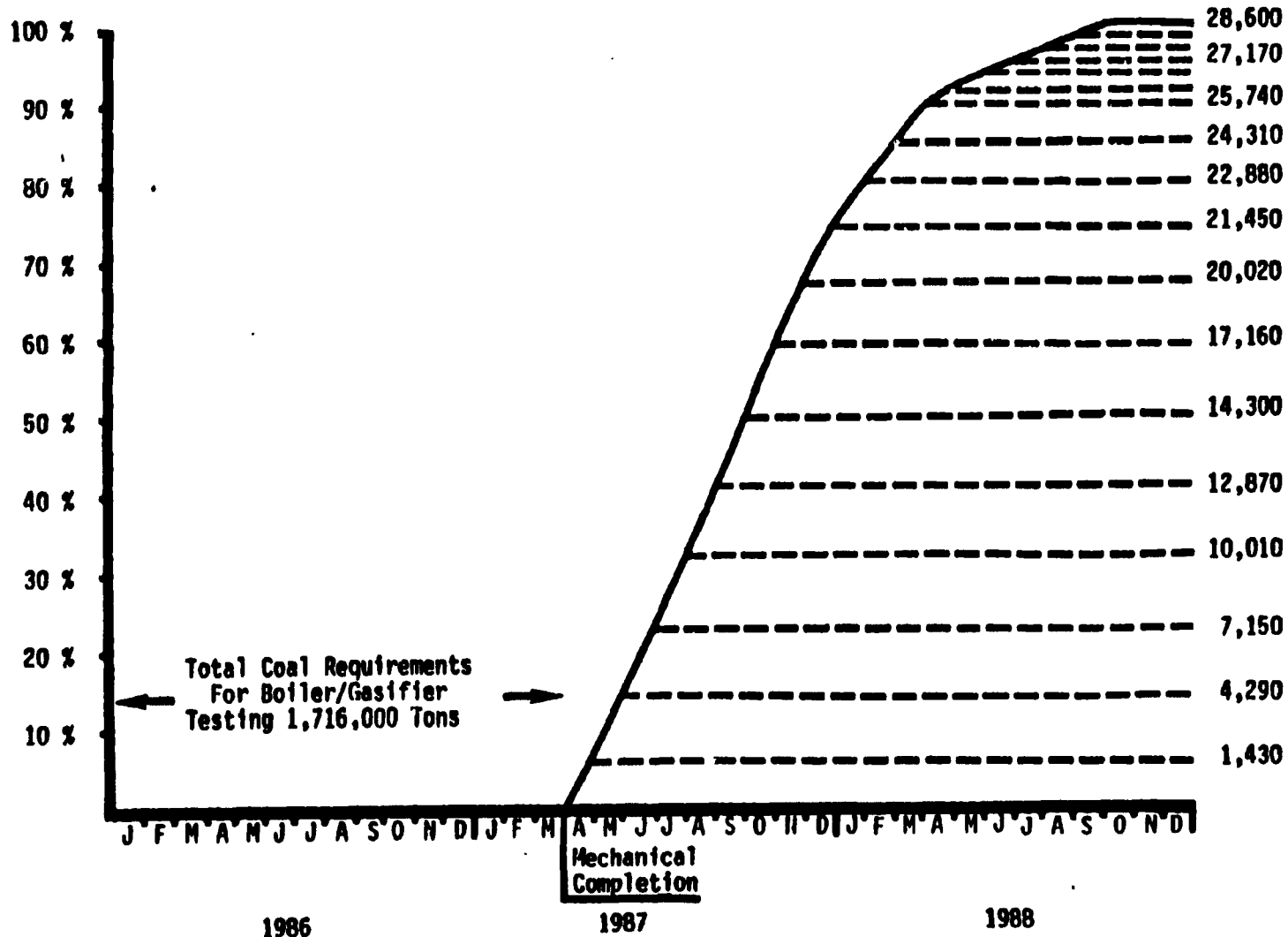
	<u>Maximum</u>	<u>Minimum</u>
<u>Free Swelling Index</u>	3	--
<u>Caking Number (Damm)</u>	14	--
<u>Hardgrove Grindability</u>		
@ % Moisture	64 @ 11.00%	



Tri-State Synfuel Plant  
Coal Requirements During  
Testing and Start-Up

Percent of Plant  
Operating Capacity

Coal Requirements  
Tons per Day



NOTE: Excludes Stockpile

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Tri-State Synfuels Plant  
Daily Coal Requirements  
During Start-Up

<u>Mechanical Completion</u> <u>03-31-87</u>	<u>Operating</u> <u>Capacity</u>	<u>Daily Coal</u> <u>Requirements (Tons)</u>
04-87	05%	1,430
05-87	15%	4,290
06-87	25%	7,150
07-87	35%	10,010
08-87	45%	12,870
09-87	50%	14,300
10-87	60%	17,160
11-87	70%	20,020
12-87	75%	21,450
01-88	80%	22,880
02-88	85%	24,310
03-88	90%	25,740
04-88	90%	25,740
05-88	90%	25,740
06-88	95%	27,170
07-88	95%	27,170
08-88	95%	27,170
09-88	100%	28,600



**TEXAS**   
**EASTERN**

EXHIBIT X-1

**INTEROFFICE CORRESPONDENCE**

TO: Distribution\* CO/DIV: Synfuels  
FROM: L. S. Rathbun DATE: January 13, 1982  
SUBJECT: Evaluating and Ranking of Coal Reserves Offered  
to Tri-State as of November 1981

As a result of our coal acquisition activities and many meetings with potential coal suppliers, Tri-State has been offered coal from mines on thirty-three different reserve blocks\*. Many of these reserves are large enough to support more than one mine and some have multiple mines planned. However, for the purpose of our acquisition program, we are generally only considering purchasing coal from one mine per reserve block at this time. (See Table 1)

It is the purpose of this memo to document the methodology used for evaluating and rating these thirty-three reserves and to recommend which should be eliminated at this point in time from further consideration. The evaluation and rating was performed by W. M. Scriber and myself. This evaluation and its results are extremely confidential and should be treated as such.

Reserves were subjectively rated as being particularly good or bad in certain categories:

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Distribution\*  
Page 2  
January 8, 1982

Quality (on an as received basis):

LSR/an

\*D. D. Adams  
P. M. Anderson  
M. D. Burke

A. de Leon  
J. M. Hossack  
R. A. Jones

M. N. Kelley  
A. Roeger

xc: W. M. Scriber  
W. N. Shoff



Table 1  
TRI-STATE SYNFUELS  
CANDIDATE COAL RESERVES

#	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Reserve Name	Henderson	Panama	Alston IE	Alston IW	Hartwich	Kaskaskia	Harrick
Company	Peabody	Peabody	Peabody	Peabody	Peabody	Peabody	Peabody
County/State	Henderson/KY	Henderson/KY	Ohio/KY	Huhlenberg/KY	Huhlenberg/KY	St. Clair/IL	Harrick/IL
<u>Mining (New/Old)</u>							
Seam							
# of Mines							
Annual Capacity							
Mining Method							
Recoverable Reserves							
<u>Transportation</u>							
Mileage							
Mode(s)							
Origin							
<u>Quality</u>							
BTU - As Received							
- Dry							
- HAF							
<u>Proximate (Raw/Washed)</u>							
Moisture							
Ash							
Volatile							
Fixed Carbon							
TOTAL							
Sulfur							
Chlorine							
Oxygen							
FSI							
Hardgrove/% Kst							
<u>Ash Fusion (Reducing)</u>							
ID							
H = W (Softening)							
H = 1/2 W (hemispherical)							
Fluid							
<u>Ash Fusion (Oxidizing)</u>							
ID							
H = W (Softening)							
H = 1/2 W (hemispherical)							
Fluid							
F.O.B. Mine Price							



WMS  
01/12/82

Table 1  
TRI-STATE SYNFUELS  
CANDIDATE COAL RESERVES

#	(8)	(9)	(10)	(11)	(12)	(13)		
CANDIDATE COAL RESERVES								
Reserve Name	N. Vanderburg	S. Vanderburg	Posey	Posey	Tamara	Delta	Denmark	Cave Coal
Company	Peabody	Peabody	Peabody	Peabody	Zeigler	AMAX	AMAX	P & H
County/State	Vanderburg/IN	Gibson/IN	Posey/IL	Posey/IL	Perry/IL	Williamson/IL	Perry/IL	Williamson/IL
<hr/>								
<u>Mining</u>								
New/Old								
Seam								
# of Mines								
Annual Capacity								
Mining Method								
Recoverable Reserves								
<u>Transportation</u>								
Mileage								
Mode(s)								
Origin								
<u>Quality</u>								
BTU - As Received								
- Dry								
- HAF								
<u>Proximate (Raw/Washed)</u>								
Moisture								
Ash								
Volatile								
Fixed Carbon								
TOTAL								
Sulfur								
Chlorine								
Oxygen								
FSI								
Hardgrove/% Moist								
<u>Ash Fusion (Reducing)</u>								
TO								
H = M(Softening)								
H = 1/2 M(hemispherical)								
Fluid								
<u>Ash Fusion (Oxidizing)</u>								
TO								
H = M(Softening)								
H = 1/2 M(hemispherical)								
Fluid								
F.O.B. Mine Price								

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Table 1  
TRI-STATE SYNFUELS  
CANDIDATE COAL RESERVES

#	(14)	(15)	(16)	(17)	(18)	(19)	(20)
Reserve Name	DeKoven	Henderson	Sebree	Okawville	Dahlgren	Greenup	White County
Company	P & H	P & H	P & H	Freeman United	Old Ben	Arco	Mapco
County/State	Union/KY	Henderson/KY	Webster/KY	Washington/IL	Dahlgren/IL	Greenup/IL	White/IL
Mining New/Old							
Seam							
# of Mines							
Annual Capacity							
Mining Method							
Recoverable Reserves							
Transportation							
Right-of-Way							
Mode(s)							
Origin							
Quality							
BTU - As Received							
- Dry							
- Moist							
Proximate (Raw/Washed)							
Moisture							
Ash							
Volatiles							
Fixed Carbon							
TOTAL							
Sulfur							
Chlorine							
Oxygen							
FSI							
Hardgrove/8 Moist							
Ash Fusion (Reducing)							
TD							
H = M(Softening)							
H = 1/4 M(Hemispherical)							
Fluid							
Ash Fusion Oxidizing							
TD							
H = M(Softening)							
H = 1/4 M(Hemispherical)							
Fluid							
F.O.B. Mine Price							

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Table 1

TRI-STATE SYNFUELS  
CANDIDATE COAL RESERVES

#	(21)	(22)	(23)	(24)	(25)	(26)	(27)
Reserve Name	Gibson	Posey	Hillsboro	Francisco	Dakota	Hamilton #1	Hamilton #2
Company	Mapco	Mapco	Consol	Consol	Consol	Island Creek	Island Creek
County/State	Gibson/IN	Posey/IN	Monroeville/IL	Gibson/IN	Knox/IN	Union/KY	Union/KY
<u>Mining</u> New/Old							
Seam							
# of Mines							
Annual Capacity							
Mining Method							
Recoverable Reserves							
<u>Transportation</u>							
Mileage							
Mode(s)							
Origin							
<u>Quality</u>							
BTU - As Received							
- Dry							
- WAF							
<u>Proximate (Raw/Washed)</u>							
Moisture							
Ash							
Volatiles							
Fixed Carbon							
TOTAL							
Sulfur							
Chlorine							
Oxygen							
FSI							
Hardgrove/% Moist							
<u>Ash Fusion (Reducing)</u>							
TD							
H = W(Softening)							
H = 1/2 W(hemispherical)							
Fluid							
<u>Ash Fusion (Oxidizing)</u>							
TD							
H = W(Softening)							
H = 1/2 W(hemispherical)							
Fluid							
F.O.B. Mine Price							

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Table 1  
TRI-STATE SYNFUELS  
CANDIDATE COAL RESERVES

#	(28)	(29)	(30)	(31)	(32)	(33)
Reserve Name	Highland	Providence #1	Providence Field	Elk Creek	Fies #9	Crescent
Company	Island Creek	Island Creek	Island Creek	Island Creek	Island Creek	Island Creek
County/State	Union/KY	Webster/KY	Webster/KY	Hopkins/KY	Hopkins/KY	Muhlenberg/KY
Mining (New/Old)						
Seam						
# of Mines						
Annual Capacity						
Mining Method						
Recoverable Reserves						
Transportation						
Rate						
Mode(s)						
Origin						
Quality						
BTU - As Received						
- Dry						
- HAF						
Proximate (Raw/Washed)						
Moisture						
Ash						
Volatile						
Fixed Carbon						
TOTAL						
Sulfur						
Chlorine						
Oxygen						
FSI						
Hardgrove / Stpt.						
Ash Fusion (Reducing)						
TD						
H - M(Softening)						
H - 1/2 M(hemispherical)						
Fluid						
Ash Fusion (Oxidizing)						
TD						
H - M(Softening)						
H - 1/2 M(hemispherical)						
Fluid						
F.O.B. Mine Price						

LIST OF COAL RESERVES OF KENTUCKY  
IS SUBJECT TO THE RESTRICTIONS ON THE  
MINE PRICE AT THE TIME OF THIS REPORT



**Table 2**  
**EVALUATION AND RATING OF COAL RESERVES OFFERED TO TRI-STATE**

Evaluation Categories										Rating	COMMENTS
Reserve		Price		Transportation Logistics	Quality		Company's Contracting Terms	Fines Disposition Possibility			
#	Company	Name	Washed		Raw	S			CI	FST	
1	Peabody -	Henderson									
2		Panama									
3		Alston 1E									
4		Alston 1W									
5		Hartwich									
6		Kaskaskia									
7		Warrick									
8		Vanderburg									
9		Posey									
10	Zeigler -	Tamaroa									
11	Amax -	Delta									
12		Denmark									
13	P & M -	Cave									
14		DeKoven									
15		Henderson									
16		Sebrex									
17	Freeman United -	Okawville									
18	Old Ben -	Dahlgren									
19	Arco -	Greenup									

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# Evaluation Categories

Page 2

<u>Reserves</u>		<u>Price</u>		<u>Transportation Logistics</u>	<u>Quality</u>		<u>Company's Contracting Terms</u>	<u>Fines Disposition Possibility</u>	<u>Rating</u>	<u>COMMENTS</u>
<u>Company</u>	<u>Name</u>	<u>Washed</u>	<u>Raw</u>		<u>SI</u>	<u>ISI</u>				
20	Mapco - White Co.									
21	Gibson									
22	Posey									
23	Consol - Hillsboro									
24	Francisco									
25	Oaktown									
26	Island Creek - Hamilton #1									
27	Hamilton #2									
28	Highland									
29	Providence #1									
30	Providence Field									
31	Elk Creek									
32	Fies #9									
33	Crescent									

+ = good

- = bad

XX= reject based on this

\* = rating could change when price is known

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Table 3  
ESTIMATED DELIVERED COAL PRICES  
(\$/ton)

#	Reserve Name	F.O.B. Price		Transportation Cost and Mode	Estimated Delivered Price	
		Raw	Washed		Raw	Washed
1	Henderson					
2	Panama					
3	Alston 1E					
4	Alston 1W					
5	Martwich					
6	Kaskaskia					
7	Warrick					
8	Vanderburg					
9	Posey					
10	Tamaroa					
11	Delta					
12	Denmark					
13	Cave Coal					
14	DeKoven					
15	Henderson					
16	Sebree					
17	Okawville					



	<u>Reserve Name</u>	<u>F.O.B. Price</u>		<u>Transportation Cost and Mode</u>	<u>Estimated Delivered Price</u>	
		<u>Raw</u>	<u>Washed</u>		<u>Raw</u>	<u>Washed</u>
18	Dahlgren					
19	Greenup					
20	White County					
21	Gibson					
22	Posey					
23	Hillsboro					
24	Francisco					
25	Oaktown					
26	Hamilton #1					
27	Hamilton #2					
28	Highland					
29	Providence #1					
30	Providence Field					
31	Elk Creek					
32	Fies #9					
33	Crescent					

NOTE: F.O.B. mine prices are escalatable from different base periods but are all generally mid to late 1981.

\* Partially washed

#### Cost Assumptions Used\*

- . Conveyor costs = \$0.25/ton-mile
- . Truck costs = \$0.10/ton-mile
- . Rail costs = \$4.00/ton used as a minimum; if rail/barge combination was used, \$1.50 transloading charge was assessed

\*Note: These costs are very "rough cut" estimates but are felt to be reflective of the relative costs of the various transportation modes available and the distances each reserve is from the Tri-State plant.

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Table 4  
EVALUATION OF COAL SUPPLIERS CONTRACTING TERMS

<u>Supplier</u>	<u>Comments on "Proposed Terms/Philosophy" for Contracting</u>	<u>Rating</u>
Amax		
Arco		
Consol		
Freeman United		
Island Creek		
Mapco		
Old Ben		
Peabody		
P & M		
Zeigler		

-- No rating possible

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Table 5  
SUMMARY OF CHARACTERISTICS  
OF CATEGORY I AND II COAL RESERVES

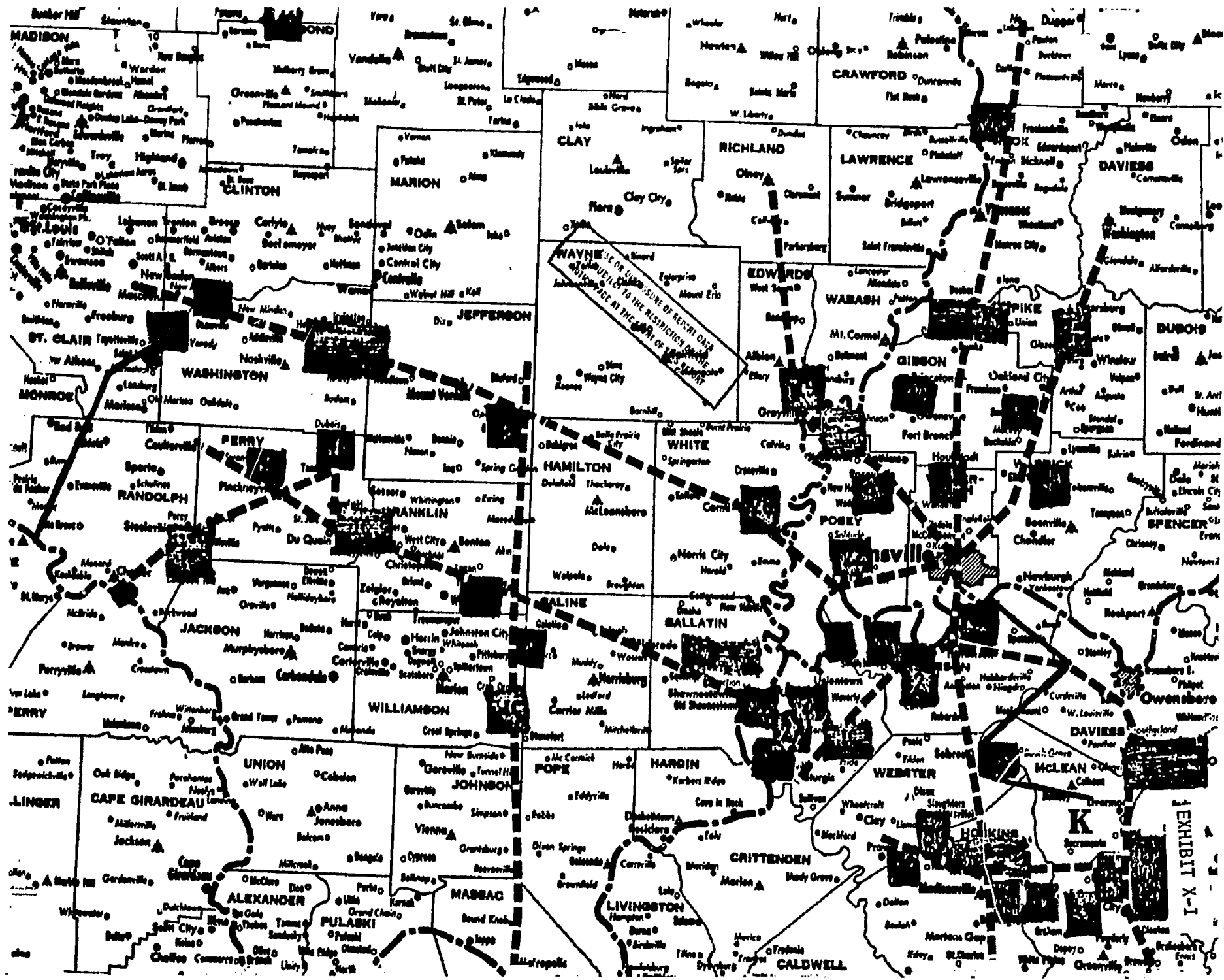
	<u>Category I Reserves</u>	<u>Category II Reserves</u>	<u>Category I &amp; II Reserves</u>
Number of reserves	10	9	19
Annual Production (mmtpy)	15.1	18.2	33.3
Location - Kentucky	6	5	11
- Illinois	2	3	5
- Indiana	2	1	3
Coal Seam - Kentucky #9	6	5	11
- Illinois #5	1		1
- Illinois #6	1	3	4
- Indiana #V	2	1	3
- Indiana #VI	0	0	0
Btu* - low	10,000	9,170	9,170
- average	11,060	10,650	10,865
- high	12,126	11,887	12,126
Sulfur* - low	2.7%	2.7%	2.7%
- average	3.5%	3.7%	3.6%
- high	4.5%	4.7%	4.7%
Ash* - low	7.5%	7.9%	7.5%
- average	11.9%	14.5%	13.1%
- high	18.8%	22.2%	22.2%
Chlorine* - low	.04%	.04%	.04%
- average	.13%	.11%	.12%
- high	.23%	.31%	.31%
F.O.B. Mine Price - low			
- average			
- high			
Delivered Price - low			
- average			
- high			

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\*contains both washed and run-of-mine coal so ranges are somewhat misleading; all are on an as-received basis.

NOTE: Averages are not weighted by volume of proposed production.







## EXHIBIT X - J

Tri-State Symbols  
Delivered Coal Price Estimates

Key No. 2	Reserve Name	Base Price Raw S/T	Transportation S/T				Delivered Price S/T	15% Sized Product Premium S/T	Delivered Price Sized Product S/T
			Rail	Barge	Combination R/B	Other Conv-Trib			
1	Henderson (Pdy)								
3	Alston IE								
4	Alston IV								
5	Marble								
6	Kaskaskia								
7	Merrick								
10	Tamara								
11	Delta <sup>3</sup>								
12	Dumark								
15	Henderson (PDM)								
16	Salvage								
17	Chauville								
20	White County								



24 Francisco

as an

N/A

(  
25 Oakton

27 Hamilton #2

28 Highland

31 Elk Creek

32 Fies #9

33 Crescent

1 Raw price is \$3.00 discount from washed price.  
2 Premium is estimated  
3 will not sell raw coal

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List of Coal Company  
Personnel to Whom Project  
Termination Letter was Sent

Mr. Jack H. Combes  
Western Sales Manager  
Island Creek Coal Sales Company  
9745 E. Hampden Avenue  
Suite 300  
Denver, Colorado 80231

Mr. R. B. Atwater  
Senior Vice President  
Consolidation Coal Company  
Consol Plaza  
Pittsburgh, PA 15241

Mr. M. William Dix, Jr.  
Manager-Market Development  
The Pittsburgh & Midway Coal Mining Co.  
1720 South Bellaire St.  
Denver, Colorado 80222

Mr. George G. Galey  
Manager-Market Development  
Amax Coal Company  
P. O. Box 967  
Indianapolis, IN 46206

Mr. John R. Tellmann  
General Manager of Sales  
Mapco Coals, Inc.  
1800 So. Baltimore Avenue  
Tulsa, OK 74119

Mr. John P. Smith  
Vice President Marketing  
Peabody Coal Company  
301 N. Memorial Dr.  
St. Louis, MO 63102

Mr. Richard J. Brooks  
Sr. Vice Pres. - Marketing and Sales  
Freeman United Coal Mining Company  
300 W. Washington St.  
Chicago, IL 60606

Mr. Michael K. Reilly  
President  
Zeigler Coal Company  
2700 River Road  
Des Plaines, IL 60018





## TRI-STATE SYN FUELS COMPANY

Michael D. Burke  
Project Director

April 14, 1982

Mr. George G. Galey  
Manager-Market Development  
Amax Coal Company  
P.O. Box 967  
Indianapolis, IN 46206

Dear Mr. Galey:

The energy and economic environment which we are experiencing these days has taken a heavy toll on the viability of many synthetic fuel projects and our Tri-State project has not been immune from these adverse conditions.

As indicated by the attached Tri-State news release the managing partners of the project, Texas Eastern Corporation and Texas Gas Transmission Corporation, have decided they will postpone the development of the Tri-State Synfuels Project. As a result of this decision Tri-State intends, effective June 7 1982, to cancel the Cooperative Agreement contracts with the United States Department of Energy and to reassess Tri-State's future level of activity. The Tri-State project will continue to regard the Geneva site as a prime location for a synfuels plant. A minimal level work effort will be ongoing with the objective of keeping the project active to the extent that it can be rapidly reactivated.

The effort that you and your staff have put into preparation and presentation of your coal reserves as candidates to supply the plant's coal needs, is both recognized and appreciated, and it is regretful that we cannot continue to move forward toward the development of a coal supply agreement at this time. A file is being developed to preserve the information you have presented so that if the Tri-State project is reactivated we will hopefully be able to pick up the coal supply program at the level to which it has developed.

Once again, your cooperation and interest in the Tri-State Project has been most appreciated. If you have any questions about the project, do not hesitate to phone either myself or Bill Scriber.

Sincerely

MDB/WMS/gb

xc: W. M. Scriber

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### 3.5 FINES DISPOSITION

One of the major findings of the large scale test of Illinois Basin coal conducted during the Fall of 1981 was that the Lurgi test gasifier equipped with a stirrer/distributor could tolerate only a minimal (less than 5%) level of coal "fines" (i.e., material less than 1/4 inch in size) in the coal feed. Since fines can be used in the plant's boilers, however, the "acceptable" level of fines for the Project was set by the amount of steam and electricity to be generated. These applications will require approximately 30% of the total Project's coal consumption, therefore a 30% fines level in the total coal used would be acceptable. Since the mining of coal in the Illinois Basin generally generates from 30-50% fines, if Tri-State bought run-of-mine coal it could have a considerable level of excess fines. Following are a number of exhibits which discuss what was done to investigate and evaluate options for resolution of the excess fines situation:

- o Exhibit X-L: Memos describing work program for determining preliminary solution.
- o Exhibit X-M: Summary of coal suppliers' response to request for a "sized product" (i.e., coal which has a lower level of fines than run-of-mine).
- o Exhibit X-N: Utilities contacted regarding purchasing excess fines or cogenerating power.
- o Exhibit X-O: Possible arrangements with Big Rivers Electric Corp.
- o Exhibit X-P: Temporary decision regarding most economic solution to excess fines.

### 3.6 COAL QUALITY PARAMETERS

One of the major responsibilities of the Coal Supply Program was to insure that the plant was designed to gasify and handle the coal which the Project would end up using as its feedstock. The final decisions of feedstock were not to be made until mid 1983. However, a large portion of the coal-related design work was to be conducted during 1982. Therefore, estimates had to be made of the ultimate quality of the coal feedstock.

Originally, an attempt was made to choose the coals which Lurgi tested (see Section IX - Coal Test Program) which were most similar to the 19 primary and secondary candidate coal reserves being considered as potential sources of feedstock. Then, design work could have been easily based upon the



**TEXAS**   
**EASTERN****INTEROFFICE CORRESPONDENCE**

TO: L. S. Rathbun -  
FROM: W. M. Scriber  
SUBJECT: COAL FINES ALTERNATIVES

CO/DIV: Synfuels  
DATE: September 18, 1981

In order to either eliminate a situation of excess coal fines at the plant site or to arrive at some means by which to dispose of the coal fines once at the plant site, a list of possible alternatives or remedies has been prepared. These alternatives are broadly divided into activities at the coal mine itself that can be implemented to limit the quantity of fines loaded into the transportation mode, and activities at the plant site that will provide for either onsite consumption of the excess fines or disposition of the fines at some other location.

- I. Coal fines limiting alternatives in the mine or at preparation
  - A. Research and experiments are currently being conducted by several mining companies in which the tooth spacing on continuous miners is being varied. Preliminary indications reveal that wider tooth spacing reduces fines generation.
  - B. Develop a supply agreement that will allow for separation of coarse and fine coal at mine preparation plant with the fine coal being sold to a third party.
  - C. In a situation where Tri-State is supplied from a multiple mine complex the supply agreement can be structured so that Tri-State will take only coarse coal or at best a limited amount of fines.
- II. Alternatives for disposal of fines assuming a conventional mix of coarse and fine coal received at the plant.
  - A. Determine optimum level of fines consumption by the gasifier following the large-scale coal test. Also determine the quantity of coal fines that will be consumed by steam and electrical generation process.

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L. S. Rathbun  
September 18, 1981  
Page Two

- B. Evaluate power generating companies in the area as to their interest in purchasing excess fines either for existing capacity or incremental capacity. During the next ten years an addition of 5,800 megawatts to present generating capacity is planned for the area.
- C. There are three other synthetic fuel plants in the area that have processes capable of taking a feedstock of coal fines. Contact has been made with one.
- D. Excess coal fines could be consumed onsite to provide export steam for sale.
- E. A cogeneration project with one of the power companies to use the excess fines for electric power generation and sale.
- F. A briquetting or pelletizing process for the excess fine coal may provide a means in which the product can be consumed in the gasifier. Lurgi, Inland Steel and FMC all have experience in these processes.
- G. Use of one or more gasifiers such as the Koppers Totzek or Westinghouse gasifier that will accept a large percentage of fines in the feedstock mix.
- H. A coal slurry pipeline is currently planned to cross Kentucky in the Tri-State area. Contact will be made with this pipeline group to determine their interest in transporting additional fines.

These alternatives will have to be evaluated as to their respective technical feasibility and economic merit and in preparing this evaluation several basic questions must first be answered. The following items are some of the questions that will need to be pursued:

- o Price differentials of coal that has a minimum fines content versus a run-of-mine coal mix.
- o Price differentials that may result from a requested mining technique.
- o Quantity of fine coal consumption by the gasifiers.
- o Quantity of fine coal consumption for steam and power generation.
- o Establishment of contact and discussions with various third parties to provide additional information and/or interest in their respective areas.

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