2.0 EXECUTIVE SUMMARY

This section summarizes the major project aspects contained in this Environmental Information Volume. The purpose and need for the project are identified, as is a summary of the proposed action. Alternatives to this project are profiled. For each environmental aspect, a summary of existing conditions and environmental consequences, if any, is provided.

2.1 Summary of Purpose and Need

The purpose of this proposed project is to demonstrate the commercial viability of Air Products and Chemicals, Inc.'s Liquid Phase Methanol (LPMEOH™) Process using coal-derived synthesis gas, a mixture of hydrogen and carbon monoxide. The Department of Energy's (DOE's) purpose for the demonstration of the proposed project is to help fulfill the goals and objectives of the Clean Coal Technology program by demonstrating the potential of a more efficient, liquid phase reaction process as a preferred alternative to gas phase reactions for methanol production.

The United States needs future sources of alternative liquid fuels. With domestic oil production declining and imports shrinking, the potential of producing affordable liquid fuels from non-petroleum sources could one day prove both strategically and economically important. The LPMEOH™ process offers an extremely attractive route to supplementing our liquid fuel supplies with methanol made from abundant United States coal reserves.

Methanol also has a broad range of commercial applications. It can be substituted for or blended with gasoline to power vehicles. It is an excellent fuel for the rapid-start combustion turbines used by utilities to meet peak electricity demands. It contains no sulfur and has exceptionally low nitrogen oxide characteristics when burned. It can also be used as a chemical feedstock.

Eastman Chemical Company currently both produces and purchases methanol for use at the site. The technology to be demonstrated at the Eastman facility could someday be used as an adjunct to a coal gasification combined cycle (IGCC) power plant -- one of the cleanest and most efficient of the 21st century power generating options. When the power plant is not generating at its full capacity, excess synthesis gas could be used to make methanol. The methanol could be stored on-site and used in peaking turbines or sold as a commercial fuel or chemical feedstock. In this configuration, the cost of making methanol from coal is likely to be competitive with stand alone natural gas-to-methanol facilities.

Air Products and Eastman entered into a joint venture known as Air Products Liquid Phase Conversion Company, L.P. (The Partnership). The Partnership is participating with the DOE in the Clean Coal Technology demonstration of Liquid Phase Methanol technology. Air Products would design and build the LPMEOH™ demonstration facility and Eastman would operate it. The demonstration unit would be a nominal 260-ton-per-day unit on a 0.6 acre plot within the existing Eastman facility in Kingsport, Tennessee.

The program objectives are to demonstrate the LPMEOH™ process scale-up and operability (up to four years) under various coal-based feed gas compositions and to gain operating experience for future synthesis gas conversion projects. If practical, the production of dimethyl ether (DME) as a mixed co-product with methanol will also be demonstrated.

LPMEOH™ technology offers significant potential to economically produce chemical feedstocks (using the United States LPMEOH™ technology over existing foreign Lurgi and Imperial Chemical Industries (ICI) methanol production technologies) and to reduce electric power generation costs with the production of alternative liquid fuels. The domestically developed LPMEOH™ technology uses United States coal to produce clean, storable, liquid fuels and chemical feedstocks. Eventual commercialization of the LPMEOH™ process in IGCC power plants would provide low priced chemical feedstocks and fuel leading to electric power generation cost savings, lower sulfur dioxide (SO_2) and nitrogen oxide (NO_x) emissions, and the reduced use of imported liquid fuels.

The methanol product from the proposed project would be tested off-site in California and West Virginia for suitability as a stationary-use fuel (boilers) and as a vehicle fuel (busses and van pools). These end-use tests would provide a basis for the comparison of the methanol as-produced with conventionally accepted fuels including emission levels and economic viability. The program goal of demonstrating methanol as a fuel would lead to the potential for greater use of oxygenated fuels, which burn cleaner than conventional fuels, thereby reducing air emissions from mobile and stationary sources.

2.2 Summary of Proposed Action

The U.S. Department of Energy, under the Clean Coal Technology Program, would provide cost-shared financial assistance for the design, construction and operation of the commercial-scale liquid phase methanol production facility by the Partnership.

The demonstration unit would be integrated with Eastman's Integrated Coal Gasification facility, accepting synthesis gas and converting it to methanol, for use as a chemical feedstock within the Eastman facility. The Eastman integrated coal gasification facility has operated commercially since 1983. At this site, it will be possible to ramp methanol production up and down to demonstrate the unique load -following flexibility of the LPMEOH™ unit for application to coal-based IGCC electric power generation facilities. Methanol fuel testing will be conducted in both on-site and off-site stationary and mobile applications, such as boilers, buses and van pools. The operation at Eastman also includes the planned production of dimethyl ether (DME) as a mixed coproduct with methanol which can be suitable as a storable fuel or as a chemical feed stock.

Several possible means for locating and operating the proposed plant were considered in developing the proposed project, including investigation and investment in alternative sites and investigation/resolution of issues relating to wastewater discharge, airborne emissions, and recovery/disposal of spent catalyst. These matters are more fully discussed in Section 3.

2.2.1 Site Location and Characteristics

The 0.6 acre site proposed for the LPMEOH™ unit is located in Kingsport, Tennessee, at the Eastman facility. Kingsport is on the western edge of Sullivan County and includes a small portion of Hawkins County. The world headquarters of Eastman Chemical Company are also located in Kingsport. The Eastman facility also includes the eastern half of Long Island, where the proposed demonstration unit would be built adjacent to existing process plants.

The Kingsport area is shown in Figure 2.2-1. The location of the proposed demonstration unit on Long Island is shown on Figure 2.2-2. A photograph of the Eastman facility as it currently exists is also shown on Plate 2.2. The current site for the proposed project is a gravel area bounded to the north by a fence, to the west by an interplant road that runs between the future process area and a chemical manufacturing plant, to the east by a pipe rack, an existing methyl acetate plant, and an interplant road, and to the south by an existing building and interplant road. The new unit would highly resemble the existing facility surroundings.

2.2.2 Physical Facility Description

The proposed project includes four major process areas. The reaction area would include the reactor and the synthesis gas recycle compressor. The purification area would include two distillation columns and their heat exchangers. The storage/utility area would comprise oil and product methanol storage. The catalyst preparation/reduction area would be under roof with several large vessels, slurry handling equipment, and a hot oil skid.

2.2.3 Process Description

The fundamental characteristics of a liquid phase reactor, which is used in the LPMEOH™ technology, make it particularly suitable for the OTM (Once Through Methanol) needs. It is unlike the conventional gas-phase reactors that use fixed beds of catalyst pellets and largely depend upon recycle dilutent gas to both dilute the carbon monoxide concentration and control the reaction exotherm. The LPMEOH™ reactor is a slurry reactor with small, powder-size catalyst particles suspended in inert mineral oil. The synthesis gas bubbles up through the slurry where the hydrogen and carbon monoxide dissolve in the oil and diffuse to the catalyst surface where the methanol reaction occurs. The product methanol diffuses out and exits with the unreacted synthesis gas. The inert oil acts as a heat sink and permits isothermal operation. The net heat of reaction is removed via an internal heat exchanger which produces steam. Unlike the gas-phase reactors that limit the per-pass conversion of synthesis gas to methanol to accommodate the reaction exotherm, the LPMEOH™ reactor maintains isothermal operation. Unlike the gas-phase reactors, the LPMEOH™ reactor is tolerant to carbon monoxide-rich gas. It does not require recycle. Shift and carbon dioxide removal are not required. Low hydrogen-to-carbon monoxide ratios are acceptable as is any carbon dioxide content. Finally, in contrast to the gas-phase reactor in which the catalyst is sensitive to flow variations and changes from steady-state, the LPMEOH™ reactor is eminently suited for on-off operation for electric load-following.

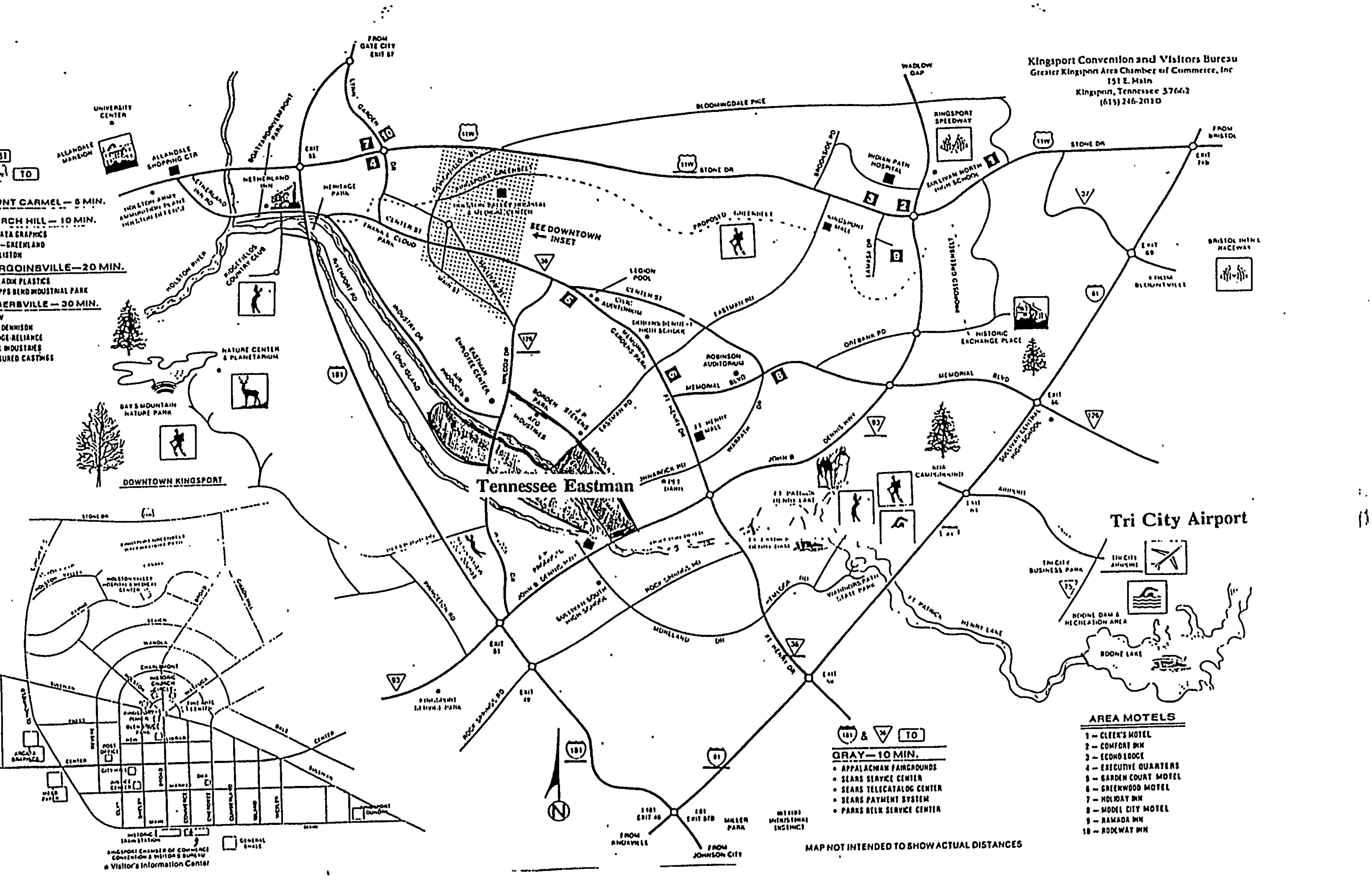

FIGURE 2.2-1 KINGSPORT AREA

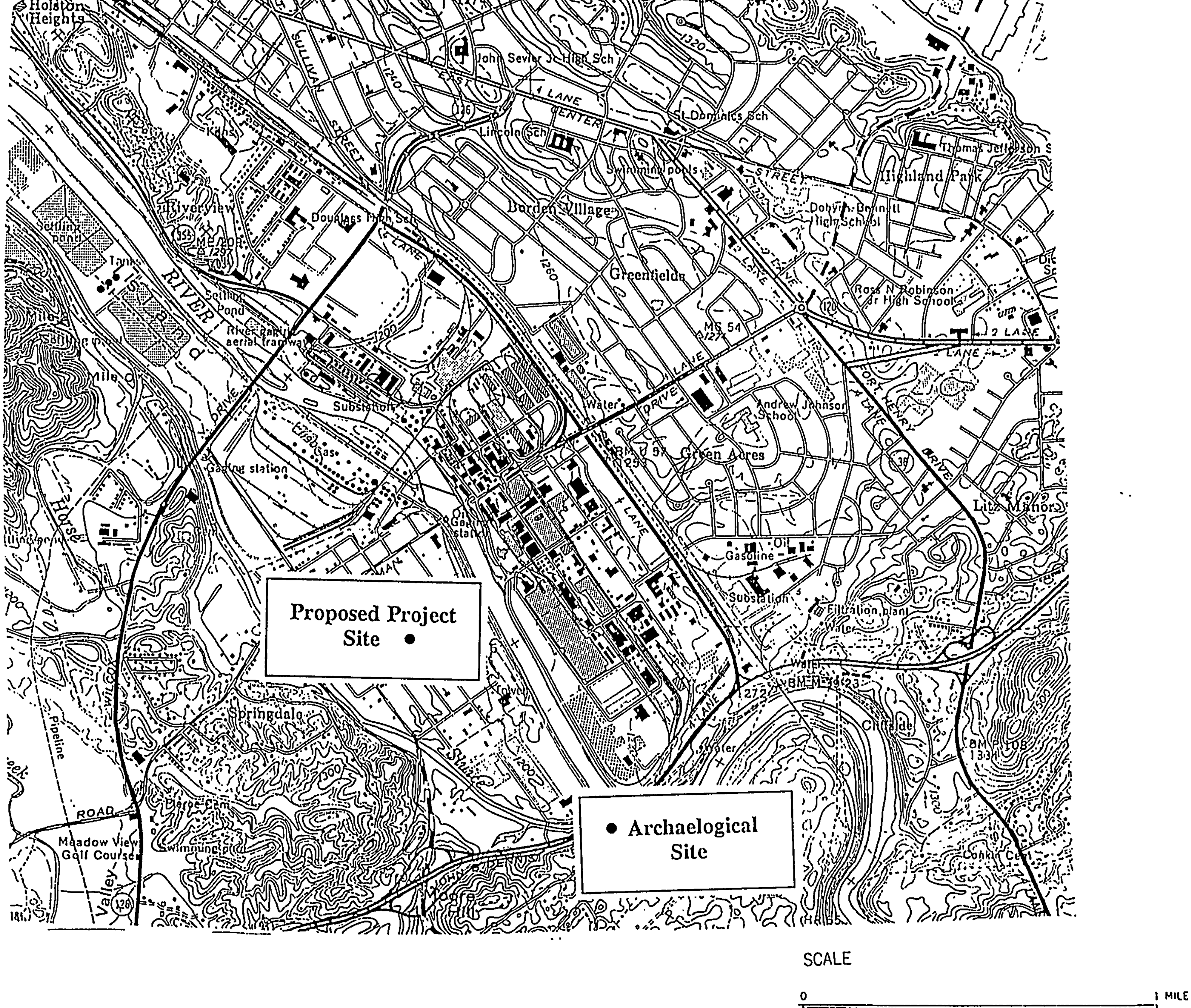

FIGURE 2.2-2 LOCATION OF THE PROPOSED PLANT

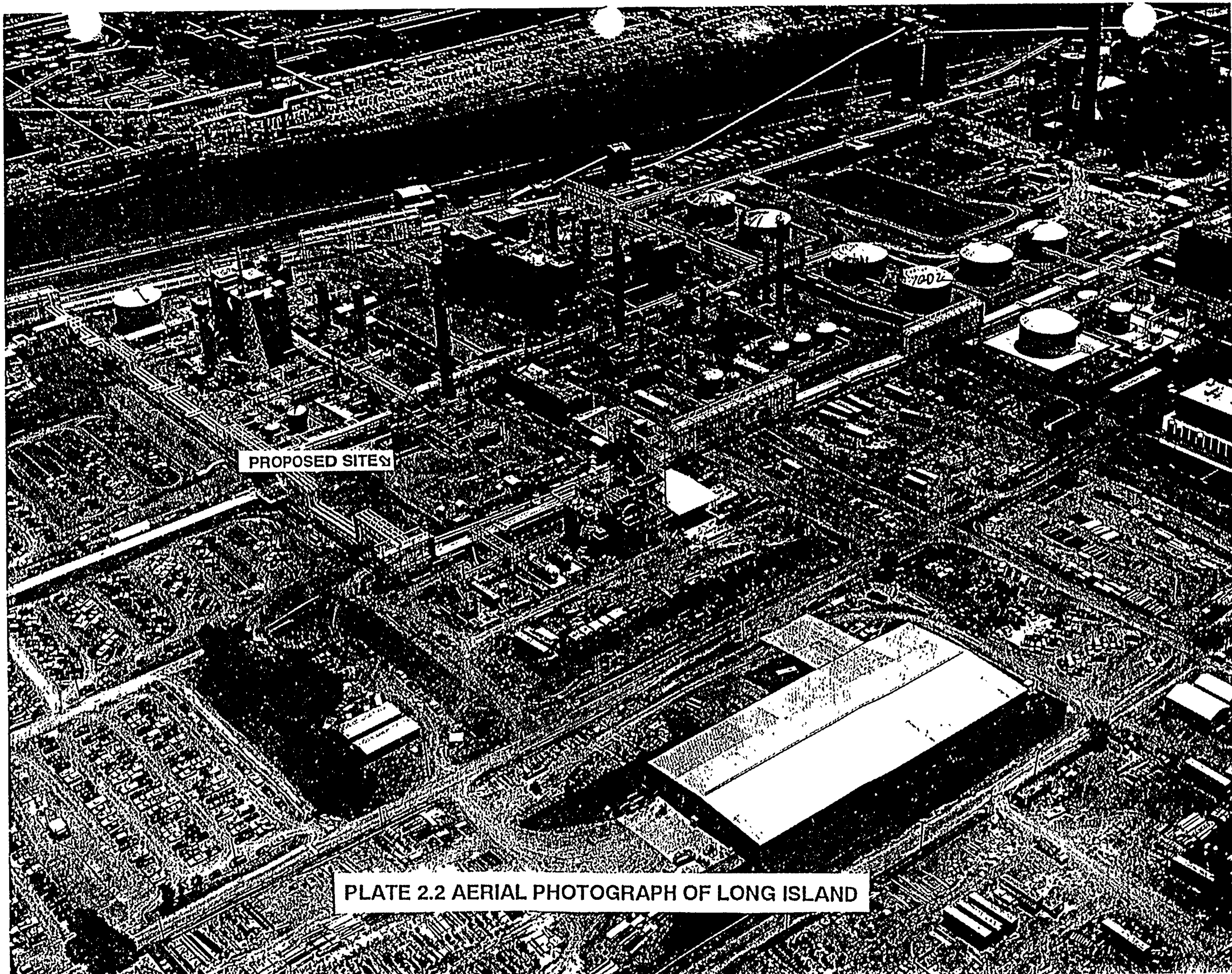

PLATE 2.2 AERIAL PHOTOGRAPH OF LONG ISLAND

The LPMEOH™ unit is to be integrated with Eastman's coal gasifier process train and would be inserted in parallel with an existing Lurgi technology methanol unit. Eastman currently both produces and purchases methanol for use at this site. The net effect of adding the LPMEOH™ demonstration unit is to require the purchase of a nominal 30 tons per day of additional methanol for the Kingsport site. When the LPMEOH™ unit is operating, the output from the Lurgi unit would be reduced. Synthesis gas would be introduced to the slurry reactor, which has liquid mineral oil with solid particles of catalyst suspended in it. The synthesis gas dissolves through the mineral oil, contacts the catalyst, and reacts to form methanol. The heat of reaction is absorbed by the mineral oil and is removed by steam coils. The methanol leaves the reactor as a vapor, is condensed to a liquid, sent to the distillation columns for removal of higher alcohols, water, and other impurities, then stored in the day tanks for sampling prior to being sent to Eastman's methanol storage. Unreacted synthesis gas is sent back to the reactor with the synthesis gas recycle compressor, improving cycle efficiency. The methanol is used for downstream feedstocks and for on-site and off-site fuel testing.

2.3 Summary of Alternatives to the Proposed Action

A number of alternatives were considered in the selection of the project as currently proposed. These are summarized below, with additional details concerning the selection and analysis of alternatives found in Section 3.2.

2.3.1 No-Action Alternative

Under the no-action alternative, the U.S. Department of Energy would not provide cost-shared financial assistance for the proposed project and the Partnership would not construct the proposed project. If the proposed project were not constructed, Eastman Chemical would continue to produce its total daily methanol requirement utilizing the existing Lurgi unit. Under this scenario, no methanol would be utilized in off-site testing.

Consequently, the no-action alternative would result in a failure to demonstrate the commercial viability of this process and the process would not be scaled-up for commercial production. Hence, all the development work and investment into the Alternate Fuels Demonstration Unit at LaPorte would be lost. The utility or industrial customer who is considering an IGCC power plant would be reluctant to include the LPMEOH™ technology if it has not been proven at a commercial scale. The benefits of developing economical chemical feedstocks and an economical, cleaner burning mobile and stationary fuel would be lost. Chemical feedstock production would therefore continue to use foreign and less cost effective technology and, for fuel methanol, the goals of increasing United States energy independence would not be met.

Should the LPMEOH™ not be funded it is highly likely that an Eastman Chemical plant expansion would be built on this 0.6 acre site with in the next decade .

2.3.2 Alternative Sites

In addition to a recent nationwide site selection search, two major alternative sites have been studied in detail for this process. The first, at Dakota Gasification Company's Great Plains Synfuels facility in Beulah, North Dakota, was initially selected as the demonstration site in late 1989. The synthesis gas supplier was unable to obtain permission to divert sufficient synthesis gas for use, and the site was rejected. In 1991, Texaco Syngas, Inc. was selected as a host site provider at the existing, but not operating, Cool Water Facility. Due to required modifications, the Cool Water Facility was judged economically unfeasible for re-start, and thus was not available as a host site. The search for a new site was then commissioned, with an emphasis on viable economics, sufficient synthesis gas supply, and low environmental impact. The result of this search was the selection of the Eastman Chemical Company's Kingsport, Tennessee site for further consideration.

The Eastman site was subsequently determined to best satisfy the requirements for developing a liquid phase methanol unit. The Eastman site can provide the coal-derived synthesis gas and ancillary facilities necessary to demonstrate all facets of the LPMEOH™ process as described previously. This site is the only existing coal gasification facility with synthesis gas available for this LPMEOH™ demonstration. The cost to build a coal gasification facility specifically to provide synthesis gas for the LPMEOH™ demonstration would be prohibitive. The site was, therefore, selected for the proposed project.

2.3.3 Alternative Technologies

The LPMEOH™ technology is a new process for methanol synthesis that has marked advantages over conventional gas-phase methanol production technologies. The key advantages include:

1) reactor feed need not be hydrogen-rich; almost any combination of hydrogen, carbon monoxide, and carbon dioxide can be processed directly without adjusting the gas composition via the shift reaction,

2) there is no need to dilute the feed gas to the reactor in order to control catalyst surface temperature,

3) highly concentrated gas streams can be processed directly, allowing much higher per-pass conversions to methanol than conventional technology, and

4) the LPMEOH™ process has been extensively and successfully tested at the Air Products/DOE Alternative Fuels Demonstration Unit (AFDU) at LaPorte, Texas, demonstrating its readiness for commercial-scale production.

The LPMEOH™ process technology was developed specifically to be used with an IGCC power plant, to be used on a Once-Through Methanol (OTM) basis and to directly process carbon monoxide-rich gases produced by advanced coal gasifiers. Usually the carbon monoxide concentration is high and the hydrogen to carbon monoxide ratio is low. Carbon dioxide content is variable depending on the type of coal feeding system, i.e., dry coal or slurry. The ability of the methanol process to load-follow electrical demand is key -- this is, on a daily basis, to start quickly, stop, and ramp-up or down rapidly. Finally, the process should be relatively simple and reliable, adding value to the IGCC operation, not detracting in any way from the high reliability expected of an IGCC installation. Conceptually the OTM synthesis step can be simply inserted in the IGCC flowsheet. In an OTM arrangement, a fraction of the synthesis gas is converted to methanol, typically between 10% and 40% of the heating value. In an electric power cycling scenario, methanol is produced during low demand periods and accumulates in storage; during peak demand it is withdrawn and burned as peaking fuel. The front-end coal gasification section runs at full capacity all of the time.

As described previously, the characteristics of the LPMEOH™ process that are responsible for its advantage in the IGCC coproduction scenario are simplicity, flexibility, resiliency, and expandability. While gas-phase technology can be applied to the coproduct scenario, the LPMEOH™ process costs less and is easier to operate. The gas-phase technology requires several additional capital-intensive processing steps. In addition, the LPMEOH™ process directly produces a methanol product suitable for direct use in many fuel applications. For these reasons, the LPMEOH™ process technology is considered the technology of choice for this application.

2.4 Summary of Affected Environment and Environmental Consequences

2.4.1 Air Quality/Air Emissions

Air quality regulatory requirements in the general vicinity of the project site were evaluated by Eastman. In addition, existing air quality background data were reviewed and compared to applicable Federal and state air quality standards. These background levels, as measured at a network of air quality monitoring sites, were evaluated with respect to the attainment status for each of the regulated pollutants. The concentrations of all regulated pollutants are in attainment with their respective standards.

The proposed project would result in very small increases in carbon monoxide and volatile organic emissions and no increases in sulfur dioxide and nitrogen oxides to the atmosphere.

The primary sources of air emissions during the construction phase of the project would be vehicular exhaust emissions, such as from construction equipment, as well as "fugitive" particulate emissions. The latter emission would be generated primarily by wind erosion during site excavation. Site watering would be implemented as appropriate.

Operational impacts of the LPMEOH™ plant would be primarily associated with equipment leak emissions and the incremental waste streams directed to on-site disposal boilers. Total emissions from equipment leaks are estimated at 9.8 tons per year including carbon monoxide and VOCs (volatile organic compounds), including methanol, which is a hazardous air pollutant, as defined in the Clean Air Act Amendments of 1990, Section 112. The fugitive emissions would be minimized by the application of modern engineered physical systems, such as low leakage control valves, and vapor return lines on truck loading stations. The project would comply with all applicable standards to protect the ambient air quality of the region. There would be a net increase in the fugitive air emissions of the combination of the Lurgi methanol unit and the LPMEOH™ methanol unit when the LPMEOH™ unit is brought onstream.

In addition to the process generated pollutants, small quantities of fugitive particulate matter emissions would result from general on-site vehicular traffic, which increases slightly due to the presence of the unit.

2.4.2 Earth Resources

The Eastman site is located in the Valley and Ridge geologic province. The region is characterized by parallel valleys and ridges. The ridges are mostly sandstone, siliceous limestone, and dolomite, and the valleys are underlain by shale and limestone. The Long Island site of the proposed methanol unit is underlain by alluvium on top of a thick layer of shale bedrock. Long Island is bounded by South Fork Holston River and by Big Sluice. No significant soil constraints were noted at the site.

Construction and operation of the LPMEOH™ plant is not expected to affect earth resources at the site. The construction lay-down area will be located a short distance from the west boundary of the proposed site. The temporary construction office will also be located there.

2.4.2 Water Resources

The major surface water feature in the site is the South Fork Holston River. The river flows southwestward to merge with the North Fork Holston River to form the Holston River. Flow is regulated by several Tennessee Valley Authority (TVA) dams. The combined flow from the South Fork Holston River and the Big Sluice averages 2610 cubic feet per second (cfs). Downstream studies of water quality have shown that most parameters measured met the state's criteria except for dissolved oxygen, nitrate, and fecal coliform. The lower dissolved oxygen concentrations are due to the Fort Patrick Henry Dam upstream of Eastman. The nitrate concentration is exceeded both upstream and downstream and is probably caused by agricultural and urban development. The presence of fecal coliform correlates to the influence of urban development near the river. Water is withdrawn from the river and used for heat removal and process water; wastewater generated by the Eastman processes is treated and returned to the river under a National Pollution Discharge Elimination System (NPDES) permit.

Groundwater resources in the vicinity have been studied for flow rates and direction of flow, and a limited amount of data are available on the surface waters bordering Long Island. The groundwater from Long Island flows towards the Big Sluce and the South Fork Holston River. Groundwater flow is approximately 1 cfs compared with river flow at 2600 cfs. Groundwater samples were taken in the mid 1980s within a quarter mile of the project site and resulting analysis revealed acceptable water quality.

Water use at the plant would be from filtered river water. The wastewater from the plant would be stormwater and water separated from the process by distillation. Process wastewater flow is expected to be 1150 gal/day. The increase in BOD load on the existing wastewater treatment facility is expected to be 4,180 lb/day.

Stormwater runoff would be collected in an oil/water separator prior to being routed to Eastman's industrial wastewater treatment facility. Oil would be collected and disposed of via energy recovery as it accumulates. The wastewater discharges are not expected to alter existing discharge characteristics.

2.4.3 Ecological Resources

Ecological resources consist primarily of open fields on Long Island and the bordering river aquatic life and birds. Water quality, as tested by the Academy of Natural Sciences of Philadelphia in the year 1990, showed some degradation at Fort Patrick Henry Dam and Eastman with improvement in the water quality downstream. The water quality showed a significant improvement in more recent years, between 1977 and 1990. Studies documented the species of algae, aquatic macrophytes, non-insect macroinvertebrates, aquatic insects, and fish in the area. No species of special concern have been identified in the vicinity of the project.

The construction and operation of the proposed project is not expected to have any impact on the local ecology. No unusual ecological resources have been identified at the project site. The proposed site, currently inside the industrial complex and idle, is filled and covered with stone, with no vegetative growth. There are no state or Federal threatened or endangered species known to be present at the proposed site, nor is the proposed site the habitat of any such species. The 0.6 acre parcel would be altered as a result of the development of the proposed unit, but this action should not cause any impact to the ecology.

2.4.4 Land Use

The proposed site is located within the Eastman facility in Kingsport. The Eastman facility comprises 3890 acres and is zoned Heavy Industrial. The proposed project site is 0.6 acres in the midst of the existing facility. Other land use in the surrounding vicinity is mixed and includes industrial, residential, commercial, and agricultural activities.

The proposed LPMEOH™ project would be located inside an existing industrial complex. As such, the project would be compatible with land uses in the area.

2.4.5 Socioeconomic Factors

The proposed site is located in Sullivan County, Tennessee. Sullivan County has a total employment of 71,000, of which 13,000 are employed by Eastman. The location offers a substantial labor pool to support activities in the area, with a significant number of trained workers available to meet construction and operational labor requirements.

At the peak of construction activity, the project would employ approximately 150 workers; their wages would contribute to economic activity in the region. Significant amounts of supplies and material would be purchased in the area; this would also have a stimulating effect upon the regional economy. The proposed project would contribute taxes to the local, state and Federal governments. Many of the services required by the plant would be provided internally; no extraordinary services would be required from governmental agencies.

2.4.6 Transportation

The Eastman site is highly accessible by road, rail, and air. The site has an entrance/exit onto I-181 leading to I-81 as well as access to State Roads 36, 126, and 93 and US-11W. Access by rail is extensive and unrestricted. The Tri-Cities Airport is less than 30 miles away. Within the Eastman facility, there are 28 miles of paved roadway and 37 miles of rail track.

Vehicular traffic would experience a transient increase during the construction period as construction workers drove on-site and deliveries were made to the site. The project would experience a maximum of 110 workers compared to the facility employment of 13,000, so the additional vehicular traffic is a very small fractional increase. After the completion of construction, the vehicular traffic would be slightly increased over the preconstruction levels due to the shipment of methanol from the site for off-site testing, the shipment of spent catalyst for recycling, and the occasional delivery of new catalyst. Coal shipments by rail should remain constant, as the existing Lurgi methanol unit would be turned down when the LPMEOH™ plant is in operation, with the net coal usage remaining constant.

2.4.7 Noise

Noise levels have been measured regularly at the Eastman perimeter since 1980. Analyses done on the noise measurements indicate the levels are consistent with the heavy industrial zoning of the Eastman site.

The noise effects of the proposed facility were evaluated for both construction and operational conditions. Increased noise would result during the construction phase from equipment, machinery, and vehicle operations. The nearest resident is about 260 feet from the proposed site and the nearest Eastman perimeter monitoring site is about 500 feet from the proposed site. During operations, the loudest known noise source would be a recycle synthesis compressor to be purchased with a noise specification of no more than 85 dBA at 3 feet. This would calculate to a noise level of less than 50 dBA at the nearest residence and less than 45 dBA at the perimeter monitoring site. To put this into perspective, listening to a TV 10 feet away has an equivalent sound level of 55-60 dBA. This would not add to the existing perimeter noise levels at Eastman.

2.4.8 Cultural Resources

Correspondence has been sent to and received from the Tennessee Historical Commission to identify any potential cultural resource concerns associated with the proposed project site. One source has indicated that Cherokee Native Americans used Long Island as a neutral zone for settling disputes, until the land was ceded in a treaty in the early 1800s. An archaeological site was revealed a mile from the proposed project site. Artifacts recovered showed the area to be a settlement from 10,000 B.C. Within several miles of the proposed site are several schools and golf courses, city parks, and Warriors' Path State Park. Tennessee Historical Commission concurs with the determination that there would be no impact on cultural resources as a result of the proposed project.

Correspondence from the Tennessee Historical Commission has been received stating their opinion that no historical resources would be impacted due to the proposed project activity. No archaeological resources are expected to be present on the site.

2.4.9 Visual Resources

The Eastman site at Kingsport is characterized by manufacturing buildings, office buildings, process plant areas including tanks, distillation columns, stacks, and steel structures. Outside the boundaries of the facility are other manufacturing industries and the town of Kingsport. Bays Mountain, south of the site, is a state nature preserve and park.

The plant would not significantly change the industrial nature of the facility, and would not significantly offer any change to the area's visual resources.

2.4.10 Solid Waste Disposal

Proposed solid waste disposal would be accomplished within the Eastman facility by the use of the site's solid waste treatment or incineration disposal facilities. Sufficient landfill capacity is available to satisfy all waste disposal requirements for the proposed LPMEOH™ plant. Spent catalyst may be reclaimed if economically feasible.