Great Plains SYNFUELS
**DAKOTA GASIFICATION COMPANY**
1600 East Interstate Avenue
Bismarck, ND 58501-0561 (701) 223-0441

October 2, 1989

North Dakota Industrial Commission
1016 East Owens Avenue, Suite 200
Bismarck, North Dakota 58501

Dear Gentlemen:

On October 3, 1988 ANG Coal Gasification Company submitted a proposal for the construction and subsequent operation of a multi-purpose, 6-inch distillation pilot plant to produce trade sample quantities of cresylic acid and individual isomers of cresol and xylenol. The Industrial Commission accepted the proposal and contributed $50,000 towards what was believed to be a $300,000 project. When Basin Electric/Dakota Gasification Company (DGC) assumed ownership of the Great Plains facility, the 6-inch fractionator project was put on hold for further review; and in May 1989 DGC informed the Industrial Commission it was cancelling the project and would not need the $50,000 grant.

DGC has continued its extensive research and development program on cresylic acid process development during 1989. The marketing department has also been active in seeking customers for the phenol it expects to produce at Beulah starting in late 1990. Several times in recent months the lack of the 6-inch pilot fractionator has hampered efforts to supply trade samples to prospective customers as well as produce large quantities of feedstocks for subsequent process development efforts. Also during 1989, contacts made with engineering companies and substantial in-house effort by DGC engineering staff produced a better scope definition for the 6-inch fractionator project. The new cost estimate based on a more completely defined scope increased the project cost to about $750,000. An intensive effort was made to canvas engineering companies and chemical manufacturers to determine if there was an existing facility which would process our materials on a contract basis. This search proved futile and again reinforced the fact that the only way for DGC to obtain the samples or feedstocks needed for its marketing or development programs would be to build its own facility.

To partly offset the project cost, DGC is requesting the North Dakota Industrial Commission to grant DGC the sum of $100,000 under North Dakota Administrative Code Section 43-03-02-02, item F, since this fractionator can make a major contribution in the success of DGC producing and selling new by-products. A check for $100 covering the registration fee is enclosed.

PROJECT TITLE: 6-INCH DIAMETER FRACTIONATION SYSTEM FOR PRODUCTION OF TRADE SAMPLES DERIVED FROM LIGNITE VIA COAL GASIFICATION

ORGANIZATION: DAKOTA GASIFICATION COMPANY

INVESTIGATOR: A. K. (FRED) KUHN

DATE OF SUBMISSION: SEPTEMBER 29, 1989

AMOUNT OF REQUEST: $100,000

industry. Cresylic acid feedstock liquids are continuously pumped to such columns, and distillates are continuously removed from such columns as products.

Laboratory scale glass columns are nearly always operated best in a batch mode rather than on a continuous basis. This difference in operating technique results in product compositions, which are unique to each process method. It is usually not possible to obtain phenolic isomer distillate products from a batch operation which compositions identical to what would be obtained from an industrial continuous column. It will be necessary to be able to provide samples having compositions which accurately represent what will be obtained from a full-scale cresylic acid plant. As the cresylic acid development program matures, it will become increasingly important to be capable of providing evaluation samples to prospective customers of such products. Such product evaluations are an important part of the foundation upon which a North Dakota cresylic acid industry must be built.

A 6-inch continuous column will enable characterization studies of impurities to accurately reflect what will be actually found in the distillates from full-scale industrial distillation equipment. Here, too, lab scale batch studies yield data which is skewed by the nature of a batch process.

Finally, studies of purification process technologies cannot be effectively carried out in a batch mode. Rectified steam and extractive distillation studies cannot be modeled effectively on a batch column. In order to optimize process parameters it is essential that a continuous column be used. It is not possible to scale up to industrial operations from small laboratory batch column data.

The laboratory scale glass column studies of the composition of crude phenols have all been complete. Several studies of distillate purification methods have been completed as have the remainder of the glass column phenolic purification studies. At this point in time, the usefulness of laboratory scale equipment will become more limited.

The next logical step in the development of cresylic acid products at the Great Plains gasification plant will be a pilot plant scale continuous 6-inch diameter fractionation column.

## 4. GOALS

The goals of this project will be:

a. To design, procure and install a high efficiency 6-inch diameter continuous fractionation column suitable for the separation of the alkyl-phenol isomers found in lignite gasification by-product liquids such as tar oil and crude phenols. Such a column will be equipped with a flash drum and dryer suitable for the preparation of such by-product liquids for the fractionation steps and all other ancillary equipment such as reboilers and condensers, feed pre-heaters, pumps, feed and storage tanks, steam ejector and necessary control instrumentation,

W. A. Sutthill - Plant Design Engineering Manager

W. Sutthill has had extensive experience in mechanical design of industrial facilities. After working with aerospace and electric utility companies, he supervised detailed engineering of the Great Plains' facilities at CE Lummus. In his current position, he is also experienced in monitoring cost and schedule for various capital projects at Great Plains.

G. G. Baker - Senior Process Development Engineer

G. Baker has had extensive experience at UNDEMRC building several pilot plant facilities. At Great Plains he has built and supervised operation of the Stretford pilot plant and is currently providing the technical expertise in building a dual solvent continuous extractor facility (cresylic acid from tar oil).

D. H. Duncan - Senior R&D Chemist

D. Duncan has had over 15 years of experience in developing methods to upgrade cresylic acid from petroleum derived feedstocks. He has been instrumental at Great Plains in developing bench-scale information to be utilized in the further development of this project.

8. QUALIFICATIONS OF APPLICANT

DGC has the necessary staff to carry out such a project. A number of earlier capital projects in connection with solving start-up problems and odor projects were similar or larger in scope.

9. BUDGET

The total estimated cost of $750,000 is broken down as follows:

| | Dollars |
|---|---|
| Engineering | 150,000 |
| Materials | 250,000 |
| Construction | 200,000 |
| Contingency 25% | 150,000 |
| Total | 750,000 |

Operating Expense, approximately $200,000 annually

DGC funding for construction and operating expenses will be provided by DGC financial resources.

10. APPENDICES

None