

## QUARTERLY TECHNICAL PROGRESS REPORT

**Report Title:** Field Demonstration of a Membrane Process to Separate Nitrogen from Natural Gas: Thirteenth Quarterly Progress Report

**Type of Report:** Quarterly Progress Report

**Reporting Period:** October 1, 2004 through December 31, 2004

**Contact:** Dr. Kaaeid Lokhandwala  
Tel: (650) 328-2228 ext. 140  
e-mail: kaaeid@mtrinc.com

**Date of Report:** February 28, 2005

**DOE Award Number:** DE-FC26-01NT41225

**Submitting Organization:** Membrane Technology and Research, Inc.  
1360 Willow Road, Suite 103  
Menlo Park, CA 94025

Tel: (650) 328-2228  
Fax: (650) 328-6580  
www.mtrinc.com

**Subcontractors:** None

**Other Partners:** ABB Lummus Global

**Project Team:** Project Officer: Anthony Zammerilli  
Contract Specialist: Keith L. Carrington

## **Disclaimer**

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

## **Abstract**

The original proposal described the construction and operation of a 1 MMscfd nitrogen removal/gas treatment system to be operated at a Butcher Energy gas field in Ohio. The gas produced at this field contained 17% nitrogen. During pre-commissioning of the project, a series of well tests showed that the amount of gas in the field was significantly smaller than expected and that the nitrogen content of the wells was very high (25 to 30%). After evaluating the revised cost of the project, Butcher Energy decided that the plant would not be economical and withdrew from the project.

Since that time, Membrane Technology and Research, Inc. (MTR) has signed a marketing and sales partnership with ABB Lummus Global, a large multinational corporation. MTR will be working with the company's Randall Gas Technology group, a supplier of equipment and processing technology to the natural gas industry.

Randall's engineering group has found a new site for the project field test at a North Texas Exploration (NTE) gas processing plant. The plant produces about 1 MMscfd of gas containing 24% nitrogen. The membrane unit will bring this gas to 4% nitrogen for delivery to the pipeline. The membrane skid is being built by ABB. NTE has ordered the required compressor and MTR is making the membrane modules. The membrane skid is scheduled to be completed by December 29. Our target is to have the unit installed and optimized by mid-January.

## Table of Contents

Introduction.....	2
Experimental.....	2
Results and Discussion .....	2
Additional Field Sites .....	3
Other Commercialization News.....	3
Conclusion .....	3
References.....	3

## Introduction

The natural gas specification for inert gases is less than 4%. On this basis, about 17% of known U.S. reserves of gas are subquality due to high nitrogen content. Some of this gas can be brought to pipeline specifications by dilution with low-nitrogen-content gas; some is treated by cryogenic condensation and fractionation. Nonetheless, about 1.0 trillion scf of known reserves are currently shut in.

This project covers the first demonstration of a new membrane technology to treat this otherwise unusable gas. The objective of this project is to develop a membrane separation process to separate nitrogen from high-nitrogen-content natural gas. To demonstrate the process, a proof-of-concept plant is being built at a North Texas Exploration (NTE) gas field in Texas/Oklahoma.

Additional test sites are also being explored.

## Experimental

The membrane system was installed and started up at the NT Exploration site. The client was expecting to get a minimum of 1 MMSCFD of inlet gas but has been only able to produce about 0.6 MMSCFD thus far. Another difficulty is that the inlet gas is water saturated which has resulted in other issues with the compression operations.

The site operator (NTE) is continuing to work on resolving the well flooding issues at the site. This has delayed the regular operation of the membrane. We expect resolution within a couple of months. If there is no resolution within that time frame we may decide to move the unit for testing to another location. An alternative location is being identified and will be reported to FETC once we have confirmation from the client.

## Results and Discussion

The membrane test unit was offline during this reporting period due to well-head flooding problems.

## **Additional Field Sites**

In September 2004, Twin Bottoms, LLC placed a commercial order for a unit to replace the test unit at the Louisa, KY, site which had been operational since July 2004. The system was shipped in November 2004 and was started up in early December. The commercial membrane system performance has been exceptional and the client is very pleased with the operation of the membrane.

## **Other Commercialization News**

MTR and ABB's Randall Gas Technology group are pursuing the commercialization of this product within the natural gas industry. In December 2004, we received a large order worth \$US850,000 for a membrane skid from a company in Kansas for a membrane system to reduce nitrogen content in a 4 MMSCFD gas stream from 40% nitrogen to about 17% nitrogen. This system will utilize eighteen 12-inch membrane modules, which represents one of the largest membrane skids sold by MTR. Incorporating 12-inch diameter membrane modules also represents a first in MTR history. The membrane system is being fabricated in Houston, TX and will be delivered to the client at the end of April 2005.

## **Conclusions**

MTR has successfully tested the nitrogen removal unit and demonstrated its performance at one site in Kentucky. The successful demonstration resulted in the sale of a commercial unit which was installed at the same site and started successful operation in December 2004. The demonstration unit at the NTE facility in North Texas is installed but awaiting complete continuous operation due to limitations imposed by lack of gas. The MTR/ABB team has also sold a new large nitrogen removal plant to a client in Kansas to process and remove nitrogen from 4 MMSCFD of natural gas. This order, worth \$US850,000, represents a very significant advance in the commercialization of this product line for MTR.

## **References**

None cited.