

**LRC-D-96-2**  
**LRC-D-96-3**  
**PRODUCTION OF ANHYDROUS AMMONIA FROM NORTH DAKOTA**  
**LIGNITE DERIVED SYNTHESIS GAS**

**CONTRACTOR:** Dakota Gasification Company

**PRINCIPAL INVESTIGATOR:** Kent E. Janssen  
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**PARTICIPANTS**

<u>Sponsor</u>	<u>Amount</u>
Dakota Gasification Company	\$100,628,729
ND Industrial Commission	
Investment (LRC-D-96-3)	\$4,200,000
<u>Grant Amount (LRC-D-96-2)</u>	<u>\$8,100,000</u>
Subtotal	<u>\$12,300,000</u>
Total Project Cost	\$112,928,729

**Project Schedule 20-Months**

Contract Date – 12/4/95  
Start Date – 2/1/95  
Completion Date – 11/1/96

**Project Deliverables**

Construction Status Reports – Monthly ✓  
Final Report – 10/31/05

**OBJECTIVE**

The objective of this clean coal demonstration project is to construct an anhydrous ammonia plant at the Great Plains Synfuels Plant. The goal of the project is to use lignite-derived synthesis gas to produce anhydrous ammonia. This project will diversify the Great Plains Synfuels Plant and yield agricultural fertilizer products derived from lignite.

**STATUS**

**Project Description**

The plant gasifies about 18,000 tons per day of lignite to produce synthesis gas.<sup>1</sup> Prior to diversification all of the synthesis gas was cooled and cleaned, the hydrogen to carbon monoxide ratio adjusted, carbon dioxide removed, and then the synthesis gas reacted in the presence of catalysis to produce methane-rich synthetic natural gas (SNG). Prior to diversification the plant produced about 157 million cubic feet per day of SNG.

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<sup>1</sup> The synthesis gas is formed by incomplete or partial combustion of lignite. Synthesis gas is a gas whose major components are hydrogen and carbon monoxide. After carbon dioxide removal, the DGC synthesis gas stream contains about 61.80% hydrogen, 20.00% carbon monoxide, and 16.90% methane.

Construction of the anhydrous ammonia project diverted 20 percent of the clean carbon dioxide-free synthesis gas stream to produce anhydrous ammonia. The remaining 80 percent of the synthesis gas is used to produce synthetic natural gas.

In the anhydrous ammonia plant, the synthesis gas stream is reacted with air, which contains nitrogen and oxygen, converting the carbon monoxide and methane from the synthesis gas stream, and oxygen from the air to carbon dioxide. The carbon dioxide is removed leaving a gas stream of nitrogen and hydrogen. The gas stream containing hydrogen and nitrogen is reacted in the presence of catalysis to yield ammonia. The ammonia stream is cooled and stored as anhydrous ammonia. The ammonia product is sold as fertilizer and used internally in an advanced flue gas desulfurization system. The flue gas desulfurization system removes sulfur dioxide with anhydrous ammonia to yield a second fertilizer, ammonia sulfate.<sup>2</sup> With these two diversification projects Great Plains produces approximately 125 million cubic feet per day of synthetic natural gas, 1,000 tons per day of anhydrous ammonia, and 135,000 tons per year of ammonia sulfate.

Construction of the anhydrous ammonia plant was completed in October 1997. Dakota Gasification Company is obligated to repay the \$4,200,000 investment, contingent on DGC profits and subject to a maximum repayment amount of \$7,500,000.

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<sup>2</sup> Dakota Gasification is marketing the ammonia sulfate as DakSul 45.