Title: **Advanced Gasification By-Product Utilization**

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Grant.: DE-FG26-03NT41795

Period of Performance: 09/01/2003 thru 08/31/2006

Date: March 26, 2004

PROGRAM OBJECTIVE

This project investigates the potential of waste streams from integrated gasification combined cycle (IGCC) power generation units to serve as precursors for value added products. These by-products can be considered a new material resource from coal. The objectives are to find applications and market options for by-products produced from IGCC chars. An ash beneficiation processing technology developed at the CAER to recover fly ash carbon from ash ponds and landfills will be applied to recover and separate marketable carbon and ash products from the gasifier chars. This technology has recovered coarse-carbon products with LOI as high as 70% and fine-carbon products separated by froth flotation as high as 60%. The CAER has previously applied this technology to recover and separate gasifier chars into carbon rich and ash products. Improvements will be made to the current process configuration to enhance the marketability of its product streams.

Work has been started to separate the solid waste streams from one of two IGCC power generation plants into three products - carbon rich, slag rich, and fine materials - by the beneficiation process. The gasifier-slag product will be evaluated to determine its suitability for use as a pozzolanic admixture in concrete or as a pelletized light-weight aggregate. The carbon-rich by-product will be evaluated as a precursor of activated carbons. The gasifier-char carbon will be subjected to thermal and chemical activation techniques. The properties of the resultant activated carbon will be characterized using state-of-the-art techniques available at the CAER

and EI. The carbon-rich gasifier char, untreated and activated, will be assessed as adsorbents for flue gas mercury (Hg) and NOX capture. Experiments to elucidate the mechanism of Hg adsorption on these materials will also be performed. The leachability of Hg captured by gasifier char carbon will be assessed by leaching tests of Hg-laden carbons. The carbon-rich by-product will be evaluated as an aggregate fuel, and as filler for conductive plastics and carbon bodies.

ACCOMPLISHMENTS TO DATE

Work completed includes the acquisition of study materials from two commercially operating gasification facilities. The materials have been recovered and separated into carbon rich fraction and ash fractions. The carbon rich fractions have been screened to -20 to + 80 mesh, and analyzed by ultimate, proximate and N_2 adsorption for surface area and pore size distribution. An Hg adsorption testing apparatus to determine the potential of the gasifier carbon products has also been upgraded and is ready to test the activated carbon produced.

FUTURE WORK

Samples will be tested for mercury capture ability, NOx capture and for use as fillers in concrete and carbon matrices in the as-received form. The carbon rich fractions will be activated by both thermal and chemical activation methods to understand porosity development in these materials. Modified materials will be tested to determine any enhancements in mercury capture or NOx capture.

NO PUBLICATIONS WERE YET SUBMITTED.

STUDENTS SUPPORTED UNDER THIS GRANT

David Graham, a PhD student in Chemical Engineering, at UK.
One graduate student at Penn State University under Maroto-Valer.