ANNUAL PROJECT REPORT
AS OF DECEMBER 2001

1. PROJECT SPONSOR:
CONSOL Energy Inc.
4000 Brownsville Road
South Park, PA 15129-9566

2. PROJECT MANAGER:
Duane C. McCoy
Sr. Engineering Consultant

PHONE: 412-854-6520
EMAIL: duanemccoy@consolenergy.com

3. OCDO GRANT NO. CDO/D-98-17

4. PROJECT UPDATE X OR
FINAL REPORT

5. PROJECT TITLE: Demonstration of the Production of Manufactured Aggregates From AEP Gavin and Conesville Station FGD Sludges

6. PROJECT TERM: FROM: 9/29/99 **TO:** 6/30/02

7. BUDGET :

CO-SPONSORS NAME	COST-SHARE
OCDO	$175,329
CONSOL ENERGY	$ 58,560
SynAggs, Inc.	$ 58,560
AEP	$ 58,208
TOTAL PROJECT COST:	$ 350,657

I. ABSTRACT

8. OVERVIEW OF PROJECT & OBJECTIVES:
Many coal-fired power plants are equipped with wet flue gas desulfurization (FGD) technology. Commercial wet FGD units produce a waste by-product filter cake (also called sludge) which is a mixture of calcium sulfite hemihydrate, calcium sulfate dihydrate, and water, with minor amounts of calcium carbonate and other components. Current practice is to dispose of the FGD sludge in a land fill, at considerable expense. A beneficial use for FGD scrubber sludge will reduce the waste management costs for coal-fired utilities. The potential benefits include: reduced power production costs, the production of a valuable material, and reduced land use for waste disposal. As a result, the utilities can be more competitive, the market for Ohio=s high sulfur coal would be preserved, and the use of FGD systems could become a more attractive alternative to fuel switching.

CONSOL is developing a process to manufacture construction aggregates from FGD sludge and boiler fly ash by **agglomeration** followed by curing. The production of road paving aggregate is an ideal use for FGD sludge because of the vast quantities of the product demanded by the road construction industry. Annually, the market for road aggregate is over 100 million tons in Ohio. The production of medium-weight and lightweight aggregates is smaller than that for road aggregate; however, they are higher-value products which improve process economics. This technology has the greatest potential for near-term commercialization.

This project will use CONSOL=s manufactured aggregate technology to (a) demonstrate that FGD sludge and fly ash produced at the AEP Gavin Station can be used to produce aggregates meeting commercial specifications for Class A road paving aggregate and medium-weight and lightweight aggregates for concrete masonry units, (b) demonstrate that the AEP Conesville Station FGD sludge and fly ash can be used to make lightweight aggregates for use in concrete masonry units and Portland cement concrete: (c) demonstrate that these products can be produced in an integrated, continuous fashion: and (d) demonstrate the use of the products in concrete masonry units (Gavin and Conesville materials) and in Portland cement concrete (Conesville material).

Because the required mix design cost for producing road aggregates which tolerate the freeze/thaw/salt conditions of northern climates is currently excessive, the original proposal plan to produce 50 tons of road aggregates for a paving demonstration has been eliminated from the program. The process can produce suitable aggregate materials which will perform well under northern climate winter conditions but the cost of the currently identified additives is too great at this time. Medium-weight and lightweight aggregates will be produced and used in the manufacture of concrete masonry units in several commercial concrete block production facilities and the Conesville material will also be use in Portland cement concrete. This demonstration is a necessary pre-commercial step to qualify the materials produced with Gavin and Conesville Station coal combustion by-products.
9. WORK DONE AND CONCLUSIONS:

During 2000 road aggregate durability became a concern when exposed to de-icing/anti-skid agents during the winter months. Ohio road construction specifications do not have a durability requirement for sodium chloride freeze/thaw exposure, however, Canada does. At no cost to the project participants, CONSOL Energy developed mix designs using special additives that improved aggregate quality to meet the Canadian sodium chloride freeze/thaw specifications. However, the use of the additives increased the aggregate production cost and currently would require a tipping fee from the waste generator to make a road aggregate project commercially viable. Since waste disposal costs are low at the Gavin Station, this is not practical. Based on discussions with program participants it was agreed to redirect efforts to demonstrating the production of higher valued lightweight aggregates for concrete block production using AEP Conesville Station FGD sludge and fly ash. Testing again began late in the year after CONSOL Energy developed and OCDO agreed to the revised program.

Conesville Station Units 5 and 6 are scrubbed. The fly ash from these units has a high density due to the high iron and low carbon (loss on ignition LOI) contents. To produce lightweight aggregate the Conesville fly ash density needs to be reduced. This can be done by removing some of the iron from the fly ash or by blending the fly ash with lighter weight ash from another station. Iron separation equipment is commercially available, however finding a toll processor that could process enough fly ash for the test program within our time constraints for operating the pilot plant became problematic. A decision was made to obtain lightweight fly ash for blending from the First Energy Sammis Station in Stratton, OH. This allowed making the lightweight aggregate in a timely fashion so that material could be available to block manufacturers early in 2002. Twenty six tons of lightweight aggregates were produced. Bench-scale tests will be run with iron reduced fly ash to produce a specification aggregate mix design so that an economic comparison can be made between iron separation and blending methods of obtaining lightweight fly ash.

Radon emission tests were conducted on commercially available lightweight and standard weight concrete blocks and on manufactured aggregates produced from Gavin Station FGD sludge and either a combination of Gavin/Mountaineer Station fly ashes (lightweight block) or Gavin fly ash only (standard weight block). No significant differences were found for the blocks. Radon concentrations in the test chamber averaged less than 1 pico curie per liter (pCi/l) for all blocks tested. By comparison the ambient baseline radon level was measured at 0.5 pCi/l while the EPA recommended remedial action level is above 4 pCi/l. These results indicate that use of manufactured aggregates made with Gavin Station materials should not present an environmental health concern. Tests have not yet been conducted on the Conesville material.

10. PLANS FOR COMING YEAR:

A number of concrete block plants in Ohio are being contacted to determine interest in producing lightweight concrete blocks using the lightweight manufactured aggregate. Once size specifications are agreed upon, stockpiled aggregates will be crushed and screened. The material will be shipped to the block plants for production run tests.

CONSOL Energy will retain a sufficient number of blocks for analysis by outside laboratories in accordance with ASTM and other test procedures.

Several bench-scale pelletization tests will be conducted to develop a mix design for Conesville FGD sludge with iron reduced Conesville fly ash. This will allow comparison of aggregates made with iron reduced, low density fly ash only and aggregates made by blending high and low density fly ashes.

The Portland cement concrete (PCC) demonstration testing will be conducted during 2002. Aggregates made from Conesville materials will be used for these tests since there is a higher potential for a commercial aggregate plant to be sited at the Conesville Station than at the Gavin Station. PCC test cylinders will be made with selected mix formulations. The cylinder specimens will be subjected to various laboratory tests, including compressive strength after 7, 14, 28, 56, and 90 days of curing, freeze/thaw, sulfate and chloride soundness, and stress/strain curves.

II. HIGHLIGHTS/ACCOMPLISHMENTS

11. Due to economic considerations the proposed road aggregate production using Gavin Station FGD sludge and fly ash was eliminated from the test program. The program was modified to include the production lightweight manufactured aggregates for concrete block manufacture using Conesville FGD sludge and fly ash. To achieve required fly ash densities, a blend (nominally 50/50) of Conesville and Sammis Station fly ashes was used for the lightweight aggregate production run. Twenty six tons of cured aggregates were successfully produced in the continuous pilot plant.

Tests demonstrated that radon emissions from block made with Gavin Station manufactured aggregates were quite similar to those from commercially available lightweight block and standard weight block. There should be no environmental health concern for manufactured aggregate block made from Gavin Station materials.

CONSOL ENERGY and SynAggs formed a joint venture, Universal Aggregates, to commercialize the manufactured aggregate process. Universal Aggregates is actively seeking sites to construct a manufactured aggregate manufacturing facility. Discussions have been held with AEP and the Conesville site was identified as the most likely candidate.

III. ARTICLES/PRESENTATIONS

12. There were no articles published or presentations made for this project in 2001.