OCDO MONTHLY PROJECT STATUS REPORT
LAND APPLICATION USES OF DRY FGD BY-PRODUCTS
OCDO GRANT AGREEMENT NO. CDO/D-89-35

STATUS REPORT NUMBER 33
REPORTING PERIOD - OCTOBER 1993

28060

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MASTER

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Land Application Uses of Dry FGD By-Products
Monthly Report
October 1993
Warren A. Dick and Joel H. Beeghly

1.0 Land Application Project

1.1 Project Organization

- 1.1.1 More detailed OSU budget information was supplied to OCDO upon request. They have not made payment to Dravo Lime for invoices back to April, 1993 due to uncertainties and difficulties completing Phase 2 and the Phase 3 mine field sites. OSU is desiring payment.

1.2 Reports, Meetings, Conferences

- 1.2.1 A paper was submitted for a Southern Illinois University Conference (Carbondale, Ill.) on coal ash utilization for next April. Two papers were submitted for presentation at the international Land Reclamation and Acid Mine Drainage Conference to be held April 25-29, 1994 in Pittsburgh.
- 1.2.2 A presentation on the overall project was presented by J. H. Beeghly to the Coal Market Strategies Conference in St. Louis, MO. This was basically the same paper presented to the American Coal Ash Symposium last January.
- 1.2.3 A paper by Prof. Bill Wolfe and coauthored by Joel Beeghly was presented at the Symposium in Denver, Colorado. The symposium was called "Recovery and Reuse of Discarded Materials and By-Products for Construction of Highway Facilities", sponsored by the Federal Highway Administration and USEPA. The subject was the OSU Truck Ramp project. A copy is attached.
- 1.2.4 A poster paper was prepared by J. H. Beeghly (both a paper and poster) for the ASTM USEPA Third International Conference on Stabilization/ Solidification (S/S) of Hazardous Wastes on the subject of using dry FGD by-products for S/S agents, i.e. NISCO by-product. The presentation was November 4, 1993 in Williamsburg, VA. Joel Beeghly, W. Wolfe and J. Bigham were authors.
- 1.2.5 Preparations were begun for a Steering Committee meeting scheduled for November 22, 1993.
- 1.2.6 The Press Release from Ohio State University has been distributed nation-wide resulting in stories appearing in several periodicals including Business Week (attached). Inquiries from 6 states for data from this project have been responded to.

1.3 Ohio Department of Transportation - Rt 541

OSU Civil Engineering has obtained support from the Ohio Department of Transportation to use the blend of Tidd PFBC bed ash and conditioned cyclone ash to repair a road slide on state Rt 541 near Coshocton, Ohio. Steve Tutokey and Joel Beeghly have been monitoring the preparation and shipment to the job site and discussed material characteristics with ODOT personnel. Steve has checked the optimum moisture content and prepared specimens for unconfined compressive strengths as part of a QC/QA plan. As of November 1, about 1,400 tons has been shipped and placed in a stockpile waiting for completion of excavation of the unstable clay. The ash will be mixed with water to go from 8-14% to 22% moisture and then placed in 6 inch lifts to form a toe or barrier to hold the side of the hill. OSU Civil Engineering is to monitor the placement of the ash but Dravo will also observe. AEP is paying for the trucking and approval from Ohio EPA was granted.

1.4 Fleming AML Reclamation Project

On October 13, W. A. Dick and J. H. Beeghly met the Ohio EPA air pollution people to discuss the need to get a fugitive dust permit. Although the Ohio EPA would prefer to exempt this project as they do other mine reclamation projects, it was agreed that we should file for a permit because of the public sensitive-nature of the job.

On October 18, W.A. Dick and J. Bird of OCDO held their first meeting with the local "citizens advisory" group. This group claims even if Ohio EPA grants a permit for the "sludge management plan" to use N-Viro Soil (a "processed" blend of Toledo sewage sludge and General Motors (GM) FBC ash), they and the city of Dover will file for a court injunction to stop same on the basis of protecting the groundwater-aquifer water supply. OCDO would like to avoid a court injunction and advises to find an alternative organic soil amendment.

Ohio EPA is expected to grant the permit for its use. The permit to use N-Viro Soil had to be in the name of Great Lakes N-Viro and the City of Toledo. If no sewage sludge is used we don't need to submit the "sludge management plan" or go thru a public hearing.

However, If another source of organic soil amendment is used, i.e. yard compost, the FBC ash will need to be mixed by some party other than N-Viro. Also, of the Ohio Div. of Reclamation buying N-Viro we will have to buy the delivery of the ash and the yard compost separately. The willingness for GM to not require indemnification without going through a purchaser and "processor" is questionable. (The cost to deliver the ash from Pontiac is about \$16 per ton which is supposedly the same or less than the tipping landfill fee to be avoided.)

Great Lakes N-Viro wants to get the satisfaction and prestige of getting the Ohio EPA permit. Then, if they pull out to appease OCDO and avoid the bad publicity of defending a court injunction, we could have to deal directly with GM. However, N-Viro states they will get us the ash alone under their contract and thus be our legal indemnification umbrella even if they don't deliver the N-Viro soil (This was confirmed on November 10, 1993.). Even with the plan to use N-Viro, some test plots of ash alone are planned. N-Viro may have the same trouble with GM's indemnification requirement as we would for the ash alone portion. GM will not ship ash in a dump truck without conditioning it. Ash shipped to N-Viro is in a truck pneumatic tanker.

FBC ash and N-Viro Soil land application could not have happened this fall because the contractor was not ready for it. The earliest date for application seems to be April, 1994.

1.5 Conesville FGD Base Course at Cattle Feed Lot

Twenty-eight (28) day unconfined compressive strengths of 200 to 300 psi have been reported by both Steve Tutokey of Dravo Lime and OSU Civil Engineering. These are on target and are expected to double by 90 days in lab curing conditions.

2.0 Contract Problems

- 2.1 See 1.1.1
- 2.2 See 1.4

3.0 Projected Work Schedule

- 3.1 Monitor ODOT Project
- 3.2 Negotiate Fleming AML Project
- 3.3 November 22, Steering Committee
- 3.4 Speak at Agronomy Society and ASTM - EPA Conferences
- 3.5 Prepare Phase 2 Report

***Agenda For Steering Committee Meeting
On
Land Application Uses Of Dry FGD By-Products***

Date: November 22, 1993

Time: 10:00 AM - 4:00 PM

Place: EORDC of the Ohio State University - State Route 215

Meeting Schedule

9:45 AM	Welcome Time (Coffee hopefully)
10:00	Introduction and Recap of Events - J.H. Beeghly
10:15	Ag Economics Presentation - Fred Hitzhuzen
11:00	Ag Lime Field Plots & Spreadability of SNRB Ash Rick Stehouwer
11:30	J. Crews Presentation - LIMB Ash for Tree Farm
12:00 PM	Box Lunch (submarine sandwiches or bring your own)
12:45	Tour: - Cattle Feed Lot Projects - 3 locations 1. Tidd PFBC Stabilized Base 2. Fixated Conesville Wet FGD Stabilized Base - Plot 1 3. Same as 2 - Plot 2
2:00	Cattle Feedlot and ODOT Embankment Projects Bill Wolfe
2:45	Fleming AML Predicament - Warren Dick
4:00	Adjourn

Take Exit 28 on I-77 about 20-25 miles south of Cambridge, Ohio. Go East about 3/4 mile on SR821. Turn left on SR215 and go about 1 mile. See EORDC Building on Left just after passing Wolf Run Campground.

OCDO MONTHLY PROJECT STATUS REPORT
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STATUS REPORT NUMBER 34
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Joel H. Beeghly (412) 777-0711
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OCDO Monthly Report
Land Application Uses of Dry FGD By-Products
November 1993

Joel H. Beeghly and Warren A. Dick

1.0 Land Application Project

1.1 Project Organization, Reports, Conferences

1.1.1 A Steering Committee meeting was held November 22 to report on OSU studies and to discuss problems to complete land application at the Fleming AML site. Minutes of the meeting are attached as prepared by OSU, Agronomy.

1.2.1 A paper was presented by J. H. Beeghly at the ASTM-USEPA Symposium on Waste Stabilization/Solidification suggesting the use of dry FGD by-product as a stabilizing agent.

OSU Agronomy made a presentation at the American Society of Agronomy annual meeting. Bill Wolfe of Civil Engineering spoke at a coal ash utilization conference at the University of Kentucky. Papers from each of these are available.

1.2.3 The US Dept. of Agriculture is planning a workshop on FGD By-Products at Purdue University for Feb. 7-8, 1994 and have asked Dravo Lime and OSU to participate. An abstract of a paper from OSU (Agronomy) was also submitted for the Purdue Industrial Conference, 9-11 May, 1994.

1.2.4 Governor George Voinovich of Ohio visited the laboratory of W. A. Dick, at OARDC, Wooster and was informed of the land application project. He was accompanied by Jackie Bird of OCDO and the Assistant Director of the Ohio EPA. See the attached article. It is believed some of the recent controversy over the Fleming AML site may have attracted his attention to this project.

1.2.5 As announced earlier the USEPA has decided on the exclusion of coal ash and wet FGD waste from hazardous waste under Sub-title C of RCRA. However, at least some clean coal technology ash by-products have not yet been excluded for lack of information. J. H. Beeghly recently was able to meet Ms. Pat Whiting of The USEPA. Her responsibility is to decide on these matters. The USEPA contact has heretofore been elusive. She said she was glad for our contact and would like our project information next spring when she can work on this issue. She will be sent a Phase 1 report. Her phone number is 703-308-8431 and she works within the "Special Waste Branch" of the office of Solid Waste.

- 1.2.6 Joel Beeghly visited General Motors, November 10 to update them of our interest in their conditioned FBC ash and to get a sample of same in both the dry and conditioned form. They add approximately 32% water on a dry weight basis. The residual moisture after 2 days was about 14%. The total neutralizing power was 43% CaCO_3 . A standard procter unconfined compressive strength at 28 days was 250 psi.

2.0 Demonstration Sites

2.1 Ohio State Route 541

A section of roadway 1 mile west of Coshocton, Ohio, on SR 541 began to show signs of slippage earlier this year. By early summer, over 35 meters (100 feet) of the shoulder and guardrail had been ruined and it was decided that a substantial repair effort was quickly needed. Bill Wolfe states in a report the following:

A field investigation undertaken by the Ohio Department of Transportation (ODOT) revealed that the embankment upon which the roadway was constructed was slipping along a failure plane. Subsequent excavation exposed a large amount of water trapped above a semi-impermeable layer of shale and beneath a layer of silty-clay. The water reduced the effective strength at the interface and ultimately led to, or at least aided in the slide. The failure at the base of the slope progressed towards the peak, eventually leading to surface settlement and ultimately roadway damage.

About 2,500 tons of a blend of approximately 67% conditioned Tidd PFBC cyclone ash and 33% bed ash mixed at the landfill was placed as a "buttress" type embankment at the base of the slope. This material replaces unstable clay that had begun to slip. Before placement of the PFBC ash, this water flow had to be captured and directed in a constructed drainage system. Both OSU Civil Engineering and Dravo Lime have been monitoring this construction by a special ODOT maintenance crew.

The Tidd material shipped to the job was tested for unconfined compressive strengths. With laboratory curing it achieved over 500 pounds per square inch in 28 days. The wet density at optimum moisture was about 130 pound per cubic foot.

2.2 Cattle Feed Lot

Bill Wolfe reported at the November 22 Steering Committee, early field test results of the Conesville Fixated Wet FGD test pads (see his enclosed minutes). Separately, Dravo Lime performed unconfined compressive strengths of three mixes and subjected them to constant laboratory curing conditions. The best 60 day strength was 420 psi for Mix #1 using 5% extra lime added at the feed lot. The strength of the control mix (1.5% lime) at 60 day was 140 psi. Bill Wolfe is coring the pads to monitoring strength gain via ambient curing.

The cattle were put on the one pad in late November. The lack of a good wearing surface is causing about 1 inch deep surface deterioration.

A set of water runoff samples was taken in November.

The Tidd PFBC pads constructed earlier are performing well.

2.3 In Place Permeability Test

At the cattle feed lot on the Conesville pads, we are performing permeability (or hydraulic conductivity) tests in the field that compliment tests in a laboratory. The apparatus used is called a double ring infiltrometer and is not costly. Good impermeable properties of stabilized FGD may permit extension of use as a for use as a clay liner or cover in lieu of clay.

2.4 Fleming AML Site

A good discussion of the political problems at the Fleming abandoned mine site occurred at the November 22 Steering Committee (see minutes). In summary, the use of the N-Viro Soil made with General Motors FBC ash and Toledo sewage sludge has been cancelled due to the adverse public reaction. The Club 3000 group may also object to the use of the same FBC ash but mixed with some other more acceptable organic material, i.e. yard compost, which must be sought. There is time to work out these problems since application must wait until dry, warmer weather in May. The contractor for the Ohio Division of Reclamation would otherwise have to use resoil material from some nearby property or have it trucked in.

Warren Dick and the writer are actively pursuing all avenues to resolve the deadlock. We will determine the availability and quality of a locally produced yard waste compost.

3.0 Contract Problems

See 2.4.

4.0 Projected Work Schedule

- 4.1 Many hundreds of soil and plant samples collected as part of the agronomic work will be processed for analyses.
- 4.2 Phase 2 report materials are starting to come in to Warren Dick's office for editing.
- 4.3 Sources of organic material located in the Tuscarawas Stark-Wayne County Arco are being sought. These organic materials will be specified for our use as composted yard grass clippings and leaves.

We will be working closely with the Tuscarawas Stark-Wayne Counties Solid Waste Management Board.
- 4.4 The Ohio State Route 541 repair job will hopefully be completed in January and monitoring equipment to test performance of the FGD as a stabilizing material will be installed. Water samples are also being collected for analyses.
- 4.5 Merry Christmas and Happy New Year.

LAND APPLICATION USES OF DRY FGD BY-PRODUCTS

Steering Committee Meeting Minutes November 22, 1993

The sixth formal meeting of the project steering committee was held from 10:00 am to 4:45 pm on November 22, 1993 at the East Ohio Resource Development Center, Belle Valley, Ohio. Participants are listed in Appendix A.

149. Introductory remarks.

The meeting was opened with Introductions and welcoming remarks by Joel Beeghly, who also gave a brief recap of issues or recent events related to the project. These were:

1. The recent US EPA regulatory determination which exempted coal combustion by-products from regulation under subtitle C of RCRA. Fluidized bed combustion wastes, however, were not exempted.
2. Meeting at DOE METC on barriers to increased utilization of coal combustion and desulfurization by-products.
3. There is a need to obtain an ASTM D-34 specification regarding use of fluidized bed materials in making concrete.
4. There is increasing interest in land application of FGD by-products as evidenced by US Bureau of Mines RFP and several workshops/meetings planned on the topic, one by USDA and one by University of Southern Illinois.
5. CONSOL has developed a haul-back plan whereby spray dryer ash will be hauled from Delaware back to a mine in Pennsylvania.
6. Some 25 papers/presentations have resulted from this project to date.
7. We have field demonstrations in place or pending for several FGD by-products:
 - LIMB - Central Fuel Stockpile, N-Viro soil,
 - OSU Spray Dryer - truck ramp, future use by BurchHydro,
 - PFBC - agronomic liming, feedlot pad, ODOT projects,
 - GM CFBC - N-Viro soil, Fleming AML, Holmes Limestone Co. coal refuse treatment,
 - Wet FGD (Conesville) - feedlot pads.

150. Agricultural Economics Report.

Fred Hitzhusen presented a re-cap of Ag Econ work to date and plans for upcoming work. Future work will include financial and economic optimization models, and assessments of the gypsum market and of cattle feedlot applications for FGD.

Lynn Forster presented the results of his study of beef cattle feedlots as potential markets for FGD by-products (published as ESO2090). In the last 40 years there has been a shift in beef production to feedlots concentrated in western Kansas, Nebraska, Oklahoma, and Texas. This is a very low return industry with cost disadvantages to smaller (<1000 head) operations. His estimates indicate

use of FGD as a cement substitute in farmer feed-lot (small) operations would save only \$0.25/cwt out of total costs of \$85.00/cwt.

Dianne Hite presented results from her study of the social costs of landfills and reclaimed mined lands. Data from the landfill study sites indicated a very strong negative impact of the landfill on property values which decreased with distance from the landfill. Effects were measurable up to 3 miles distance, and were still in evidence at the Alum Creek site where the landfill has been closed for 14 years. A problem with the Gahana site was that too many variables were found to affect property values and not enough data was available to develop a multiple regression model to satisfactorily account for all the variables. A hedonic pricing model will be used to assess the impacts of reclamation activity on the surrounding area. Extensive data have been collected from sites in the Muskingum Conservancy District and she is now ready to begin the modelling phase of the work.

151. Use of FGD In acid forest soils.

Jerry Crews of the US Forest Service reported results of his greenhouse study investigating LIMB by-product as an alkaline amendment for acid forest soil and its effect on growth of red oak. LIMB amendment did have a positive effect on oak growth at rates up to 2 times the liming requirement of the soil. Leachate data gave no indication of potential problems from leaching of metals from the LIMB material. Leachate B was increased at high LIMB rates.

152. Agronomy Report.

Rick Stehouwer reviewed results from studies, conducted by himself and Dr. Paul Sutton, using FGD by-products as alkaline amendments in acid agricultural soils. Greenhouse studies showed alfalfa growth was improved by LIMB and PFBC bed and fly ash, while there was no effect on fescue growth. Leachate Ca, Mg, and S was increased and Al, Mn, and Fe was decreased by FGD amendment. There was a large effect of crop on leachate quality. In general leachate concentrations of macro-elements were much higher with alfalfa than with fescue. Leachate concentrations and plant uptake of potentially toxic metals was not affected by FGD amendment.

Field spreading trials using SNRB by-product material and commercial spreading equipment indicated the need for the by-products to be pelletized or prilled. Severe dusting and very low delivery were problems with a spinner spreader, and low delivery and uneven distribution were problems with a drop spreader.

Field agronomic trials were initiated at 3 locations (Wooster, Coshocton, and Canfield) in the fall of 1992 with the application of PFBC material. Plots were planted to alfalfa and corn. Soil cores showed surface (0-10 cm) pH was increased to near 7, with smaller increases below the depth of incorporation (10-20 cm). There were also increases in soil Ca, Mg, and S with clear evidence of downward movement below the zone of incorporation. Alfalfa yield was increased at the Wooster site by PFBC, but a summer drought reduced yields and eliminated other expected PFBC treatment effects on both alfalfa and corn.

153. Tour of feedlots.

The group toured 3 feedlots constructed at EORDC using FGD materials. The first were the bull feeding pens constructed using PFBC materials. These have held up well so far, and have been in use for several months. The second two lots are storage pads for round hay bales. These two pads were constructed using wet FGD scrubber sludge from the Conesville plant. Quick lime (CaO) was added to enhance cementation, in one case at the plant and in the other at EORDC during construction. The wet FGD pads appear to have developed sufficient strength to support machinery moving bales as well as cattle hooves. However, a suitable wearing surface must still be developed to allow cleaning the pads to be scraped clean of manure and waste hay without damage to the pad.

154. Civil Engineering Report.

Bill Wolfe reported on CE field projects including the OSU truck ramp, the EORDC feedlots, and two highway embankment projects with ODOT. He also presented some data from cores taken from the feedlots.

Two separate highway embankment projects have been initiated in cooperation with ODOT. The project to repair a slip on highway 541 near Coshocton will utilize approximately 2,200 tons of PFBC by-product. The second project to repair a slip on highway 83 is still in the planing stages.

155. Fleming AML.

Warren Dick brought the group up to date on the controversy surrounding our plans for Fleming AML site, and led a discussion of our response to these events. Most of the opposition appears to be initiated by the Club 3000 group, active in Tuscarawas and Stark counties. Jackie Bird reported that this group has hired lawyers and plans to bring legal action against all persons involved in the Fleming reclamation project. She also reported that Senator DiDonato felt there was public deception on the part of N-Viro when they insisted on pushing EPA for a ruling on using their product if they, in fact, have no intent to use it. There is also mistrust among the general public in the Dover area because of differing, and apparently contradictory information supplied by various state agencies and individuals involved in the reclamation project. It was acknowledged that there is clearly a need for better communication and coordination among all agencies and players involved in the project. In retrospect we also should have involved local elected officials, local public health, water, and sewer authorities, and local SCS and Cooperative Extension agents in planning and implementing the project from the very start.

Jerry Harness emphasized that the US-DOE does not want to see this project become a lightning rod for adverse public sentiment. Jackie Bird echoed this opinion on behalf of OCDO. Warren Dick agreed that OSU also wanted to avoid any legal action over the site. He stressed that we should continue to try to work with Club 3000 and other local individuals opposed to the project to try to educate them as to the facts of what our project involves and the potential risks and benefits to them as a result of the project.

RESEARCH CENTER NEWS

OARDC

Newsletter of the Ohio Agricultural Research and Development Center,
College of Agriculture, The Ohio State University
Dr. Thomas L. Payne, Director

November 1993
Vol. 37, No. 11

From the Director

Gov. Voinovich and his cabinet visit Wooster on Nov. 15

The Wooster campus was fortunate to have hosted a regional meeting of Gov. George Voinovich and his cabinet on Nov. 15. It provided us an opportunity to show the Governor some of what we're doing. In fact, we were able to capture him for a one-stop tour of Warren Dick's lab. Warren and Rick Stehouwer brought the Governor up to date on their research on beneficial ways to use ash and other byproducts from coal air scrubbers. The project has major backing from seven agencies and businesses, including the Ohio Coal Development Office of the Ohio Department of Development. Jackie Bird, director of the Ohio Coal Development Office, joined the tour.

Tom Payne (left), Rick Stehouwer, Gov. George Voinovich and Warren Dick visit in Warren's lab in Williams Hall.

After the tour, we sponsored a reception for the Governor in the lobby of Fisher Auditorium. Many of our friends in the community and the Ohio legislature were able to attend.

At the cabinet meeting in Fisher Auditorium, Gov. Voinovich recognized the importance of OARDC to the state's number-one industry--agriculture--and his support in the last biennium. We sure appreciate that support.

State of Ohio Environmental Protection Agency

P.O. Box 1049, 1800 WaterMark Dr.
Columbus, Ohio 43266-0149
(614) 644-3020
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George V. Voinovich
Governor

Donald R. Schregardus
Director

CONTACT: Nancy O'Meara
614-644-2160
DATE: December 10, 1993

CITIZEN'S ADVISORY

National N-Viro Tech Corporation has withdrawn its sludge management plan application for the Fleming project. N-Viro Tech's application, therefore, is no longer under consideration by the Agency. The application was for the use of sewage sludge treated by the N-Viro process to reclaim a 10-acre strip mined area located in sections 11 and 12, Franklin Township, Tuscarawas County.

Sewage sludge is the solid material removed during the treatment of municipal wastewater. The N-Viro product was proposed to be used as an organic soil material to encourage the growth of vegetation at the Fleming site.

The Ohio Coal Development Office has informed Ohio EPA a composted organic material will be used with the Flu Gas Desulfurization (FGD) waste in the two Ohio State University-run test sites.

FGD is a by-product created when high sulfur coal is burned and the exhaust (flue) gases are scrubbed. FGD will be beneficially-used to reclaim the abandoned mine site and return highly acidic soil to a neutral pH.

When beneficially-used, FGD is not regulated under solid waste regulations. All beneficial-use proposals are reviewed by Ohio EPA's Division of Surface Water to determine if potential for water pollution exists. If potential for water pollution exists, the Agency may require plan approval to protect ground water and surface water.

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Joel H. Beeghly (412) 777-0711
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Land Application Uses of Dry FGD By-Products
Monthly Report
December, 1993
Warren A. Dick and Joel H. Beeghly

1.0 Land Application Project

- 1.1 Reports, Meetings, etc.** - The OCDO annual summary progress report was written and submitted. A copy is attached. A meeting with OCDO by M. Babu, Vice President of Dravo and the writer was held to discuss project problems and other future projects.

Phase 2 Report - All project participants were requested to submit their Phase 2 results to Warren Dick by January 7, 1994 and information is being collated and a draft document is being generated.

Phase 1 Report - The Phase 1 Report will be published by EPRI. A hard copy of the report along with a computer disk file of the entire Phase 1 report have been sent to the EPRI publisher. The tentative publication is March 1, 1994.

The DOE-METC is preparing a separate document that will exempt the project from filing an Environmental Impact Assessment Statement. Ohio State University is providing information to support this new exemption application and Mary Beth Ashbaugh is the DOE person working on preparing and submitting the final version of the exemption. This exemption will include approval for the acreages proposed for reclamation by the ODNR using FGD and yard clipping compost.

1.2 Demonstration Sites

- 1.2.1 AML Site** - W. A. Dick and the writer met with the spokesman of a group to discuss two separate allegations that they were the "deep pockets" to financially support the legal expenses of a threatened court injunction. They denied same. With other input from Jackie Bird who had conversation with Representative Greg DiDanoto, we feel the Fleming AML site is still a candidate site as long as no sewage sludge is used. Club 3000 leadership has written that they are now opposed to the use of the FGD by-product but we feel they will get no support from the local public officials.

W. A. Dick and the writer met with the County Solid Waste Management District to solicit help in finding a list of capable yard compost suppliers. Their Executive Director, Mr. Phil Palumbo will help us discuss our project with his board of directors, who are the county commissioners, and later organize a public meeting.

1.2.2. ODOT - Route 541 - Project Using Tidd PFBC By-Product

A report of the characterization data, that Steve Tutokey and the chemical lab performed, on the conditioned Tidd PCFB blend material shipped to the above ODOT road reconstruction project was sent to Bill Wolfe, OSU Civil Engineering. Unconfined compressive strength (UCS) tests by Dravo Lime Company on four samples ranged at 28 days from 510 to 620 psi. About 2,500 ton of the 3,220 ton delivered was used in the buttress or barrier preventing this embankment from slipping again. ODOT plans to use the remaining tonnage for base material. Wet

weather has delayed completing the road reconstruction. ODOT states they are very satisfied with the performance of the material.

1.2.3 Cattle Feed Lot - Conesville Wet FGD Stabilized Base Course

Unconfined compressive strengths (UCS) at optimum moisture content (OMC) over 500 psi after 90 days of lab curing were recorded by Dravo Lime on the Mix #1 of stabilized Conesville wet FGD filter cake placed at the OSU feed lot. The fly ash to filter cake was 1.66:1 by dry weight and 5% lime fines were added at the job site. A table of data of the 3 mixes and a control mix (normal production to landfill) is attached. This material is only a base material and not a good wearing surface. There is no reason not to pave an asphaltic wearing course (hot mix or cold bonded) on top of the FGD base. The base strengths of 300 psi should be adequate. Brood cows have been on the one test pad eating large round bales since early December.

Table 1
Conesville Stabilized Base Mixes
Cattle Feedlot Test Results - Dravo Lime Co.

Mix	Fly Ash: Filtercake (dry basis)	% CaO Fines	Mix % Solids	Wet Density lb./cu. ft.	Unconfined Compressive Strength, psi			
					Day lab curing			
					14	28	60	90
Control Mix	1.6:1	1.5	58.4	96.7	50	70	140	290
Mix 1*	1.6:1	6.5	61.7	97.2	100	190	420	580
Mix 2*	1.6:1	6.5	63.1	99.8	110	260	350	480
Mix 3*	1.6:1	11.5	62.8	99.1	80	220	260	310
Legend: Mix 1* 5% lime added at feed lot Mix 2* 5% lime extra added at Conesville Plant Mix 3* 5% lime extra added at Conesville Plant and 5% added at feed lot								

1.2.4 LIMB Ash Stockpile

A sample of the conditioned LIMB ash now in a stockpile for 2 1/2 years was obtained at the Central Fuel Co. (Kimble's) location for analysis by OSU and Dravo Lime. Keith Kimble is now interested in using the material in a blend of coal bottom ash or limestone screenings (fines) that he has to make a road base material. Trial mixes of the bottom ash blend were made by Dravo Lime.

2.0 Contract Problems - Sec 1.2.1

3.0 Work Schedule

- 3.1 Continue editing of the Phase 2 report.**
- 3.2 Attend workshop (February 7-8) at Purdue University on agronomic uses of FGD by-products. (This meeting is organized by the U.S. Department of Agriculture.)**
- 3.3 Meet with county, township and local officials to present the Fleming AML reclamation plan. After this meeting the permit will be submitted to Ohio EPA (by middle of February).**
- 3.4 Complete ODOT project on Route 541.**
- 3.5 Continue to develop plans for the LIMB ash stockpile.**
- 3.6 Decide on proposal to AEP and ODOT concerning the Rt 83 embankment.**

**ANNUAL PROJECT REPORT
AS OF DECEMBER 1993**

1. PROJECT SPONSOR:

Dravo Lime Company
3600 One Oliver Plaza
Pittsburgh, PA 15222

2. PROJECT MANAGER:

R. C. Forsythe
J. H. Beeghly

TELEPHONE: 412-777-0711

3. OCDO GRANT NO: CDO/D-89-35

**4. PROJECT UPDATE X OR
FINAL REPORT _____**

5. PROJECT TITLE: LAND APPLICATION USES OF DRY FGD BY-PRODUCTS

6. PROJECT TERM: FROM: DECEMBER, 1990 TO FEBRUARY, 1995

7. PROJECT: NAME COST SHARE

CO-SPONSORS: <u>OCDO</u>	<u>\$2,227,533</u>
<u>DOE-METC</u>	<u>\$1,266,125</u>
<u>DRAVO LIME CO.</u>	<u>\$ 227,969</u>
<u>EPRI</u>	<u>\$ 200,000</u>
<u>OHIO EDISON CO.</u>	<u>\$ 200,000</u>
<u>AMERICAN ELECTRIC POWER CO.</u>	<u>\$ 160,000</u>
<u>OHIO STATE UNIVERSITY</u>	<u>\$ 115,500</u>

TOTAL PROJECT COST \$4,397,167

I. ABSTRACT

Objectives:

1. To characterize the materials generated from dry FGD processes.
2. To demonstrate the utilization of dry FGD by-products as a soil amendment material on agricultural lands and on an active and abandoned surface coal mine.
3. To demonstrate the use of dry by-products as an engineering material for soil stabilization.
4. To determine the quantities of dry FGD by-products that can be utilized in each of these applications.
5. To determine the environmental and economic impact of using dry FGD by-product.
6. To calibrate environmental, engineering and economic models that can be used to determine the applicability and costs of utilizing these processes at any site.

Work Done and Conclusions in 1993

1. After an extensive review, the Phase 1 report on dry FGD by-product characterization was finalized and approximately 85 copies have been sent out. The Electric Power Research Institute has agreed to publish the report.
2. Phase 2 agronomic (both greenhouse and field plots) and engineering laboratory studies of characterization of FGD by-product and soil (spoil) mixtures were completed. Preparation of a Phase 2 report has begun. Negligible adverse results were found to negate the beneficial uses that were established. Mini-field demonstrations conducted under Phase 2 were monitored to confirm continued success. The LIMB ash stockpile has had negligible adverse environmental impact. The OSU truck ramp continues to perform.

(over)

3. Phase 2 Economic Studies by OSU Department of Agricultural Economics have analyzed how and when it would be in the best interest of a power company to subsidize beneficial uses such as soil amendment versus the cost of landfilling. They have also further concluded the adverse effect on property values from nearby landfills and abandoned coal mines.
4. A 40,000 sq. ft. stabilized base course obtaining strength of 1,000 psi was constructed for a cattle feed lot using about 500 ton blend of conditioned cyclone ash and bed ash from the Tidd PFBC unit. Concrete like strengths have developed. Negligible environmental impact has been recorded during construction and from use. Performance is expected to be very satisfactory based on the first six months of use.
5. Two stabilized base courses each 15,000 sq. ft. were constructed for a cattle feed lot and hay bale storage area using fixated wet FGD Conesville filter cake mixed with conventional fly ash and lime fines. Performance results await at least one winter season.
6. Our project has provided assistance in the reconstruction of Ohio Route 541 near Coshocton, Ohio. Over 3,000 tons of Tidd PFBC blended ash as described in #4 above was used to buttress an embankment that had slipped due to entrapment of groundwater flow.
7. Plans to use a synthetic soil made of a processed blend of General Motors fluidized combustion bed ash (FBC) and sewage sludge at the Fleming abandoned mine site were canceled due to community opposition. An alternative plan to use locally produced yard waste compost as the necessary organic soil amendment is being developed for the 13 acre test site near Dover, Ohio.
8. Plans to use the dry FGD by-product as an alkaline amendment in treating acid overburden at an active mine site were abandoned due to indemnification requirements and the fact the overburden did not conclusively require an alkaline amendment. Alternative plans are being developed to stabilize and neutralize coal refuse wastes from coal washing plants and to construct stabilized base for coal yard and roadway application.

Plans for Upcoming Year

1. Continue to measure alfalfa and corn response in aglime field plots and soil chemical changes in the FGD treated plots.
2. Monitor performance of stabilized base construction at cattle feed lots and ODOT route 541. Evaluate environmental impact.
3. Complete Phase 2 report.
4. Complete construction of test and control plots on individual watersheds at Fleming abandoned mine lands site using General Motors FBC ash and local yard compost in cooperation with the Ohio Division of Reclamation and the county solid waste management district.
5. Construct stabilized base in loadout yard of coal preparation plant.
6. Determine beneficial use of dry FGD by-products in acid neutralization and stabilization of coal refuse in a full scale plant trial.

II. HIGHLIGHTS

1. Approximately 85 copies of Phase 1 Report distributed and many favorable comments received.
2. Three demonstrations of stabilized base and embankment were successfully constructed and preliminary results appear satisfactory: cattle feed lot pads using i) Tidd PFBC and ii) Conesville fixated wet FGD filter cakes and iii) ODOT embankment using Tidd PFBC blended cyclone and bed ash.
3. Site preparation began on the abandoned mineland site. During the EPA hearings major opposition from a local citizens group prevented the choice of the advanced alkaline stabilized sludge soil amendment material made with FBC ash.
4. Alfalfa yields in the field in first year of growth on a Wooster agricultural were increased using the PFBC blended ash.
5. Ohio Governor George Voinovich visited the OSU laboratory of Warren Dick along with Ohio EPA Assistant Director to receive an up to date report on their research on beneficial uses of FGD by-products.

III. ARTICLE / PRESENTATIONS

Fourteen formal presentations were made in 1993 at conferences such as American Coal Ash, EPA-EPRI SO₂ Control, Pittsburgh Coal, ASTM Waste Stabilization, America Society of Agronomy, Department of Energy, and others. The Ohio State University generated a press release which was used by many publications. Several tours were given of the cattle feed lot project and Ohio Governor Voinovich visited OSU Agronomy as mentioned above. At least 6 specific requests from other States for information on the "Properties of FGD By-Products" were filled.

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