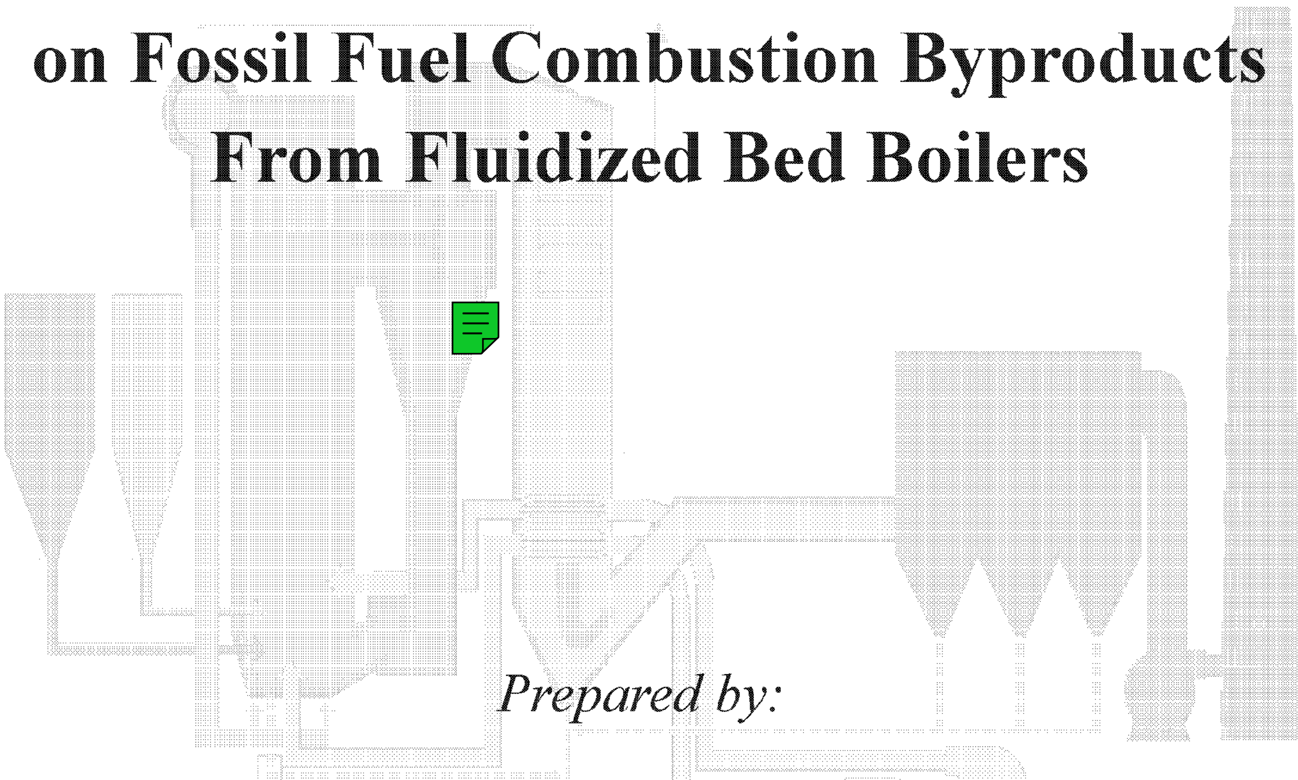
Report to the U.S. Environmental Protection Agency on Fossil Fuel Combustion Byproducts From Fluidized Bed Boilers



Prepared by:

The CIBO Special Project on Non-Utility Fossil Fuel Ash Classification, an *Ad Hoc* Committee of the Council of Industrial Boiler Owners (CIBO) and ICF Kaiser Consulting Group

November, 1997

cibo

ICF KAISER

NOTICE OF DISCLAIMER

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APPENDIX A

1996 SURVEY OF FOSSIL FUEL FLUIDIZED BED COMBUSTION BYPRODUCTS

COUNCIL OF INDUSTRIAL BOILER OWNERS
SPECIAL PROJECT ON NON-UTILITY
FOSSIL FUEL BY-PRODUCT CLASSIFICATION

FOSSIL FUEL FLUIDIZED BED COMBUSTION BY-PRODUCTS SURVEY

August 26, 1996

Facility Name:

Does this completed survey contain CBI?

☐ Yes ☐ No

CIBO SPECIAL PROJECT ON NON-UTILITY FOSSIL FUEL BY-PRODUCT CLASSIFICATION

FOSSIL FUEL FLUIDIZED BED COMBUSTION BY-PRODUCTS SURVEY

All information to be recorded on this survey will be site specific, unless otherwise noted. All quantitative information should refer to the 1995 calendar year, unless otherwise stated. If requested information is ONLY available at your facility for fiscal years not coinciding with calendar years, then provide requested information for the most recent fiscal year and indicate the period covered by the fiscal year in the section designated for comments (Section VII).

*The information required for this survey should be derived from information already collected by your facility/company -- **THERE IS NO REQUIREMENT FOR ADDITIONAL TESTING OR ANALYSIS**.*

In an effort to make this survey as clear and complete as possible, please do not leave any questions unanswered. If specific questions are not applicable to your facility, please indicate by answering those questions with "N/A". If you do not know the information requested, the information is unavailable, or release of such information would violate company policy, these questions should be answered accordingly. No questions should be left blank.

Certain questions may require you to provide either process-specific information or cost/management information that your facility/company may consider to be proprietary. The CIBO Special Project Group has established strict procedures for handling proprietary or confidential business information (CBI). Only the President of CIBO (Bob Bessette) and Bracewell & Patterson, L.L.P. (Project Counsel) will be allowed to review CBI information. CBI responses will be aggregated with non-CBI information when presented in all public reports, working drafts, and other documents. If you believe that specific survey responses are CBI, please check the box on the cover page and provide the CBI-response(s) on Attachment 3.

In this survey, attempts have been made to standardize the responses in order to make compilation of the information less difficult. Wherever possible, please provide your responses in terms of the specified units or time frames.

Please take time to review the attached glossary while completing the survey. You will understand the questions better and some confusion will be eliminated.

Any questions regarding completion of the survey should be directed to Mr. Howard Finkel, ICF Kaiser, at (703) 934-3940, between the hours of 9:00 a.m. and 7:00 p.m. EST, Monday through Friday.

*This survey should be completed (handwritten responses are acceptable) and returned by **September 30, 1996** to RCRA Special Project, CIBO, 6035 Burke Centre Parkway, Suite 360, Burke, Virginia 22015. Lastly, please be sure to complete the respondent signature block on page 66.*

TABLE OF CONTENTS

I. General Facility Information

1.01 Facility Name:____

1.02 Facility Location[1]:

Street: ____

City: ______________________ State: ______________________

1.03 Facility Owner: ____

1.04 Facility Contact Person: ______________________________________

Title: ____

1.05 Phone Number: (____)____________________

Fax Number: (____)_____________________

1.06 EPA Facility Hazardous Waste Generator Number (if applicable): _____________

1.07 Standard Industrial Classification (SIC) code: ____________

1.08 Type and Numbers of Fluidized Bed Combuster Boiler(s):

☐ Bubbling Bed - _____ ☐ Circulating Fluidized Bed - _____

☐ Other (please specify)______________________________________

1.09 Type and Number of Other Boiler(s):

☐ Stoker _____ ☐ Pulverized Coal _____ ☐ Other _____

1.10 Total Facility Production Capacity

Electrical Output ______ MW (sold) Electrical Output ______ MW (internal)

Total Process Heating Load ______ gross lbs/hr

1.11 Does this facility sell electricity?

☐ Yes ☐ No

1.12 Does this facility sell steam?

☐ Yes ☐ No

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[1] Do not give a P.O. Box number. If there is no street address where the plant is located, identify by noting the city (or town/village) and state, and by providing a complete narrative description of the location (e.g., on Route 29, six miles west of the intersection of Routes 117 and 219, directly adjacent to Scott's Paper Co.).

1.13 Is this Facility certified by FERC as a:

☐ Cogeneration Facility ☐ Small Power Production Facility

☐ Exempt Wholesale Generator

1.14 Please attach a detailed facility map (preferably a 7.5-minute quadrangle map, but any available map - such as one included with a permit application, will suffice) extending one mile beyond the perimeter of the facility in each direction to include all equipment, storage facilities, waste management units, environmental monitoring devices, geographical attributes, etc., discussed in this survey along with the latitude/longitude of the site. We recognize that points beyond the boundary of the facility are not owned by your organization, therefore, you may not be able to obtain information about these areas. Please describe these areas and attributes to the best of your ability.

Instructions for completing the FACILITY SITE MAP:

a. *Use either a 7.5-minute quadrangle map or an existing topographic map of any size (such as one included with a permit application) that can adequately show the relative size and location of waste management units, relevant environmental features, and monitoring locations. Include topography, north direction arrow, and an appropriate scale for your facility on the map. If a topographic map is unavailable, please provide a site map or plot plan.*

b. *Waste management units include surface impoundments, waste piles, and landfills, etc., where solid wastes (as defined by 40 CFR 261; see Glossary) are treated, stored, or disposed. Label each of these waste management units with a unique identifier (e.g., WASTE WATER TREATMENT POND - WWTP, ASH PILE #1 - AP#1, LANDFILL - LF) as these will be referenced later.*

c. *Indicate relevant environmental monitoring locations (including NPDES & SPDES outfalls), which include ground water monitoring wells, ambient surface water monitoring locations, and ambient air monitoring locations.*

d. *Indicate which waste management units are or have been used to manage Fossil Fuel Combustion By-products (FFCBs).*

e. *The following page is an example of a facility site map.*

1.15 Which of the following categories describes the surface rights ownership of the land on which this facility is located? (check all boxes that apply)

☐ Federal

☐ State

☐ Indian

☐ Private

☐ Other (please specify)____ insert map here....

1.16 What is the approximate location of the center of this facility? (Report longitude and latitude OR township, range, and section)

a. Longitude: _____ degrees: _____ minutes: _____ West

b. Latitude: _____ degrees: _____ minutes: _____ North

OR

c. Township: ________ Range: _____ Section: _____

II. Process Input/Output Characteristics

2.01 Please review the attached FBC Fossil Fuel Power Plant Mass Balance which shows all of the relevant inputs (designated as A - E), block operations (designated as I - V), and outputs (designated as 1 - 6) at a typical FBC plant. Using this diagram as an example, please prepare a mass-balance diagram that shows all of inputs, block operations, and outputs applicable to your facility. Take care to consider all operations (and inputs/outputs) ancillary to power/steam production.

Answer questions 2.02 through 2.18 for each Fluidized Bed Combuster boiler at your facility. If more than one boiler was operational during 1995, please photocopy and complete this section for each boiler separately.

2.02 This portion of the survey refers to FBC unit number ___, which was manufactured by _________ ____.

2.03 FBC unit number ___ was put in to service on ______ and is a:

- ☐ Bubbling Bed
- ☐ Circulating Fluidized Bed
- ☐ Other (please specify)____

2.04 Please complete the following table for FBC unit number ____ using annual data.

Operational Data	**1995**	**1994**	**1993**	**1992**	**1991**	**1990**
Output - Process Steam (million lbs)						
Capacity Factor (%)						

SCHEMATIC DIAGRAM OF TYPICAL FBC FOSSIL FUEL POWER PLANT MASS BALANCE

[Cross-Out All Blocks That Do Not Apply]

Plant Inputs

2.05 Please complete the following table for FBC unit number ____ using 1995 data:

A: Fuels	Purpose (1)	Description (2)	Source (Mine/State)	Annual Usage	Units	Permit Limits Annual Max. (specify units)	% of Total
1							
2							
3							
4							
5							
6							
7							

(1) Primary ($\geq$50 percent by weight), Secondary (co-fired), Start-Up, Flame Stabilization. If other, please specify.

(2) Choose one of the following fuel types: anthracite coal, bituminous coal, lignite coal, sub-bituminous coal, petroleum coke, coke breeze, anthracite culm, bituminous gob, waste oils, wood chips, tires, natural gas, propane, No. 2 Oil, No. 6 Oil, other. If other, please specify.

2.06 Are any of the fuels being processed on-site to improve characteristics such that anything is added to or removed from the fuel?

Fuel No.	Processing (Yes/No)	Description of Processing Operation (Do not include size reduction or drying operations)
1	_____	____
2	_____	____
3	_____	____
4	_____	____
5	_____	____
6	_____	____
7	_____	____

2.07 Please attach a schematic diagram of the fuel processing operation(s) (if available). If not applicable, please indicate "N/A": ___________.

2.08 Please provide the range (minimum and maximum) and representative quality of each fuel as fired. If more than one fuel is used, please photocopy the next two forms and complete for each fuel.

Note: If the fuel quality information is available in an electronic form please provide a copy on the enclosed computer disk.

PROXIMATE ANALYSIS (weight %) - FUEL No._____

Parameters - (units)	Minimum Value	Average Value	Maximum Value
HHV - (BTU/lb)			
Sulfur (%)			
Ash (%)			
Vol. Matter (%)			
Moisture (%)			
Fixed Carbon (%)			
Btu per pound			

ULTIMATE ANALYSIS (weight %) - FUEL No._____

Parameters - (units)	**Minimum Value**	**Average Value**	**Maximum Value**
HHV - (BTU/lb)			
Carbon (%)			
Hydrogen (%)			
Nitrogen (%)			
Chlorine (%)			
Sulfur - Total (%)			
Sulfur - Pyritic (%)			
Oxygen (%)			
Moisture (%)			
Ash (%)			
Fuel Ash Mineral Analysis			
- SiO_2			
- Al_2O_3			
- TiO_2			
- Fe_2O_3			
- CaO			
- MgO			
- Na_2O			
- K_2O			

Please attach the results of any Trace Element analyses for antimony, arsenic, barium, beryllium, cadmium, chromium, lead, mercury, nickel, selenium, silver, thallium, vanadium, and zinc, <u>if available</u>. In addition, please provide the results (if any) from analyses for radionuclides.

2.09 Describe the types of fuels used over the past five years:

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2.10 Describe the types of storage facilities employed for each type of fuel:

Fuel Type	**Storage**
1.	
2.	
3.	
4.	
5.	

2.11 Describe any operational/engineering changes (if any) made since the initial construction of FBC unit number ____ to accommodate new/alternative fuels and/or changes in permit conditions:

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2.12 Please complete the following table for FBC unit number ____ using 1995 data:

B: Sorbents	**Description**	**Annual Usage (tons)**	**Percent of Total FBC Feed**
1.			
2.			
3.			

2.13 What are the range and typical value for the ratio of calcium used for sulfur dioxide control to the amount of sulfur in the fuel?

	Minimum	**Average**	**Maximum**
Ca/S Ratio	______	______	______
Limestone/Fuel	______	______	______

2.14 Please provide chemical analysis data for Sorbent "1" in the following table:

Parameters	**Minimum Value**	**Average Value**	**Maximum Value**
$CaCO_3$ (%)			
$MgCO_3$ (%)			
Inert (%)			
Moisture (%)			

Please attach the results of Trace Element analyses of Sorbent "1" for antimony, arsenic, barium, beryllium, cadmium, chromium, lead, mercury, nickel, selenium, silver, thallium, vanadium, and zinc if available. In addition, please provide the results (if any) from analyses for radionuclides.

2.15 Please provide chemical analysis data for Sorbent "2" in the following table:

Parameters	**Minimum Value**	**Average Value**	**Maximum Value**
$CaCO_3$ (%)			
$MgCO_3$ (%)			
Inert (%)			
Moisture (%)			

Please attach the results of Trace Element analyses of Sorbent "2" for antimony, arsenic, barium, beryllium, cadmium, chromium, lead, mercury, nickel, selenium, silver, thallium, vanadium, and zinc if available. In addition, please provide the results (if any) from analyses for radionuclides.

2.16 Please provide chemical analysis data for Sorbent "3" in the following table:

Parameters	Minimum Value	Average Value	Maximum Value
$CaCO_3$ (%)			
$MgCO_3$ (%)			
Inert (%)			
Moisture (%)			

Please attach the results of any Trace Element analyses of Sorbent "3" for antimony, arsenic, barium, beryllium, cadmium, chromium, lead, mercury, nickel, selenium, silver, thallium, vanadium, and zinc if available. In addition, please provide the results (if any) from analyses for radionuclides.

2.17 Please complete the following table for all non-combustible commodities (such as sand) used in FBC unit number ____ using 1995 data:

C: Non-Combustible Commodities	Purpose	Annual Usage	Units
1.			
2.			
3.			
4.			
5.			

Please attach the results of any Trace Element analyses of the non-combustible commodities for antimony, arsenic, barium, beryllium, cadmium, chromium, lead, mercury, nickel, selenium, silver, thallium, vanadium, and zinc if available. In addition, please provide the results (if any) from analyses for radionuclides.

2.18 Please complete the following table for all process chemicals used either as boiler inputs to FBC unit number ____ or other plant operations that generate wastes that are co-managed with FFCBs using 1995 data:

D: Process Chemicals	Purpose	Description	System Used In	Annual Usage	Units
1.					
2.					
3.					
4.					
5.					

2.19 Please complete the following table for the entire facility using 1995 data:

E: Raw Water	Purpose	Source	Annual Usage (MG/day)
1.			
2.			
3.			

System Descriptions

2.20 **I - FBC Combuster**: Provide a brief written description of the FBC combuster unit (including heat exchangers and air pollution control devices) and operating parameters and their relationship to the steam boiler(s). In addition, please attach a schematic diagram of the FBC combuster unit. (An existing plant drawing will suffice.)

2.21 Please describe any operations conducted at the facility that either affect the quantity/characteristics of the FFCBs or generate materials[2] that are co-managed with the FFCBs. In particular, describe the types of ash collection, conditioning, and transport equipment and practices used at your facility. In addition, please attach a schematic diagram showing the specific operations - an existing plant drawing will suffice.

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Plant Discharges

2.22 Referring back to your process flow diagram requested on page 6, please complete the following table to describe any plant discharges or by-products that are co-managed with FFCBs:

[2] Examples of materials that may be co-managed with FFCBs include: boiler chemical cleaning wastes, demineralizer regenerant and rinses, coal/storage pile runoff, general site runoff, pyrites, boiler blowdown, coal mill rejects/pyrites, cooling tower blowdown, low pressure plant service water, non-contact cooling water, wastewater treatment sludge/residuals, contaminated and dredged soils, floor drains and sumps, air heater and precipitator wash, laboratory wastes, water treatment wastes, domestic/municipal wastes, and other miscellaneous plant wastes.

Plant Discharges	Description	Annual Quantity (units)	Applicable Permit/Regulatory Control
Combustion By-Products			
2A.			
2B.			
2C.			
Special & Contract Disposal			
3A.			
3B			
3C			
3D.			
3E.			
SANITARY SEWAGE			
4A.			
4B.			
4C.			
NPDES/SPDES Discharge			
5A.			
5B.			
5C.			
Storm Water Run-Off			
6A.			
6B.			
6C.			

2.23 Referring back to your process flow diagram requested on page 6, please complete the following table to describe any plant discharges or by-products that are <u>not co-managed</u> with FFCBs:

Plant Discharges	**Description**	**Annual Quantity (units)**	**Applicable Permit/Regulatory Control**
Air Emissions			
1A.			
1B			
1C			
Combustion By-Products			
2A.			
2B.			
2C.			
Special & Contract Disposal			
3A.			
3B			
3C			
3D.			
SANITARY SEWAGE			
4A.			
4B.			
4C.			
NPDES/SPDES Discharge			
5A.			
5B.			
5C.			
Storm Water Run-Off			
6A.			
6B.			
6C.			

2.24 How often are plant turn-arounds (maintenance) conducted? ___________________

2.25 Are any wastes generated during plant turn-arounds co-managed with FFCBs?

☐ Yes ☐ No (Skip to Section III)

If yes, please complete the following table:

Plant Turn-Around Wastes	**Source**	**Description**	**Quantity**	**Units**
1.				
2.				
3.				
4.				
5.				
6.				

III. Fossil Fuel Combustion By-Products Generation

Answer questions 3.01 through 3.06 for each FBC boiler at your facility. If more than one boiler was operational during 1995, please photocopy and complete this section for each FBC boiler separately.

3.01 This portion of the survey refers to FBC unit number ____.

3.02 What type of FBC by-product collection devices are used?

- ☐ Multicyclone
- ☐ Baghouse
- ☐ Electrostatic Precipitator
- ☐ Other (specify) ______________________________

3.03 What is the configuration of these units (e.g., cyclone followed by a baghouse)? (Refer to process schematics provided earlier)

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3.04 Please describe how (and where) the fossil fuel combustion by-products (FFCBs) are removed from the FBC unit.

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3.05 Please describe the frequency with which the FFCBs are removed from the combuster.

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3.06 Are FFCBs temporarily stored on-site prior to final disposition?

☐ Yes ☐ No

If yes, please describe where the FFCBs are stored, how long they are stored on-site, and how they are removed.

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3.07 Are FFCBs temporarily stored off-site prior to final disposition?

☐ Yes ☐ No

If yes, please describe where the FFCBs are stored, how long they are stored on-site, and how they are removed.

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3.08 Are the FFCBs conditioned (e.g., water added) prior to storage?

☐ Yes ☐ No

If yes, please provide a description of the conditioning process, including the sources of water (e.g., surface water, ground water, municipal water, storm water runoff, mine drainage, plant wastewater) and/or the identity of other additives.

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3.09 Are the FFCBs conditioned (e.g., water added) prior to final disposition?

☐ Yes ☐ No

If yes, please provide a description of the conditioning process, including the sources of water (e.g., surface water, ground water, municipal water, storm water runoff, mine drainage, plant wastewater) and/or the identity of other additives.

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3.10 Are the FFCBs mixed or co-managed with any other materials or solid wastes prior to storage/final disposition? (check all that apply)

☐ Yes - Storage ☐ Yes - Final Disposition ☐ No (Skip to 3.11)

If yes, please specify these materials (and/or solid wastes) and volumes.

Material/ Solid Waste	**Source**	**Quantity**	**Units**	**Estimated/ Actual**
1.				
2.				
3.				
4.				
5.				

3.11 Please provide the following information on FBC by-product generation. (If your facility tracks this information for fly ash and bed ash separately, you do not need to total the fly ash and bed ash numbers to compute a value for the "Total FFCBs" column.)

Generation/Beneficial Use/Disposal Information	Total FFCBs	If Measured Separately	
		Fly Ash	Bed Ash
Tons generated (removed from system) in 1995			
A. Tons disposed in 1995			
B. Tons used as cement/concrete/grout in 1995			
C. Tons used as flowable fill in 1995			
D. Tons used as structural fill in 1995			
E. Tons used as mineral filler in 1995			
F. Tons used as snow and ice control in 1995			
G. Tons used as blasting grit/roofing granules in 1995			
H. Tons used in mining applications in 1995			
I. Tons used in waste stabilization/solidification in 1995			
J. Tons used in agriculture in 1995			
K. Tons used as other: __________________ in 1995			
L. Tons used as other: __________________ in 1995			
M. Tons used as other: __________________ in 1995			
The total of A through M should equal tons generated in 1995			
Tons generated in 1994			
A. Tons disposed in 1994			
B. Tons used as cement/concrete/grout in 1994			
C. Tons used as flowable fill in 1994			
D. Tons used as structural fill in 1994			
E. Tons used as mineral filler in 1994			
F. Tons used as snow and ice control in 1994			
G. Tons used as blasting grit/roofing granules in 1994			
H. Tons used in mining applications in 1994			
I. Tons used in waste stabilization/solidification in 1994			
J. Tons used in agriculture in 1994			
K. Tons used as other: __________________ in 1994			
L. Tons used as other: __________________ in 1994			

Generation/Beneficial Use/Disposal Information	Total FFCBs	If Measured Separately	
		Fly Ash	Bed Ash
M. Tons used as other: __________________ in 1994			
The total of A through M should equal tons generated in 1994			
Tons generated in 1993			
A. Tons disposed in 1993			
B. Tons used as cement/concrete/grout in 1993			
C. Tons used as flowable fill in 1993			
D. Tons used as structural fill in 1993			
E. Tons used as mineral filler in 1993			
F. Tons used as snow and ice control in 1993			
G. Tons used as blasting grit/roofing granules in 1993			
H. Tons used in mining applications in 1993			
I. Tons used in waste stabilization/solidification in 1993			
J. Tons used in agriculture in 1993			
K. Tons used as other: __________________ in 1993			
L. Tons used as other: __________________ in 1993			
M. Tons used as other: __________________ in 1993			
The total of A through M should equal tons generated in 1993			
Tons generated in 1992			
A. Tons disposed in 1992			
B. Tons used as cement/concrete/grout in 1992			
C. Tons used as flowable fill in 1992			
D. Tons used as structural fill in 1992			
E. Tons used as mineral filler in 1992			
F. Tons used as snow and ice control in 1992			
G. Tons used as blasting grit/roofing granules in 1992			
H. Tons used in mining applications in 1992			
I. Tons used in waste stabilization/solidification in 1992			
J. Tons used in agriculture in 1992			

Generation/Beneficial Use/Disposal Information	Total FFCBs	If Measured Separately	
		Fly Ash	**Bed Ash**
K. Tons used as other: __________________ in 1992			
L. Tons used as other: __________________ in 1992			
M. Tons used as other: __________________ in 1992			
The total of A through M should equal tons generated in 1992			
Tons generated in 1991			
A. Tons disposed in 1991			
B. Tons used as cement/concrete/grout in 1991			
C. Tons used as flowable fill in 1991			
D. Tons used as structural fill in 1991			
E. Tons used as mineral filler in 1991			
F. Tons used as snow and ice control in 1991			
G. Tons used as blasting grit/roofing granules in 1991			
H. Tons used in mining applications in 1991			
I. Tons used in waste stabilization/solidification in 1991			
J. Tons used in agriculture in 1991			
K. Tons used as other: __________________ in 1991			
L. Tons used as other: __________________ in 1991			
M. Tons used as other: __________________ in 1991			
The total of A through M should equal tons generated in 1991			
Tons generated in 1990			
A. Tons disposed in 1990			
B. Tons used as cement/concrete/grout in 1990			
C. Tons used as flowable fill in 1990			
D. Tons used as structural fill in 1990			
E. Tons used as mineral filler in 1990			
F. Tons used as snow and ice control in 1990			
G. Tons used as blasting grit/roofing granules in 1990			
H. Tons used in mining applications in 1990			

Generation/Beneficial Use/Disposal Information	Total FFCBs	If Measured Separately	
		Fly Ash	Bed Ash
I. Tons used in waste stabilization/solidification in 1990			
J. Tons used in agriculture in 1990			
K. Tons used as other: __________________ in 1990			
L. Tons used as other: __________________ in 1990			
M. Tons used as other: __________________ in 1990			
The total of A through M should equal tons generated in 1990			

3.12 Please provide an explanation of any recent facility-wide initiatives to develop programs to reduce the volume of FFCBs, and/or water or air emissions:

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3.13 Referring back to question 3.11, please describe all future plans for beneficial use applications for your FFCBs:

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> *If your facility does not provide FBC by-products for beneficial reuse applications, skip this section and proceed to Section IV.*

3.14 Referring back to question 3.11, please describe the most significant beneficial use applications for your FFCBs that were used prior to 1995:

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3.15 Referring back to question 3.11, please describe the most significant beneficial use applications for your FFCBs conducted in 1995:

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3.16 Has your facility provided FFCBs for a beneficial use project that was performed either as part of a study or as a routine operation where environmental monitoring data (e.g., surface water or ground-water data) were collected to evaluate the effects of the FFCBs?

☐ Yes ☐ No

Please provide a hard copy of any reports or analytical laboratory results that document the environmental affects of FFCBs on the environment. Please also provide a map or drawing showing monitoring locations in relationship to the beneficial use project.

3.17 If available, please provide a hard copy of any letters or reports from Environmental or other Governmental Agencies that support the beneficial use of FFCBs (for example, letters that support the use of FFCBs for mine reclamation projects).

3.18 Is the beneficial use of your facility's FFCBs subject to permitting by the Department of Environmental Resources/Protection Mining Division for use in mine reclamation?

☐ Yes ☐ No

If yes, would you be willing to provide a copy of the original permit application, including all analytical results? (In Pennsylvania this application is referred to as the Module 25.)

☐ Yes ☐ No ☐ Maybe

3.19 Is the beneficial use of your facility's FFCBs regulated under any other state (or Federal) Program/Regulation/Permit?

☐ Yes ☐ No

If yes, please identify the program/regulation.

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3.20 Referring to question 3.11, please describe/identify any costs, avoided costs, and revenues associated with the beneficial use of your facility's FFCBs. For each category, as applicable, please provide and distinguish between initial capital costs and ongoing operating and maintenance expenses. Cost information may be presented as estimates, ranges, or actual/projected costs in <u>current dollars</u> to the generator.

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3.21 Please describe/identify the environmental, economic, and social benefits associated with the beneficial use of your facility's FFCBs.

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3.22 Have there been any permit compliance violations/issues or documented environmental damage caused by the FFCBs utilization methods/projects used/conducted by this facility?

☐ Yes ☐ No

If yes, please explain: ____________________

3.23 Have neighbors or citizens groups opposed any FFCBs beneficial use projects conducted by your facility?

☐ Yes ☐ No

If yes, please explain: ____________________

IV. Fossil Fuel Combustion By-Products Characterization

The purpose of this section is to collect as much data as possible to characterize the physical and chemical (total constituent and leachable) characteristics of the FBC fly ash, FBC bed ash, and/or mixtures of these by-products when co-managed with other materials. You may either (1) submit hard copies of Laboratory Reports that provide all relevant information, including the sample identification and point of collection, type of procedure, analytical data, and if available, Quality Control (QC) information, analytical methods, and detection limits, etc., or (2) complete the attached data tables.

We request that you provide data for years 1990 through 1995, as available.

4.01 Have you collected samples of the FFCBs (e.g., fly ash and/or bed ash)?

☐ Yes ☐ No (Skip to Section V)

4.02 Were these samples analyzed for any physical parameters (such as bulk density, hydraulic conductivity, particle size distribution, degree of compaction, unit weight/maximum proctor density at moisture content, or bearing ratio, etc.,)? If so, please either provide, as an attachment, a hard copy of the Laboratory Report that provides the results of these analyses or complete the following table.

☐ Yes ☐ No (Skip to question 4.06)

These data should be provided for both the FBC fly ash and bed ash (and/or the mixture).

Year	**Physical Parameters**	**FBC Fly Ash**	**FBC Bed Ash**	**FBC Fly Ash & Bed Ash (If Combined)**	**Units**
19__	Bulk Density				
	Hydraulic Conductivity				
	Particle Size Distribution				
	Degree of Compaction				
	Unit Weight/Maximum Proctor Density at Moisture Content				
	California Bearing Ratio				

4.03 If you provided analytical data that represents the mixture of both FBC fly ash and bed ash, please provide the relative percentages (by weight) of each material.

☐ Yes ☐ No (Skip to 4.04)

Percent fly ash: _________ Percent bed ash: ________

4.04 Provide a description of the sampling procedures (e.g., random grab samples, composite samples) used to collect the FFCBs for analysis (including location of sampling).

____
____
____
____
____
____
____

4.05 Were the samples of FFCBs derived from the same fuels and relative percentages reported in question 2.05?

☐ Yes (Skip to 4.06) ☐ No

If no, please describe the specific fuels (using the fuels listed in question 2.05) and relative percentages being used when these FFCBs were generated using the following table.

Fuels	**Quantity**	**Units**	**% of Total**
1.			
2.			
3.			
4.			
5.			
6.			
7.			

4.06 Were these samples analyzed for the total constituent concentrations of any organic or inorganic constituents (and/or radionuclides)?

☐ Yes ☐ No (Skip to question 4.13)

4.07 The samples analyzed represent:

A. Fly Ash	☐	Yes	☐	No
B. Bed Ash	☐	Yes	☐	No
C. Fly Ash and Bed Ash	☐	Yes	☐	No
D. Fly Ash Comanaged W/Other Materials	☐	Yes	☐	No
E. Bed Ash Comanaged W/Other Materials	☐	Yes	☐	No
F. Fly Ash/Bed Ash Comanaged W/Other Materials	☐	Yes	☐	No

Please either provide, as an attachment, a hard copy of the Laboratory Report that provides the results of these analyses or complete the following table. In addition, please provide one set of responses for the fly ash, bed ash, or combination(s) of the two, and one or more sets as necessary, for mixtures of any of these by-products and any other materials.

4.08 Were QA/QC data generated for the total constituent analyses?

☐ Yes ☐ No

If yes, please indicate where these data reside: ____

____

> If you are completing the table in lieu of providing copies of laboratory reports, please copy the following table to report data for years 1990 through 1995.

Total Constituent Concentrations

☐ Fly Ash/Bed Ash Only ☐ Fly Ash/Bed Ash Comanaged W/Other Materials

Year 199___	Constituents/Parameters	FBC Fly Ash	FBC Bed Ash	FBC Fly Ash & Bed Ash (If Combined)	Units
Inorganics					
1	Aluminum				
2	Antimony				
3	Arsenic				
4	Barium				
5	Beryllium				
6	Boron				
7	Cadmium				
8	Chromium				
9	Cobalt				
10	Copper				
11	Iron				
12	Lead				
13	Manganese				
14	Mercury				
15	Molybdenum				
16	Nickel				
17	Potassium				
18	Selenium				
19	Silver				
20	Thallium				
21	Vanadium				
22	Zinc				
Miscellaneous Parameters/Radionuclides					
1	Acid Neutralizing Potential				

Year 199___	Constituents/Parameters	FBC Fly Ash	FBC Bed Ash	FBC Fly Ash & Bed Ash (If Combined)	Units
2	Ammonia-Nitrogen				
3	Chemical Oxygen Demand				
4	Chloride				
5	Cyanide				
6	pH				
7	Phenolics				
8	Sodium				
9	Total Organic Carbon				
10	Total Organic Halides				
11					
12					
13					
14					
15					
Organic Constituents: Includes any Volatile and Semi-Volatile Organics, Pesticides/Herbicides, and Dioxins and Furans					
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					

Year 199___	Constituents/Parameters	FBC Fly Ash	FBC Bed Ash	FBC Fly Ash & Bed Ash (If Combined)	Units
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					

Please indicate whether these data are reported on a dry weight or wet weight (as received) basis:

☐ Dry weight basis ☐ Wet weight basis

4.09 If you provided analytical data that represents the mixture of both FBC fly ash and bed ash, please provide the relative percentages (by weight) of each material.

☐ Yes ☐ No (Skip to 4.10)

Percent fly ash: _________ Percent bed ash: ________

4.10 Provide a description of the sampling procedures (e.g., random grab samples, composite samples) used to collect the FFCBs for analysis (including location of sampling).

____

____

____

____

____

____

____

4.11 Were the samples of FFCBs derived from the same fuels and relative percentages reported in question 2.05?

☐ Yes (Skip to 4.12) ☐ No

If no, please describe the specific fuels (using the fuels listed in question 2.05) and relative percentages being used when these FFCBs were generated using the following table.

Fuels	**Quantity**	**Units**	**% of Total**
1.			
2.			
3.			
4.			
5.			
6.			
7.			

4.12 Were these samples representative of normal operating conditions?

☐ Yes (Skip to 4.13) ☐ No

If No, discuss why these samples were not representative of normal operating conditions. In addition, please discuss what factors may have influenced the sampling and analysis results.

____

____

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____

____

____

4.13 Were these samples analyzed for the leachable constituent concentrations of any of inorganic (including radionuclides) or organic constituent?

☐ Yes ☐ No (Skip to Section V.)

4.14 The samples analyzed represent:

A. Fly Ash	☐	Yes	☐	No
B. Bed Ash	☐	Yes	☐	No
C. Fly Ash and Bed Ash	☐	Yes	☐	No
D. Fly Ash Comanaged W/Other Materials	☐	Yes	☐	No
E. Bed Ash Comanaged W/Other Materials	☐	Yes	☐	No
F. Fly Ash/Bed Ash Comanaged W/Other Materials	☐	Yes	☐	No

Please either provide, as an attachment, a hard copy of the Laboratory Report that provides the results of these analyses or complete the following table. In addition, please provide one set of responses for the fly ash, bed ash, or combination(s) of the two, and one or more sets as necessary, for mixtures of any of these by-products and any other materials.

4.15 Were QA/QC data generated for the leachable analyses?

☐ Yes ☐ No

If yes, please indicate where these data reside: ________________________________

____

If you are completing the table in lieu of providing copies of laboratory reports, please copy the following table to report data for years 1990 through 1995.

Leachable Constituent Concentrations

☐ Fly Ash/Bed Ash Only ☐ Fly Ash/Bed Ash Comanaged W/Other Materials

Year 199___	Constituents	FBC Fly Ash	FBC Bed Ash	FBC Fly Ash & Bed Ash (If Combined)	Units	Leaching Procedure 1/
Inorganics						
1	Aluminum					
2	Antimony					
3	Arsenic					
4	Barium					
5	Beryllium					
6	Boron					
7	Cadmium					
8	Chromium					
9	Cobalt					
10	Copper					
11	Iron					
12	Lead					
13	Manganese					
14	Mercury					
15	Molybdenum					
16	Nickel					
17	Potassium					
18	Selenium					
19	Silver					
20	Thallium					
21	Vanadium					
22	Zinc					

Year 199___	Constituents	FBC Fly Ash	FBC Bed Ash	FBC Fly Ash & Bed Ash (If Combined)	Units	Leaching Procedure 1/
Organic Constituents: Includes any Volatile and Semi-Volatile Organics, Pesticides/Herbicides, and Dioxins and Furans						
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						

1/ Please specify whether the TCLP, EP Toxicity, SPLP, or some other leaching procedure was used.

4.16 If you provided analytical data that represents the mixture of both FBC fly ash and bed ash, please provide the relative percentages (by weight) of each material.

☐ Yes ☐ No

Percent fly ash: _________ Percent bed ash: ________

4.17 Provide a description of the sampling procedures (e.g., random grab samples, composite samples) used to collect the FFCBs for analysis (including location of sampling).

____

____

____

____

____

____

____

4.18 Were the samples of FFCBs derived from the same fuels and relative percentages reported in question 2.05?

☐ Yes (Skip to 4.19) ☐ No

If no, please describe the specific fuels (using the fuels listed in question 2.05) and relative percentages being used when these FFCBs were generated using the following table.

Fuels	**Quantity**	**Units**	**% of Total**
1.			
2.			
3.			
4.			
5.			
6.			
7.			

4.19 Were these samples representative of normal operating conditions?

☐ Yes (Skip to Section V.) ☐ No

If no, discuss why these samples were not representative of normal operating conditions. In addition, please discuss what factors may have influenced the sampling and analysis results.

V. Fossil Fuel Combustion By-Products Management

5.01 Please describe your current FFCBs management practices, including how you decide how and where a specific material should be disposed and whether or not the material should be beneficially used.

____

____

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____

____

____

____

5.02 Does your facility manage any FFCBs in a land-based management unit?

☐ Yes ☐ No (Skip to Section VI.)

> ***If yes**, please answer questions 5.03 through 5.38 for each specific FFCB management unit (e.g., storage pile, landfill) operated in 1995. Photocopy these pages as needed for each unit. The waste management units must be shown on the schematic prepared for Section I. The remaining questions (5.39 through 5.93) apply to the overall facility where FFCBs are managed in land-based units.*

5.03 If your facility relies on an off-site management unit that is operated by an outside organization:

A) What is the distance, by road, to the off-site management unit in miles: ________.

B) What is the cost to you of this off-site FFCB management?

Tipping fee _______ $/ton and Transportation ______ $/ton, **OR**

Total Cost _______ $/ton.

Please provide below the name, contact person, and phone number of the commercial organization and request them to complete the remainder of this section.

Commercial Organization: ___________________________

Contact Name: _________________________________

Phone Number: (   )______________________________

5.04 Which FFCBs management unit is the subject of this question set? _______________

5.05 What is the schematic label (from the schematic in Section I) on the FFCBs management unit: ____ ________________

5.06 Which of the following categories describes the surface rights ownership of the land on which this FFCBs management unit is located? (check all boxes that apply)

A. ☐ Federal

B. ☐ State

C. ☐ Indian

D. ☐ Private

E. ☐ Other (please specify)_______________________________________

5.07 What is the approximate location of the center of this FFCBs management unit? (Report longitude and latitude OR township, range, and section)

a. Longitude: ______ degrees: ______ minutes: _____ West

b. Latitude: ______ degrees: ______ minutes: _____ North

OR

c. Township: ________ Range: _____ Section: _____

5.08 Describe the specific character of the FFCBs management unit (refer to question 3.11):

A. ☐ Waste Pile

B. ☐ Landfill

1. ☐ Monofill
2. ☐ Industrial/Subtitle D Landfill
3. ☐ Municipal Solid Waste (MSW) Landfill
4. ☐ Hazardous Waste Landfill
5. ☐ Stope
6. ☐ Quarry
7. ☐ Other (please specify) ______________________________

C. ☐ Surface Impoundment

1. ☐ Industrial/Subtitle D Impoundment
2. ☐ Hazardous Waste Impoundment

D. ☐ Other (please specify) __________________________________

5.09 What year was this unit constructed: __________________________________

5.10 What year was material first placed into this unit: _________________________

5.11 Does this unit currently receive FFCBs?

☐ Yes ☐ No

5.12 What were the "inputs" to this FFCBs management unit and what was the quantity of each input in years 1990 through 1995. Please provide the units of measurement.

Inputs	**1995**	**1994**	**1993**	**1992**	**1991**	**1990**	**Units**
1.							
2.							
3.							
4.							
5.							

5.13 What are the approximate dimensions of this FFCBs management unit (select one of the two specified units of measure for each dimension)

Above Grade Height: ________ feet **OR** ________ yards

Below Grade Depth: ________ feet **OR** ________ yards

Surface Area - Top: ________ ft^2 **OR** ________ sq. yds.

Surface Area - Base: ________ ft^2 **OR** ________ sq. yds.

Overall Dimensions: Length _______ x Width _______ x Depth ______ (ft)

5.14 What is the total capacity of this unit: ________ Specify Units: __________

5.15 What was the approximate total amount of material in this FFCBs management unit on December 31, 1995? (Report the quantity in place)

Cumulative amount of material: _________ Specify Units: _________

5.16 What was the anticipated remaining useful life of this FFCBs management unit on December 31, 1995?

Remaining useful life: _____________ years

5.17 Does this facility have approved Operating Permit, Closure Plan, or other type of permit?

☐ Yes ☐ No (Skip to question 5.19)

5.18 If requested at a later date, would you be willing to provide a hard copy of the permit(s)

☐ Yes ☐ No ☐ Maybe

5.19 Please identify the types of permits held by this facility by completing the following table.

FFCBs Management Unit Component/Operation	Permit (Yes/No)	Required by State/County (Specify)	Permitting Authority
1.			
2.			
3.			
4.			
5.			

5.20 Please briefly describe (and provide a cross-sectional drawing) how this unit was constructed:

____

____

____

____

5.21 Which of the following best describes the "liner" under this FFCBs management unit:

A. ☐ Bedrock

B. ☐ In-situ clay/shale

C. ☐ Recompacted local clay/shale

D. ☐ Asphalt

E. ☐ Concrete

F. ☐ Synthetic (specify type and number of layers): ____________________
____

G. ☐ Other (specify): ______________________________________

H. ☐ No Liner

I. ☐ Not applicable to this type of FFCBs management unit.

5.22 Please describe both how this unit is operated (Past, Current, Future) and the overall site conditions (including depth to ground water):

____

____

____

____

____

____

____

____

5.23 What were the capital costs for constructing this unit? ___________ YR: ________
(We will aggregate all of this information and present as a range.)

5.24 Is the value for capital costs provided in 5.23?

☐ Estimated ☐ Actual

5.25 What are that annual O&M costs for operating/maintaining this unit? ____________

☐ Estimated ☐ Actual

5.26 Does any form of treatment occur in this FFCBs management unit?

☐ Yes ☐ No (Skip to 5.28)

5.27 What type of treatment occurs in this unit (check all that apply)?

A. ☐ Equalization

B. ☐ Solids precipitation

C. ☐ pH adjustment

D. ☐ Chemical treatment

E. ☐ Dewatering

F. ☐ Other (specify) ____

G. ☐ None

5.28 If any materials were removed from this FFCBs management unit in 1995, please complete the table below. Otherwise, skip to question 5.30.

Use	Destination	Quantity	Physical Form	If Liquid	
				% Solids	**pH**
1.					
2.					
3.					
4.					
5.					

5.29 Does the facility periodically test the chemical composition of the material removed from this FFCBs management unit?

- ☐ Yes (please provide hard copy reports of the analytical data)
- ☐ No
- ☐ N/A

5.30 Does this FFCBs management unit have a runoff collection system?

☐ Yes ☐ No (Skip to question 5.34)

5.31 Does this facility periodically test the chemical composition of the runoff?

- ☐ Yes (please provide hard copy reports of the analytical data)
- ☐ No

5.32 Please describe how the runoff is treated prior to disposal or use. (If no treatment is provided, indicate "none")

____

____

____

____

5.33 How is the collected runoff disposed of or used (check all that apply)?

A. ☐ Discharged to surface water (stream, lake, river, ocean, etc.)

B. ☐ Discharged to municipal sewage system

C. ☐ Discharged to land (i.e., non-agricultural land application)

D. ☐ Holding/settling/evaporation ponds

E. ☐ Agricultural irrigation

F. ☐ Recycling back to the Facility for use

G. ☐ Other (specify) ____

5.34 Does this facility have a leachate collection system?

☐ Yes ☐ No (Skip to question 5.39)

5.35 Please describe the leachate collection system: ____

____

____

____

5.36 Does this facility periodically test the chemical composition of the collected leachate?

☐ Yes (please provide hard copy reports of the analytical data)

☐ No

5.37 Please describe how the leachate is treated prior to disposal or use. (If no treatment is provided, indicate "none")

____

____

____

5.38 How is the collected leachate disposed of or used (check all that apply)?

A. ☐ Discharged to surface water (stream, lake, river, ocean, etc.)

B. ☐ Discharged to municipal sewage system

C. ☐ Discharged to land (i.e., non-agricultural land application)

D. ☐ Holding/settling/evaporation ponds

E. ☐ Agricultural irrigation

F. ☐ Recycling back to the Facility for use

G. ☐ Other (specify) ____

5.39 Were any of the following environmental protection practices being used on this FFCBs management unit in 1995 (check all that apply)?

A. ☐ Dust suppression/control

B. ☐ Runon/runoff controls

C. ☐ Slurry walls

D. ☐ Liner with leachate collection

E. ☐ Compaction

F. ☐ Covering

G. ☐ Other (specify): ____

5.40 Is any part of this facility located in one of the following areas (check all that apply)?

A. ☐ 100-year floodplain

B. ☐ Area designated as a wetland

C. ☐ Karst terrain

D. ☐ Fault area

E. ☐ Endangered species habitat

F. ☐ None of the above.

5.41 Please provide a discussion of the site climatology (seasonal range in temperatures, rainfall, etc.).

____

____

____

____

5.42 If known, what is the approximate number of residents living within the boundary of this facility? (If none, enter "0".)

______ residents

5.43 If known, what is the approximate number of residents living within one mile outside the boundary of this facility? (If none, enter "0".)

_______ residents

5.44 If known, how far outside the boundary of this facility is the nearest residence (select one of the two units of measure)?

_______ yards **OR** ______ miles

5.45 If known, what is the general direction of the nearest residence from the center of this facility (check only one box)?

- ☐ North
- ☐ Northeast
- ☐ East
- ☐ Southeast
- ☐ South
- ☐ Southwest
- ☐ West
- ☐ Northwest

5.46 Please label aquifers by name or designate according to location (the letters A, B, and C will identify the assigned aquifer throughout this section as well as the facility site map):

A: ____

B: ____

C: ____

5.47 What is the typical depth from the bottom of this facility to the water in the nearest aquifer at its HIGHEST seasonal level? (if the bottom of the unit is below the water level, indicate this by providing a negative number in your responses)

A - Depth to water in wet season: _________________ feet

B - Depth to water in wet season: _________________ feet

C - Depth to water in wet season: _________________ feet

5.48 What is the typical depth from the bottom of this facility to the water in the nearest aquifer at its LOWEST seasonal level? (if the bottom of the unit is below the water level, indicate this by providing a negative number in your responses)

A - Depth to water in dry season: _________________ feet

B - Depth to water in dry season: _________________ feet

C - Depth to water in dry season: _________________ feet

5.49 What are the typical permeability (hydraulic conductivity), porosity, and hydraulic gradient of the nearest aquifer beneath this facility? (Select one of the two specified units of measure for permeability)

I. A - Permeability: ________ centimeters/second **OR** _______ feet/minute

B - Permeability: ________ centimeters/second **OR** _______ feet/minute

C - Permeability: ________ centimeters/second **OR** _______ feet/minute

II. A - Porosity: ________ %

B - Porosity: ________ %

C - Porosity: ________ %

III. A - Hydraulic gradient: ________ %

B - Hydraulic gradient: ________ %

C - Hydraulic gradient: ________ %

5.50 What are the principal uses of the water in the nearest aquifer beneath this facility? (place an "X" in the appropriate box)

Principal Water Use	**Aquifer A**	**Aquifer B**	**Aquifer C**
Municipal			
Rural domestic (non-agricultural)			
Agricultural			
Commercial/industrial			
Other (specify):____________			
Unknown			
No current use of this aquifer			

5.51 Is the uppermost aquifer useable (as defined by RCRA - See the attached Glossary)?

☐ Yes ☐ No

If no, please describe why not (e.g., insufficient aquifer depth, thickness, or permeability, salinity):

____

____

____

____

5.52 Did your facility monitor the water quality in the nearest aquifer beneath the facility in 1995 or earlier?

☐ Yes ☐ No (Skip to question 5.63)

5.53 How many ground-water monitoring locations for the nearest aquifer beneath this facility were operated in 1995? (Each location must be labeled on the facility site map.)

Number of upgradient monitoring locations: _______________

Number of downgradient monitoring locations: ______________

5.54 What is the typical depth and length of the monitoring well screen in these ground water wells?

Typical well screen depth: ___________ feet

Typical well screen length: ___________ feet

5.55 How often were ground water samples collected in 1995?

Frequency (weekly, monthly, quarterly, semi-annually, annually): _______________

Total number of samples collected in 1995: _______________

5.56 Which of the following parameters and constituents were monitored in the ground water beneath the facility in 1995 (or earlier)? (Check all that apply)

A.	☐	pH	H.	☐	Specific Conductance
B.	☐	Temperature	I.	☐	Total Solids
C.	☐	Total Organic Carbon	J.	☐	Total Organic Halides
D.	☐	Major Cations	K.	☐	Major Anions
E.	☐	Volatile Organics	L.	☐	Semi-Volatile Organics
F.	☐	Pesticides/Herbicides	M.	☐	Dioxins/Furans
G.	☐	Metals	N.	☐	Radionuclides

5.57 Please provide a hard copy of all analytical laboratory reports for all monitoring events conducted at this facility between 1990 and 1995, including relevant Quality Control data and the identity of all applicable laboratory procedures/methods (including Method No.). If these data are available in electronic format, please also send an electronic copy on floppy disk.

5.58 Has the facility ever detected a ground water concentration in either the upgradient or downgradient monitoring wells in excess of the primary maximum contaminant levels (MCLs)? (See Attachment 1 for a list of the MCLs.)

☐ Yes ☐ No (Skip to question 5.60)

5.59 For those constituents in excess of the primary MCLs, please provide the following information requested in the table.

Constituents	**Upgradient Concentration (mg/L)**	**Downgradient Concentration (mg/L)**	**Date Sample Collected**
1.			
2.			
3.			
4.			
5.			

5.60 Has the facility ever detected a ground water concentration in either the upgradient or downgradient monitoring wells in excess of the secondary MCL? (See Attachment 2 for a list of the secondary MCLs.)

☐ Yes ☐ No (Skip to question 5.63)

5.61 For those constituents in excess of the secondary MCLs, please provide the following information requested in the table.

Constituents	**Upgradient Concentration (mg/L)**	**Downgradient Concentration (mg/L)**	**Date Sample Collected**
1.			
2.			
3.			
4.			
5.			

5.62 Briefly explain why the ground water downgradient of this facility exceeded national or secondary drinking water standards:

____

____

____

5.63 List the number of public and/or private drinking water wells located within the boundary of this facility, within 0.5 miles outside the boundary of this facility, within 1 mile outside the boundary of this facility, and greater than 1 mile outside the boundary of this facility. (If no wells enter "0", if you do not know enter "Unknown")

DW Well(s)	W/In Boundary	<0.5 miles	0.5-1 mile	>1 mile
Public	_______	_____	_____	______
Private	_______	_____	_____	______

5.64 What is the distance from the boundary of this facility to the nearest body of surface water?

____________________ feet **OR** ____________________ miles

5.65 Did your facility monitor ambient surface water quality near this facility in 1995 (or earlier). Do not consider monitoring conducted for NPDES or SPDES discharges in responding to this question.

☐ Yes ☐ No (Skip to question 5.82)

5.66 How many ambient surface water monitoring (including NPDES & SPDES) locations did this facility operate in 1995. (Each location must be labeled on the facility site map).

Number of monitoring locations: _______________

5.67 How often were surface water samples collected in 1995?

Frequency (weekly, monthly, quarterly, semi-annually, annually): _______________

Total number of samples collected in 1995: ______________

5.68 Which of the following parameters and constituents were monitored in the surface water near the facility in 1995 (or earlier)? (Check all that apply)

A. ☐ pH
B. ☐ Temperature
C. ☐ Total Organic Carbon
D. ☐ Major Cations
E. ☐ Volatile Organics
F. ☐ Pesticides/Herbicides
G. ☐ Metals
H. ☐ Specific Conductance
I. ☐ Total Solids
J. ☐ Total Organic Halides
K. ☐ Major Anions
L. ☐ Semi-Volatile Organics
M. ☐ Dioxins/Furans
N. ☐ Radionuclides

5.69 Please provide a hard copy of all analytical laboratory reports for all monitoring events conducted since 1990, including relevant Quality Assurance/Quality Control data. In addition, provide all relevant Quality Assurance/Quality Control information and identify all applicable laboratory procedures/methods (including Method No.). If these data are available in electronic format, please send an electronic copy on disk.

5.70 Is the ambient surface water near the facility fresh (not brackish or salt water)?

☐ Yes ☐ No (Skip to question 5.79)

5.71 Has the facility ever detected a surface water concentration in either the upstream or downstream monitoring locations in excess of the primary MCLs?

☐ Yes ☐ No (Skip to question 5.73)

5.72 For those constituents in excess of the primary MCLs, please provide the following information requested in the table.

Constituents	Upstream Concentration (mg/L)	Downstream Concentration (mg/L)	Date Sample Collected
1.			
2.			
3.			
4.			
5.			

5.73 Has the facility ever detected a surface water concentration in either the upstream or downstream monitoring locations in excess of the secondary MCLs?

☐ Yes ☐ No (Skip to question 5.76)

5.74 For those constituents in excess of the secondary MCLs, please provide the following information requested in the table.

Constituents	Upstream Concentration (mg/L)	Downstream Concentration (mg/L)	Date Sample Collected
1.			
2.			
3.			
4.			
5.			

5.75 Briefly explain why the surface water downstream of this facility exceeded primary or secondary MCLs:

____

____

____

5.76 Has the facility ever detected a surface water concentration in either the upstream or downstream monitoring locations in excess of the national ambient water quality criteria for fresh (not brackish or salt) water?

☐ Yes ☐ No (Skip to question 5.79)

5.77 For those constituents in excess of the national ambient water quality criteria, please provide the following information requested in the table.

Constituents	Upstream Concentration (mg/L)	Downstream Concentration (mg/L)	Date Sample Collected
1.			
2.			
3.			
4.			
5.			

5.78 Briefly explain why the surface water downstream of this facility exceeded the national ambient fresh (not brackish or salt) water quality criteria:

____

____

____

____

SKIP TO QUESTION 5.82

5.79 Has the facility ever detected a surface water concentration in either the upstream or downstream monitoring locations in excess of the national ambient water quality criteria for marine life?

☐ Yes ☐ No (Skip to question 5.82)

☐ Not applicable (Skip to question 5.82)

5.80 For those constituents in excess of the national ambient water quality criteria for marine life, please provide the following information requested in the table.

Constituents	Upstream Concentration (mg/L)	Downstream Concentration (mg/L)	Date Sample Collected
1.			
2.			
3.			
4.			
5.			

5.81 Briefly explain why the surface water downstream of this facility exceeded the national ambient marine water quality criteria for the protection of aquatic life:

____

____

____

____

5.82 Did your facility monitor ambient air quality near this facility in 1995?

☐ Yes ☐ No (Skip to Section VI)

5.83 How many ambient air quality monitoring locations were operated near this facility in 1995:

Number of monitoring locations: ________________

5.84 Excluding continuous monitoring, approximately how many times was the ambient air sampled at each location in 1995?

Frequency of sampling: ________________ times in 1995

5.85 Which of the following parameters and constituents were monitored in the ambient air near this facility in 1995? (Check all that apply)

☐ Particulate matter

☐ Metals

☐ Other (specify): ____

5.86 Please provide a hard copy of all analytical laboratory reports, including relevant Quality Control data and the identity of all applicable laboratory procedures/methods (including Method No.). If these data are available in electronic format, please also send an electronic copy on floppy disk.

5.87 Do you have a wind rose for this facility?

☐ Yes (If yes, please provide it) ☐ No

5.88 Has the ambient air quality monitoring near this facility indicated an exceedance of National Ambient Air Quality Standards (NAAQS) or National Emissions Standards for Hazardous Air Pollutants (NESHAP)?

☐ Yes ☐ No (Skip to Section VI)

5.89 For those constituents in excess of either the NAAQS or NESHAP, please provide the following information requested in the table.

Constituents	**Upwind Concentration (mg/L)**	**Downwind Concentration (mg/L)**	**Date Sample Collected**
1.			
2.			
3.			
4.			
5.			

5.90 Briefly explain why the ambient air downwind of this facility exceeded the either the NAAQS or NESHAP:

____

____

____

____

____

____

____

5.91 Is any treatment (e.g., conditioning, stabilization) of the ash being utilized, mandated or required?

☐ Yes ☐ No

If yes, what treatment is being done and what permits and/or approvals were required?

____

____

____

____

5.92 Is the operation of the FFCB management unit(s) governed by federal, state, and/or local regulations and/or permits?

☐ Yes ☐ No

If yes, please identify whether these apply to the storage and/or disposal of FFCBs. Please also identify which media are covered (air, ground water, surface water, other).

____

____

____

____

____

5.93 Have there been any permit compliance violations/issues or documented environmental damage caused by the FFCBs utilization/disposal methods used by this facility?

☐ Yes ☐ No

If yes, please explain: ____

____

____

____

____

5.94 Have neighbors or citizens groups opposed the FFCBs handling or other activities at this facility?

☐ Yes ☐ No

If yes, please explain: ____

____

____

VI. Potential Future FFCBs Management Practices

The following questions deal specifically with FFCBs. These questions will focus on 1996 or potential future changes in waste management units that have affected or will affect the facility's management of FFCBs.

6.01 Have there been any changes in 1996 in the facility's FFCBs management unit(s) that received FFCBs in 1995? Examples of eligible changes include: changes in operating status, expansions, and changes in the handling of FFCBs.

☐ Yes ☐ No (Skip to question 6.03)

6.02 Briefly describe these 1996 changes in the facility's FFCBs management unit(s) and their potential effect on the management of FFCBs:

6.03 Are any potential changes planned in calendar years 1997 through 2000 in the facility's FFCBs management unit(s) that received FFCBs in 1995? Examples of eligible changes include: changes in operating status, expansions, and changes in the handling of FFCBs.

☐ Yes ☐ No (Skip to Section VII)

6.04 Briefly describe these potential changes in the facility's FFCBs management unit(s) and their effect on the management of FFCBs:

VII. Respondent Comments

Please use this section for comments or explanations of specific answers contained in the body of this survey. Photocopy this section for additional space, if required.

VIII. Respondent Signature Block

I certify that I have personally examined and am familiar with the information submitted in this survey and all attached documents, and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe to the best of my knowledge, that submitted information is true, accurate, and complete.

_________________________ _________________________

(Name - Please Sign) (Title)

Upon completion of the survey, it should be returned by August 30, 1996 to:

Mr. Bob Bessette
President
Council of Industrial Boiler Owners
6035 Burke Centre Parkway, Suite 360

Burke, Virginia 22015

GLOSSARY OF TERMS
FOSSIL FUEL FLUIDIZED BED COMBUSTION SURVEY

acid cleaning solution wastes - Water side cleaning wastes resulting from the removal of mineral scale and corrosion products from boilers. The EPA considers this to be a low volume waste.

agricultural use - Soil amendment, other than mine spoil amendment (see also mining industry/surface reclamation), for changing physical and/or chemical characteristics of the soil to improve crop yield.

air pollution control devices - Devices used to limit particulate or gaseous emissions form boilers and other industrial or commercial operations to the atmosphere.

alkaline cleaning solution wastes - Water-side cleaning waste resulting primarily from the removal of oil, grease, temporary coatings with some removal of flaky surface oxides and mill scale from boilers. The EPA considers this to be a low volume waste.

alkaline passivating waste - Water-side cleaning waste resulting form the neutralization of acidity after acid cleaning of a boiler. The EPA considers this to be a low volume waste.

aquifer - A water-bearing subsurface formation of permeable rock, sand, or gravel capable of yielding quantities of water to wells or springs. A useable aquifer is one that may be used for agricultural and industrial purposes as swell as human consumption.

aragonite - An unconsolidated form of limestone formed by precipitation of calcium carbonate ($CaCO_3$) in water.

as fired fuel - The condition of the fuel as fed to the furnace in a boiler. The fuel requires no additional processing to allow it to be used in the furnace.

ash -The incombustible solid matter in fuel.

bed ash - The bottom ash from a fluidized bed combustion boiler.

beneficiation - The treating of a raw material so as to improve its properties. For fuel processing it may involve a flotation process for separating out high fuel value material form waste material. In the context of coal mining, the mining company may beneficiate coal by washing int in order to obtain and ship a better quality fuel.

beneficial use - A use which is of benefit as a substitute for natural or commercial products and does not contribute to adverse effects on health or environment.

boiler blowdown - Removal of a portion of boiler water for the purpose of reducing solid concentrations or discharging sludge. The EPA considers this to be a low volume waste.

boiler cleaning waste - Waste resulting from the cleaning of fossil fuel fired boilers. Boiler cleaning wastes are either water-side or gas-side cleaning wastes. The EPA considers this to be a low volume waste.

capacity - The load for which a generating unit or other electrical apparatus is rated, either by the manufacturer or user.

capacity factor - A measure of the level of plant utilization. It is calculated as the total output over a period of time divided by the product of the rated capacity over the same time period.

cement and concrete products - When used in this document, the quantity of combustion byproducts used in the manufacture of Portland cement, as a raw feed or in a blended cement; and combustion byproducts used as a mixture ingredient in the production of fresh concrete for a variety of uses.

co-combustion byproducts - Combustion byproducts derived from the burning of either (1) a mixture of fossil fuels, or, (2) fossil fuels and other fuels.

co-managed wastes - Mixtures of one or more of the combustion wastes with one or more other wastes generated in conjunction with the combustion of fossil fuels that are necessarily associated with the production of energy.

cogeneration facility - 1) When used in the context of economic regulation, a power plant and interconnecting transmission facilities that meets the operating and efficiency standards and ownership criteria as determined by the FERC; 2) a facility that is engaged in cogeneration.

cogeneration - The sequential production of useful thermal energy (heat or steam and electricity for use in industrial or commercial, heating, or cooling purposes.

composite sample - A sample composed of several sub-samples collected either over time or over a volume of material to be representative of the sampled material.

compression test - A method used to measure the amount of force that can be applied to an object of known area before failure.

confidential business information (CBI) - Information on items considered to either be proprietary or trade secret, such as product formulation or process economics. CBI information is protected from unauthorized disclosure. EPA regulations regarding confidentiality are contained in 40 CFR Part 2, Subpart B.

cooling tower blowdown - Water withdrawn from the cooling system in order to control the concentration of impurities in the cooling water. The EPA considers this to be a low volume waste.

culm - The refuse (tailings) from anthracite production.

demineralizer regeneration and rinses waste - A low volume wastewater generated from the treatment of water to be used at the plant. Generally, demineralized water is used as boiler feedwater. The EPA considers this to be a low volume waste.

disposal - The discharge, deposit, injection, dumping, spilling, leaking, or placing of any solid waste or hazardous waste into or on any land or water such that any constituent thereof may enter the environment or be emitted into the air or discharged into any waters, including ground waters.

dolomite - Loosely used term to describe any carbonate rock containing 20 percent or more magnesium carbonate ($MgCO_3$).

effluent - A waste liquid in its natural state or partially or completely treated that discharges into the environment from a manufacturing or treatment process.

exempt wholesale generator (EWG) - A person or entity determined by the FERC to be in business of owning or operating all or part of a facility used to generate electric energy exclusively for sale at wholesale, including the interconnection transmission facilities.

flowable fill - Use of combustion byproducts in a fluid mixture resembling a grout for backfill applications where bearing strengths as well as excavatability are needed comparable to those of compacted soils. The mixture may have a variety of proportions, with typical ingredients including water and fly ash, along with optional fillers such as bottom ash or sand and small, if any, additions of Portland cement.

FFCB (fossil fuel combustion byproducts) - The solid combustion byproducts from combustion of fossil fuels. In the case of pulverized fuel and stoker fired combustion these by products consist of fly ash, bottom ash, boiler slag and FGD byproducts. In the case of fluidized bed combustion the byproducts consist of fly and bottom ash.

fly ash - In the case of pulverized fuel and stoker feed combustion, suspended ash particles carried in the flue gas. For fluidized bed combustion includes suspended ash particles, fine char, unreacted limestone and anhydrite (calcium sulfate) carried in the flue gas.

fugitive dust - Particles suspended int he air by either wind erosion or mechanical disturbances.

fuel - A substance containing combustibles used for generating heat.

gas-side cleaning waste - Waste produced during the removal of residues (usually fly ash and soot) from the gas-side of the boiler (air pre-heater, economizer, superheater, stack, and ancillary equipment). The EPA considers this to be a low volume waste.

gob - The refuse from bituminous coal production.

grab sample - A single sample of a material (e.g., soil, coal) that is collected at one time for laboratory analysis.

ground water -The water contained within the pore spaces of subsurface formations below the water table and within the zone of saturation.

ground water monitoring well - A well used to obtain ground-water samples for water-quality analysis.

high volume waste - The solid combustion byproducts of fossil fuels and FGD materials generated by a boiler. Recognized as high volume due to the quantity produced compared to other wastes associated with plant operations. In the case of pulverized fuel and stoker combustion these wastes consist of fly ash, bottom ash, boiler slag, and flue gas desulfurization wastes. In the case of fluidized bed combustion these waste consist of fly ash and bed ash.

land disposal - The placement of wastes in a landfill, surface impoundment, waste pile, injection well, land treatment facility, salt dome formation, salt bed formation, or underground mine or cave.

landfill - A disposal facility or part of a facility where hazardous or non-hazardous waste is placed in or on land which is not a land treatment facility, a surface impoundment or injection well.

leachate - In the context of this report, 1) the liquid resulting from water percolating through, and dissolving materials in waste, and; 2) the liquid resulting from the use of a leaching solution on a waste in a laboratory test to characterize the hazardous of the waste.

lime - A calcined or burned form of limestone popularly know as quick lime and hydrated lime.

limestone - Broad term used to describe carbonate rocks or fossils consisting primarily of calcium carbonate or combinations of calcium carbonate and magnesium carbonate with varying amounts of impurities. Generally found as a bedded sedimentary rock composed mainly of calcium carbonate, or a rock type composed of, in general, at least 80 percent of carbonates of calcium and magnesium.

liner - A mitigative measure used to prevent ground-water contamination in which synthetic, natural clay, or bentonite materials that are compatible with the wastes are used to seal the bottom and sides of surface impoundments and landfills.

low volume waste - Wastes generated during equipment operation and maintenance and water purification processes. Low volume waste include boiler cleaning solutions, boiler blowdown, demineralizer regenerants and rinses, pyrites and cooling tower blowdown.

mineral filler - In this report, the use of a fossil fuel combustion byproduct to; 1) compensate for deficient fines in aggregate mixes, or to impart other physical characteristics to the aggregate mixture, 2) substitute the use of fossil fuel combustion byproducts for other minerals or compounds in coatings, paints, plastics and metals.

mining applications - the use of fossil fuel combustion byproducts to; 1) in surface mining for reclamation in a landfill like application to restore surface mined areas to original or desirable contours, or to amend mine spoil materials and acid mine drainage, 2) in underground mining use as a flowable fill to control surface subsidence conditions, control mine fires or seal shafts.

miscellaneous/other - Use of fossil fuel combustion byproducts in any application not otherwise described in this glossary of terms. PLEASE SPECIFY HOW USED WHEN COMPLETING THE SURVEY.

monofill - A landfill that contains one type of waste, such as fossil fuel combustion byproducts.

moisture content - The weight of the amount of water in a substance, expressed as a percent.

NPDES permits - EPA permits to discharge wastewaters from a point source into surface waterways, issued under the National Pollutant Discharge Elimination System (NPDES).

off-site - Geographically noncontiguous property, or contiguous property that is not owned by the same person or entity. The opposite of on-site.

on-site - The same or geographically contiguous property which may be divided by public or private right(s) of way, provided the entrance and exit between the properties is at or across-roads, intersections, and access is by crossing as opposed to going along the right(s) of way. Noncontiguous properties owned by the same person or entity connected by a right of way which the person or entity controls and to which the public does not have access, is also considered on-site property.

petroleum coke - Solid carbonaceous residue remaining in oil refining stills after distillation process.

radionuclides - Elements that emit alpha, beta, and/or gamma rays by the spontaneous disintegration of atomic nuclei.

road base - Aggregate beneath the wearing surface of a road that acts as a support or substrate.

small power production facility - A type of FERC qualifying facility that is i) limited in size, ii) limited in fuel types used and iii) meets FERC's ownership criteria.

snow and ice control - Use of bottom ash or other fossil fuel combustion byproduct as an alternative to sand for road de-icing operations and skid control.

solid waste - As defined by RCRA the term "solid waste" means any garbage, refuse, sludge from a water treatment plant, water supply treatment plant, or air pollution control facility and other discarded material, including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations, and from community activities, but does not include solid or dissolved material in domestic sewage, or solid or dissolved materials in irrigation return flows or industrial discharges which are point sources subject to permits under the Clean Water Act, or special nuclear or byproduct material as defined by the Atomic Energy Act of 1954.

special & contract disposal wastes - These wastes include various spent materials and solid wastes that are generated at the facility and require management. Example wastes include: boiler cleaning chemicals, pyrites, contaminated and dredged soils, laboratory wastes, spent solvents, spent lubricants, office wastes, and other miscellaneous plant wastes.

structural fills - As used in this report, the use of fossil fuel combustion byproducts in an embankment application to improve the topography and/or provide foundation support for commercial, residential or other construction.

subbase - In the context of roads, an underlying support placed below what is normally construed as the road base.

sump effluents - Waste from sumps that collect floor and equipment drains. The EPA considers this to be a low volume waste.

surface impoundment - A facility which is a natural topographic depression, artificially excavation, or diked area formed primarily of earthen materials (although it may be lined with artificial materials), which is designed to hold an accumulation of liquid wastes or wastes containing free liquids.

ton - A weight equal to 2,000 pounds.

trace element - An element that appears in a naturally-occurring concentration of less than 1 percent.

treatment - Any method, technique, or process, including neutralization, designed to change the physical, chemical, or biological character or composition of a waste so as to neutralize it, recover it, make it safer to transport, store or dispose of, or amenable for recovery, storage, or volume reduction.

waste management unit - Locations at which fossil fuel combustion byproducts are treated, stored, accumulated, recovered for reuse, or disposed. Storage and holding tanks and similar units where fossil fuel byproducts are kept for short periods of time are not considered as waste management units.

waste solidification and stabilization - Use of fossil fuel combustion byproducts either alone or interblended with lime and/or Portland cement or other agents to encapsulate or immobilize municipal sludges, non-toxic and toxic materials, and non-hazardous and hazardous materials.

water table - The level below which the soil or rock is saturated with water. It is also the upper boundary of the saturated zone. At this level, the hydraulic pressure is equal to atmospheric pressure.

ATTACHMENT 1

PRIMARY MCLS

Constituents	Primary MCL
Arsenic	0.05 mg/L
Barium	2.0 mg/L
Cadmium	0.005 mg/L
Chromium - Total	0.1 mg/L
Chromium - Hexavalent	0.5 mg/L
Copper	1.3 mg/L
Lead	0.015 mg/L
Mercury	0.002 mg/L
Nitrite as N	1 mg/L
Nitrate as N	10 mg/L
Total Nitrite & Nitrate	10 mg/L
Selenium	0.05 mg/L
Silver	0.05 mg/l
Radium-226 & Radium-228	5.0 pCi/L
Gross Alpha Particle Activity	15.0 pCi/L
Gross Beta	4.0 milirem/yr
Strontium-90	8.0 pCi/L
Tritium	20,000 pCi/L

ATTACHMENT 2

SECONDARY MCLS

Constituents	Secondary MCL
Aluminum	0.05 to 0.2 mg/L
Chloride	250 mg/L
Copper	1.0 mg/L
Corrosivity	Non-corrosive
Fluoride	2.0 mg/L
Iron	0.3 mg/L
Manganese	0.05 mg/L
pH	6.5 to 8.5 units
Silver	0.1 mg/L
Sulfate	250 mg/L
Total Dissolved Solids (TDS)	500 mg/L
Zinc	5 mg/L

ATTACHMENT 3

CBI RESPONSES

Please specify question number and provide your response below for each question considered to be CBI.

CIBO Special Project on FBC Ash Classification

Appendix B: Non-Utility Electric Power Generation

Prepared by Jack Hawks

U.S. Generating Company

Introduction

The modern non-utility electric power generation industry began with a federal law enacted in November 1978, "The Public Utility Regulatory Policies Act" (PURPA).[3] This law spawned a new class of power companies in the 1980s and 1990s that came to be known as independent power producers (IPPs). Prior to 1978, non-utility electricity generation had largely been confined to the industrial sector. There, operators of factories and manufacturing plants found it beneficial to purchase their own power generation equipment and generate their own electricity.

As the public utility industry matured, however, and as central-station power generation brought forth economies-of-scale, a high degree of reliability, and lower unit costs of electricity than smaller plants could achieve, the lure of "self-generation" became less attractive. PURPA changed all of that by providing the impetus for independent power production and by providing industrial firms with an economic incentive to revisit the self-generation option.

PURPA created a regime of enforceable contracts between the multiple parties involved in development of an independent power project. Further, it was the institutionalization of these contracts that led to the competitive revolution now transforming the utility industry. PURPA also made it possible for a group of power plant developers in the mid-1980s to utilize a federal government research program and to create a sector of the power generation industry that uses a relatively new technology, fluidized bed combustion (FBC), to generate electricity and produce thermal energy. FBC owes much of its commercial success to private industry and government initiatives associated with the U.S. Department of Energy's Clean Coal Technology Program.[4]

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[3] Public Law No. 95-617, 92 Stat. 3117 (codified in U.S.C. sections 15, 16, 26, 30, 42, and 43).

[4] U.S. Dept. of Energy, *Clean Coal Technology-The New Coal Era*, DOE/FE-0217P, March 1992, pp. 15-17.

FBC has demonstrated substantial environmental benefits in terms of pollutant emissions reductions from the principal solid-fuel feedstocks used to produce electricity -- coal, coal-mining waste and petroleum coke. FBC has also captured the beneficial uses of the solid combustion byproducts. While the non-utility sector also makes extensive use of conventional pulverized-coal, steam-electric generation technology, the present discussion is limited to FBC. The following subjects about independent power and FBC technology are addressed:

- **a brief history of independent power and the role of PURPA**
- **the structure of an independent power project, both historical and future**
- **comparisons with utility industry generation and regulation**
- **the environmental, economic and social benefits associated with FBC plants**
- **the role of ash in the economics of solid-fuel IPP power plants**
- **the value of FBC technology in the competitive, restructured electricity market**

The Evolution of Independent Power

The history of independent power can be segmented into three distinct periods: 1) The "PURPA Era," which lasted from 1978 to 1992; 2) The "Restructuring Era," which began in 1992 and, arguably, ended in the summer of 1996; and 3) The "Competitive Era," which effectively began in 1996 with the issuance of the Federal Energy Regulatory Commission (FERC) Orders 888 and 889, the landmark rules on open transmission access/stranded cost recovery and on electronic systems that share information on available transmission capacity. The Competitive Era also began with the first state legislation on utility restructuring and retail competition to be enacted. Coincident with the FERC Orders, which went into effect on July 9, 1996, New Hampshire was completing the nation's first full-scale pilot program on retail competition. This program allowed a 3 percent cross-section of utility customers in the state to choose their own power supplier directly, with the local utility being used to deliver the power.

Also, just three weeks after the FERC rules took effect, Rhode Island followed New Hampshire into the competitive arena by enacting legislation requiring the implementation of full retail competition by all electricity suppliers and full choice of supplier by electricity customers. By the end of 1996, two more states -- California and Pennsylvania -- had enacted legislation that required implementation of retail competition. Oklahoma, Montana, Maine and Nevada had all joined the legislative parade by mid-1997. These events mark the formal beginning of the Competitive Era, which is expected to continue indefinitely. All three eras are distinguished by defining milestones and characteristics.

The PURPA Era: 1978-1992

The PURPA Era began with legislation that was enacted largely in response to the oil shortages and market dynamics of the mid-1970s. PURPA was intended to reduce U.S. reliance on foreign oil imports, stimulate the use of renewable energy sources in power production, and spur conservation efforts and efficiency improvements in electricity generation and use.

PURPA was successful in achieving all of these goals, especially in reducing oil imports. Although the United States still imports 54% of its petroleum requirements[5] -- largely because of decisions made by the oil producing community that dramatically lowered the retail price of oil products -- oil consumption for electricity generation has declined significantly. The market share for petroleum in electric power generation stands at 2 percent today, compared with 17 percent in 1973.[6] In the independent power industry, oil's share as the primary fuel for power generation is even less -- 1.2 percent.[7] Figure 1 shows the composition of fuels for electricity generation in 1978 and 1995, illustrating the decline for oil, natural gas and hydro, and the corresponding increases for coal and nuclear.

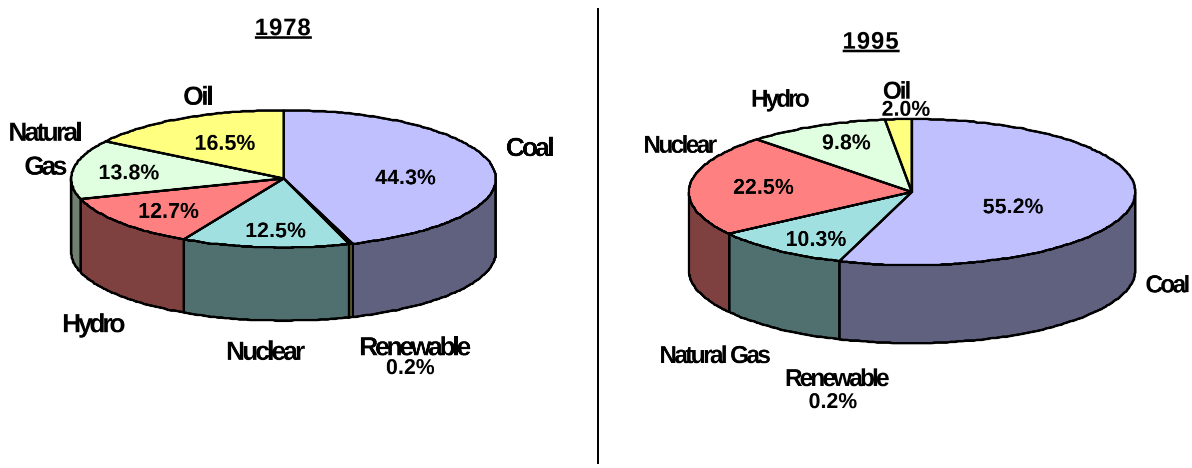
[5]U.S. Energy Information Administration, *Monthly Energy Review,* Washington, D.C., June 1996, p. 41.

[6]Id.; p. 95.

[7]Hagler Bailly Consulting, Inc., *Profile X -- Global Independent Power Market: 1996 Status and Trends*; Arlington, Va., April 1996; p. 2-7.

A major reason for oil's decline in power generation is that PURPA stimulated fuel diversity in power production by a new group of electric power generators. This led to widespread acceptance and use of minority fuels such as natural gas, hydro, municipal solid waste, coal-mining waste,

Figure 1
Sources of Energy for Electric Generation
Total Electric Utility Industry



Sources: Edison Electric Institute, *Historical Statistics of the Electric Utility Industry-through 1992*, March 1995, p. 145;
Edison Electric Institute, *1995 Statistical Yearbook of the Electric Utility Industry*, July 1996 (advance release)

petroleum coke, agricultural matter, wind, geothermal and solar. In states like California, there was wind, sunshine, steam geysers, orange groves and vineyards, all translating into wind farms, solar plants, geothermal plants and agricultural waste power plants. In other states such as Pennsylvania, the fuel diversity focus was on the huge piles of coal-mining waste that had accumulated over the decades. Figure 2 illustrates independent power's fuel diversity and the fundamental differences with utilities in terms of primary energy source. Here, natural gas dominates, while FBC's primary fuels, coal and coal-mining waste, rank second and third.[8]

Prior to the enactment of the Bevill Amendment to RCRA in 1980, there were relatively few FBC units in operation in the United States. A number of factors, however, came together in the mid-to-late 1980s to stimulate the growth of FBC technology. One was the federal government's emphasis on the commercialization of clean-coal technologies. Another was the favorable regulatory climate in some states like Pennsylvania that encouraged the use of the coal-mining waste resource. A third factor was state environmental programs that recognized

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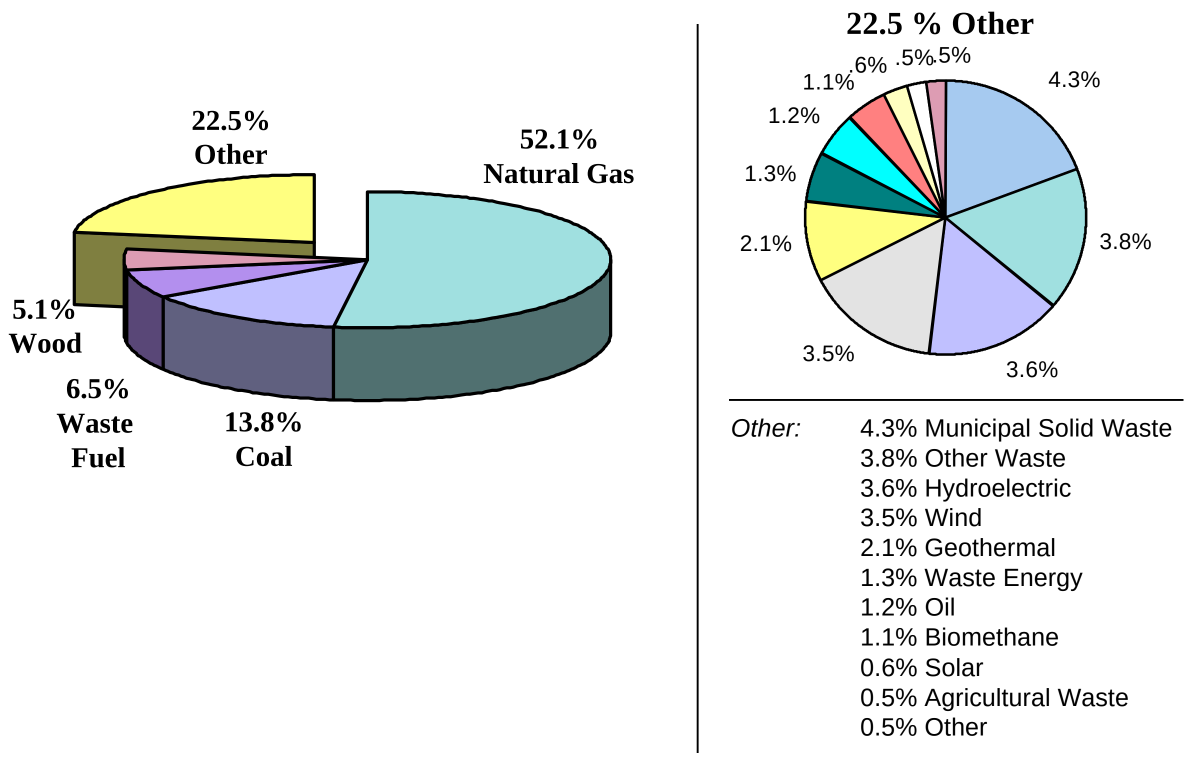
[8]Id.; pp. 2-3 and 3-9.

the value of coal waste power projects. A fourth factor was the ability of a number of power plant developers and engineering/construction companies to marry the FBC technology with the fuel potential in the coal waste material. FBC has taken hold in several states, particularly those with substantial quantities of previously unusable waste anthracite (culm) and bituminous (gob) coal.

Figure 2
Composition of Fuels for IPP Generation - 1995



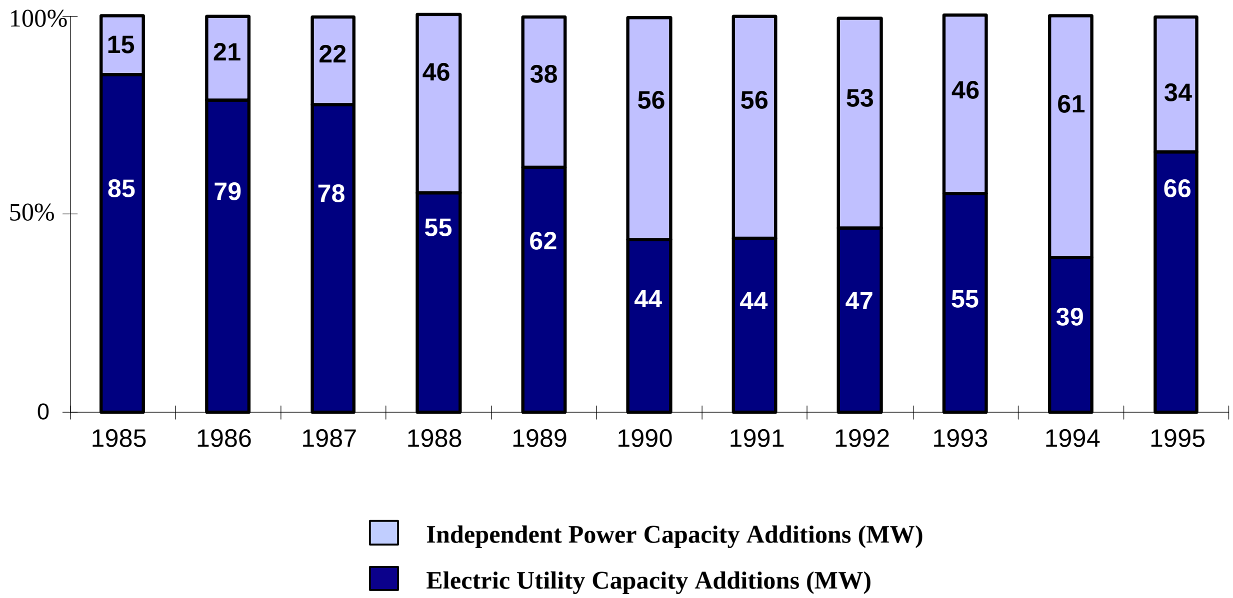
With coal waste, the sponsors of FBC projects discovered that if small particles of the low-grade fuel were totally suspended in air, they could burn effectively. They further discovered that a very tall furnace would allow more complete combustion of the carbon content of the fuel. Finally, they realized that they could get even better combustion if they recirculated the fuel through the furnace several times until all of the carbon had burned, leaving nothing but ash. Thus, the Circulating Fluidized Bed (CFB) boiler became the standard for coal waste power plants. Today, there are 18 privately owned and operated coal waste facilities in Pennsylvania producing more than 1,000 megawatts -- approximately 55 percent of the state's installed IPP capacity.[9]

[9]David F. Martin, Testimony of ARIPPA before the Pennsylvania Joint Legislative Air and Water Pollution Control Conservation Committee, Pottsville, Pa., April 17, 1996, pp. 4-6; CIBO Special Project Data Base of Fluidized Bed Combustion Power Plants, October 31, 1995.

In 1978, there were no IPPs other than self-generating industrial companies. By 1985, IPPs accounted for approximately 2 percent of all installed generating capacity. By 1996, this percentage had grown to 7.8 percent.[10] Equally significant is the fact that independent power's share of installed generating capacity added each year has grown steadily since 1988. As Figure 3 shows, independent

[10] Id.; p.3-3; *1995 Statistical Yearbook of the Electric Utility Industry*; Edison Electric Institute; Washington, DC.

Figure 3
Share of Domestic Generating Capacity Additions:
Independent Power and Utility (%)



power's share of capacity added each year peaked at 67 percent in 1994, averaging about 50 percent throughout the 1990s.[11]

Among other things, PURPA sanctioned the development of a new class of electricity generators called "Qualifying Facilities" (QFs). QFs were composed of cogenerators and small power producers (SPPs) that used waste, biomass or renewable fuels. Cogeneration is the sequential production of two forms of energy -- electricity and steam (or hot water) -- from a single source of energy. The source is normally coal, coal-mining waste, natural gas or oil. It was this 'two-for-one' arrangement that allowed PURPA to address the energy efficiency and conservation issues directly. Cogeneration substantially increased the efficiency of traditional power plants, thereby conserving natural resources. SPPs were equally valuable to the PURPA

[11]Hagler-Bailly Consulting, Inc., Profile X, p. 3-4.

sponsors because they opened a new channel for the efficient use of environmentally preferable natural resources that otherwise might not occur.

To counter the natural tendency of utilities to avoid purchasing QF electricity and select their own self-build options when considering new generating capacity, Congress stipulated in PURPA that utilities must purchase electricity from and sell backup power to QFs. This action created the economic incentive for QFs to be developed. Further, utilities were required to pay QFs a price that either would not exceed the utility's ability to purchase that power elsewhere or would be equal to or less than what the utility would spend to build the power plant itself. This price was the purchasing utility's avoided cost. This requirement was put in place to ensure that the power produced by QFs would be the most economically available new capacity at the time utilities signed power purchase contracts. As a result of the mandatory purchase requirement, other safeguards provided to QFs, and the fact that early QFs performed according to their contractual terms, it became evident to customers and policymakers that vertically integrated utilities did not need to be the only sources of reliable electric power.

Despite the limitations that existed on who and what could qualify, as well as specific limits on size, technology, and ownership, QFs flourished during the PURPA Era. From 1978 to 1989, the number of operating QF power plants rose from zero to 576. By 1993, the number had grown to more than 1,200,[12] suggesting that once the regulatory hurdles, financing uncertainty, risk allocation measures and construction efficiencies were successfully navigated, the time lag for development decreased significantly. During this latter time frame, installed QF generating capacity rose to 47,774 megawatts from 27,429 megawatts.[13]

Aside from the lessons learned in development, risk management, financing and construction, the power purchase agreement (PPA) emerged as the most important factor in the economic

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[12]Energy Information Administration, Electric Power Annual-1993 (Dec. 1994), Wash., D.C., p. 124, Table 77.

[13]Id.

and physical growth of IPPs. Most PPAs provided certainty for independent power plants in terms of operation, expected performance, and revenue streams by including certain provisions. Among them were: 'must-run' clauses (24-hour operation, except for maintenance); performance bonus and penalty clauses; different payment schedules for available capacity and energy actually produced and distributed to the grid; and compensation for specific availability and capacity factor targets. The viability of the IPP plant was contingent on meeting these contract provisions; thus, a high level of operating effectiveness was ensured.

This period also marked the emergence of a market for nontraditional power supply sources beyond the purchases required by PURPA. Because of the constraints imposed on QFs by PURPA, generating companies began to look for other avenues in which to compete -- not as QFs, but as pure wholesale generating companies. At the same time, power marketers, which buy and sell power, but do not own generation or transmission assets, began to emerge. Both entities looked beyond the single-asset, single customer formula into the burgeoning bulk power market.

Two regulatory realities limited independent power companies' growth. One was the ownership and financial limitations of the Public Utility Holding Company Act of 1935 (PUHCA). The other problem was that these generators needed unimpeded transmission service to reach customers in the bulk power market. These were the pressure points that drove the electricity policy debate in Congress during the early 1990s. They eventually stimulated passage of new legislation that opened up the wholesale market to a new wave of competition, thereby ushering in the Restructuring Era.

The Restructuring Era: 1992-1996

Recognizing that PURPA had gone far beyond its original goals by creating a new class of competitive generation companies, and that a lack of access to transmission lines (which were owned by utilities and government agencies) remained a major barrier to these new competitors, Congress passed the Energy Policy Act of 1992 (EPAct).[14] EPAct became the engine that subsequently drove the movement to full competition in the wholesale and retail markets in the mid-to-late 1990s.

EPAct's primary objective was to promote competition in the bulk power market. First, the law created a new market entrant called "Exempt Wholesale Generators" (EWGs), which could own and/or operate generating plants, sell electricity on a wholesale basis only, and still be exempt from the PURPA QF limitations and the strictures of PUHCA.

Second, EPAct authorized FERC to require utilities owning high-voltage transmission lines to provide wholesale transmission services to any electric utility, federal power marketing agency or any other person generating electricity for resale purposes. FERC was also required to develop a rule that required transmitting utilities to submit information annually on what transmission capacity was available and what the known constraints were in the transmission system.

FERC pursued a number of initiatives to ensure that competition developed in the wholesale market. Among them was an aggressive posture toward implementation of Section 211 of the Federal Power Act, which gave FERC authority to approve applications for interconnections to the grid. Other options included a new look at undue discrimination in providing transmission service and easing market entry for new generators.

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[14]Public Law No. 102-486, 106 Stat. 2776 (1992), codified at, among other places, 15 U.S.C. §79z-5a and 16 U.S.C. §§ 796 (22-25), 824j-l.

FERC's goal was "to facilitate the development of competitively priced generation supply options, and to ensure that wholesale purchasers of electric energy can reach alternative power suppliers and vice versa."[15] The mechanics involved in achieving this goal are the chief elements of utility industry restructuring that are in place today.

Somewhat paradoxically, EPAct served to stimulate the regulatory desire to further industry restructuring, wholesale competition and ultimately, retail customer choice -- faster than the customer market did. First, FERC moved aggressively to expand its Section 211 authority by granting early requests for transmission service and including "network service," rather than the more limiting "point-to-point" service (designated points of receipt and delivery of power) typically granted by transmission owners.[16] Network service allows full integration of the loads of an applicant and other generating plants with the transmission owner's own resources on an instantaneous basis.

Second, FERC determined that the availability of transmission capacity was one of the principal impediments to competition and that as long as the transmission-owning utility is fairly compensated for the use of its wires with no commensurate downturn in reliability, then more open transmission service was in the public interest. This finding had significant implications for IPPs because it signaled to customers, legislators and state regulators that enhanced competition was on the horizon, along with the promise of lower prices for consumers.

Third, FERC realized that Section 211 authority was not sufficient to handle the growing competitive pressures at the wholesale level. It promulgated a "comparability standard" in the two years following enactment of EPAct to deal with competitor claims of undue discrimination in receiving transmission service. The standard went through several iterations,

[15] Federal Energy Regulatory Commission, 18 CFR Parts 35 and 385, Docket Nos. RM95-8-000 and RM94-7-001, *Promoting Wholesale Competition Through Open Access Non-Discriminatory Transmission Service by Public Utilities; Recovery of Stranded Costs by Public Utilities and Transmitting Utilities*, Washington, D.C., April 24, 1996, p. 32.

[16] Id., pp. 33-34

but it came down to this: For a utility voluntarily seeking approval of its proposed transmission rates, "an open access tariff that is not unduly discriminatory or anti-competitive should offer third parties access on the same or comparable basis, and under the same or comparable terms and conditions, as the transmission provider's [own] uses of its system."[17]

Fourth, state regulators who oversaw monopoly utility regulation in high-cost states became enamored with the possibilities of restructuring and competition, especially at the local distribution level where customer rates were highest. The level of state interest culminated with the April 20, 1994, announcement by the California Public Utility Commission that it was pursuing an order leading to full retail competition, including customer choice of supplier, unbundling of rates and service, and modifying the vertically integrated utility structure.

The California announcement precipitated a move in numerous other state public utility commissions to address the issues of competition and choice. By 1996, 41 states had initiated regulatory proceedings to examine these issues and determine the best course of action for their utility customers.[18]

Fifth, FERC moved ahead on a number of fronts, issuing several Notices of Proposed Rulemaking (NOPRs), Policy Statements and Inquiries during the Restructuring Era. In chronological order, they were: (1) Regional Transmission Group (RTG) Policy Statement;[19] (2) Stranded Cost NOPR;[20] (3) Pooling Notice of Inquiry;[21] (4) Transmission Pricing Policy Statement;[22] (5) Notice of Inquiry on Merger Policy,[23] and (6) the Mega-NOPR.[24] Space

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[17]Id., p. 37.

[18]Testimony of the Honorable Cheryl L. Parrino, Chair of the Wisconsin Public Service Commission, on behalf of the National Association of Regulatory Utility Commissioners before the U.S. Senate Committee on Energy and Natural Resources, March 6, 1996.

[19]*Policy Statement Regarding Regional Transmission Groups*, 58 FR 41626, August 1993.

[20]*Recovery of Stranded Costs by Public Utilities and Transmitting Utilities*, NOPR, 59 FR 35274, July 1994.

[21]*Inquiry Concerning Alternative Power Pooling Institutions Under the Federal Power Act*, 59 FR 54851, October 1994.

[22]*Inquiry Concerning the Commission's Pricing Policy for Transmission Services Provided by*

(continued...)

limitations prevent a detailed description of each of these initiatives. The key message is that rapidly evolving power markets and increasing competitive pressures forced FERC to accept the fact that EPAct and Section 211 were not enough to eliminate undue discrimination in the use of the transmission system. This realization created a flurry of regulatory activity that had a profound effect on the marketplace not foreseen by the sponsors of EPAct.

This activity shifted the momentum inexorably toward further competitive inroads and had the effect of shifting the balance of power from utilities to customers. A number of large customer groups began the drumbeat for legislation to mandate competition, prompting many 'Ratepayer Advocate' departments within state governments to assert that competition must treat all customers equitably. During 1996, the Restructuring Era gave way to the Competitive Era.

The Competitive Era: 1996 and Beyond

As noted above, the customer is now driving the electric power supply market -- not utilities, not IPPs, not regulators and not legislators. For this reason, it is appropriate to label 1996 as the turning point to the new era of competition. FERC Orders 888 and 889 are the technical rules that will reshape the utility industry and wholesale power market and set the stage for full competition. Along with further guidance on market structure, market governance, utility mergers, and transmission pricing, they will minimize barriers of entry for competitors, mitigate market power problems, and provide the crucial nexus for all competitors needing equal access to critical market and customer information (that now resides almost exclusively with utilities).

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[22](...continued)
Public Utilities Under the Federal Power Act, 59 FR 55031, November 1994.

[23]*Inquiry Concerning the Commission's Merger Policy Under the Federal Power Act: Policy Statement,* 61 FR 68595, December 1996.

[24]*Open Access Transmission, Comparability of Service and Stranded Cost Recovery*; NOPR, 60 FR 17662, April 1995.

It is, however, the state-level pilot programs on customer choice and the associated state legislation implementing retail competition that are the current defining characteristics of the new era. Indeed, the prevailing mood now, after 60 years of increasing government intervention in the utility industry, is to substitute market competition for direct government control of the supply aspects associated with electricity production and delivery. Part of this mood is a reflection of high electricity costs in many regions of the country; part is the desire of many politicians to give states more control over local businesses and markets; and part is the positive deregulation experience in other industries.

Beyond FERC Orders 888 and 889, the New Hampshire and Rhode Island legislation and the New Hampshire pilot program, several other state actions are paving the way. Following the Rhode Island restructuring legislation, the California General Assembly passed landmark legislation on August 31, 1996, that completely transforms the utility industry in the state. The Pennsylvania General Assembly did the same thing on November 26, 1996. Oklahoma followed suit on April 28,1997, followed by Montana (May 2), Maine (May 29) and Nevada (July 9). A number of other states will likely follow soon with legislation.

Foremost among the California law is the ability of retail customers to choose among alternative electricity suppliers as of January 1, 1998. The bill also creates an Independent System Operator for the high-voltage transmission system and a spot market for electricity called a Power Exchange. Significantly, the California legislative model was a key influence on the Pennsylvania proceeding. Both influenced the proceedings in Montana and Oklahoma, and both will influence other state legislative activity in the 1997-99 time frame.

Equally important is the impact on the state legislative associations such as the American Legislative Exchange Council (ALEC) and the National Conference of State Legislatures (NCSL). ALEC, especially, has been aggressive in this regard. At year-end 1996, it produced generic model legislation that is available for members to introduce throughout the country.[25]

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[25]"American Legislative Exchange Council, Board of Directors vote, December 3, 1996.

NCSL has initiated similar deliberations. All of this activity has been the imprimatur that has institutionalized the Competitive Era.

The Competitive Era is further manifested by the intense price competition among power marketers today. Bulk power transactions increased at a dramatic rate in 1996 as annual sales totaled 234 million megawatt-hours (MWhs) in 1996, compared with 27.6 million MWhs in 1995.[26] Amazingly, sales in the first quarter of 1997, 168.6 million MWhs, was already 72 percent of the entire total for 1996.[27] Although power marketing trades are still a small fraction of total annual wholesale transactions and the total amount of electricity used by end-users (3,011 billion kilowatt-hours in 1995),[28] the trend is clear. Full competition means that bulk power transactions on a continuous basis will be the primary means of supplying electricity to customers.

Structure of an Independent Power Project

Experience since 1978 has proved that establishing a limited partnership as the basic investment vehicle for an independent power project is the best way of organizing the capital structure to distribute project risks among the participants and limit the owners' exposure to financial loss. The limited partnership is the entity that owns the plant, plus other assets such as the PPA, the fuel supply agreement, and the environmental and regulatory permits. The limited partnership then contracts with other project participants for needed services, such as operations and maintenance.

Construction of an independent power plant is financed entirely with debt. Usually, equity is committed to the project once the debt financing is arranged, but formally contributed when construction has been completed. After an IPP plant becomes operational, the committed equity is contributed, resulting in about 80 percent of the project's capital cost being debt

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[26]McGraw-Hill News, Power Markets Week, February 26, 1996, p. 6 and March 3, 1997, pp. 8-9.
[27]McGraw-Hill News, Power Markets Week, June 2, 1997, pp. 6-7.
[28]Cambridge Energy Research Associates, Executive Roundtable, June 18, 1996, p. 13.

financed, with the remainder being equity. The debt financing is usually in the form of non-recourse project loans whereby the obligation to repay the loan is secured only by the project's assets (the plant itself and the PPA), and not by the plant's ultimate owners. This arrangement is known as 'non-recourse' financing.

The plant itself is normally built under a lump-sum, turnkey construction contract between the limited partnership and the construction company. "Turnkey," in this instance, means that the contractor is responsible for delivering a fully tested and operational plant to the owners. The limited partnership also contracts with a firm specializing in onsite power plant operations and maintenance. Daily management of the plant usually resides with an agent or affiliate of the limited partnership. Fuel supply for the plant traditionally has matched the duration of the PPA. In this manner, changes in fuel costs can be contractually matched to energy revenues from the utility. All IPP FBC plants operating today fit this general framework.

This capital structure means that risk management and optimizing plant operations are the cornerstones of the independent power project. Unlike other aspects of the plant, these elements will continue to be paramount in a deregulated environment. What will change as industry restructuring moves forward is the manner in which sales are consummated (short-term contracts instead of long-term agreements; multiple customers instead of one or two) and how new power plants are financed (more equity, less debt). Both changes greatly alter the risk calculus.

The key elements of most existing IPP projects are the PPA, the fuel supply and the industrial steam host (if the project was conceived as a cogeneration plant). The PPA is a contract (typically 15-30 years) that calls for the sale of electricity to an investor-owned or municipal utility on a wholesale basis. The utility then resells and distributes that power to its retail customer base. The length of the contract and the expected revenue streams are the critical factors justifying the capital investment required to build the plant.

Beyond the power sales, fuel supply and transportation requirements and the steam sales to the industrial host, there are myriad development issues that must be resolved during development. Among them are:

securing the power plant site
executing the engineering, procurement and construction contract
executing the O&M contract,
securing the necessary environmental and regulatory permits
ensuring that there is substantial local community support for the plant
gaining the necessary political support from elected officials
establishing a process plant interface program internally and externally
resolving the equity needs and partnership structures
arranging the debt financing

Figure 4 shows how all of these components interact to create a successful project. With so many different parties and disciplines involved, it is crucial to allocate the risks involved -- business, financial, fuel, interest rate, environmental, construction, operational and regulatory -- to those best able to manage them. To date, this approach has worked in the vast majority of FBC plants. Only one FBC project has failed as a result of flawed operating/business risk assessments, and it was subsequently purchased by the customer utility.[29]

This careful balance, combined with the single-asset, non-recourse project financing model, is particularly susceptible to regulatory or market-based changes, which can significantly impact costs, risk allocation or the duration of any long-term arrangements that limit certain risk exposures. A

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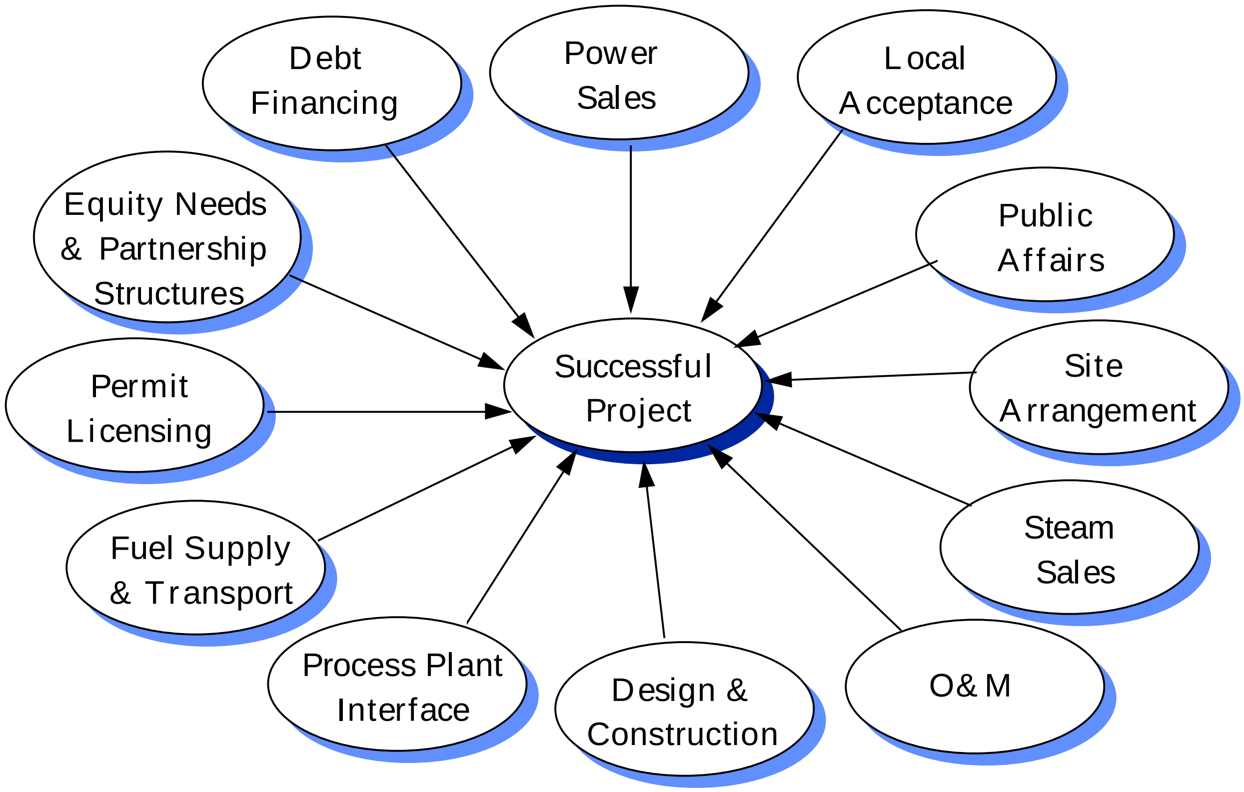
[29]Ray Pospisil, *Electrical World*, Vol. 209, No. 7, "Star-Crossed IPP Finds A New Home," July 27, 1995, p. 32.

Figure 4
Successful IPP Components



sudden and unanticipated increase in the cost of maintaining regulatory compliance could have severe, and perhaps fatal, consequences for a typical IPP project.

Because the FBC power plants are more capital and labor-intensive than plants fueled by natural gas or pulverized coal, it is not clear how they will fare under deregulation. The defining characteristic of future IPPs will be the lack of a long-term PPA as the asset underpinning the financing. From now on, most new power plants will be developed and financed on the basis of a market assessment limited to short-term contracts and multiple transactions and customers. A small number will be built to serve a single large industrial customer, but not many.

Therefore, these "merchant" plants will not have a single customer obligated to purchase all of the plant's output. They will necessarily subscribe to a riskier operating philosophy; that is, build the plant, offer an attractive product (low-cost, reliable power) and seek customers aggressively. A riskier profile also means that future plants will be financed with more owners' equity than today -- more like other capital-intensive commodity industries. In terms of pricing, electricity is rapidly moving from a cost-of-service to a commodity basis, with less emphasis on planning, fuel source, or plant type (base load, intermediate, or peaking).

With an uncertain marketplace establishing price, determining when and where new plants will be built and allowing brand new generation to compete favorably against existing (and not fully depreciated) generation, the implications for FBC plants are significant. First, existing facilities may face political and/or competitive pressure -- or may even be required -- to have their existing PPAs renegotiated or bought out by their utility customers.

In the former instance, a renegotiation will likely mean a closer match with the current market (less "must-run" status, more partial dispatchability; lower energy price, higher capacity price). The plant will then operate for its contract life, albeit under some pressure from the marketplace to convert to a different operating profile. In the latter instance, the buyout must cover the remaining debt, while allowing the plant to compete on the basis of variable operating costs. Satisfying these two requirements could provide an incentive for existing FBC plants to sell their original contracts.

Second, developers of new FBC plants must be able to create a new project that will effectively compete against existing (but largely depreciated) utility generation, existing IPP generation and new generation, regardless of the source. Here, the challenge will be to build a plant with an "all-in" price that can succeed against an existing plant whose capital investment has already been largely recovered through the customer rate base. A difficult proposition, but not impossible, as indicated by new natural gas combined-cycle plant designs.

Third, FBC merchant plants must be timed to fit the new market. How? By evaluating the effect of utility plant retirements and more stringent environmental regulations for older plants on electricity demand. Both situations will increase demand, while greater reliance on combined-cycle technology puts upward pressure on gas prices. This bodes well for solid fuels using FBC.

Comparison of IPP Generation With Utility Generation

Figure 5 summarizes some of the key distinctions between IPP and utility generation of electric power, as they have existed over the three principal eras described above.

From the standpoint of IPP project sponsors, the most relevant comparison with utility-owned generation is in the area of regulation. Specifically, changes in regulatory requirements affecting both utilities and IPPs are treated differently in terms of financial impact. A new environmental regulation imposed on a utility plant requiring significant new investment can be recovered through an increase in captive customer rates.

For the IPP, the economic cost and financial impact must be absorbed in the existing contract with the utility. There is no incentive for the utility to allow an increase in the contract price, even if it would simply be passed through to customers with concurrence from the state public utility commission (PUC). Further, requesting a contract change to allow for a new regulatory requirement means that other contract areas will be vulnerable to pressure. The risk is too large for the IPP, so the additional regulatory investment will be a penalty against the project's existing income.

FIGURE 5

COMPARISON OF IPP AND UTILITY GENERATION OF ELECTRICITY

PURPA ERA		RESTRUCTURING		COMPETITIVE	
IPP	***UTILITY***	***IPP***	***UTILITY***	***IPP***	***UTILITY***
Regulation/Business Structure Limited Partnership PUC Approval of PPA Strict Siting/ Environmental regulation - "Need Standard" Contract regime puts ceiling on cost of production	**Regulation/Business Structure** Vertically-integrated monopoly Rates established by PUC Old plants "grandfathered" under Clean Air Act regs. Regulatory compact limits profits, not production cost	**Regulation/Business Structure** Limited Partnership Pressure to renegotiate PPAs FERC approval of market-based rates Long-term view is obsolete Power marketing affiliates Open access to transmission	**Regulation/Business Structure** Monopoly structure remains PUC pressure on unbundling, corporate separation PUC pressure on stranded costs Power marketing affiliates Open access to transmission	**Regulation/Business Structure** "Pools" of assets No "need standard" Short-term contracts w/ long-term assets Fuels, Commodity, Trading Expertise Open access to transmission	**Regulation/Bus. Structure** Functional separation of gen., trans., distribution Mandated or voluntary divestiture No "cost-of-service" generating plants Open access to transmission
Revenues/Costs Long-term PPA Fixed revenue stream All costs at risk of project. No pass-through for cost increases, regardless of cause	**Revenues/Costs** "Cost-of-service" ratemaking Revenues from customer rates Some special discount rates for large industrial customers	**Revenues/Costs** Long-term PPA Fixed revenue stream All costs at risk of project. No pass-through for cost increases, regardless of cause Some PPA renegotiations	**Revenues/Costs** "Cost-of-service" ratemaking Revenues from customer rates More special industrial rates New revenues for transmission services	**Revenues/Costs** Short-term competitive sales (new) Long-term contract sales (existing) Recovered from competitive sales - production still at risk.	**Revenues/Costs** Partially from regulated rates Partially from competitive sales

FIGURE 5 (continued)
COMPARISON OF IPP AND UTILITY GENERATION OF ELECTRICITY

PURPA ERA		RESTRUCTURING		COMPETITIVE	
IPP	*UTILITY*	*IPP*	*UTILITY*	*IPP*	*UTILITY*
Customers Investor-Owned Utility Industrial company	**Customers** Residential Commercial Industrial Institutional	**Customers** Utility Industrial company Power marketer	**Customers** Residential Commercial Industrial Institutional	**Customers** Investor-owned dist. utility Munis, co-op, PUDs Power marketers Supply aggregators Industrial firms	**Customers** Residential Commercial Industrial Institutional
Capital Structures 80% Debt/20% Equity Project financing Bank syndicates	**Capital Structures** 50% Debt/50% Equity Corporate financing High-quality public debt	**Capital Structures** 80% Debt/20% Equity Project financing Bank syndicates Investment grade bonds	**Capital Structures** 50% Debt/50% Equity Corporate financing High-quality public debt	**Capital Structures** More balanced debt/equity Corporate financing Pooled asset financing Higher quality public debt	**Capital Structures** 50% Debt/50% Equity Corporate financing High-quality public debt

FIGURE 5 (continued)
COMPARISON OF IPP AND UTILITY GENERATION OF ELECTRICITY

PURPA ERA		RESTRUCTURING		COMPETITIVE	
IPP	***UTILITY***	***IPP***	***UTILITY***	***IPP***	***UTILITY***
<u>Results/Outcome</u> **Lower cost than utility** **Higher returns than utility** **Development costs "at-risk"** **PURPA stimulates competition among IPPs** **Environmental improvements** **Heat rate/efficiency improvements** **Loss of revenue approach to plant operations**	**<u>Results/Outcome</u>** **Limits on utility returns leads to higher costs** **System reliability is paramount** **Resentment against mandatory purchase provisions in PURPA** **Tension w/IPPs increases over competitive policy issues** **Differential cost of production approach to plant operations** **Large-scale centralized power generation**	**<u>Results/Outcome</u>** **EPAct creates "exempt wholesale generators"** **EPAct stimulates open transmission access; comparability of service** **Drumbeat begins for comparable environmental standards between IPPs and utilities** **PPA renegotiations begin**	**<u>Results/Outcome</u>** **Mergers begin as utilities respond to competitive threats** **Competitive tensions created between high-cost and low-cost utilities** **Some utilities position themselves for competition** **FERC-jurisdictional utilities offer open access, comparable service** **Utility restructuring begins**	**<u>Results/Outcome</u>** **Capital deployment a function of MW book, not utility PPA** **Regional strategies evolve in response to new risk profiles** **More resources spent on protecting existing assets than previously assumed** **Generation becomes a 'fuel-neutral" decision, based solely on meeting the market price**	**<u>Results/Outcome</u>** **Many utility mergers** **Many utility divestitures** **Many utilities split into generators and distributors** **Independent System Operators control transmission system** **Many utilities look overseas for new business and growth**

There are significant technical differences between utility generation and private power in the four major areas of concern -- development, financing, construction and operation. During plant development, preliminary design and engineering, permitting, site acquisition and infrastructure needs are totally at risk for the IPP. That is, if the project doesn't make it to financing, these expenses are lost. For the utility plant under similar circumstances, these expenses can be recovered through the existing rate design, as long as they are deemed by the PUC to be prudently incurred.

The non-recourse project-financing model for IPPs was described earlier. The chief differences with the utility finance model involve the levels of debt and the entity responsible for debt repayment. Project debt in an IPP project typically reaches 80 percent, with equity contributing 20 percent. The utility capital structure is often 50 percent debt, 40 percent common equity and 10 percent preferred equity. Also, corporate assets instead of the assets of a single plant, are pledged for utility debt. Therefore, it is the utility corporation, rather than the individual capital project, that is at risk for the debt.

The IPP project financing model requires a larger degree of due diligence during project development and, thus, greater transaction costs during financial closing. One reason for this is the fact that development costs are capitalized in an IPP project. Another is that the contract parties have independent technical/financial assessments made in order to confirm the assumed risks and the project's economic viability.

As the power generation sector is deregulated, the financing differences between utility and IPP generation will disappear. It is likely that most generating plants of the future will be financed as a pool of assets and will be evaluated on their ability to sell into a competitive market. Further, financing structures will move toward the type used in more cyclical commodity-based industries such as pulp and paper, chemicals, petroleum refining, etc. Some non-recourse debt will still be feasible, but it will depend on the lenders' comfort with the

plant's ability to compete. Power plant financing will look more like corporate balance sheet financing.[30]

The Economic and Environmental Benefits of FBC Plants/Role of Ash

The economics of FBC power plants are completely intertwined with the environmental benefits that these facilities are able to sustain. That is, environmental mitigation is a source of additional expense in the design of the plant, yet it is also a way of preventing additional expense in the continued operation of the plant. Therefore, the discussion of this section will begin with the environmental attributes of FBC plants, followed by how they contribute to the plants' economic performance. Unless otherwise indicated, the points that follow involve the use of waste coal in a circulating fluidized bed boiler.

The environmental advantages of FBC power plants relate to air and water quality improvements, as well as land use improvements. All of them are dramatic improvements over conventional steam-electric technology and, in the case of waste coal, over the current condition of the land surrounding the fuel preparation sites. Specifically, the air quality benefits are dramatically lower emission rates for sulfur dioxide (SO2), nitrogen oxides (NOx), and particulates (if a sophisticated baghouse/advance fabric filter system is used). Representative decreases in air emissions for FBC facilities in comparison with older solid-fuel power plants are on the order of 95 percent for S02 and 80 percent for NOx.[31]

The water quality benefits involve surface water, erosion and sediment control measures, reduction of acid mine drainage into surface and ground waters, and, in the case of zero-discharge water treatment systems, lower cooling water requirements and no process water discharges to the surrounding environment. Land use benefits are significant: removal of mine refuse piles; remediation and reclamation of abandoned mine sites; and the productive

[30] John R. Cooper, Infrastructure Finance, "Once and Future Heroes," Dec./Jan. 1996, p. 124.

[31] Emission rates of Pennsylvania waste-coal facilities compared with average of utility steam-electric plants. (get data citation)

uses of the FBC ash generated by the combustion process -- as a soil amendment, a key agent in mine reclamation, or as road-bed filler. Other productive uses of ash involve the costs that are avoided because the ash does not have to be landfilled.

These environmental benefits readily translate into social and economic benefits for energy consumers. For instance, reclamation of an existing, but abandoned, mine site, eliminates a potential fire hazard, since spontaneous combustion at such sites is not uncommon. Such reclamation turns an unsafe public nuisance (garbage dump, danger to children, outdoor party disturbance, etc.) into a productive piece of property for a municipality. In 1995, a group of Pennsylvania FBC power plants consumed more than 7.8 million tons of coal mining waste, filled 4.4 million cubic yards of abandoned strip mines and reclaimed more than 600 acres of land.[32] All of this was accomplished at no cost to taxpayers in the state.

The pace of reclamation will accelerate as the power plants mature in terms of operations. Hundreds of additional acres will ultimately be reclaimed as a result of continued operations over the 40-year lives of these facilities. The University of Pennsylvania, in an analysis of the environmental and economic benefits of FBC plants in the state, estimated that the Commonwealth would save $240 million in expenses associated with reclaiming these mine sites if the state had to undertake this task.[33] This estimated savings, which covered a 40-year period, included consumption of 460 million tons of mine refuse, 250 million cubic yards of ash that would be disposed of in the mine reclamation, and 4,400 acres that will ultimately be reclaimed.[34]

The same report uncovered other significant economic benefits for the 13 plants covered in the study. For instance, over the life of the plants, reduction in mine drainage to local streams and rivers could result in a savings of $10.9 million annually to the state in terms of the avoided

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[32]David F. Martin, Testimony of ARIPPA before the Pennsylvania Joint Legislative Air and Water Pollution Control Conservation Committee, Pottsville, Pa., April 17, 1996, p 10.

[33] *Economic and Environmental Impacts of Pennsylvania's Clean-Coal Technology Projects*, The Center for Energy and Environment, University of Pennsylvania, 1994, p. 7.

[34]*Id.*

cost of water treatment.[35] Overall, the Commonwealth of Pennsylvania may avoid up to $16.9 million annually in environmental clean-up costs.[36]

With respect to jobs, the University of Pennsylvania found that the FBC plants in the state (13 in operation, plus six in development) would ultimately create 4,321 permanent operational jobs, of which 1,064 would be directly related to plant operations. These jobs would have a total annual payroll of $44.4 million.[37] Further, these facilities would contribute nearly $9 million annually in tax revenues and would have a total net present value in excess of $3 billion over 40 years in terms of positive economic value to the state.[38] When such calculations are expanded across the country to include all FBC facilities, the economic benefits are substantial.

The Value of FBC Technology in Today's Electricity Market

The singular conclusion that can drawn from the discussion herein on the role of FBC in the independent power market is that the technology commercialized out of DOE's Clean-Coal Technology Program has been an unqualified success. This conclusion can be justified on the basis of any of the three principal criteria on which such a judgment is made - operational performance, environmental improvement and direct economic benefits.

First, the performance of these facilities has been extraordinary. Operational capacity factors (the ratio of hours of operation to hours available to operate) typically exceed 90 percent and often approach 100 percent. These numbers compare very favorably with historical utility averages in the 70-80 percent range. Such performance is critical in a competitive power market where the unit cost of production will be a key determinant as to whether a given power plant is dispatched.

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[35]*Id.*
[36]*Id..*, p.1.
[37]*Id.*, p.10.
[38]*Id.*

Second, the air, water and land improvements are extraordinary. One of the primary benefits of the evolving competitive power market has been the remarkable environmental improvements in all three areas. Again, a significant component of the competitive market will be optimal environmental performance. The FBC technology is well positioned to contribute in this area as the demand for new, clean solid-fuel power plants resumes after the current surplus of existing capacity (resulting largely from the continued operation of old, obsolete technologies beyond their anticipated lives) has been eliminated.

Third, the economic performance alone of FBC facilities can be used to assert their success in the power generation marketplace. All of these facilities were constructed at a price that met the financial constraints placed on them. All of them will be very competitive on a variable cost basis, as their original capital investments are paid off. And all of them have resulted in real, measurable economic benefits in terms of jobs, payroll, revenues to communities in the form of materials and services procured, tax revenues and cost-savings for local and state governments.

All of these benefits were recognized by the Pennsylvania General Assembly in a March 1997 Committee Report.[39] Among the recommendations offered were these:

> **The General Assembly needs to recognize the environmental benefits provided by [FBC] waste coal-fueled power production facilities during the restructuring of the electric utility industry. The benefits include improved water quality, land reclamation, and the elimination of health and safety hazards.**
>
> **The economic and environmental benefits that cogeneration and other waste coal-fueled facilities provide to the local and state economy should be considered when comparisons are made to the cost of power purchased from these facilities.**

[39] *Pennsylvania's Environment and the Future of Independent Power Producers*, Joint Legislative Air and Water Pollution Control and Conservation Committee, Pennsylvania General Assembly, March 1997, p. 11.

The Committee encourages the Department of Environmental Protection to continue to utilize the ash produced by waste coal-fueled facilities primarily to reclaim sites damaged by the state's long history of coal mining. The Department's studies have continued to show that the use of this ash is beneficial to the local environment.

The Committee supports the recommendation to amend the federal Surface Mining Conservation and Reclamation Act to include a reduction in the reclamation fee in situations where coal refuse banks are being used and reclaimed.

APPENDIX C

COMPARISON OF UTILITY AND NON-UTILITY FOSSIL FUEL USES, TECHNOLOGY, AND COMBUSTION BYPRODUCT MANAGEMENT PRACTICES

Comparison of Utility and Non-utility Fossil Fuel Uses, Technology and Combustion Byproduct Management Practices

This report has been focused on fluidized bed combustion technology that is used by both the utility and non-utility sector of the U. S. economy. In addition to FBC technology, utilities and non-utilities use a variety of "conventional" combustion technologies (described in Chapter 3) and fossil fuels. The conventional technologies and fossil fuels produce FFCBs that are characteristically similar but differ in magnitude between the utility and non-utility sectors. This appendix provides several qualitative or descriptive comparisons between the conventional technologies used by the utility and non-utility sectors and FBC technology as well as the management practices used for FFCBs.

To develop the information for this appendix we developed a simple survey instrument that was designed to collect the desired qualitative or descriptive information. The questionnaire was kept relatively short, and most questions were easily answered by the facility operator by either checking a box or providing a short narrative description. A copy of the survey instrument is included at the end of this appendix. This survey was mailed in January 1997 to all CIBO member companies and a select list of other companies known to operate non-utility boilers. A total of 60 surveys representing 244 boilers were returned. The study population from this survey covered 10 Standard Industrial Classification ("SIC")codes as shown in Table C-1 below. In those cases where a survey contained information on both conventional and fluidized bed combustion, the FBC data was aggregated with other CIBO Special Project data for presentation in the comparison matrix. Information contained in the comparison matrix on utilities was provided by the Utilities Solid Waste Activities Group.

Table C - 1

SIC CODES CONTAINED IN STUDY POPULATION

SIC Code	Description	Number of Facilities
20	Food and kindred products	4
21	Tobacco products	4
26	Paper and allied products	8
28	Chemicals, allied products	14
33	Primary metal industries	2
35	Machinery, except electric	3
37	Transportation equipment	4
38	Instruments, related products	1
49	Electric generation	17
82	Universities	2
	Unidentified	1

The survey was designed to gather general information on state permitting activities for disposal of fossil fuel combustion byproducts generated by the non-utility conventional combustion technologies. The following paragraphs describe the results of this portion of the survey.

Does a State or Local regulatory agency require a permit for disposal of combustion byproducts in a company controlled landfill or impoundment at the facility site?

	No. of Responses
Yes a permit is required	**20**
No a permit is not required	**16**
No Response	**24**

Has a State or a Local regulatory agency issued a permit for disposal of combustion byproducts in a company controlled landfill or impoundment at the facility site?

	No. of Responses
Yes a permit has been issued	**16**
No a permit has not been issued	**37**
A permit application has been submitted	**0**
No Response	**17**

To communicate the environmental setting for combustion byproduct disposal at your facility copies of permits for landfills or impoundments would be helpful. If possible, please provide a copy of any such permit and indicate by checking the following boxes if attached

	No. of Responses
Yes a permit is attached	**2**
No a permit is not attached	**48**
No Response	**10**

Is testing of the facility's combustion byproducts required by a State or Local permit or regulation?

	No. of Responses
Yes testing is required	31
No testing is not required	21
No Response	8

Please indicate what testing of combustion byproducts your facility performs (check all that are applicable):

No. of Responses	
39	Toxic Characteristic Leaching Procedure (TCLP) [U. S. EPA Method 1311]
3	Extraction Procedure Toxicity (EP Tox.) [U. S. EPA Method 1310]
2	Synthetic Precipitation Leaching Procedure (SPLP) [U. S. EPA Method 1312]
6	RCRA Total Metals
1	California Soluble Threshold Limit Concentration (STLC) [CAM-17]
1	California Total Threshold Limit Concentration (TTLC) [CAM-17]
10	Other

What is the frequency of the testing described above?

	No. of Responses
Daily	0
Weekly	1
Monthly	1
Semi-annual	0
Annual	23
Seasonal	2
Other	16

Are the results of the above testing provided to a State or Local regulatory agency?

	No. of Responses
Yes	**12**
No	**25**

The following tables provide a qualitative comparison between the conventional technologies used by utilities and non-utilities and FBC technology.

UTILITY AND NON-UTILITY COMPARISON MATRIX			
PARAMETER	**UTILITY CONVENTIONAL**	**NON-UTILITY CONVENTIONAL**	**FLUIDIZED BED COMBUSTION**
Combustion Technology and Single Boiler Size Information	**Cyclone 34 MWe to 977 MWe** **Pulverized 140 MWe to 1,300 MWe** **Stoker 14 MWe to 57 MWe** **Oil 15 MWe to 635 MWe**	**Cyclone 275,000 to 500,000 lb/hr** **No. of boilers 8** **Pulverized 25 to 377 MWe and/or 40,000 to 2,500,000 lb/hr** **No. of boilers 58** **Stoker 6 to 40 MWe and/or 25,000 to 300,000 lb/hr** **No. of boilers 128** **Oil ~37,500 to 225,000 lb/hr** **No. of boilers 13** **Does this oil boiler have a particulate control system?** **Yes 2, No 5, (7 total responses)** **Other: (Natural Gas, Chemical Recovery, Biomass)** **12.5 to ~67 MWe and/or 40,000 to 500,000 lb/hr** **No. of boilers 37**	**Bubbling Bed** **20,000 lb/hr to 160 MWe** **No. of boilers in survey: 5** **No. of facilities in survey: 5** **Circulating Fluidized Bed** **20 MWe to 110 MWe** **No. of boilers in survey: 68** **No. of facilities in survey 43**

UTILITY AND NON-UTILITY COMPARISON MATRIX

PARAMETER	UTILITY CONVENTIONAL	NON-UTILITY CONVENTIONAL	FLUIDIZED BED COMBUSTION
Steam Use	Electricity generation Cogeneration (electricity & heating/cooling)	No. of Responses Electricity generation 10 Cogeneration (electricity & heating/cooling) 32 Process heat use 32 Heating/cooling 26 Mechanical drive 18 Other 2	Electricity generation Cogeneration (electricity & heating/cooling) Process heat use Heating/cooling Mechanical drive
Primary Fossil Fuels Used (primary fuel, >51% fuel weight input to boiler)	Anthracite Coal Bituminous Coal Lignite Coal Sub-bituminous Coal Fuel Oil (No. 6) Natural Gas Other	No. of Responses Bituminous Coal 51 Lignite Coal 1 Sub-bituminous Coal 2 Fuel Oil (No. 2) 2 Fuel Oil (No. 6) 2 Natural Gas 13 Other 4	No. Facilities / No. Boilers Bituminous Coal 21 43 Lignite Coal 2 3 Sub-bituminous Coal 4 7 Anthracite Culm 6 9 Bituminous Gob 5 11 Natural Gas 1 1 Petroleum Coke 5 8 Other (non fossil) 1 1

UTILITY AND NON-UTILITY COMPARISON MATRIX			
PARAMETER	**UTILITY CONVENTIONAL**	**NON-UTILITY CONVENTIONAL**	**FLUIDIZED BED COMBUSTION**
Secondary Fuels Used (<49% fuel weight input to boiler)	**Coal Cleaning Silt** **Petroleum Coke** **Coal Coke** **Refuse Derived Fuel** **Tire Derived Fuel** **Wood/Biomass** **Solid Waste from facility processes** **Contaminated soils** **Used oil** **Sanitary Sewage Sludge** **Other - paper sludge**	**No. of Responses** **Bituminous Coal 2** **Sub-bituminous Coal 1** **Fuel Oil (No. 2) 8** **Fuel Oil (No. 6) 7** **Natural Gas 12** **Off gases from facility processes 6** **Petroleum Coke 1** **Tire Derived Fuel 2** **Wood/Biomass 1** **Solid Waste from facility processes 5** **Sanitary Sewage Sludge 1** **Other**	**No. Facilities No. Boilers** **Anthracite Coal 2 4** **Bituminous Coal 3 7** **Fuel Oil 6 9** **Natural Gas 4 4** **Propane 1 1** **Petroleum Coke 3 3** **Tire Derived Fuel 3 8** **Wood/Biomass 3 10**

UTILITY AND NON-UTILITY COMPARISON MATRIX							
PARAMETER	**UTILITY CONVENTIONAL**	**NON-UTILITY CONVENTIONAL**		**FLUIDIZED BED COMBUSTION**			
Start-up Fuels	**Fuel Oil (No. 2)**		**No. of**		**No. Facilities**	**No.**	
	Fuel Oil (No. 6)	**Responses**		**Boilers**			
	Natural Gas	**Fuel Oil (No. 2)**	**20**	**Fuel Oil**	**12**	**18**	
	Propane	**Fuel Oil (No. 6)**	**2**	**Natural Gas**	**19**	**27**	
		Natural Gas	**22**	**Propane**	**3**	**3**	
		Propane	**4**				
		Other	**19**				

UTILITY AND NON-UTILITY COMPARISON MATRIX			
PARAMETER	**UTILITY CONVENTIONAL**	**NON-UTILITY CONVENTIONAL**	**FLUIDIZED BED COMBUSTION**
Sulfur Dioxide Control (Flue Gas Desulfurization, FGD)	**<u>Wet Scrubber Processes</u>** **Limestone - natural oxidation** **Limestone - inhibited oxidation** **Limestone - forced oxidation** **Lime** **Magnesium enhanced lime** **Dual alkali** **Soda ash** **Magnesium Oxide** **<u>Semi-dry & Dry Processes</u>** **Lime spray dry absorber** **Circulating dry scrubber** **<u>Other Processes</u>** **Furnace sorbent injection - calcium based sorbents** **Convective pass injection - calcium hydrate sorbent** **Backend injection - sodium based sorbents**	**<u>No. of Responses</u>** **<u>Wet Scrubber Processes</u>** **Dual alkali 1** **<u>Semi-dry & Dry Processes</u>** **Lime spray dry absorber 5** **<u>Other Processes</u>** **Other 3**	**Limestone injection facilities 37** **<u>Other Bed Materials</u>** **Fired Clay** **Sand** **Gravel**

UTILITY AND NON-UTILITY COMPARISON MATRIX			
PARAMETER	**UTILITY CONVENTIONAL**	**NON-UTILITY CONVENTIONAL**	**FLUIDIZED BED COMBUSTION**
NOx Control	**Combustion Control Methods** Low NOx burners Air staging Fuel staging Operational modifications **Post-combustion Control Methods** Selective Catalytic Reduction Selective Non-catalytic Reduction	**No. of Responses** **Combustion Control Methods** Low NOx burners 17 Air staging 18 Fuel staging 3 Operational modifications 2 **Post-combustion Control Methods** Selective Catalytic Reduction 3 Selective Non-catalytic Reduction (SNCR) 1	**Combustion Control Methods** Air stageing **Post-combustion Control Methods** **No. Facilities** Selective Catalytic Reduction 0 Selective Non-catalytic Reduction (SNCR) 5
Particulate Control	Cold Electrostatic Precipitator Hot Electrostatic Precipitator Fabric Filter (baghouse) Mechanical Collector	**No. of Responses** Cold Electrostatic Precipitator 12 Hot Electrostatic Precipitator 12 Fabric Filter (baghouse) 31 Mechanical Collector 19	**No. of Facilities** Cold Electrostatic Precipitator 2 Hot Electrostatic Precipitator 0 Fabric Filter (baghouse) 38 Mechanical Collector 0

UTILITY AND NON-UTILITY COMPARISON MATRIX			
PARAMETER	**UTILITY CONVENTIONAL**	**NON-UTILITY CONVENTIONAL**	**FLUIDIZED BED COMBUSTION**
Ash Transportation From Collection Point To Storage/Disposal	**Fly Ash** **Dry: Mechanical Yes, Pneumatic Yes** **Wet (Sluice) Yes** **Bottom Ash/Boiler Slag** **Dry: Mechanical Yes, Pneumatic Yes** **Wet (Sluice) Yes** **Is the same system used for fly ash & bottom ash/boiler slag?** **_X_ Yes _X_ No** **If ash is transported by dry systems, is the ash conditioned (water added) for disposal? _X_ Yes ____ No**	**Fly Ash (No. of Responses)** **Dry: Mechanical 4, Pneumatic 46** **Wet (Sluice): 9** **Bottom Ash/Boiler Slag** **Dry: Mechanical 8, Pneumatic 33** **Wet (Sluice): 16** **Is the same system used for fly ash & bottom ash/boiler slag?** **Yes 55 No 0** **If ash is transported by dry systems, is the ash conditioned (water added) for disposal? Yes 49 No 0**	**Fly Ash** **Dry: Mechanical No, Pneumatic Yes** **Wet (Sluice) No** **Bottom Ash/Bed Ash** **Dry: Mechanical Yes, Pneumatic Yes** **Wet (Sluice) No** **Is the same system used for fly ash & bottom ash/boiler slag?** **___ Yes _X_ No** **If ash is transported by dry systems, is the ash conditioned (water added) for disposal? _X_ Yes ____ No**

UTILITY AND NON-UTILITY COMPARISON MATRIX			
PARAMETER	**UTILITY CONVENTIONAL**	**NON-UTILITY CONVENTIONAL**	**FLUIDIZED BED COMBUSTION**
High Volume Combustion Product Management Techniques	**Is Bottom Ash/Boiler Slag Managed by same techniques as Fly Ash?** **_X_ Yes _X_ No** **If no, please place a BA in space provided in the listing under <u>Fly Ash</u> for the management practices used.** **If yes, are Fly Ash and Bottom Ash/Boiler Slag managed in the same facility?** **_X_ Yes ____ No** **Is the FGD Waste managed by same techniques as Fly Ash?** **_X_ Yes _X_ No** **If no, please place a FGD in space provided in the listing under <u>Fly Ash</u> for the management practices used.** **If yes, are Fly Ash and FGD waste managed in the same facility?** **____ Yes _X_ No (most of the time)**	**(No. Responses)** **Is Bottom Ash/Boiler Slag managed by same techniques as Fly Ash?** **Yes 33 No 20** **If no, please place a BA in space provided in the listing under <u>Fly Ash</u> for the management practices used.** **If yes, are Fly Ash and Bottom Ash/Boiler Slag managed in the same facility?** **Yes 36 No 0** **Is the FGD Waste managed by same techniques as Fly Ash?** **Yes 4 No 5** **If no, please place a FGD in space provided in the listing under <u>Fly Ash</u> for the management practices used.** **If yes, are Fly Ash and FGD waste managed in the same facility?** **Yes 4 No 1**	**Is Bottom Ash/Bed Ash managed by same techniques as Fly Ash?** **_X_ Yes _X_ No** **If yes, are Fly Ash and Bottom Ash/Bed Ash managed in the same facility?** **_X_ Yes _X_ No**

UTILITY AND NON-UTILITY COMPARISON MATRIX			
PARAMETER	**UTILITY CONVENTIONAL**	**NON-UTILITY CONVENTIONAL**	**FLUIDIZED BED COMBUSTION**
High Volume Combustion Byproduct Management Techniques continued	**Fly Ash** **Unlined utility controlled landfill with other company generated wastes** **Lined utility controlled landfill with other company generated wastes** **Unlined utility controlled landfill without other company generated wastes** **Lined utility controlled landfill without other company generated wastes** **Commercial landfill for "special" or hazardous waste** **Commercial landfill municipal or general solid waste** **Unlined utility controlled**	**Fly Ash (No. of responses)** **Unlined company controlled landfill with other company generated wastes** **9** **Lined company controlled landfill with other company generated wastes** **1** **Unlined company controlled landfill without other company generated wastes** **7** **Lined company controlled landfill without other company generated wastes** **2** **Commercial landfill for "special" or hazardous waste 3**	**Fly Ash (No. of Facilities)** **Unlined company controlled landfill with other company generated wastes** **0** **Lined company controlled landfill with other company generated wastes** **5** **Unlined company controlled landfill without other company generated wastes** **1** **Lined company controlled landfill without other company generated wastes** **1** **Commercial landfill for "special" or hazardous waste 2**

UTILITY AND NON-UTILITY COMPARISON MATRIX			
PARAMETER	**UTILITY CONVENTIONAL**	**NON-UTILITY CONVENTIONAL**	**FLUIDIZED BED COMBUSTION**
High Volume Combustion Byproduct Management Techniques continued	**Fly Ash - continued** **Lined utility controlled impoundment without other company generated wastes** **Return to coal mine** **X** **Beneficial Use** **Cement/concrete** **Flowable fill** **Structural fill** **Roadbase/subbase** **Mineral filler** **Mining applications** **Snow & ice control** **Wallboard** **Waste stabilization** **Agriculture** **Misc./other**	**Fly Ash - continued** **(No. of Responses)** **Lined company controlled impoundment without other company generated wastes** **0** **Return to coal mine** **8** **Beneficial Use** **Cement/concrete** **19** **Flowable fill** **6** **Structural fill** **14** **Roadbase/subbase** **13** **Snow & ice control** **3** **Blasting grit/roofing** **1** **Waste stabilization** **5** **Agriculture** **7** **Misc./other** **12**	**Fly Ash - continued** **(No. of Facilities)** **Lined company controlled impoundment without other company generated wastes** **0** **Return to coal mine** **0** **Beneficial use** **Cement/concrete** **3** **Flowable fill** **1** **Structural fill** **6** **Mining applications** **16** **Waste stabilization** **11** **Agriculture** **5** **Misc./other** **7**

UTILITY AND NON-UTILITY COMPARISON MATRIX			
PARAMETER	**UTILITY CONVENTIONAL**	**NON-UTILITY CONVENTIONAL**	**FLUIDIZED BED COMBUSTION**
Low Volume Combustion Byproduct Management Techniques	**Separately managed under RCRA subtitle C or D, NPDES or other state & federal programs Yes @ some facilities** **One or more co-managed with High Volume Wastes (HVW) Yes** **Low Volume Wastes Co-Managed w/ HVW by facility** **Cooling tower blowdown** **Boiler blowdown** **Boiler cleaning chemical waste** **Demineralizer regenerant/rinses** **Coal storage pile runoff** **General site runoff** **Pyrites** **Coal mill rejects/pyrites** **Plant service water** **Non-contact cooling water** **Wastewater treatment sludges/residuals**	**Separately managed under RCRA subtitle C or D, NPDES or other state & federal programs 19 Responses** **One or more co-managed with High Volume Wastes (HVW) 8 Responses** **Low Volume Wastes Co-Managed w/ HVW by facility No. of Responses** **Cooling tower blowdown 4** **Boiler blowdown 9** **Boiler cleaning chemical waste 6** **Demineralizer regenerant/rinses 7** **Coal storage pile runoff 3** **General site runoff 8** **Pyrites 2** **Coal mill rejects/pyrites 4** **Plant service water 5** **Non-contact cooling water 6** **Wastewater treatment sludges/residuals 11**	**Separately managed under RCRA subtitle C or D, NPDES or other state & federal programs Yes @ some facilities** **One or more co-managed with High Volume Wastes (HVW) 11 Facilities** **Low Volume Wastes Co-Managed w/ HVW No. Facilities** **Cooling tower blowdown 1** **Boiler blowdown 1** **Boiler cleaning chemical waste ____** **Demineralizer regenerant/rinses 1** **Coal storage pile runoff 1** **General site runoff ____** **Pyrites ____** **Coal mill rejects/pyrites ____** **Plant service water ____**

UTILITY AND NON-UTILITY COMPARISON MATRIX			
PARAMETER	**UTILITY CONVENTIONAL**	**NON-UTILITY CONVENTIONAL**	**FLUIDIZED BED COMBUSTION**
Boiler Cleaning Waste Generation	**Fire-side/gas-side cleaning** **Wash frequency: Varies,** **_3_ months; to** **_5_ year(s)** **Volume of waste per cleaning** **Varies, 50,000 gallons to 1-million gallons** **Water-side cleaning** **Chemical cleaning frequency:** **Varies, _2_ years to _7_ years** **Volume of waste per cleaning:** **Varies, 150,000 gallons to 2.5-million gallons**	**Fire-side/gas-side cleaning** **Wash frequency: Varies,** **3 months; to** **7 year(s); or, as needed.** **Volume of waste per cleaning** **Varies, 1,500 gallons to 60,000 gallons** **Water-side cleaning** **Chemical cleaning frequency:** **Varies, never, 1 year to 10 years.** **Volume of waste per cleaning:** **4,500 gallons to 300,000 gallons**	**Fire-side/gas-side cleaning** **Wash frequency:** **___ months;** **___ year(s); or,** **other ____________________** **Volume of waste per cleaning** **____________ gallons** **Water-side cleaning** **Chemical cleaning frequency:** **____ months;** **___ year(s); or,** **other ___________________** **Volume of waste per cleaning:** **____________ gallons**

Attachment C - 1

Survey Document

CIBO SPECIAL PROJECT

on

NON-UTILITY FOSSIL FUEL ASH CLASSIFICATION

INSTRUCTIONS FOR COMPLETING

COMPARISON MATRIX & QUESTIONNAIRE

JANUARY 3, 1997

Background

The CIBO Special Project on Non-utility Fossil Fuel Ash Classification (the "Special Project") has focused its efforts on fluidized bed combustion. The conventional combustion technologies (stoker, cyclone and pulverized) used by both utilities and industry have been extensively studied by the United States Environmental Protection Agency ("EPA") in its 1988 Report to Congress and the 1993 Regulatory Determination, however, the data that EPA examined was limited to coal combustion by utilities. In the pending regulatory determination, EPA is considering fluidized bed combustion, conventional coal firing by non-utilities, co-burning of fossil fuels and other opportunity fuels, and co-management of high and low volume wastes associated with combustion of fossil fuels. The Special Project has been asked by the EPA to provide comparisons and contrasts whenever possible between utility and non-utility operations as they pertain to fossil fuel combustion and combustion byproduct management. To accomplish this task, the attached "Comparison Matrix & Questionnaire" has been developed. The column entitled "Utility Conventional" will be completed using data that is being developed by the Utilities Solid Waste Activities Group and its contractor the Electric Power Research Institute. The two remaining comparison columns are the subject of this questionnaire.

Instructions

IF YOUR FACILITY USES BOTH OIL AND OTHER FOSSIL FUELS AS PRIMARY BOILER FUELS PLEASE COPY THIS "COMPARISON MATRIX & QUESTIONNAIRE" AND COMPLETE A SEPARATE SURVEY FOR THE OIL FIRED BOILERS AND THE OTHER FOSSIL FUEL FIRED BOILERS. DO NOT COMBINE OIL FIRED AND OTHER FOSSIL FUEL FIRED BOILERS IN ONE "COMPARISON MATRIX & QUESTIONNAIRE."

Page 1 is a general information section. The "short description of the facility's boilerhouse configuration" should include the number of boilers, the types of fuel used, any FGD system, and the particulate control system. Please indicate by checking the boxes provided if copies of fuel or ash analysis are provided.

The balance of the survey can be completed by either filling in a blank or by checking (✓) all items that are applicable.

If your facility has both conventional and fluidized bed combustion boilers, and you have not yet returned the Special Project's "Fossil Fuel Fluidized Bed Combustion By-Products Survey" please complete both

<u>columns in the "Comparison Matrix & Questionnaire".</u> Otherwise, just complete the "Non-Utility Conventional" Column.

Instructions Page 1

If your facility uses only one (1) primary fossil fuel, has more than one size of boiler for each combustion technology and uses common combustion byproduct management for all boilers, please copy Page 3 of the survey and complete a separate copy of Page 3 for each size of boiler and only one copy of the balance of the survey.

Page 4 of the "Comparison Matrix and Questionnaire" deals with the primary fossil fuel used in the boilers shown on Page 3. The EPA has defined "primary" as meaning the fuel that is 51% or more of the fuel weight input to the boiler. Other fuels used in the boiler are "secondary" or start-up and are covered by other questions. If no one fuel is 51% or greater please complete the "Other" line as "Not Applicable" and proceed to Page 4.

For "Secondary Fuels" please provide a description of any "off gases from facility processes" if used, for example carbon monoxide. Likewise, please provide a description of any "solid wastes from facility processes" that are used as fuel. An example would be recycled paper fibers. An "other" category is provided if none of the provided descriptions can describe a fuel you may use. Please provide a description for any entry under "other."

Please note the supplemental instructions on Page 8 regarding how to describe how Bottom Ash/Boiler Slag and/or FGD waste is managed if not managed with the facility's Fly Ash.

Also, Pages 9 and 10 have questions asking about both unlined and lined landfills and impoundments that may be used for disposal of combustion byproducts and other facility wastes. <u>Please read these descriptions carefully.</u>

If you have any questions regarding this survey please contact either:

Bob Svendsen	**Bob Bessette**
Foster Wheeler Power Systems	**Council of Industrial Boiler Owners**
(540) 341-7437	**(703) 250-9042**

Please return the completed "Comparison Matrix and Questionnaire" to:

Bob Bessette
Council of Industrial Boiler Owners
6035 Burke Centre Parkway, Suite 360
Burke, VA 22015

by February 7, 1997.

Thank you in advance for your time in completing this survey.

Instructions Page 2

CIBO SPECIAL PROJECT
on
NON-UTILITY FOSSIL FUEL ASH CLASSIFICATION

COMPARISON MATRIX & QUESTIONNAIRE
JANUARY 3, 1997

Facility Name:____
Facility Location:
Street Address:____
City: ______________________ **State:**__________ **ZIP Code** ___________
Facility Owner: ____
Facility Contact Person: ________________________**Title:** __________________
Phone Number: __________________ **FAX Number:** ______________________
Facility Primary Business: ______________________ **SIC Code** _________________
Other Facility Business: _______________________ **SIC Code** _________________
Short description of facility's boilerhouse configuration: _____________________________
____
____
____
____
____
____
____
____
____
____

Copies of fuel or ash analysis would be helpful in communicating the similarity of utility and non-utility fuels and ash characteristics. Please provide copies of any readily available fuel or ash analysis and indicate by checking the following boxes if attached.

Fuel analysis is attached **Ash analysis is attached**

Does a State or Local regulatory agency require a permit for disposal of combustion byproducts in a company controlled landfill or impoundment at the facility site?

Yes a permit is required **No a permit is not required**

COMPARISON MATRIX & QUESTIONNAIRE

Has a State or a Local regulatory agency issued a permit for disposal of combustion byproducts in a company controlled landfill or impoundment at the facility site?

Yes a permit has been issued **No a permit has not been issued**

A permit application has been submitted

To communicate the environmental setting for combustion byproduct disposal at your facility copies of permits for landfills or impoundments would be helpful. If possible, please provide a copy of any such permit and indicate by checking the following boxes if attached.

Yes a permit is attached **No a permit is not attached**

Is testing of the facility's combustion byproducts required by a State or Local permit or regulation?

Yes testing is required **No testing is not required**

Please indicate what testing of combustion byproducts your facility performs (check all that are applicable):

Toxic Characteristic Leaching Procedure (TCLP) [U. S. EPA Method 1311]
Extraction Procedure Toxicity (EP Tox.) [U. S. EPA Method 1310]
Synthetic Precipitation Leaching Procedure (SPLP) [U. S. EPA Method 1312]
Multiple Extraction Procedure (MEP) [U. S. EPA Method 1320]
Synthetic Groundwater Leaching Procedure (SGLP)
Long-Term Leaching Procedure (LTL)
RCRA Total Metals
California Waste Extraction Test (WET)
California Soluble Threshold Limit Concentration (STLC) [CAM-17]
California Total Threshold Limit Concentration (TTLC) [CAM-17]
ASTM C-311 (Fly Ash for Use As A Mineral Admixture in Portland Cement Concrete)
Other (describe) ____
Other (describe) ____

What is the frequency of the testing described above?
Daily **Weekly** **Monthly** **Semi-annual** **Annual**
Other (describe) ____
Other (describe) ____

Are the results of the above testing provided to a State or Local regulatory agency? **Yes** **No**

COMPARISON MATRIX & QUESTIONNAIRE			
PARAMETER	**UTILITY CONVENTIONAL**	**NON-UTILITY CONVENTIONAL**	**FLUIDIZED BED COMBUSTION**
Combustion Technology and Single Boiler Size Information	**Cyclone 34 MWe to 977 MWe** **Pulverized __ MWe to 1,300 MWe** **Stoker 14 MWe to 57 MWe** **Oil ___ MWe to ___ MWe**	**Cyclone ____ MWe and/or** **________________ lb/hr** **No. of boilers ____** **Pulverized ____ MWe and/or** **________________ lb/hr** **No. of boilers ____** **Stoker ____ MWe and/or** **________________ lb/hr** **No. of boilers ____** **Oil ____ MWe and/or** **_________________ lb/hr** **No. of boilers ____** **Does this oil boiler have a particulate control system?** **____ Yes ____ No** **Other: _____________________** **____MWe and/or** **_________________ lb/hr** **No. of boilers ____**	**Bubbling Bed** **____ MWe and/or** **__________________lb/hr** **No. of boilers ____** **Circulating Fluidized Bed** **____ MWe and/or** **__________________lb/hr** **No. of boilers ____** **Other: _____________________** **____MWe and/or** **________________ lb/hr** **No. of boilers ____**

COMPARISON MATRIX & QUESTIONNAIRE			
PARAMETER	**UTILITY CONVENTIONAL**	**NON-UTILITY CONVENTIONAL**	**FLUIDIZED BED COMBUSTION**
Steam Use	**Electricity generation** **Cogeneration (electricity & heating/cooling)**	**Electricity generation** ____ **Cogeneration (electricity & heating/cooling)** ____ **Process heat use** ____ **Heating/cooling** ____ **Mechanical drive** ____ **Other** _________________ ____	**Electricity generation** ____ **Cogeneration (electricity & heating/cooling)** ____ **Process heat use** ____ **Heating/cooling** ____ **Mechanical drive** ____ **Other** __________________ ____

COMPARISON MATRIX & QUESTIONNAIRE			
PARAMETER	**UTILITY CONVENTIONAL**	**NON-UTILITY CONVENTIONAL**	**FLUIDIZED BED COMBUSTION**
Primary Fossil Fuels Used (primary fuel, >51% fuel weight input to boiler)	**Anthracite Coal Bituminous Coal Lignite Coal Sub-bituminous Coal Fuel Oil (No. 2) Fuel Oil (No. 6) Natural Gas Other**	**Anthracite Coal ___ Bituminous Coal ___ Lignite Coal ___ Sub-bituminous Coal ___ Anthracite Culm ___ Bituminous Gob ___ Coal Cleaning Silt ___ Crude Oil ___ Fuel Oil (No. 2) ___ Fuel Oil (No. 6) ___ Natural Gas ___ Propane ___ Off gases from facility processes ______________________ ___ ______________________ ___ Petroleum Coke ___ Coal Coke ___ Orimulsion ___ Other ___________________ ___**	**Anthracite Coal ___ Bituminous Coal ___ Lignite Coal ___ Sub-bituminous Coal ___ Anthracite Culm ___ Bituminous Gob ___ Coal Cleaning Silt ___ Crude Oil ___ Fuel Oil (No. 2) ___ Fuel Oil (No. 6) ___ Natural Gas ___ Propane ___ Off gases from facility processes ______________________ ___ ______________________ ___ Petroleum Coke ___ Coal Coke ___ Orimulsion ___ Other ___________________ ___**

COMPARISON MATRIX & QUESTIONNAIRE			
PARAMETER	**UTILITY CONVENTIONAL**	**NON-UTILITY CONVENTIONAL**	**FLUIDIZED BED COMBUSTION**
Secondary Fuels Used (<49% fuel weight input to boiler)	**Anthracite Coal ___ Bituminous Coal ___ Lignite Coal ___ Sub-bituminous Coal ___ Anthracite Culm ___ Bituminous Gob ___ Coal Cleaning Silt ___ Crude Oil ___ Fuel Oil (No. 2) ___ Fuel Oil (No. 6) ___ Natural Gas ___ Propane ___ Off gases from customer's processes ______________________ ___ ______________________ ___ Petroleum Coke ___ Coal Coke ___ Orimulsion ___ Refuse Derived Fuel ___ Tire Derived Fuel ___ Wood/Biomass ___ Solid Waste from facility processes ______________________ ___ ______________________ ___ ______________________ ___ Sanitary Sewage Sludge ___ Other __________________ ___ Other __________________ ___**	**Anthracite Coal ___ Bituminous Coal ___ Lignite Coal ___ Sub-bituminous Coal ___ Anthracite Culm ___ Bituminous Gob ___ Coal Cleaning Silt ___ Crude Oil ___ Fuel Oil (No. 2) ___ Fuel Oil (No. 6) ___ Natural Gas ___ Propane ___ Off gases from facility processes ______________________ ___ ______________________ ___ Petroleum Coke ___ Coal Coke ___ Orimulsion ___ Refuse Derived Fuel ___ Tire Derived Fuel ___ Wood/Biomass ___**	**Anthracite Coal ___ Bituminous Coal ___ Lignite Coal ___ Sub-bituminous Coal ___ Anthracite Culm ___ Bituminous Gob ___ Coal Cleaning Silt ___ Crude Oil ___ Fuel Oil (No. 2) ___ Fuel Oil (No. 6) ___ Natural Gas ___ Propane ___ Off gases from facility processes ______________________ ___ ______________________ ___ Petroleum Coke ___ Coal Coke ___ Orimulsion ___ Refuse Derived Fuel ___ Tire Derived Fuel ___ Wood/Biomass ___ Solid Waste from facility processes ______________________ ___ ______________________ ___ ______________________ ___ Sanitary Sewage Sludge ___ Other __________________ ___ Other __________________ ___**

COMPARISON MATRIX & QUESTIONNAIRE			
PARAMETER	**UTILITY CONVENTIONAL**	**NON-UTILITY CONVENTIONAL**	**FLUIDIZED BED COMBUSTION**
Start-up Fuels	**Fuel Oil (No. 2)** **Fuel Oil (No. 6)** **Natural Gas** **Propane**	**Fuel Oil (No. 2)** ____ **Fuel Oil (No. 6)** ____ **Natural Gas** ____ **Propane** ____ **Other** _________________ ____	**Fuel Oil (No. 2)** ____ **Fuel Oil (No. 6)** ____ **Natural Gas** ____ **Propane** ____ **Other** _________________ ____
Sulfur Dioxide Control (Flue Gas Desulfurization, FGD)	**<u>Wet Scrubber Processes</u>** **Limestone - natural oxidation** **Limestone - inhibited oxidation** **Limestone - forced oxidation** **Lime** **Magnesium enhanced lime** **Dual alkali** **Soda ash** **Magnesium Oxide** **<u>Semi-dry & Dry Processes</u>** **Lime spray dry absorber** **Circulating dry scrubber** **<u>Other Processes</u>** **Furnace sorbent injection - calcium based sorbents** **Convective pass injection - calcium hydrate sorbent** **Backend injection - sodium based sorbents**	**<u>Wet Scrubber Processes</u>** **Limestone - natural oxidation** ___ **Limestone - inhibited ox.** ___ **Limestone - forced oxidation** ___ **Lime** ___ **Magnesium enhanced lime** ___ **Dual alkali** ___ **Soda ash** ___ **Magnesium Oxide** ___ **Seawater** ___ **<u>Semi-dry & Dry Processes</u>** **Lime spray dry absorber** ___ **Circulating dry scrubber** ___ **<u>Other Processes</u>** **Furnace sorbent injection - calcium based sorbents** ___ **Convective pass injection - calcium hydrate sorbent** ___ **Backend injection - sodium based sorbents** ___ **Other** _________________ ___	**Limestone injection** ____ **Dolomite injection** ____

COMPARISON MATRIX & QUESTIONNAIRE			
PARAMETER	**UTILITY CONVENTIONAL**	**NON-UTILITY CONVENTIONAL**	**FLUIDIZED BED COMBUSTION**
NOx Control	**Combustion Control Methods** Low NOx burners Air staging Fuel staging Operational modifications **Post-combustion Control Methods** Selective Catalytic Reduction Selective Non-catalytic Reduction	**Combustion Control Methods** Low NOx burners ___ Air staging ___ Fuel staging ___ Operational modifications ___ **Post-combustion Control Methods** Selective Catalytic Reduction ___ Selective Non-catalytic Reduction ___	**Combustion Control Methods** Air staging ___ Fuel staging ___ Operational modifications ___ **Post-combustion Control Methods** Selective Catalytic Reduction ___ Selective Non-catalytic Reduction ___
Particulate Control	Cold Electrostatic Precipitator Hot Electrostatic Precipitator Fabric Filter (baghouse) Mechanical Collector	Cold Electrostatic Precipitator ___ Hot Electrostatic Precipitator ___ Fabric Filter (baghouse) ___ Mechanical Collector ___ Other ____________________ ___	Cold Electrostatic Precipitator ___ Hot Electrostatic Precipitator ___ Fabric Filter (baghouse) ___ Mechanical Collector ___ Other ____________________ ___

COMPARISON MATRIX & QUESTIONNAIRE			
PARAMETER	**UTILITY CONVENTIONAL**	**NON-UTILITY CONVENTIONAL**	**FLUIDIZED BED COMBUSTION**
Ash Transportation From Collection Point To Storage/Disposal	**<u>Fly Ash</u>** **Dry: ___Mechanical ___ Pneumatic** **Wet (Sluice) ____** **<u>Bottom Ash/Boiler Slag</u>** **Dry: ___Mechanical ___ Pneumatic** **Wet (Sluice) ____** **Is the same system used for fly ash & bottom ash/boiler slag?** **___ Yes ___ No** **If ash is transported by dry systems, is the ash conditioned (water added) for disposal? _____ Yes ____ No**	**<u>Fly Ash</u>** **Dry: ___Mechanical ___ Pneumatic** **Wet (Sluice) ____** **<u>Bottom Ash/Boiler Slag</u>** **Dry: ___Mechanical ___ Pneumatic** **Wet (Sluice) ____** **Is the same system used for fly ash & bottom ash/boiler slag?** **___ Yes ___ No** **If ash is transported by dry systems, is the ash conditioned (water added) for disposal? _____ Yes ____ No**	**<u>Fly Ash</u>** **Dry: ___Mechanical ___ Pneumatic** **Wet (Sluice) ____** **<u>Bottom Ash/Bed Ash</u>** **Dry: ___Mechanical ___ Pneumatic** **Wet (Sluice) ____** **Is the same system used for fly ash & bottom ash/boiler slag?** **___ Yes ___ No** **If ash is transported by dry systems, is the ash conditioned (water added) for disposal? _____ Yes ____ No**

COMPARISON MATRIX & QUESTIONNAIRE			
PARAMETER	**UTILITY CONVENTIONAL**	**NON-UTILITY CONVENTIONAL**	**FLUIDIZED BED COMBUSTION**
High Volume Combustion Product Management Techniques	**Is Bottom Ash/Boiler Slag Managed by same techniques as Fly Ash? ____ Yes ____ No If no, please place a BA in space provided in the listing under <u>Fly Ash</u> for the management practices used. If yes, are Fly Ash and Bottom Ash/Boiler Slag managed in the same facility? ____ Yes ____ No Is the FGD Waste managed by same techniques as Fly Ash? ____ Yes ____ No If no, please place a FGD in space provided in the listing under <u>Fly Ash</u> for the management practices used. If yes, are Fly Ash and FGD waste managed in the same facility? ____ Yes ____ No If yes, are Fly Ash , Bottom Ash/Boiler Slag and FGD waste managed in the same facility? ____ Yes ____ No**	**Is Bottom Ash/Boiler Slag managed by same techniques as Fly Ash? ____ Yes ____ No If no, please place a BA in space provided in the listing under <u>Fly Ash</u> for the management practices used. If yes, are Fly Ash and Bottom Ash/Boiler Slag managed in the same facility? ____ Yes ____ No Is the FGD Waste managed by same techniques as Fly Ash? ____ Yes ____ No If no, please place a FGD in space provided in the listing under <u>Fly Ash</u> for the management practices used. If yes, are Fly Ash and FGD waste managed in the same facility? ____ Yes ____ No If yes, are Fly Ash , Bottom Ash/Boiler Slag and FGD waste managed in the same facility? ____ Yes ____ No**	**Is Bottom Ash/Bed Ash managed by same techniques as Fly Ash? ____ Yes ____ No If no, please place a BA in space provided in the listing under <u>Fly Ash</u> for the management practices used. If yes, are Fly Ash and Bottom Ash/Bed Ash managed in the same facility? ____ Yes ____ No**

COMPARISON MATRIX & QUESTIONNAIRE			
PARAMETER	**UTILITY CONVENTIONAL**	**NON-UTILITY CONVENTIONAL**	**FLUIDIZED BED COMBUSTION**
High Volume Combustion Byproduct Management Techniques continued	**Fly Ash** **Unlined utility controlled landfill with other company generated wastes ____** **Lined utility controlled landfill with other company generated wastes ____** **Unlined utility controlled landfill without other company generated wastes ____** **Lined utility controlled landfill without other company generated wastes ____** **Commercial landfill for "special" or hazardous waste ____** **Commercial landfill municipal or general solid waste ____** **Unlined utility controlled impoundment with other company generated wastes ____** **Lined utility controlled impoundment with other company generated wastes ____** **Unlined utility controlled impoundment without other company**	**Fly Ash** **Unlined company controlled landfill with other company generated wastes ____** **Lined company controlled landfill with other company generated wastes ____** **Unlined company controlled landfill without other company generated wastes ____** **Lined company controlled landfill without other company generated wastes ____** **Commercial landfill for "special" or hazardous waste ____** **Commercial landfill municipal or general solid waste ____** **Unlined company controlled impoundment with other company generated wastes ____** **Lined company controlled impoundment with other company generated wastes ____** **Unlined company controlled**	**Fly Ash** **Unlined company controlled landfill with other company generated wastes ____** **Lined company controlled landfill with other company generated wastes ____** **Unlined company controlled landfill without other company generated wastes ____** **Lined company controlled landfill without other company generated wastes ____** **Commercial landfill for "special" or hazardous waste ____** **Commercial landfill municipal or general solid waste ____** **Unlined company controlled impoundment with other company generated wastes ____** **Lined company controlled impoundment with other company generated wastes ____** **Unlined company controlled impoundment without other company generated wastes ____**

COMPARISON MATRIX & QUESTIONNAIRE			
PARAMETER	**UTILITY CONVENTIONAL**	**NON-UTILITY CONVENTIONAL**	**FLUIDIZED BED COMBUSTION**
High Volume Combustion Byproduct Management Techniques continued	**<u>Fly Ash - continued</u>** **Lined utility controlled impoundment <u>without</u> other company generated wastes ____** **Return to coal mine ____** **<u>Beneficial Use</u>** **Cement/concrete ____** **Flowable fill ____** **Structural fill ____** **Roadbase/subbase ____** **Mineral filler ____** **Snow & ice control ____** **Blasting grit/roofing ____** **Wallboard ____** **Waste stabilization ____** **Agriculture ____** **Misc./other __________ ____** **Other _________________ ____**	**<u>Fly Ash - continued</u>** **Lined company controlled impoundment <u>without</u> other company generated wastes ____** **Return to coal mine ____** **<u>Beneficial Use</u>** **Cement/concrete ____** **Flowable fill ____** **Structural fill ____** **Roadbase/subbase ____** **Mineral filler ____** **Snow & ice control ____** **Blasting grit/roofing ____** **Wallboard ____** **Waste stabilization ____** **Agriculture ____** **Misc./other __________ ____** **Other _________________ ____**	**<u>Fly Ash - continued</u>** **Lined company controlled impoundment <u>without</u> other company generated wastes ____** **Return to coal mine ____** **<u>Beneficial use</u>** **Cement/concrete ____** **Flowable fill ____** **Structural fill ____** **Roadbase/subbase ____** **Mineral filler ____** **Snow & ice control ____** **Blasting grit/roofing ____** **Wallboard ____** **Waste stabilization ____** **Agriculture ____** **Misc./other ___________ ____** **Other __________________ ____**

COMPARISON MATRIX & QUESTIONNAIRE			
PARAMETER	**UTILITY CONVENTIONAL**	**NON-UTILITY CONVENTIONAL**	**FLUIDIZED BED COMBUSTION**
Low Volume Combustion Byproduct Management Techniques	**Separately managed under RCRA subtitle C or D, NPDES or other state & federal programs ____ One or more co-managed with High Volume Wastes (HVW) ____ <u>Low Volume Wastes Co-Managed w/ HVW by facility</u> Cooling tower blowdown ____ Boiler blowdown ____ Boiler cleaning chemical waste ____ Demineralizer regenerant/rinses ____ Coal storage pile runoff ____ General site runoff ____ Pyrites ____ Coal mill rejects/pyrites ____ Plant service water ____ Non-contact cooling water ____ Wastewater treatment sludges/residuals ____ Contaminated & dredged soils ____ Floor drains & sumps ____ Air preheater & precipitator wash waste ____ Laboratory wastes ____ Water treatment wastes ____**	**Separately managed under RCRA subtitle C or D, NPDES or other state & federal programs ____ One or more co-managed with High Volume Wastes (HVW) ____ <u>Low Volume Wastes Co-Managed w/ HVW by facility</u> Cooling tower blowdown ____ Boiler blowdown ____ Boiler cleaning chemical waste ____ Demineralizer regenerant/rinses ____ Coal storage pile runoff ____ General site runoff ____ Pyrites ____ Coal mill rejects/pyrites ____ Plant service water ____ Non-contact cooling water ____ Wastewater treatment sludges/residuals ____ Contaminated & dredged soils ____**	**Separately managed under RCRA subtitle C or D, NPDES or other state & federal programs ____ One or more co-managed with High Volume Wastes (HVW) ____ <u>Low Volume Wastes Co-Managed w/ HVW by facility</u> Cooling tower blowdown ____ Boiler blowdown ____ Boiler cleaning chemical waste ____ Demineralizer regenerant/rinses ____ Coal storage pile runoff ____ General site runoff ____ Pyrites ____ Coal mill rejects/pyrites ____ Plant service water ____ Non-contact cooling water ____ Wastewater treatment sludges/residuals ____ Contaminated & dredged soils ____ Floor drains & sumps ____ Air preheater & precipitator wash waste ____ Laboratory wastes ____ Water treatment wastes ____ Domestic/municipal wastes ____**

COMPARISON MATRIX & QUESTIONNAIRE			
PARAMETER	**UTILITY CONVENTIONAL**	**NON-UTILITY CONVENTIONAL**	**FLUIDIZED BED COMBUSTION**
Boiler Cleaning Waste Generation	**Fire-side/gas-side cleaning** **Wash frequency:** **___ months;** **___ year(s); or,** **other ______________________** **Volume of waste per cleaning** **_____________ gallons** **Water-side cleaning** **Chemical cleaning frequency:** **____ months;** **___ year(s); or,** **other ____________________** **Volume of waste per cleaning:** **____________ gallons**	**Fire-side/gas-side cleaning** **Wash frequency:** **___ months;** **___ year(s); or,** **other ______________________** **Volume of waste per cleaning** **____________ gallons** **Water-side cleaning** **Chemical cleaning frequency:** **____ months;** **___ year(s); or,** **other ____________________** **Volume of waste per cleaning:** **____________ gallons**	**Fire-side/gas-side cleaning** **Wash frequency:** **___ months;** **___ year(s); or,** **other ______________________** **Volume of waste per cleaning** **____________ gallons** **Water-side cleaning** **Chemical cleaning frequency:** **____ months;** **___ year(s); or,** **other ____________________** **Volume of waste per cleaning:** **____________ gallons**

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APPENDIX D

BOILER INPUT FORMATION AND PROCESSING

APPENDIX D

BOILER INPUT FORMATION AND PROCESSING

Coal

How is coal formed?

"Coal is formed from plants by chemical and geological processes which occur over millions of years. Layers of plant debris are deposited in wet or swampy regions under conditions which prevent exposure to air and complete decay as the debris accumulates. Bacterial action, pressure and temperature act on the organic matter over time to form coal. The geochemical process that transforms plant debris to coal is called coalification. The first product of this process, peat, often contains partially decomposed stems, twigs, bark and is not classified as coal. However, peat is progressively transformed to lignite, the lowest grade or "rank" of coal, which eventually can become anthracite, the highest grade or rank of coal, given the proper progression of geological changes."[40]

"The coal fields were formed from ancient peat swamps which were subjected to intense heat and pressure for millions of years. The temperature and pressure were accomplished by the deposition of rocks and soils from the area around the swamps as the swamps subsided. The subsidences were formed at depths of up to 7,000 meters where a temperature of 200º C and a pressure of 1,500 kg/cm^2 can occur. The degree of coalification depends on the temperature and pressure to which the swamp was subjected. Catastrophic earth movements which formed the mountains probably formed many of the coal fields.

[40]*Steam its generation and use 40th edition*, Babcock & Wilcox, a McDermott company, Edited by S.C. Stultz and J.B. Kitto, Barberton, OH, 1992, Chapter 8, Pg. 8-3.

The major elemental components of coal are carbon, hydrogen, oxygen, nitrogen, and sulfur. Empirical formulas have been found to range from $C_{75}H_{140}O_{56}N_2S$ for a low grade peat to $C_{240}H_{90}O_4NS$ for a high grade anthracite coal. These formulas exclude the ash content of the coals, which ranges from 3 percent to 30 percent. The variations in the coal formulas and in the ash content can be attributed to the conditions under which the coalification of peat swamps occurred.

Organic constituents of coal are derived from the decay of plant material, which consists of vitrinite (the wood parts), sporinite (the waxy coating of spores and pollen), fusinite (charcoal from forests fires), and micrinite (origin unknown). Inorganic constituents are derived from the earth's crustal formations which surround the peat swamps.

Inorganic chemical constituents of coal can be separated into three major categories with respect to their relative concentrations in the coal. The grouping includes major constituents (greater than 1 percent), minor constituents (generally, 0.1 percent to 1 percent), and trace constituents (less than 0.1 percent).

The components of peat have a large potential for trapping many elements; however, the actual concentrations of trace elements in coal are highly variable and are, in fact, quite low in some parts of a swamp. For example, suppose the peat swamp was located in a basin surrounded by hills. The rocks in the hills were eroded over time by natural processes. During this process, trace elements were released along with chemically altered mineral grains and washed by rain and streams down into the basin. Heavy inorganic metals tended to be trapped in the margins of the swamp. The center of the coal seam

formed from that swamp then tended to contain lower concentrations of trace elements."[41]

"Coal is very heterogeneous and can vary in chemical composition by location. In addition to the major organic ingredients (carbon, hydrogen and oxygen) coal also contains impurities. The impurities that are of major concern are ash and sulfur."[42]

Ash

"Ash is the non-combustible residue after complete combustion of the coal. It is composed of the oxides formed from the mineral constituents of coal. However, these minerals may be present in two forms in coal: as visible impurities, or as minute impurities so finely divided and so intimately mixed that they may be considered a part of the coal structure.

The ash results from mineral or inorganic material introduced during coalification. Ash sources include inorganic substances, such as silica, which are part of the chemical structure of the plants. Dissolved inorganic ions and mineral grains found in swampy water are also captured by the organic matter during early coalification. Mud, scale and pyrite are deposited in pores and cracks of the coal seams and contribute to the ash content."[43]

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[41]Characterization of Ash from Coal-Fired Power Plants, Tennessee Valley Authority, Chattanooga Power Research Staff, Prepared for Industrial Environmental Research Lab, 1977, Section 5, pp. 11 and 15.

[42]S.C. Stultz and J.B. Kitto, 1992, op cit., Pg. 8-3.

[43]Combustion Fossil Power Systems, A Reference Book on Fuel Burning and Steam Generation, Third Edition, Combustion Engineering, Inc., Joseph G. Singer, Editor, Windsor, CT, 1981, Chapter 2, Pg. 2-11.

Sulfur

Sulfur occurs in coal in three forms: 1) organic sulfur, which is part of the coal's molecular structure, 2) pyritic sulfur, which occurs as the mineral pyrite, and 3) sulfate sulfur, primarily from iron sulfate. The principal sulfur source is the sulfate ion, which is found in water. Fresh water has a low sulfate concentration while salt water has a high sulfate content. Therefore, bituminous coal, deposited in the interior of the U.S. when seas covered this region, are high in sulfur. Some Iowa coals contain as much as 8 percent sulfur."[44] Many of the coal deposits in the western states such as Wyoming and Montana contain less than 1 percent sulfur which is indicative of coal formation in a freshwater environment.

How is coal classified?

Before discussing the various types of coal it is useful to know something about the system used to classify the various types of coal that has been established by the American Society for Testing and Materials (ASTM). The ASTM classification is a system which uses the volatile matter (VM) and fixed carbon (FC) results determined by chemical analysis of the coal as a ranking criteria.

> **"Volatile matter is that portion which, exclusive or water vapor, is driven off in gas or vapor form when the coal is subjected to a standardized temperature test. It consists of hydrocarbons and other gases resulting from distillation and decomposition."[45]**

[44]S.C. Stultz and J.B. Kitto, 1992, op cit., Chapter 8, Pg. 8-3.
[45]Joseph G. Singer, 1981, op cit., Chapter 2, Pg. 2-10.

> **"The fixed carbon is the combustible residue left after driving off the volatile matter. It is not all carbon, and its form and hardness are an indication of the coking properties of a coal, and therefore, a guide in the choice of fuel-firing equipment in general, the fixed carbon represents that portion of the fuel that must be burned in solid state."[46]**

The ASTM system used to classify coals by rank is provided in Exhibit 1. Exhibit 2 provides the ranking of seventeen selected U.S. coals, arranged in order of the ASTM classification.

What are the various types of coal?

"*Peat*. Peat, the first product in the formation of coal, is a heterogeneous material consisting of partially decomposed plant and mineral matter. Its color ranges from yellow to brownish black, depending on its geologic age. Peat has a moisture content up to 70% and a heating value as low as 3,000 Btu/lb (6,978 kJ/kg).

***Lignite*. Lignite is the lowest rank coal. Lignites are relatively soft and brown to black in color with heating values of less than 8,300 Btu/lb (19,306 kJ/kg). The deposits are geologically young and can contain recognizable remains of plant debris. The moisture content of lignites is as high as 30% but the volatile content is also high; consequently, they ignite easily. Lignite coal dries when exposed to air and spontaneous combustion during storage is a concern. Long distance shipment of**

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[46]Ibid., Pg. 2-11.

EXHIBIT 1[a]

CLASSIFICATION OF COALS BY RANK[b] (ASTM D 388)

Class	Group	Fixed Carbon Limits, % (Dry Mineral-Matter-Free Basis)		Volatile Matter Limits % (Dry, Mineral-Matter-Free Basis)		Calorific Value Limits, Btu/lb (Moist,[c] Mineral-Matter-Free Basis)		Agglomerating Character
		Equal or Greater Than	Less Than	Greater Than	Less Than	Equal or Greater Than	Equal or Less Than	
I. Anthracitic	1. Meta-anthracite	98	-	-	2	-	-	Non agglomerating
	2. Anthracite	92	98	2	8	-	-	
	3. Semianthracite [d]	86	92	8	14	-	-	
II. Bituminous	1. Low volatile bituminous coal	78	86	14	22	-	-	Commonly agglomerating
	2. Medium volatile bituminous coal	69	78	22	31	-	-	
	3. High volatile A bituminous coal	-	69	31	-	14,000	-	
	4. High volatile B bituminous coal	-	-	-	-	13,000	14,000	
	5. High volatile C bituminous coal	-	-	-	-	11,500	13,000	
						10,500[d]	11,500	Agglomerating
III. Subbituminous	1. Subbituminous A coal	-	-	-	-	10,500	11,500	Non-agglomerating
	2. Subbituminous B coal	-	-	-	-	9,500	10,500	
	3. Subbituminous C coal	-	-	-	-	8,300	9,500	
IV. Lignitic	1. Lignite A	-	-	-	-	6,300	8,300	
	2. Lignite B	-	-	-	-	-	6,300	

[a] Steam its generation and use 40th edition, Babcock & Wilcox, a McDermott company, Edited by S.C. Stultz and J.B. Kitto, Barberton, OH, 1992, Chapter 8, Pg. 8-5.

[b] This classification does not include a few coals, principally non-banded varieties, which have unusual physical and chemical properties and which come within the limits of fixed carbon or calorific value of the high volatile bituminous and Subbituminous ranks. All of these coals either contain less that 48% dry, mineral-matter-free Btu/lb.

[c] Moist refers to coal containing its natural inherent moisture but not including visible water on the surface of the coal.

[d] If agglomerating, classified in low volatile group of the bituminous class.

[e] Coals having 69% or more fixed carbon on the dry, mineral-matter-free basis shall be classified according to fixed carbon, regardless of the calorific value.

[f] It is recognized that there may be non-agglomerating varieties in these groups of the bituminous class, and there are notable exceptions in high volatile C bituminous group.

EXHIBIT 2[a]

SEVENTEEN SELECTED U.S. COALS ARRANGED IN ORDER OF ASTM CLASSIFICATION

	Coal Rank		Coal Analysis, Bed Moisture Basis					Rank	Rank			
No.	Class	Group	State	County	M	VM	FC	A	S	Btu	FC	Btu
1	I	1	PA	Schuylkill	4.5	1.7	84.1	9.7	0.77	12,745	99.2	14,280
2	I	2	PA	Lackawanna	2.5	6.2	79.4	11.9	0.60	12,925	94.1	14,880
3	I	3	VA	Montgomery	2.0	10.6	67.2	20.2	0.62	11,925	88.7	15,340
4	II	1	WVA	McDowell	1.0	16.6	77.3	5.1	0.74	14,715	82.8	15,600
5	II	1	PA	Cambria	1.3	17.5	70.9	10.3	1.68	13,800	81.3	15,595
6	II	2	PA	Somerset	1.5	20.8	67.5	10.2	1.68	13,720	77.5	15,485
7	II	2	PA	Indiana	1.5	23.4	64.9	10.2	2.20	13,800	74.5	15,580
8	II	3	PA	Westmoreland	1.5	30.7	56.6	11.2	1.82	13,325	65.8	15,230
9	II	3	KY	Pike	2.5	36.7	57.5	3.3	0.70	14,480	61.3	15,040
10	II	3	OH	Belmont	3.6	40.0	47.3	9.1	4.00	12,850	55.4	14,380
11	II	4	IL	Williamson	5.8	36.2	46.3	11.7	2.70	11,910	57.3	13,710
12	II	4	UT	Emery	5.2	38.2	50.2	6.4	0.90	12,600	57.3	13,560
13	II	5	IL	Vermilion	12.2	38.8	40.0	9.0	3.20	11,340	51.8	12.630
14	III	1	MT	Musselshell	14.1	32.2	46.7	7.0	0.43	11.140	59.0	12,075
15	III	2	WY	Sheridan	25.0	30.5	40.8	3.7	0.30	9,345	57.5	9,745
16	III	3	WY	Campbell	31.0	31.4	32.8	4.8	0.55	8,320	51.5	8,790
17	IV	1	ND	Mercer	37.0	26.6	32.2	4.2	0.40	7,255	55.2	7,610

[a] Steam its generation and use 40th edition, Babcock & Wilcox, a McDermott company, Edited by S.C. Stultz and J.B. Kitto, Barberton, OH, 1992, Chapter 8, Pp.. 8-6.

Notes:

For definition of Rank Classification according to ASTM requirements, see Exhibit 4-1.

Data on Coal (Bed Moisture Basis)

M = equilibrium moisture, %; VM = volatile matter, %; Rank FC=dry, mineral-matter-free fixed carbon, %; FC = fixed carbon, %; A = ash, %; S = sulfur, %; Rank Btu = moist, mineral-matter-free Btu/lb; Btu = Btu/lb, high heating value.

Calculations by Parr formulas.

these coals is usually not economical because of their high moisture and low Btu contents. The largest lignite deposit in the world spreads over the regions of North and South Dakota, Wyoming, and Montana in the U.S. and parts of Saskatchewan and Manitoba in Canada.

Subbituminous. Subbituminous coals are black, having little of the plant like texture and none of the brown color associated with the lower rank lignite coal. Subbituminous coals are noncoking (i.e. undergo little swelling upon heating) and have a relatively high moisture content which averages from 15 to 30%. They also display a tendency toward spontaneous

combustion when drying. Although they are high in volatile matter content and ignite easily, subbituminous coals generally have less ash and are cleaner burning than lignite coals.

Subbituminous coals in the U.S. in general have a very low sulfur content, often less than 1 percent. Because they have reasonably high heating values [8,300 to 11,500 Btu/lb (19,306 to 26,749 kJ/kg)] and low sulfur content, switching to subbituminous coal has become an attractive option for many power plants to limit SO_2 emissions.

***Bituminous*. Bituminous coal is the rank most commonly burned in electric utility and non-utility boilers. In general, it appears black with banded layers of glossy and dull black. Typical bituminous coals have heating values of 10,500 to 14,000 Btu/lb (24,423 to 36,053 kJ/kg) and a fixed carbon content of 69 to 86%. The heating value is higher but moisture and volatile content are lower than the subbituminous and lignite coals. Bituminous coals rarely experience spontaneous combustion in storage. Furthermore, the high heating value and fairly high volatile content enable bituminous coals to burn easily when pulverized to a fine powder. Some types of bituminous coal, when heated in the absence of air, soften and release volatiles to form the porous, hard, black product known as *coke.* Coke is used as fuel in blast furnaces to make iron.**

***Anthracite*. Anthracite, the highest rank of coal, is shiny black, hard and brittle, with little appearance of layers. It has the highest content of fixed carbon, 86 to 98%. However, its low volatile content makes it a slow burning fuel. Most anthraciteshave a very low moisture content of about 3% and heating values of 15,000 Btu/lb (34,890 kJ/kg) which are slightly above the best quality bituminous coals. Anthracite is low in sulfur and volatiles and burns with a hot, clean flame. These qualities make it a premium fuel used mostly for domestic heating."[47]**

How is coal mined?

"Underground mining systems utilize either *conventional* or *continuous* methods. Conventional methods are those that involve the use of separate equipment units to execute successive operations by cutting, drilling, blasting, and loading operations, in a multiple number of interconnected parallel entries. Continuous systems may be divided into those that involve boring, ripping or auger-type continuous miners working in a discrete number of individual locations or interconnected entries; and those that involve continuous *longwall* shearing or planing machines that extract coal from a single mining face of significant length. Continuous miners and longwall units incorporate the separate operations that are involved with conventional equipment units in a single operation. Both conventional and continuous methods involve the use of intermediate and final haulage systems for subsequent transport of the broken coal to the surface.

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[47]S.C. Stultz and J.B. Kitto, 1992, op cit., Pp. 8-6 through 8-7.

Surface mining systems may be subdivided into four major methods: contour mining, mountaintop removal, area mining, and open pit mining. Contour mining involves the removal of overburden material by the excavation of a pit of significant length and limited width, along the coal outcrop as defined by the intersection of a nearly horizontal coal seam and a moderate or steeply dipping land surface. Mountaintop removal, on the other hand, involves the complete removal of the total volume of material overlying an extensive seam area, as defined by the closed outcrop elevation contour of a relatively flat seam and the enclosing moderate or steeply dipping terrain. Both contour stripping and mountaintop removal are used for the mining of seams that occur above drainage. While contour mining and mountaintop removal are both utilized in mountainous terrain, the contour method removes only a narrow band of overburden along the outcrop elevation and leaves a "highwall" at the pit limits that must be returned to original contour, while mountaintop removal removes all of the material overlying the total seam area with only a relatively flat surface to be reclaimed.

Area mining denotes the use of surface excavation equipment in relatively flat or gently sloping terrain to expose a coal seam lying below drainage, by successive excavation of a series of parallel pits of considerable length and moderate width and depth. The overburden material from the pit being mined is placed into the previously excavated adjacent pit by the excavating equipment. Open pit mining, while also normally used to recover seams occurring below drainage, involves the use of surface excavators to remove that volume of overburden necessary to expose variously oriented seams, with subsequent transport of the overlying material by mobile haulage units for temporary or permanent disposal in fills and/or other open pit areas as the pit develops. Both methods require returning the area to the approximate original contour by grading operations prior to the completion of required reclamation measures."[48]

Why is coal cleaning necessary?

"The demand for coal cleaning has increased in response to environmental regulations restricting sulfur dioxide (SO_2) emissions from coal-fired boilers. The demand is also due to a gradual reduction in run-of-mine coal quality as higher quality seams are depleted and continuous mining machines are used to increase production. Approximately 70% of coal mined for electric utility use is cleaned in some way. A significant portion of the coal used by industrial plants, coke and gas plants and exporters is also cleaned.

Coal cleaning and preparation cover a broad range of intensity, from a combination of initial size reduction, screening to remove foreign material, and sizing discussed previously, to more extensive processing to remove additional ash, sulfur and moisture more intimately associated with coal.

[48]Coal Preparation 5th edition, AIME, Edited by Joseph W. Leonard, III and Byron C. Hardinge, Littleton, CO, 1991 Chapter 4, Pp.. 155-156.

The potential benefits of coal cleaning must be balanced against the associated costs. The major costs to consider, in addition to the cleaning plant capital and operating costs, include the value of the coal lost to the refuse product through process related inefficiencies and the cost of disposing the refuse product. Generally, the quantity of coal lost increases with the degree of desired ash and sulfur reduction. Economic optimum levels of ash and sulfur reduction can be established by balancing shipping and postcombustion cleanup costs against precombustion coal cleaning costs."[49]

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[49]S.C. Stultz and J.B. Kitto. 1992, op cit., Pg. 11-4.

What processes are used to clean coal?

"The initial steps in the coal cleaning process include removal of trash, crushing the run-of-mine coal and screening for size segregation. After the raw run-of-mine coal is crushed and properly sized so that it can be more efficiently cleaned, one or more of the following operations are then used to produce and dewater a reduced ash and sulfur product.

***Gravity*. Concentration by specific gravity and the subsequent separation into multiple products is the most common means of mechanical coal cleaning. Concentration is achieved because heavier particles settle farther and faster than lighter particles of the same size in a fluid medium. Coal and impurities may be segregated by their inherent differences in specific gravity, as indicated in Exhibit 3.**

EXHIBIT 3

TYPICAL SPECIFIC GRAVITIES OF COAL AND RELATED IMPURITIES

Material	Specific Gravity
Bituminous coal	1.10 to 1.35
Bone coal	1.35 to 1.70
Carbonaceous shale	1.60 to 2.20
Shale	2.00 to 2.60
Clay	1.80 to 2.20
Pyrite	8.80 to 5.20

The fluid separating medium may consist of a suspension of raw coal in water or air, a mixture of sand and water, slurry of finely ground magnetite or an organic liquid with an intermediate specific gravity. Aqueous slurries of raw coal and magnetite are currently the most common separating media.

If the effective separating specific gravity of the media is 1.5, particles with a lower specific gravity are concentrated in the clean coal product and heavier particles are in the reject or refuse produce. Several factors prevent ideal separation in practice.

Gravity separation processes concentrate particles by mass. The mass of a particle is determined by its specific gravity and particle size. Raw coal consists of particles representing a continuous distribution of specific gravities and sizes. It is quite possible for a larger, less dense particle to behave similarly to a smaller particle with a higher specific gravity. For example, a relatively smaller pyrite particle may settle at similar rate as a larger coal particle. The existence of *equal settling* particles can lead to separating process inefficiency. Fine pyrite in the clean coal product and coarse coal in the refuse are commonly referred to as *misplaced material.* The amount of misplaced material is determined by the quantity and distribution

of the raw coal impurities, the specific gravity of separation, and the physical separation efficiency of the segregated material.

A significant amount of material with a specific gravity close to the desired specific gravity of separation results in a more inefficient separation. If the amount of *near gravity material* exceeds approximately 15 to 20% of the total raw coal, efficient gravity separation is difficult.

The most common wet gravity concentration techniques include jigging, tabling and dense media processes. Each technique offers technical and economic advantages.

***Jigging*. In a coal jig, a pulsating current of water is pushed upward in a regular, periodic cycle through a bed of raw coal supported on a screen plate. This upward or pulsion stroke of the cycle causes the bed to expand into a suspension of individual coal and refuse particles. The particles are free to move and generally separate by specific gravity and size, with the lighter and smaller pieces of coal moving to the upper region of the expanded bed. In the downward or suction stroke of the cycle, the bed collapses and the separation is enhanced as the larger and heavier pieces of rock settle faster than the coal. The pulsion/suction cycle is repeated continuously. The separated layers are split at the discharge end of the jig to form a clean coal and a refuse product. The bed depth at which the cut is made determines the effective specific gravity of separation.**

The upward water pulsating can be induced by using a diaphragm or by the controlled release of compressed air in a adjacent compartment. This type of jig may be used to process a wide feed size range. Typically, the specific gravity of separation ranges from 1.4 to 1.8. The separation efficiency may be enhanced by pre-screening the feed to remove the fines for separate processing.

***Tabling*. A concentrating, pitched table is mounted so that it may be oscillated at a variable frequency and amplitude. A slurry of coal and water is continuously fed to the top of the table and is washed across it by the on-coming feed. Diagonal bars, or *riffles*, are spaced perpendicular to the flow of particles. The coal-water mixture and oscillating motion of the table create a *hindered settling* environment in which the lower gravity particles rise to the surface. Higher specific gravity particles are caught behind the riffles and transported to the edge of the table, away from the clean coal discharge.**

Tables are generally used to treat 0.375 in. x 0 (9.53mm x 0) coal. Three or four tables may be stacked vertically to increase throughput while minimizing plant floor space requirements.

***Dense media separation*. In dense or heavy media separation processes, the raw coal is immersed in a fluid with a specific gravity between that of the coal and the refuse. The specific gravity differences cause the coal and refuse to migrate to opposite regions in the separation vessel. In coal preparation, the heavy media fluid is usually an aqueous suspension of the fine magnetite in water.**

***Flotation*. Coal and refuse separation by *froth flotation* is accomplished by exploiting difference in coal and mineral matter surface properties rather than specific gravities. Air bubbles are passed through a suspension of coal and mineral matter in water, which is agitated to prevent particles from settling out. Air bubbles preferentially attach to the coal surfaces which are generally more hydrophobic, or difficult to wet. The coal then rises to the surface where it is concentrated in a froth on top of the water. The mineral matter remains dispersed. Chemical reagents, referred to a collectors and frothers, are added to enhance the selective attachment of the air bubbles to the coal and to permit a stable froth to form.**

Flotation is generally used for cleaning coal finer than 48 mesh (300 microns). The efficiency of the process can be enhanced by carefully selecting the type and quantity of reagents, fine grinding to generate discrete coal and refuse particles, and generating fine air bubbles.

***Dry processing*. Dry coal preparation processes account for a small percentage of the total coal cleaned in the U.S. In general, pneumatic processing is only applied to coal less than 0.5 in. (12.7 mm) in size with low surface moisture.**

***Dewatering*. Dewatering is a key step in the preparation of coal. Reducing the fuel's moisture content increased its heating value per unit weight. Because coal shipping charges are based on tonnage shipped, a reduction in moisture content results in lower shipping costs per unit heating value.**

Coarse coal, greater than 0.375 in. (9.53mm) particle size, can be sufficiently dewatered using vibrating screens. Intermediate size coal, 0.375 in. (9.53mm) by approximately 28 mesh (600 microns), is normally dewatered on vibrating screens followed by centrifuges.

Fine coal dewatering often involves the use of a thickener to increase the solids content of the feed to a vacuum drum, vacuum disc filter or high gravity centrifuge. The filter cake may be mixed with the coarser size fractions to produce a composite product satisfying the specifications. Fine coal dewatering also services to clarity the water for reuse in the coal preparation plant. Fines must be separated from the recycled water to maximize the efficiency of the separation processes.

Thermal dewatering may be necessary to meet product moisture specifications when the raw coal is cleaned at a fine size to maximize ash and sulfur rejection. The various types of thermal dryers include rotary, cascade, reciprocating screen, suspension and fluidized-bed dryers. Cyclones or bag filters are used to prevent fine dust emissions from the dryer. The collected fine coal may be recycled to support dryer operation. Thermal drying represents an economic tradeoff of reduced product moisture content versus heat required to fire the dryer."[50]

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[50] S.C. Stultz and J.B. Kitto, 1992, op cit., Pp. 11-5 through 11-7.

The coal preparation processes described above that separates clean coal from the as-mined raw coal generates a waste stream known as coal refuse. The coal refuse stream is generically referred to in the coal industry as Culm, Gob and Silt or Slurry depending upon the type of coal being cleaned.

What is Culm?

Culm or anthracite coal refuse is the byproduct of the coal cleaning processes described above that are used to separate anthracite coal from impurities in the coal seam or that are added during the mining process. Culm is a heterogeneous material containing small amounts of: misplaced anthracite coal; bone coal which is anthracite coal with a relatively high percentage of ash; carbonaceous shale, shale, clay and small amounts of pyrite. An excerpt from a publication issued by the Pennsylvania Geologic Survey in 1928 defined culm as follows:

> **"The term culm has evolved in its meaning since the beginning of anthracite mining. In the early days of the industry practically all the coal was prepared dry. The fine-sized material, as well as the sizes which were not marketable at that time, were deposited along with the waste material in huge banks on the breaker property. These banks contain 50 to 80 per cent coal, and some of them have large percentages of steam sizes in them. These banks are known as culm banks. A culm bank is defined as an accumulation of rock, bone, and coal from an old dry breaker."[51]**

What is Gob?

Gob, or bituminous coal refuse, is also a heterogeneous material which contains small amounts of bituminous coal created by the coal cleaning process. Gob contains; misplaced bituminous coal; bone coal which is bituminous coal with a relatively high percentage of ash; carbonaceous shale, shale, clay and pyrites. Gob also tends to contain more sulfur than culm since bituminous coal is inherently higher in sulfur than anthracite coal.

What is Silt?

Anthracite or Bituminous Silt, or Slurry as it is sometimes referred to, is a high ash waste product, usually less than 1/8" in size, generated during the wet gravity concentration techniques used to separate the clean coal product from the high ash reject stream emanating from the coal preparation facility. The silt or slurry because of its high moisture content is usually contained in settling ponds or impoundments.

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[51] Anthracite Culm and Silt, Pennsylvania Geological Survey Fourth Series Bulletin M-12, Commonwealth of Pennsylvania, Department of Internal Affairs, James D. Sisler, Thomas Fraser and Dever C. Ashmead, Harrisburg, PA, 1928, p. 15.

Petroleum Coke

How is petroleum formed?

"Petroleum is formed under the earth's surface by the decomposition of marine organisms. The remains of tiny organisms that live in the sea --and, to a lesser extent, those of land organisms that are carried down to the sea in rivers and of plants that grow on the ocean bottoms --are enmeshed with the fine sands and silts that settle to the bottom in quiet sea basins. Such deposits, which are rich in organic materials, become the source rocks for the generation of crude oil. The process began many million of years ago with the development of abundant life, and it continues to this day. The sediments grow thicker and sink into the sea floor under their own weight. As additional deposits pile up, the pressure on the ones below increase several thousand times, and the temperature rises by several hundred degrees. The mud and sand harden into shale and sandstone; carbonate precipitates and skeletal shells harden into limestone; and the remains of the dead organisms are transformed into crude oil and natural gas.

Once the petroleum forms, it flows upward in the earth's crust because it has a lower density than the brines that saturate the interstices of the shales, sands, and carbonate rocks that constitute the crust of the earth. The crude oil and natural gas rise into the microscopic pores of the coarser sediments lying above. Frequently, the rising material encounters an impermeable shale or dense layer of rock that prevents further migration; the oil has become trapped, and a reservoir of petroleum is formed. A significant amount of upward-migrating oil, however, does not encounter impermeable rock but instead flows out at the surface of the earth or onto the ocean floor. Surface deposits also include lakes and escaping natural gas."[52]

What is thermal cracking and why was it used?

In an effort to increase the yield from distillation, the thermal cracking process was developed. In this process, the heavier portions of the crude oil were heated under pressure and at a higher temperatures. This resulted in the large hydrocarbon molecules being split into smaller ones, so that the yield of gasoline from a barrel of crude oil was increased. The efficiency of the process was limited, however, because at the high temperatures and pressures that were used, a large amount of coke was deposited in the reactors. This in turn required the use of still higher temperatures and pressures to crack the crude oil. A coking process was then invented in which fluids were recirculated; the process ran for a much longer time, with far less buildup of coke."[53]

What is petroleum coke?

[52]"Petroleum," Microsoft (R) Encarta, Copyright © 1994 Microsoft Corporation, Copyright (c), 1994 Funk & Wagnalls Corporation.

[53]Ibid.

"The heavy residuals from petroleum cracking processes are presently used to produce a higher yield of lighter hydrocarbons and a solid residue suitable for fuel. Characteristics of these residues vary widely and depend on the process used. Solid fuels from oil include delayed coke, fluid coke and petroleum pitch. Some selected analyses are given in Exhibit 4.

The delayed coking process uses residual oil that is heated and pumped to a reactor. Coke is deposited in the reactor as a solid mass and is subsequently stripped, mechanically or hydraulically, the form of lumps and granular material. Some cokes are easy to pulverize and burn while others are difficult.

Fluid coke is produced by spraying hot residual feed onto externally heated seed coke in a fluidized bed. The fluid coke is removed as small particles, which are built up in layers. This coke can be pulverized and burned, or it can be burned in a cyclone furnace or in a fluidized bed. All three types of firing require supplemental fuel to aid ignition.

EXHIBIT 4

SELECTED ANALYSES OF SOLID FUELS DERIVED FROM OIL

Analysis (dry basis) % by wt	Delayed Coke		Fluid Coke	
Proximate:				
VM	10.8	9.0	6.0	6.7
FC	88.5	90.0	93.7	93.2
Ash	0.7	0.1	0.3	0.1
Ultimate:				
Sulfur	9.9	1.5	4.7	5.7
Heating value:				
Btu/lb	14,700	15,700	14,160	14,290
(kJ/kg)	(34,192)	(36,518)	(32,936)	(33,239)

The petroleum pitch process is an alternate to the coking process and yields fuels of various characteristics. Melting points vary considerably, and the physical properties vary from soft and gummy to hard and friable. The low melting point pitches may be heated and burned like heavy oil, while those with higher melting points may be pulverized or crushed and burned."[54]

Start-up, Auxiliary and Supplemental Fuels

[54] S.C. Stultz and J.B. Kitto, 1992, op cit., Pp. 8-17 and 8-18.

Optimization of fuel sources to enhance American energy independence is increased with FBC technology. An inherent capability of FBC is fuel flexibility. The material inventory comprising the "bed" provides a tremendously large, relatively hot, moving surface area that, via abrasion, exposes and allows even the smallest amounts of combustible materials to burn. In a very few cases of extremely high moisture and/or ash content fuels, auxiliary fuel use is required to sustain the combustion process (e.g., various process waste sludges used as a primary fuel). To optimize FBC system capabilities it is important for the systems to be designed for either a specific fuel(s) or for a variety of fuel sources, depending on the plant requirements.

The fuel flexibility of FBC technology provides energy consumers with the option of using fuel sources that are not available with conventional forms of combustion technology, such as stokers and pulverized fuel suspension firing systems. FBC also provides an environmentally benign alternative means of disposing of waste streams generated as byproducts of other industrial processes or fuel preparation operations (i.e., coal mining waste products such as anthracite culm and bituminous gob, pulp and paper industry waste sludges and waste water treatment/sewage sludges, and tires, to name just a few).

The combination of limestone use and lower combustion temperatures in FBC also appears to have the potential of reducing some air emissions, allowing the consideration of some otherwise unusable fuel sources.

The following is a partial listing of alternative fuels which are currently used in FBC systems or which have been or can be used:

> **Biomass (agricultural wastes such as orchard pruning, rice hulls, cotton wastes, coffee grounds, tobacco stems, bagasse, chick litter and cow manure, wood wastes from construction, saw mills, pulping and de-barking operations)**
>
> **Coal and coal mining waste products (high sulfur, high ash, low heating value coals, coal mining silts, anthracite culm, bituminous gob)**
>
> **Industrial wastes (waste process materials such as paper and cardboard, waste plastics, coke breeze)**
>
> **Petroleum industry wastes (oil refining wastes such as delayed petroleum coke, fluid coke, sponge coke, heavy oil residuals, pitch and oil shales)**
>
> **Municipal solid waste**

Limestone Characteristics

Sorbents, primarily carbonate rocks and sediments, are used in fluidized-bed combustors for the capture of SO_2 generated during the combustion of a sulfur-bearing fossil fuel. Limestone

and dolostone are the principal carbonate rock types; however, limestone is the preferred carbonate rock type utilized in fluidized-bed combustors because of its higher calcium carbonate content. Unconsolidated carbonate sediment, such as aragonite sand, is used on a more limited basis due to its localized occurrence in the southern United States. Exhibit 5 presents the characteristics of sorbents used by the Special Project Survey respondents.

<u>Formation and Occurrence of Limestone</u>

Carbonate rocks form by the burial and cementation of carbonate sediments. Limestone is comprised predominately of the mineral calcite ($CaCO_3$) whereas dolostone is comprised primarily of the mineral dolomite ($CaMg(CO_3)_2$). The majority of economically important limestone deposits in the United States formed in a relatively shallow marine environment from carbonate sediments which were biological in origin. Carbonate sediments may contain skeletal components (e.g., coral), non-skeletal grains (e.g., ooids), lime mud (e.g., micrite), and non-carbonate impurity minerals (e.g., terrigenous quartz and clay). Carbonate sediments contain calcite and/ or aragonite as the primary

EXHIBIT 5

CHARACTERISTICS OF SORBENTS USED IN FBC BOILERS (SUMMARY)

CaCO3							
Primary Fuel	**Minimum**		**Mean**		**Maximum**		
	MIN	**MAX**	**MIN**	**MAX**	**MIN**	**MAX**	**N**
Coal	73.89	95	38.51	98.5	78.02	99.5	21
Petroleum Coke	89.54	89.54	91.05	91.05	93.04	93.04	1
Waste Coal	42	92.67	45	98.49	48	97.04	12

MgCO3							
Primary Fuel	**Minimum**		**Mean**		**Maximum**		
	MIN	**MAX**	**MIN**	**MAX**	**MIN**	**MAX**	**N**
Coal	0.3	5.46	0.2	16	2	10	17
Petroleum Coke	2.07	2.07	2.25	2.25	2.52	2.52	1
Waste Coal	0.5	54	0.24	56	4.06	58	11

Inert							
Primary Fuel	**Minimum**		**Mean**		**Maximum**		
	MIN	**MAX**	**MIN**	**MAX**	**MIN**	**MAX**	**N**
Coal	1	12.3	1	61.29	10	18.6	15
Petroleum Coke							
Waste Coal	0.31	13	1.31	19.9	3.29	23	9

Moisture							
Primary Fuel	**Minimum**		**Mean**		**Maximum**		
	MIN	**MAX**	**MIN**	**MAX**	**MIN**	**MAX**	**N**
Coal	0.01	0.2	0.06	5	0.18	5	18
Petroleum Coke	0.01	0.01	0.16	0.16	0.31	0.31	1
Waste Coal	0.1	1	0.1	2.5	0.2	5.04	9

mineral phase. Calcite can occur as either a low-magnesium or high-magnesium calcite. The distinction between low-magnesium and high-magnesium calcite is usually drawn at 4 mole % (3.4 wt.%) $MgCO_3$; however, high-magnesium calcite typically ranges between 11 to 19 mole % (9.4 to 16.5 wt.%) $MgCO_3$.[55] Aragonite and high magnesium calcite are eventually converted to low-magnesium calcite as the sediment is lithified into a rock. Dolomite is uncommon in recent carbonate sediments and when it is present, it is of replacement origin. Modern-day analogs of carbonate environments which are used to interpret ancient limestone

[55] Tucker, M. E. and Wright, P. V., 1990, *Carbonate Sedimentology*, Oxford, Blackwell Scientific Publications, 482 p.

sequences include, but are not limited to, the Bahama Platform, South Florida Shelf, Shark Bay of Western Australia, Persian Gulf, Yucatan Peninsula, and the Netherlands Antilles.[56,57,58]

The chemical and physical properties of limestone are affected by the depositional environment in which they formed as well as the post-depositional changes that occurs as the carbonate sediment is transformed into a rock. These post-depositional changes are commonly referred to as diagenesis. Diagenesis includes grain compaction, lithification by void-filling cements, and dissolution and neomorphism (recrystallization) of the original sediment. Physical properties such as crystallinity are affected by the diagenetic process. In addition to diagenetic processes the limestone may be further altered by metamorphic processes as a result of elevated temperature and/or pressure. Metamorphism can convert the limestone into a coarsely crystalline marble, the metamorphic equivalent of limestone.

Chemical Composition of Limestones

The chemical composition of limestones is widely varied. When determining the chemical composition of limestones for fluidized-bed applications, most sorbent suppliers monitor and report the calcium, magnesium, and silica (or insoluble) content. Specifications for the calcium carbonate ($CaCO_3$) content of fluidized-bed sorbents have been relaxed in recent years as fluidized-bed operators attempt to optimize their sorbent consumption and cost. Most fluidized-bed facilities utilize a sorbent with a $CaCO_3$ content greater than 75% by weight (wt.%), while keeping the silica content low in an effort to minimize boiler tube erosion.

Exhibit 6 reports the chemical composition of limestones and dolostones. Exhibit 6 was compiled from several sources.[59,60,61,62] The major/ minor analyses of twenty Pennsylvania

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[56] Ibid.

[57] Wilson, J. L., 1975, *Carbonate Facies in Geologic Time*, New York, Springer-Verlag, 471 p.

[58] Bathurst, R. G., 1975, *Carbonate Sediments and Their Diagenesis*, New York, Elsevier, 658 p.

[59] Morrison, J. L., Romans, D. E., Liu, Y., Hu, N., Pisupati, S. V., Miller, B. G., Miller, S. F. and Scaroni, A. W., 1994, Evaluation of Limestones and Dolostones For Use As Sorbents in Atmospheric Pressure Circulating Fluidized-Bed Combustors, Pennsylvania Energy Development Authority, Final Report PEDAFR 893-4016, 124 p.

[60] Veizer, J., 1983, *Trace Elements and Isotopes in Sedimentary Carbonates*, In: Reeder, R. J., Carbonates: Mineralogy and Chemistry, Mineralogical Society of America, p. 265-300.

[61] Rose, A. W., Hawkes, H. E. and Webb, J. S., 1979, *Geochemistry in Mineral Exploration*, New York, Academic Press, 657 p.

[62] EPA, 1995, Technical Background Document Supporting Proposed Administrative Reporting Exemptions For Certain Release of Radionuclides, 41 p.

sorbents were determined as part of a sorbent evaluation study conducted by The Pennsylvania State University.[63]

[63]Morrison, J. L., Romans, D. E., Liu, Y., Hu, N., Pisupati, S. V., Miller, B. G., Miller, S. F. and Scaroni, A. W., 1994, op cit.

EXHIBIT 6

GENERALIZED CHEMICAL COMPOSITION OF LIMESTONES AND DOLOSTONES

Major/Minor		Trace		Radionuclides	
	wt. %		ppm		pCi/g
CaO	55.7 - 27.8	Hg	0.04	U^{238}	0.099 - <8.25
MgO	0.4 - 21.7	Pb	9	Th^{232}	0.02 - < 2.75
SiO_2	0.7 - 18.9	As	1		
Al_2O_3	0.1 - 4.0	Cr	11		
TiO_2	< 0.03 - 0.2	Co	0.1		
Fe_2O_3	< 0.1 - 2.4	Ni	20		
Na_2O	< 0.02 - 0.4	F	330		
K_2O	0.05 - 2.6	Cl	150		
P_2O_5	< 0.1	Se	0.08 - 0.88		
SO_3	< 0.1 - 0.6	Cd	0.035		
		Sb	0.2 - 0.3		
		Mn	1100		
		Be	Not Measured		
		Ba	10		
		B	20		
		Mo	0.4		
		V	20		
		Cu	4		
		Zn	20		

Major/ Minor analyses reported as wt. % on an oxide basis[a]
Trace element analyses report as ppm[b,c]
Radionuclides reported as pCi/g[d]

[a] **Morrison, J. L., Romans, D. E., Liu, Y., Hu, N., Pisupati, S. V., Miller, B. G., Miller, S. F. and Scaroni, A. W., 1994, op cit.**

[b] **Veizer, J., 1983, op cit.**
[c] **Rose, A. W., Hawkes, H. E. and Webb, J. S., 1979,op cit.**
[d] **EPA, 1995, op cit.**

This study was conducted primarily to determine the effect of chemical composition on SO_2 capture; therefore, a broad compositional range of limestones and dolostones was evaluated. In addition to the major/ minor analyses, the trace elements are reported in Exhibit 6 since the Clean Air Act Amendments of 1990 have identified 13 elements and their compounds, which

are commonly found in coal, as hazardous air pollutants (HAPs).[64] In addition to these specific elements, radionuclides have also been listed as HAPs. These 13 elements and radionuclides, along with barium (Ba), boron (B), molybdenum (Mo), and vanadium (V; as vanadium pentoxide) which are regulated (RCRA, Irrigation Water Standards), and copper (Cu) and zinc (Zn) which have water quality issues associated with them, are currently being assessed for possible future regulation as toxic emissions from coal-fired power plants.[65] Therefore, the concentration of these trace elements and radionuclides for limestones and dolostones are presented since they are cofired with coal.

Limestone Quarrying and Processing

Limestone is an industrial mineral that is considered a high volume, low-value commodity. Most limestone in the United States is mined from open quarries.[66] Underground mining and the dredging of unconsolidated carbonate sediments in the southern United States provide additional sources of limestone for industry and fluidized-bed operators. In surface and underground mines, the bedrock must be drilled and blasted to extract the rock and prepare it for crushing. The blast rock is crushed by primary crushers which reduces the size down to a nominal six-inch top size. To process the limestone into the specified particle size gradation for the fluidized-bed combustor market, the limestone is dried to remove its surface moisture. The limestone can then be reduced in size using pulverizing mills, or a series of screens and crushers used in a closed circuit. Ball mills, roller mills, rod mills, and vertical shaft impactors are examples of fine-grinding mills which are commonly used. The type of processing equipment used is not as important as the ability to arrive at an acceptable particle size gradation for the end user. In most cases, where truck delivery of finished material is most economical, pneumatic tankers are employed in order to reduce fugitive dust emissions in the transfer of material from the delivery vehicle to the storage silo. Where economic factors dictate, raw limestone aggregate is delivered and processed on-site utilizing the same processing equipment as would be found at the quarry site.

Sorbent Properties Which Affect Sorbent Performance

The physical and chemical properties of limestones and dolostones affect the nature of the calcines produced and consequently their sulfation behavior. Sorbent properties which are known to influence sorbent performance include: chemical composition, sulfation

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[64]Miller, S. J., Ness, S. R., Weber, G. F., Erickson, T. A., Hassett, D. J., Hawthorne, S. B., Katrinak, K. A. and Louie, P. K., 1996, A Comprehensive Assessment of Toxic Emissions From Coal-Fired Power Plants: Phase I Results From The U.S. Department of Energy Study, U.S. Department of Energy, Final Report, 165 p.

[65]Ibid.

[66]Carr, D. D., Rooney, L. F. and Freas, R. C., 1994, *Limestone and Dolomite*, In: Carr, D. D., Industrial Minerals and Rocks, Society for Mining, Metallurgy, and Exploration, Inc., p. 605-629.

temperature, particle size, porosity, pore size distribution, surface area, attrition potential, and petrographic variability.[67]

The $CaCO_3$ content of a sorbent is not a significant predictor of sorbent utilization as high calcium utilization can be achieved by lower purity limestones due to the effect of impurities on the pore structure development during calcination.[68] **The calcination rate dominates the overall reaction rate initially, followed by the sulfation rate once a significant amount of CaO had been generated. The faster the calcination rate, the better is the performance of the limestone.**[69]

Studies on sorbent behavior have established that each sorbent has an optimum temperature for sulfation, and that this temperature is residence time dependent.[70] **Sorbent requirement has been shown to be more of a function of operating temperature than chemical composition. Sorbents with $CaCO_3$ contents ranging from 49.6 to 99.4 wt. % were effective in maintaining emissions compliance in a 30 MW(e) fluidized-bed power plant.**[71]

The particle size distribution influences calcium utilization, heat transfer, and the operating stability of the system.[72] **Particle size affects both the residence time and the rates of calcination and sulfation. For instance, in large particles, the nature and extent of porosity is believed to be the controlling factor in the sorbent's sulfation behavior. As the particle size is decreased, porosity becomes less important. As calcination occurs, the porosity of the sorbent increases due to the release of CO_2. Surface area, like porosity, increases with extent of**

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[67]Miller, B. G., Romans, D. E. and Scaroni, A. W., 1990, *Characterization of Limestones For FBC Systems*, In: Proceedings of the Fluidized Bed Boilers-SO_2 Capture Aspects, National Stone Association, Pittsburgh, Pennsylvania, p. 29.

[68]Morrison, J. L., Liu, Y., Romans, D. E., Pisupati, S. V., Scaroni, A. W. and Miller, S. F., 1993, *Evaluation of Sorbent Performance for Atmospheric Circulating Fluidized-Bed Combustor Applications*, In: Proceedings of the SO_2 Capture Seminar "Sorbent Options and Considerations", National Stone Association, Cincinnati, Ohio, p. 8-1 to 8-27.

[69]Haji-Sulaiman, M. Z. and Scaroni, A. W., 1992, *The Rate Limiting Step in the Sulfation of Natural Limestones During Fluidized Bed Coal Combustion*: Fuel Processing Technology, vol. 31, p. 193-208.

[70]Morrison, J. L., Liu, Y., Romans, D. E., Pisupati, S. V., Scaroni, A. W. and Miller, S. F., 1993,op cit.

[71]Morrison, J. L., Romans, D. E., Liu, Y., Hu, N., Pisupati, S. V., Miller, B. G., Miller, S. F. and Scaroni, A. W., 1994, op cit.

[72]Liu, Y. and Scaroni, A. W., 1996, *The Attrition Behavior of Sorbents in Fluidized Bed Combustion: Effect of Grain Structure and Physical Strength*, In: The Proceedings of the Pittsburgh Coal Conference, University of Pittsburgh, Pittsburgh, Pennsylvania, p. 43-48.

calcination. For larger particles, the slow rate of SO_2 diffusion through the product layer limits the extent of sulfation.[73]

Sorbent attrition refers to the decrease in particle size which results from particle-particle collisions, particle-furnace wall collisions, and from thermal degradation. The physical and chemical properties of the sorbent, fluidizing velocity, and fuel ash content influence the rate of sorbent attrition. Attrition can be beneficial if it exposes unreacted CaO surfaces; however, excessive attrition leads to premature removal of unreacted CaO from the system. The optimum rate of attrition is sorbent dependent and has not yet been established. The grain structure and physical strength of the sorbents influence attrition behavior. It has been shown that fine-grained sorbents with a range of chemical compositions have higher physical strength and greater resistance to degradation for both raw and calcined samples than did their coarse-grained counterparts (with respect to $CaCO_3$ content).[74] Abrasion was the principal attrition mechanism for fine-grained sorbents, while there was initial fragmentation for coarse-grained samples. Thermal stress caused fracturing along grain boundaries for coarse-grained samples which, together with the structure changed caused by calcination, resulted in fragmentation. Sulfation showed negligible effect on the behavior of fine-grained samples, but significantly reduced fragmentation of coarse-grained samples.

Variability in petrographic composition can be used to explain variations in sorbent requirement among samples having similar chemical compositions.[75] Hot-stage scanning electron microscopy (SEM) and microprobe analysis of the sulfur distribution of sulfated particles produced in a laboratory-scale fluidized-bed reactor showed that certain sorbents developed thermally-induced fractures (TIFs), while others with comparable $CaCO_3$ contents did not.[76,77,78,79] The TIFs promoted SO_2 diffusion into the particle and, as a consequence, the sulfation behavior of such sorbents was less particle size dependent than was that for the sorbents which did not develop TIFs.

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[73]Pisupati, S. V., Wasco, R. S., Morrison, J. L. and Scaroni, A. W., 1996, *Sorbent Behavior in Circulating Fluidized Bed Combustors: Relevance of Thermally Induced Fractures to Particle Size Dependence*: Fuel, vol. 75, p. 759-768.

[74]Liu, Y. and Scaroni, A. W., 1996, op cit.

[75]Morrison, J. L., Romans, D. E., Liu, Y., Hu, N., Pisupati, S. V., Miller, B. G., Miller, S. F. and Scaroni, A. W., 1994, op cit.

[76]Ibid.

[77]Morrison, J. L., Liu, Y., Romans, D. E., Pisupati, S. V., Scaroni, A. W. and Miller, S. F., 1993, op cit.

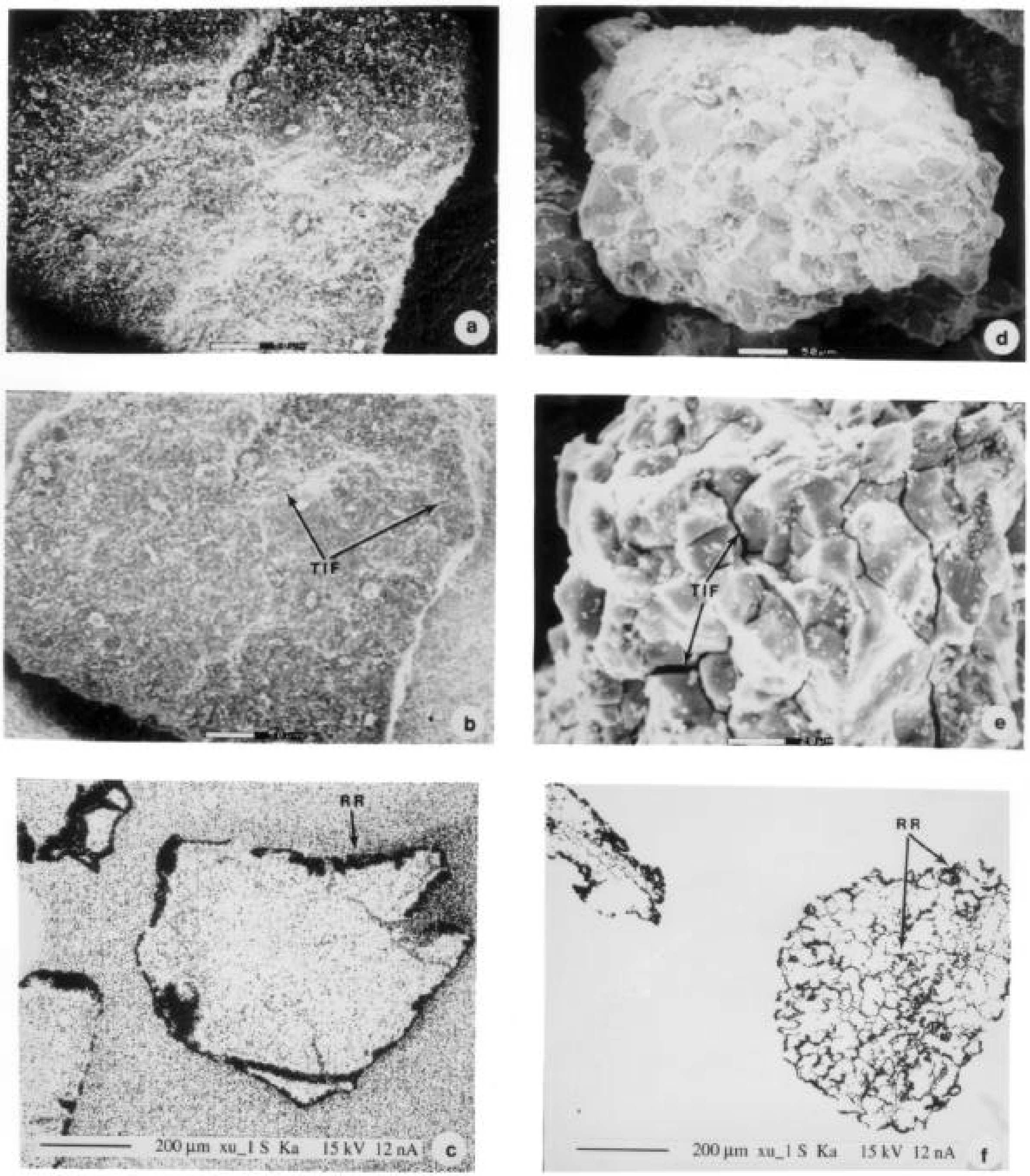
[78]Pisupati, S. V., Wasco, R. S., Morrison, J. L. and Scaroni, A. W., 1996, op cit.

[79]Liu, Y., Morrison, J. L. and Scaroni, A. W., 1995, *The Role of Thermally-Induced Fractures in the Calcination and Sulfation Behavior of Sorbents in Fluidized Bed Combustors*, In: The Proceedings of the Pittsburgh Coal Conference, University of Pittsburgh, Pittsburgh, Pennsylvania, p. 219-224.

In Exhibit 7, six photomicrographs are presented to illustrate the occurrence of TIFs. Exhibit 7 is a SEM photomicrograph of a 18 x 35 mesh limestone particle that has a fine-grained (micritic) texture. The same particle is shown in Exhibit 7(b) after to heating to 1,000 C using the hot-stage SEM. Note that the TIFs are limited in their occurrence. A cross-sectional view of the sulfated fine-grained limestone particle in Exhibit 7(c) shows that sulfur occurs as a $CaSO_4$ reaction rim along the perimeter of the particle (shown as a dark maroon region). Exhibit 7(d) is a SEM photomicrograph of a 18 x 35 mesh limestone particle which has coarse-grained (spar) texture. Unlike the fine-grained limestone, the coarse-grained limestone exhibited extensive TIFs production along grain boundaries after being heated in the hot-stage SEM (Exhibit 7(e)). The sulfur distribution in the coarse-grained limestone occurred as reaction rims along individual grain boundaries. The TIFs served as feeder pores into the particle enabling the SO_2 to deeply penetrate the particle.

EXHIBIT 7

THERMALLY INDUCED FRACTURES (TIFs) IN LIMESTONE



APPENDIX E

ESTIMATE OF INDUSTRY-WIDE FBCB GENERATION RATES

Estimate of the Volume of 1995 Combustion Byproducts from Fluidized Bed Combustion Units Firing Fossil Fuels

As part of the survey of FBC units the Special Project collected information on the volume of combustion byproducts produced during 1995 from each plant that responded to the survey. This survey also contained information on the type of fossil fuel used at each plant and, the electrical capacity of the facility. The survey provided information from 39 facilities representing 123 boilers, with 38 facilities data being used to prepare an estimate of the volume of combustion byproducts produced in 1995. One facilities actual data was excluded from this estimate as it was received to late to include in the Special Project data base used to develop this estimate.

The volume of combustion byproducts produced at any facility will be a function of the fuel characteristics (heating value, ash content, sulfur content), unit size, unit operating schedule, and in the case of limestone injection for sulfur dioxide control the characteristics of the limestone used (purity, reactivity) and the calcium to sulfur ratio. Since all of these variables are not known for each operating facility the Special Project developed an estimate of 1995 combustion byproducts volume by the following steps.

1. **The list of active FBC units was sorted by the type of fuel being used at the facility. The fuel type selected was based on the survey response, or from commercial data bases and manufacturer reference lists. In a few cases where no information was available, a fuel type was assumed based on the likely fuel to be used by the size and location of the facility.**

   Fuel types considered in this estimate include:

Bituminous coal (bit. coal)
Blend (bituminous coal other fossil and non fossil fuels)
Bituminous coal and petroleum coke (coal/pc, coal > 50% of mixture)
Anthracite culm (culm)
Natural gas and refinery off gas (gas)
Bituminous gob (gob)
Lignite coal (lignite)
Petroleum coke and bituminous coal (pc/coal, petroleum coke > 50% of mixture)
Peat (peat)
Petroleum coke (pet coke)
Subbituminous coal (sub bit.)

2. **An equivalent electrical capacity (MWe) was determined for those facilities where no electrical capacity information was available. The MWe was calculated by dividing the rated steam flow (in lbs/hr) by 10,000 lbs/hr per MWe.**

3. **For each fuel type, an average tons/MWe was calculated based on survey data with the following exceptions:**

   For the coal/pc mix the actual reported quantities were used at each facility

   No combustion byproducts were estimated for gas fired facilities

   For the pc/coal mix the actual reported quantity was used in the estimate

   For peat the average tons/MWe for lignite was used

For pet coke the value reported for the Fort Howard Paper Corporation was excluded from the calculation of the tons/MWe since it appeared to include coal combustion byproducts from non-FBC units. The tons/MWe developed for the NISCO facility was used to calculate the estimated volume

For subbituminous coal the actual reported values were used for each facility

4. For those facilities that did not respond to the survey, the average tons/MWe was multiplied by the MWe to estimate the volume of 1995 combustion byproducts produced. For those facilities that responded to the survey the actual 1995 combustion byproducts volume was used.

By following the methodology outlined above, the estimate developed for total combustion byproducts produced by FBC units tends to be a median value of 9,417,500 tons. The methodology described uses average values from operating facilities which reflect the affects of the various variables that control the volume of combustion byproducts produced. Other estimates based on ratios of number of facilities reporting to total population, number of boilers reporting to total boiler population and megawatts reporting to total megawatts provided estimates that ranged from 9,091,600 tons to 13,150,560 tons. The following table shows the range of estimates developed using all the methods described herein.

Comparison of Estimating Methods

Description	Estimated Volume (short tons)
Ratio of reported MWs in survey to total study population MWs (3,004 to 4,591)	**9,091,600**
Estimate based on average generation rates for each fuel type based on survey data	**9,417,500**
Ratio of number of boilers reporting in survey to total study population (61 to 123)	**11,955,650**
Ratio of number of facilities reporting in survey to total study population (38 to 84)	**13,150,560**

APPENDIX F

USDA MANUAL FOR APPLYING FLUIDIZED BED COMBUSTION RESIDUE TO AGRICULTURAL LANDS

United States
Department of
Agriculture

Agricultural
Research
Service

ARS-74

August 1988

Manual for Applying Fluidized Bed Combustion Residue to Agricultural Lands

ABSTRACT

Stout, W.L., J.L. Hern, R.F. Korcak, and C.W. Carlson. 1988. Manual for Applying Fluidized Bed Combustion Residue to Agricultural Lands. U.S. Department of Agriculture, Agricultural Research Service, ARS-74, 15 pp.

Atmospheric fluidized bed combustion (AFBC) is a process that reduces sulfur emissions from coal-fired electric-generating plants. The residue from this process is a mixture of alkaline oxides, calcium sulfate, and coal ash constituent. Since 1976, USDA/ARS has investigated the potential agriculture use of this residue. The investigations comprised an extensive series of laboratory, greenhouse, field plot, and animal feeding experiments. The best and safest use of AFBC residue in agriculture was as a substitute for agricultural lime. This report contains guidelines for applying AFBC residue to agricultural lands.

KEYWORDS: Coal, gypsum, lime, reclamation, soil acidity, sulfur.

This research was conducted under Department of Energy Contracts Nos. DE-AI21-76-MC-10391 and DE-AI21-86-MC23160 and Tennessee Valley Authority Contract No. TV-67-131A.

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MANUAL FOR APPLYING FLUIDIZED BED COMBUSTION RESIDUE TO AGRICULTURAL LANDS

W.L. Stout, J.L. Hern, R.F. Korcak, and C.W. Carlson

To conform to Environmental Protection Agency standards, coal-burning electric-generating plants must adopt effective methods to remove SO_2[1] from exhaust gases. One method is the atmospheric fluidized bed combustion (AFBC) process. In this process, crushed coal and a finely ground sorbent, usually limestone, are suspended or "fluidized" by jets of air. They are burned at a controlled velocity and optimum temperature. Sulfur in the coal reacts with Ca in the limestone to form gypsum, or $CaSO_4$. A part of the resulting residue is a dry granular mixture composed predominantly of CaO and $CaSO_4$, with small amounts of metal oxides.

AFBC residue contains alkaline oxides and plant nutrients that are useful in agriculture. It also has other elements that can be toxic to plants and animals if they enter the food chain in excessive amounts. To evaluate the potential benefits and hazards of AFBC residue to agriculture, the Agricultural Research Service (ARS) conducted research at several locations in the Eastern and Southeastern United States. This research was supported by the Department of Energy and the Tennessee Valley Authority National Fertilizer Development Center.

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[1]For meaning of chemical symbols, see Appendix III.

This report presents guidelines for the safe and efficient use of AFBC residue in agriculture based on ARS research. The AFBC residues used in this study were the spent bed materials from experimental bubbling bed combustors. However, the guidelines should also be applicable to similar AFBC residues. This report is intended as a manual for power plant managers, consultants, and Government agency personnel who utilize AFBC residues. It does not exempt AFBC residues from guidelines established by State and Federal regulatory agencies.

AGRICULTURAL CONSIDERATIONS

AFBC residue components important to agriculture are divided into four groups (table 1)--lime, essential plant nutrients, heavy metals, and phytotoxic elements (25). This division is not absolute because some of the components can be placed in more than one group depending on their relative and absolute amounts and their interactions in the soil system.

Lime, the first group in table 1, is mainly a mixture of CaO and MgO. If the residue is quenched after combustion, these compounds revert to the hydroxide form. They also revert to the hydroxide form when they combine with water in the soil.

Lime is expressed as the neutralizing potential of the residue compared with an equal amount of ground agricultural limestone, usually $CaCO_3$. The bulk of the AFBC residue research conducted by ARS included using the lime in the residue to increase low soil pH. Based on this research, the best agricultural use of AFBC residue is as a lime source for croplands (3, 5, 25, 26), orchards (6, 9-16, 27), pastures (23), and reclaimed surface mines (4-24).

Table 1
Variations in some chemical constituents of 9 samples of atmospheric fluidized bed combustion (AFBC) residue and soils

Group	Component	AFBC residue[1] Average	AFBC residue[1] Range	Soils[2] Average	Soils[2] Usual range
		Percent of $CaCO_3$			
Lime	CaO and MgO	60	31-100		
		Micrograms per grams of dry material			
Essential plant nutrients	Ca	380,000	240,000-460,000		
	S	92,000	72,000-140,000	850	100-1,500
	Mg	7,100	5,000-12,000		
	K	2,500	500-8,000		
	P	430	380-500		400-3,000
	Fe	11,000	800-16,000	---	14,000-40,000
	Mn	485	210-685	850	200-3,000
	Mo	.19	.12-.28	2	.2-5
	B	110	95-170	10	2-100
Essential plant nutrients / Heavy metals	Cu	15	12-19	20	2-100
Essential plant nutrients / Heavy metals	Zn	55	29-105	50	10-300
Heavy metals	Ni	21	13-29	40	5-500
	Pb	3.2	1.5-7.5	10	2-200
	Cd	.5	---	.5	.01-.70
	Cr	15	9-23	200	5-1,000
Phytotoxic elements	Se	.29	.16-.58	---	.1-2
	Al	10,000	4,000-20,000	---	14,000-40,000

[1]From Stout, W.L., and others (25).
[2]From Baker, D.E., and L. Chesnin (2).

Essential plant nutrients (table 1) are those required for growth and reproduction of plants. The first five elements in this group (Ca, S, Mg, K, and P) are needed by plants in large amounts.

The large amounts of Ca in AFBC residues (table 1) occur not only as $Ca(OH)_2$ and CaO but also as $CaSO_4$, a compound commonly known as gypsum. Applying these compounds to acid soils has long been known to decrease soil acidity and promote root growth. This is particularly beneficial where crop production is limited by shallow rooting conditions.

Soils in the Eastern United States generally receive no direct S fertilization. In the past, sufficient S was applied to agricultural land as impurities in N and P fertilizers and through atmospheric fallout from fossil fuel combustion. In recent years, research in the Eastern United States has shown that if high crop yields are to be obtained, some crops require S fertilization. AFBC residues can be an effective source of this fertilizer (20). Although large amounts of S would be added to the soil with the land application of AFBC residues, these amounts should pose no threat to ground water quality (21, 22).

Magnesium, K, and P occur in lesser amounts than Ca or S. Magnesium and K likely appear as oxides, hydroxides, or sulfates in the residue. Phosphorus probably occurs as a form of calcium phosphate. Since these elements are regularly added to soil in the form of lime or fertilizer, their presence in AFBC residue is desirable.

The next six essential plant nutrients (Fe, Mn, Mo, B, Cu, and Zn) are required by the plant in minute amounts and are generally referred to as micronutrients. Because of the oxidizing conditions to which these elements are exposed during combustion, Fe, Mn, Cu, and Zn probably occur as oxides in the residue, and B and Mo as borates and molybdates. In the past, these elements have not been applied to agricultural land as extensively as the macronutrients. Native amounts of these elements and fertilizer impurities were relied on to supply sufficient amounts of micronutrients to crops. However, with more intensive cropping systems and purer, high analysis fertilizers, the need for micronutrient fertilization is becoming more apparent, and the presence of these nutrients in AFBC residues may be beneficial.

Although micronutrients are essential for plant growth, they can be toxic to plants or animals if they are excessive or disproportionate in the soil. The amounts of these elements in AFBC residues, with the exception of B, are within the range of these elements usually found in soils (table 1). No phytotoxic effects of micronutrients have been observed when AFBC residue was used as a lime source (25). However, the availability of micronutrients to plants depends not only on the amounts applied in AFBC residue but also on native amounts in the soil, the soil pH, interactions with other ions, the solubility of the compound containing the element, and the specific crop being grown. Therefore, their entrance into the food chain via AFBC residue application should be carefully monitored.

The amount of B in AFBC residue is higher than that found in soils. Generally B is not toxic in most agricultural soils unless supplied in excessive amounts of fertilizers (19). Some crops such as alfalfa require yearly applications of about 2 pounds per acre of B for maximum yields. Some sensitive crops have exhibited B toxicities and decreased yields when B was applied from 0.5 to 4.5 pounds per acre (19). Therefore, care should be taken when applying AFBC residues with high levels of B to sensitive crops such as cherry, peach, lupine, and kidney bean, especially when these crops are growing on sandy soils.

The next group is the heavy metals. Elements in this group probably occur as oxides. They are of concern, especially Cd, since they can cause serious metabolic problems in animals and humans when ingested in excessive amounts or when they accumulate in the food chain. Interest in heavy metals was stimulated by the increased use of sewage sludge on agricultural lands; thus, most of the work concerning heavy metals has pertained to using sewage sludge. Compared to sewage sludge, AFBC residues studied so far contain very low levels of heavy metals (25). Also, levels of heavy metals in AFBC residues are within ranges usually found in soils (table 1). In addition, the oxide form of heavy metals in AFBC residues renders them much less available to plants than the organic forms in sewage sludge. The accumulation of heavy metals by plants grown on AFBC residue-treated soils (25, 26) has not been shown to be a hazard to animals consuming these plants (7, 23). Nevertheless, loading of these metals on agricultural soils through AFBC residue application should not exceed loadings recommended for sewage sludge (table 2). Also, any enhancement of these metals in soils should be carefully monitored through appropriate soil tests.

Although Se can be toxic to plants, some species native to Se rich soils not only tolerate but may even require it (1). Although Se toxicities are common in the Great Plains and Rocky Mountain States, several areas in the United States such as the Pacific Northwest, Southeastern

Table 2
Maximum cumulative metal loadings on soils according to textural class[1]

Metal	Loamy sand, sandy loam	Fine sandy loam, very fine sandy loam, loam, silt loam,	Silt, clay loam, sandy clay loam, silty clay loam, sandy clay, silty clay, clay
	Pounds per acre		
Cd	2	3	4.5
Zn	50	150	300.0
Cu	25	75	150.0
Ni	10	30	60.0
Pb	100	300	600.0
Cr	100	300	600.0

[1]From Baker, D.E., and others (1).

Coastal Plain, and the Northcentral and Northeastern States, have Se levels in forages that are too low for grazing animals (17). Selenium in AFBC residues could be beneficial in these areas.

Levels of Al in AFBC residues are slightly less than those found in soils (table 1). Aluminum can be phytotoxic when it is solubilized at low pH, generally below pH 5.0. Since Al toxicity is easily corrected by liming, it is of minor concern in AFBC residues.

GUIDELINES FOR LAND APPLICATION

The best agricultural use of AFBC residue is as a lime source on cropland, pastures, or reclaimed surface mines. It is attractive to agriculture and the power industry because it attacks soil acidity, which is the major recurring soil fertility problem in humid regions, and it provides a means of using the maximum amount of AFBC residue that currently would be environmentally safe. A flow chart for applying AFBC residue to cropland is shown in figure 1 and an example of calculations is given in figure 2. For this example, soil data are taken from Appendix II and AFBC residue data from table 1. Soil texture is assumed to be silt loam and the crop is assumed to be alfalfa.

The first task is to determine the soil texture of the distribution area and the amount of lime required to raise the soil pH to the desired level for the crop to be grown (figs. 1 and 2, task 1). Information on soil texture can be obtained through the USDA Soil Conservation Service or county agricultural Extension offices. Lime requirement is best determined by using current soil tests provided by either State land grant university laboratories or private laboratories. Tests calibrated for local soil conditions should be used. Addresses of soil testing laboratories can be obtained from State agricultural Extension offices.

The first decision step is to determine whether lime is needed for the specific crop to be grown (fig. 1). In this example, 1.7 tons per acre of ground limestone (App. II) is needed to raise the soil pH to a desirable level for alfalfa (fig. 2, decision 1). If soil tests indicate that no lime is required, no AFBC residue should be applied.

Since the composition of AFBC residues is dependent on variables such as the composition of the coal and sorbent and the operating parameters of the combustion unit (8), the second task in using a specific AFBC residue is to determine its composition (fig. 1). This step is necessary to determine the level of residue components that can be useful in agriculture as well as of those that might have some adverse effects on the environment. Analytical methods developed by ARS for the elemental analyses of AFBC residues are detailed in Appendix I. Values obtained from these methods indicate the total amounts of constituents in a specific residue. Analyses for lime equivalency, heavy metals, and B will be critical in determining whether the tested batch of AFBC residue is acceptable for land application (fig. 2, task 2).

The second decision step (figs. 1 and 2) is to determine whether the lime equivalency of the AFBC residue is greater than 30 percent. Application of AFBC residues with lime equivalencies of less than 30 percent is not recommended. Research data used to develop this manual have been generated with residues having lime equivalencies of at least 30 percent, and extrapolation beyond the range of existing data is not recommended.

The third task is to determine the application rate of the AFBC residue (fig. 1). The application rate of acceptable AFBC residue during any one year should be controlled by the lime requirement of the soil, the lime content of the residue, and the heavy metal levels in the residue. This is done by dividing the lime requirement by the quantity of the carbonate equivalency in percent divided by 100 (fig. 2, task 3).

In this example, the AFBC residue application rate is 2.8 tons per acre. Application of AFBC residue above the calculated application rate is not recommended because of the risk of excessive levels of soil pH and soil salinity and the adverse changes in soil physical properties due to the cementitious properties of AFBC residue.

The fourth task is to determine the loading of heavy metals (fig. 1). This is done by multiplying the concentration of each heavy metal by the application rate (fig. 2, task 4).

The fifth task is to calculate the total heavy metal loadings for the distribution area (fig. 1). This is done by adding the previous heavy metal loadings to the current proposed heavy metal loadings (fig. 2, task 5). In the example, there was no previous heavy metal loading, so the total loading is equal to the current proposed loadings.

The third decision step is to determine whether the total loading of any of the heavy metals or the current proposed B loading is excessive (fig. 1). The decision on heavy metal loading is based on comparing the recommended loadings for heavy metals applied in sewage sludge (1). This is done by comparing the total loading with the recommended loading rates for sewage sludge (fig. 2, decision 3). In this example, heavy metal loadings were extremely low. The decision on B is determined on the sensitivity of the crop grown under local conditions to B application. In this example, B loading is below the amount of B that the grower would apply to the crop. Therefore, the grower may want to decrease the B applied in purchased fertilizer. Since the total heavy metal loadings and the current B loading were within limits, the decision in this example would be to apply this AFBC residue at the calculated application rate. If the calculated loading of any heavy metal or B is higher than the recommended loadings, do not apply the residue.

The sixth task (figs. 1 and 2) is to apply the residue to the distribution area according to the local cropping practices. In this task, common sense is the most important factor. The following are a few items to consider when applying AFBC residue or any other material to croplands:

1. Avoid applying residue when cropland is too wet to support the weight of the application equipment. This will prevent soil compaction problems.

2. Avoid spreading residue where it may be washed into streams or sinkholes by runoff from sudden heavy rains.

3. Avoid allowing animals to graze on pastures limed with AFBC residue until there has been sufficient rain to wash the residue from the herbage. Although there is little danger to the animal from directly ingesting heavy metals from the residue, the CaO and $Ca(OH)_2$ in the residue can be caustic to the gastrointestinal tracts of grazing animals.

4. Apply the residue evenly over the distribution area.

5. Make sure the spreading equipment is calibrated and is in good working order.

6. Apply residues so that there is sufficient time for soil reaction before planting the crop.

The seventh task is to monitor the pH and heavy metals in soils treated with AFBC residue (figs. 1 and 2). An example of a soil test suitable for monitoring heavy metals is given in Appendix II.

The fourth decision step is to determine whether heavy metal levels are within the "normal" range according to the soil test used (figs. 1 and 2). If so, proceed to decision 5. If not, discontinue AFBC applications.

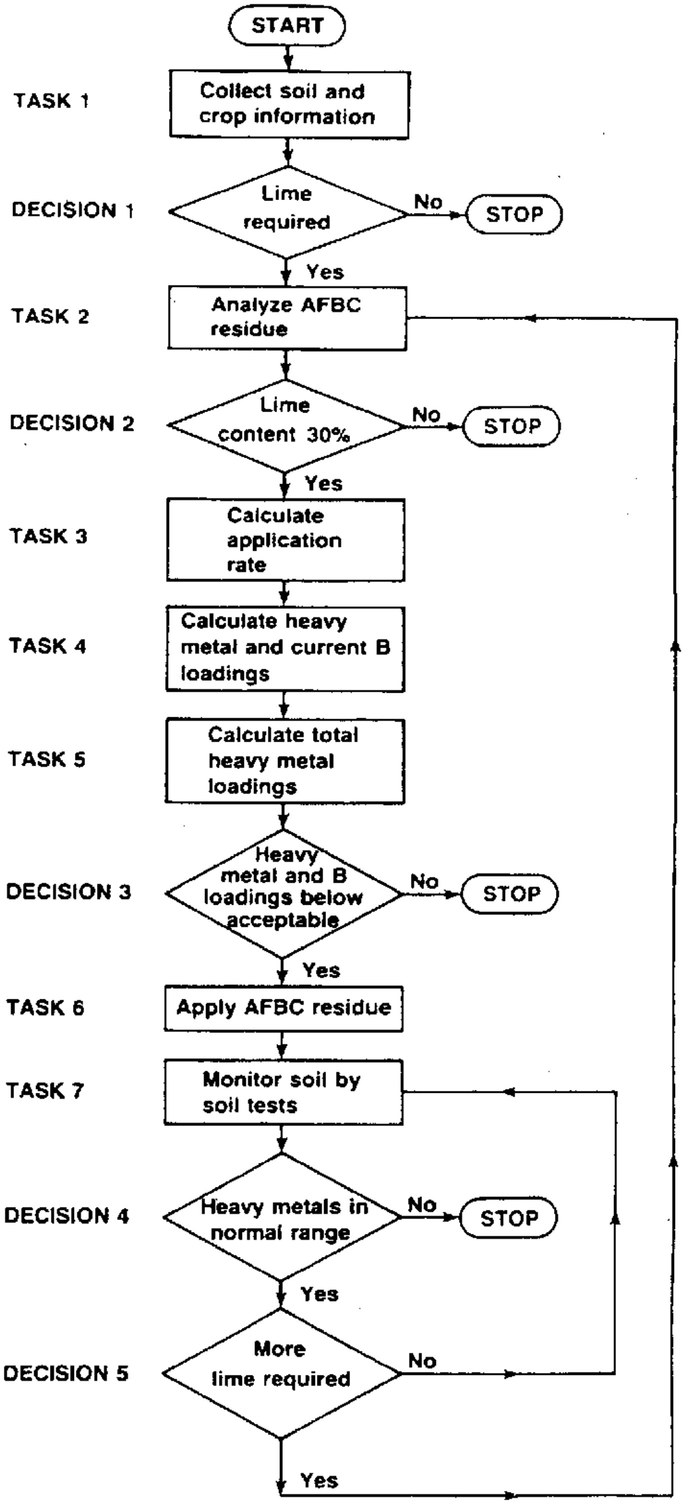

Figure 1
Flow chart for applying AFBC residue to cropland.

Task 1 Soil and crop information

Soil type: Silt loam
Crop: Alfalfa
Lime requirement: 1.7 tons/acre

Decision 1 Lime is required for this crop. Proceed to next task.

Task 2 AFBC residue analyses (table 1)

Lime content	60% $CaCO_3$
Cd	0.05 ppm
Zn	55 ppm
Cu	15 ppm
Ni	21 ppm
Pb	3.2 ppm
Cr	15 ppm
B	110 ppm

Decision 2 $CaCO_3$ is greater than 30 percent. Proceed to next step.

Task 3 Calculate AFBC residue application rate.

Rate = Lime requirement/(lime content/100)
= 1.7 tons/acre/(60/100)
= 2.8 tons/acre

Task 4 Calculate heavy metal and B loadings.

Loading = element content x rate x 0.002[1]

	Ppm		Tons/acre		Pounds/acre		
Cd	0.5	x	2.8	x	0.002	=	0.003
Zn	55	x	2.8	x	.002	=	.310
Cu	15	x	2.8	x	.002	=	.084
Ni	21	x	2.8	x	.002	=	.118
Pb	3.2	x	2.8	x	.002	=	.018
Cr	15	x	2.8	x	.002	=	.084
B	110	x	2.8	x	.002	=	.620

[1]0.002 is a conversion factor used when the concentration of the element is expressed in ppm, ug/g, or mg/kg.

Task 5 Calculate total heavy metal loadings (pounds per acre); previous loading was 0.

	Current and total loading	Maximum loading[1]
Cd	0.003	4.5
Zn	.310	300
Cu	.084	150
Ni	.118	60
Pb	.018	600
Cr	.084	600

[1]Values for silt loam soil in table 2.

Decision 3 Total cumulative heavy metal loadings below maximum and current B loading below 2 pounds per acre. Proceed with application.

Task 6 Apply AFBC residue according to local cropping practices.

Task 7 Monitor pH and heavy metals in the soil with appropriate soil tests.

Decision 4 If there is no rapid increase in heavy metal above normal levels in the soil, go to decision 5; discontinue AFBC residue applications.

Decision 5 If soil needs more lime, return to task 2; or go to task 7.

Figure 2
Example of calculations for applying AFBC residue to cropland.

The fifth decision step is to determine whether additional residue can be applied to the distribution area (figs. 1 and 2). If soil tests indicate no additional lime is needed, go to task 7 (figs. 1 and 2). If the soil requires more lime, return to task 2.

NONRECOMMENDED USES

Use of AFBC residue as a Ca or S supplement in animal diets has been reported (18). This use is not recommended because most likely the small amount of residue that could be used as a feed additive would not justify the work involved in the Food and Drug Administration approval process.

Research on disposal rates of AFBC residues on orchards has been reported (15). Disposal rates are defined as amounts in excess of those calculated from soil test recommendations. Applying AFBC residues to agricultural land at disposal rates is not recommended. The long-term and permanent effects of such high rates on the physical and chemical properties of soils and effect on ground water quality are not known.

CAUTIONS

AFBC residue is a highly caustic material that can severely damage unprotected skin, lungs, and eyes. When AFBC residues are exposed to water, an exothermic reaction will result. It should not be assumed that personnel who regularly spread agriculture lime are aware of the potential health hazards associated with spreading caustic AFBC residues. Proper safety precautions in compliance with OSHA and NIOSH standards must be observed.[2]

[2]OSHA = Occupational Safety and Health Administration; NIOSH = National Institute for Occupational and Safety Health.

In addition to the potential health hazard to humans, AFBC residues can be extremely corrosive to application equipment. Also, AFBC residues have similar cementitious properties and can form hard deposits. Therefore, equipment used to apply AFBC residues should be thoroughly washed with water to prevent costly equipment damage.

If it is necessary to store quantities of AFBC residues on site before spreading, care should be taken to protect the material from the weather. Exposure to precipitation can cause a hardened crust to form on the material or can contaminate surface runoff entering streams or ground water. Storage problems can best be eliminated by spreading AFBC residues as soon as they are delivered to the site.

The sale and use of AFBC residues as an agricultural lime are subject to State and Federal lime and environmental regulations.

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Sampling

Results of any technique can be seriously jeopardized if proper sampling criteria are not selected and implemented. Consideration of original AFBC residue lot size, its physical nature (size fractions), and accessibility affect the procedure adopted for obtaining representative samples. Sampling techniques for solid fertilizers may be employed as outlined in "Official Methods of Analysis of the Association of Official Analytical Chemists" (A.O.A.C., 2.001). If the material has been bagged, lay the bag horizontally and remove cores diagonally from end to end. From lots of more than 10 bags, take cores from at least 10 bags. When necessary to sample lots of less than 10 bags, take 10 cores but at least 1 from each bag. Bulk material or stockpiled sources can be sampled by drawing vertical cores or collecting samples as the material drops from the loading chute or belt (A.O.A.C., 2.001). Caution should be taken as to the caustic properties of this material, and proper safety procedures should be followed to avoid contact with and breathing of AFBC residue.

Samples should be delivered to the laboratory in sealed, clean glass or polyethylene containers and reduced in size using a sample splitter or riffle. Samples can be stored at room temperature for several months.

Grinding

Samples should be ground with a stainless steel or ceramic grinder. Adequate homogeneity can be achieved by reducing particle size fractions to 0.20 mm or less.

Assays

Calcium Carbonate Equivalency. To determine the lime content of AFBC residue, use a given amount to react with an excess quantity of HCl and then back-titrate with NaOH to determine its neutralizing potential with respect to $CaCO_3$. Units are expressed as $CaCO_3$ equivalency.

Procedure:

1. Weigh 1.00 g of dry AFBC residue (2 hours at 90°C) in a 125 mL Erlenmeyer flask. Add 10 mL of deionized H_2O and swirl. Let stand for 1 minute.

2. Slowly add 20 mL of 1 M HCl while stirring. Caution: Rapid addition of HCl may cause excessive heat and splashing. ADD HCl SLOWLY! Let stand for 15 minutes, stirring every 3 minutes.

3. Add 3 drops of phenolphthalein (1% percent phenolphthalein-methanol solution) and back-titrate to the end point with 1.0 M NaOH solution.

4. Record the milliliters of NaOH used and calculate the $CaCO_3$ equivalency (eq) as follows:

   $$100 - \frac{(20 - \text{mL NaOH})}{0.2} = \%\ \text{calcium carbonate eq}$$

Macrocomponents (Al, Ca, Fe, Mg, and Na). Macrocomponents can be determined by atomic spectroscopy of acid digests of AFBC residue. Either flame atomic absorption-emission (AA) or inductively coupled plasma-atomic emission (ICP) can be used to adequately determine the levels of these components.

Procedure:

1. Place 1.00 g of dry AFBC residue in a 125 mL Erlenmeyer flask having a 24/40 ground glass joint.

2. Slowly and carefully add 5 mL of redistilled concentrated HNO_3. Heat for 30 minutes (do not boil).

3. Add 10 mL of redistilled concentrated HCl, connect the refluxing condenser, and reflux for 2 hours.

4. Quantitatively transfer the sample to a 50 mL volumetric flask using deionized H_2O and filter.

5. Dilute it appropriately with 1 M HNO_3 for spectroscopic technique of choice. A suitable ionization suppressor such as $LaCl_3$ will be necessary for AA determination of alkali metals. If ICP is employed with a capillary glass pneumatic nebulizer, adding a surfactant such as Triton-X (0.1 percent by volume) will improve the stability of the sample introduction system. Using a high-salt nebulization system will eliminate this need when employing ICP.

Metals (Cd, Cr, Cu, Mn, Ni, Pb, Sr, and Zn). Analysis of low level metals can be carried out on the digest prepared for macroelement evaluation prior to their being diluted. Depending on the final level of respective metals, determinations by flame AA or ICP techniques are normally suitable for these elements. However, if evaluation is needed at the subpart per million level, flameless AA techniques or electrochemical procedures such as differential pulse polarography may need to be employed.

Sulfur Content. If S content is of interest, combustion analysis techniques are adequate and very convenient for this determination. In this procedure a suitable combustion analyzer is used, such as the LECO model SC-132. Analysis is performed by rapid oxidation of the AFBC residue sample at approximately 1500°C to convert contained S components to gaseous SO_2. The combustion gases are purified and the level of SO_2 is determined as it passes through an infrared flow cell. Instrument responses are compared to previously burned sulfur standards and the results are directly reported as percent S. Sample requirements are minimal, requiring 100 to 200 mg of dry, ground AFBC residue per assay.

Boron Content. Boron levels can be estimated by evaluating the original acid extract by ICP. One must assume that the contribution from borosilicate glassware is consistent enough to allow for blank subtraction. In practice, the amount of B corrected for by outside contributors is small and normally less than 10 percent of the determined value.

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APPENDIX II. SAMPLE SOIL TEST REPORT

State University Soil Testing Laboratory
College Town, USA 10069

Test for: John Doe
Hill Side Farms
Beckley, WV 16865

Soil type: Dekalb stoney silt loam

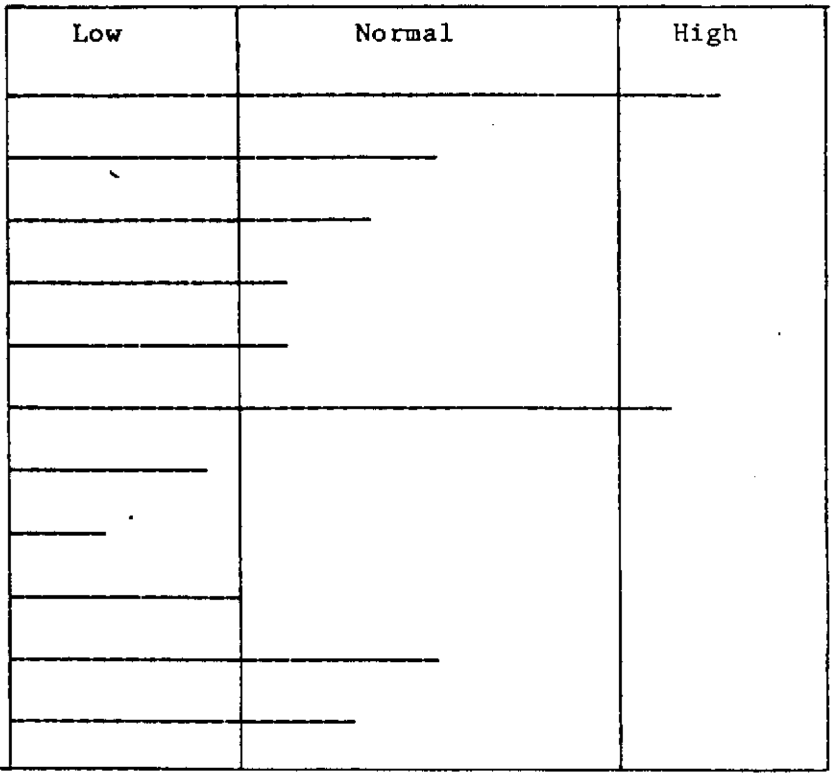
Field No.: S40

Crop: Alfalfa

Date	pH	Buffer pH	Lime required (tons/acre)	CEC (meq/100 g)
10/30/87	5.9	6.66	1.7	15.3

Test level

	Pounds/acre
Phosphorus	155
Potassium	620
Magnesium	728
Calcium	3,200
Manganese	81
Iron	226
Copper	4.0
Zinc	2.6
Lead	3.2
Nickel	7.0
Cadmium	.5



acre – unit of land area equal to 43,560 square feet.

cation – positively charged atom or group of atoms such as Ca^{2+}, Mg^{2+}, and NH_4^+.

CEC – abbreviation for cation exchange capacity, which is the sum total of exchangeable cations that a soil can adsorb, usually expressed in milliequivalents per 100 g of soil.

distribution area – land area where AFBC residue is applied to soil surface to raise soil pH.

hectare – unit of land area equal to 10,000 square meters.

ion – electrically charged atom or group of atoms.

meq – abbreviation for milliequivalent, which is 1 mg of hydrogen or amount of any other ion that will combine or replace it.

mg/kg – milligrams per kilogram.

phytotoxic – toxic to plants.

ppm – parts per million.

sinkhole – hole formed in carbonate rocks (for example, limestone, dolomite, and marble) by the action of water serving to conduct surface water to an underground water table.

soil texture – relative proportions of sand, silt, and clay in soil.

toxic substances – various chemicals that have a detrimental health effect on animals and humans if consumed in sufficient quantity. Some of these substances include trace metals, pesticides, chlorine-containing organic residues, and nitrogen compounds such as nitrate.

Chemical symbol	Chemical
Al	Aluminum
B	Boron
Ca	Calcium
$CaCO_3$	Calcium carbonate
CaO	Calcium oxide
$Ca(OH)_2$	Calcium hydroxide
$CaSO_4$	Calcium sulfate, gypsum
Cd	Cadmium
Cr	Chromium
Cu	Copper
Fe	Iron
HCl	Hydrochloric acid
HNO_3	Nitric acid
K	Potassium
$LaCl_3$	Lanthanum chloride
Mg	Magnesium
MgO	Magnesium oxide
Mn	Manganese
Mo	Molybdenum
N	Nitrogen
Na	Sodium
NaOH	Sodium hydroxide
Ni	Nickel
P	Phosphorus
Pb	Lead
S	Sulfur
Se	Selenium
SO_2	Sulfur dioxide
Sr	Strontium
Zn	Zinc

APPENDIX IV. CONVERSION TABLE

Multiply	By	To obtain
acre	0.405	hectare (ha)
pounds (lb)	.454	kilogram (kg)
ton, English	.907	ton, metric (tonne, metric (t))
pounds per acre (lb/acre)	1.12	kilograms per hectare (kg/ha)
tons per acre, English	2.24	tonnes per hectare, metric (t/ha)
percent (%)	$1x10^4$	parts per million (ppm)
parts per million (ppm)	1.0	milligrams per kilogram (mg/kg)
milligrams per kilogram (mg/kg)	1.0	micrograms per gram (ug/g)

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APPENDIX G

FBCB RISK SCREENING CRITERIA AND RESULTS

Historical Bevill Study RTC Screening Levels for Leachate Data

	1988 RTC Coal Combustion	1990 RTC Mineral Processing			1993 RTC CKD						1993 Regulatory Determination		
					Ground Water Pathway (mg/l)		Surface Water Pathway (mg/l)				Ground Water Pathway (mg/l)		Aquatic Ecological Risk (mg/l)
	PDWS (mg/l)	Human Health (Ingestion) (mg/L)	Aquatic Ecological (mg/L)	Water Resource Damage (mg/L)	10x Primary MCL	10 x HBL	100 x Primary MCL	100 x HBL	100 x AWQC	Human Fish Ingestion health Factor	10x Primary MCL	10 x HBL	100 x AWQC
Aluminum			8.7	50					8.7				8.7
Antimony		0.14	160	4500	0.06	0.14	0.6	1.4	32	160	0.06		160
Arsenic	0.05	0.002	1.3	0.5	0.5	0.002	5	0.02	19	2.3	0.5	0.002	4.8
Barium	1	18	0.53	0.12	20	25	200	250		7100	20	25	5000
Beryllium		1.8	500	7.5	0.04	0.00081	0.4	0.0081	0.11	0.049	0.04	0.00081	0.53
Boron		32	500	7.5								32	
Cadmium	0.01	0.18	0.11	0.1	0.05	0.18	0.5	1.8	0.11	1	0.05	0.18	0.11
Chromium	0.05	1.8	1.1	0.5	1	1.8	10	18	1.1	100	1	1.8	1.1
Cobalt				0.5									
Copper		13	2.9	13							13		1.2
Iron			100	3									100
Lead	0.05	0.21	0.32	0.05	0.15		1.5		0.32		0.15		0.32
Manganese		70	100	0.5								70	100
Mercury	0.002	0.1	0.0012	0.02	0.02	0.0078	0.2	0.078	0.0012	0.0006	0.02	0.0078	0.0012
Molybdenum				0.1								1.8	
Nickel		7	0.83	2	1	7	10	70	16	81	1		16
Potassium													
Selenium	0.01	1.1	0.5	0.1	0.5	1.8	5	18	0.5	150	0.5		0.5
Silver	0.05	1.1	0.012	0.5		1.8		18	0.12	880		1.8	0.012
Thallium		0.025	4	4.6	0.02	0.024	0.2	0.24	0.8	0.0028	0.02	0.024	4
Vanadium		2.5	128	1		2.4		24		280		2.4	128
Zinc		70	8.6	50								70	
Number above Reg. level													

Notes:

Constituents for which there were no regulatory levels were left blank.
Hexavalent chromium regulatory levels were used when available.
Chromium concentrations in leachate were assumed to be hexavalent.
Arsenic, Beryllium, and Hexavalent chromium cancer levels were used.

Fly Ash - Ratio of Mean Concentration to Regulatory Levels

1988 RTC Coal Combustion	1990 RTC Mineral Processing			1993 RTC CKD						1993 Regultory Determination		
				Ground Water Pathway		Surface Water Pathway				Ground Water Pathway		Aquatic Ecological Risk
PDWS	Human Health (Ingestion)	Aquatic Ecological	Water Resource Damage	10x Primary MCL	10 x HBL	100 x Primary MCL	100 x HBL	100 * AWQC	Human Fish Ingestion health Factor	10x Primary MCL	10 x HBL	100 * AWQC
		1.26	0.22					1.26				1.26
	4.36	0.00	0.00	10.17	4.36	1.02	0.44	0.02	0.00	10.17		0.00
2.20	55.00	0.08	0.22	0.22	55.00	0.02	5.50	0.01	0.05	0.22	55.00	0.02
1.20	0.07	2.26	10.00	0.06	0.05	0.01	0.00		0.00	0.06	0.05	0.00
	0.03	0.00	0.01	1.25	61.73	0.13	6.17	0.45	1.02	1.25	61.73	0.09
	0.02	0.00	0.07								0.02	
2.60	0.14	0.24	0.26	0.52	0.14	0.05	0.01	0.24	0.03	0.52	0.14	0.24
3.60	0.10	0.16	0.36	0.18	0.10	0.02	0.01	0.16	0.00	0.18	0.10	0.16
			0.14									
	0.00	0.02	0.00							0.00		0.05
		0.00	0.12									0.00
4.00	0.95	0.63	4.00	1.33		0.13		0.63		1.33		0.63
	0.01	0.00	0.78								0.01	0.00
15.00	0.30	25.00	1.50	1.50	3.85	0.15	0.38	25.00	50.00	1.50	3.85	25.00
			3.60								0.20	
	0.02	0.13	0.06	0.11	0.02	0.01	0.00	0.01	0.00	0.11		0.01
11.00	0.10	0.22	1.10	0.22	0.06	0.02	0.01	0.22	0.00	0.22		0.22
0.54	0.02	2.25	0.05		0.02		0.00	0.23	0.00		0.02	2.25
	2.00	0.01	0.01	2.50	2.08	0.25	0.21	0.06	17.86	2.50	2.08	0.01
	0.02	0.00	0.05		0.02		0.00		0.00		0.02	0.00
	0.01	0.07	0.01								0.01	
7	3	4	5	5	5	1	2	2	3	5	4	3

Fly Ash - Ratio of Maximum Concentration to Regulatory Levels

1988 RTC Coal Combustion	1990 RTC Mineral Processing			1993 RTC CKD						1993 Regultory Determination		
				Ground Water Pathway		Surface Water Pathway				Ground Water Pathway		Aquatic Ecological Risk
PDWS	Human Health (Ingestion)	Aquatic Ecological	Water Resource Damage	10x Primary MCL	10 x HBL	100 x Primary MCL	100 x HBL	100 * AWQC	Human Fish Ingestion health Factor	10x Primary MCL	10 x HBL	100 * AWQC
		2.76	0.48					2.76				2.76
	10.71	0.01	0.00	25.00	10.71	2.50	1.07	0.05	0.01	25.00		0.01
12.00	300.00	0.46	1.20	1.20	300.00	0.12	30.00	0.03	0.26	1.20	300.00	0.13
8.00	0.44	15.09	66.67	0.40	0.32	0.04	0.03		0.00	0.40	0.32	0.00
	0.03	0.00	0.01	1.25	61.73	0.13	8.17	0.45	1.02	1.25	61.73	0.09
	0.04	0.00	0.19								0.04	
5.00	0.28	0.45	0.50	1.00	0.28	0.10	0.03	0.45	0.05	1.00	0.28	0.45
18.20	0.51	0.83	1.82	0.91	0.51	0.09	0.05	0.83	0.01	0.91	0.51	0.83
			0.22									
	0.01	0.04	0.01							0.01		0.11
		0.01	0.23									0.01
10.40	2.48	1.63	10.40	3.47		0.35		1.63		3.47		1.63
	0.02	0.01	2.20								0.02	0.01
145.00	2.90	241.67	14.50	14.50	37.18	1.45	3.72	241.67	483.33	14.50	37.18	241.67
			7.20								0.40	
	0.04	0.30	0.13	0.25	0.04	0.03	0.00	0.02	0.00	0.25		0.02
24.00	0.22	0.48	2.40	0.48	0.13	0.05	0.01	0.48	0.00	0.48		0.48
1.00	0.05	4.17	0.10		0.03		0.00	0.42	0.00		0.03	4.17
	2.00	0.01	0.01	2.50	2.08	0.25	0.21	0.06	17.86	2.50	2.08	0.01
	0.02	0.00	0.05		0.02		0.00		0.00		0.02	0.00
	0.06	0.52	0.09								0.06	
8	5	5	8	7	5	2	4	3	3	7	4	4

Bed Ash - Ratio of Mean Concentration to Regulatory Levels

1988 RTC Coal Combustion	1990 RTC Mineral Processing			1993 RTC CKD						1993 Regultory Determination		
				Ground Water Pathway		Surface Water Pathway				Ground Water Pathway		Aquatic Ecological Risk
PDWS	Human Health (Ingestion)	Aquatic Ecological	Water Resource Damage	10x Primary MCL	10 x HBL	100 x Primary MCL	100 x HBL	100 * AWQC	Human Fish Ingestion health Factor	10x Primary MCL	10 x HBL	100 * AWQC
		1.10	0.19					1.10				1.10
	2.36	0.00	0.00	5.50	2.36	0.55	0.24	0.01	0.00	5.50		0.00
0.52	13.00	0.02	0.05	0.05	13.00	0.01	1.30	0.00	0.01	0.05	13.00	0.01
1.50	0.08	2.83	12.50	0.08	0.06	0.01	0.01		0.00	0.08	0.06	0.00
	0.09	0.00	0.02	4.25	209.88	0.43	20.99	1.55	3.47	4.25	209.88	0.32
	0.03	0.00	0.13								0.03	
2.30	0.13	0.21	0.23	0.46	0.13	0.05	0.01	0.21	0.02	0.46	0.13	0.21
2.20	0.06	0.10	0.22	0.11	0.06	0.01	0.01	0.10	0.00	0.11	0.06	0.10
			0.19									
	0.00	0.02	0.00							0.00		0.05
		0.01	0.27									0.01
3.20	0.76	0.50	3.20	1.07		0.11		0.50		1.07		0.50
	0.00	0.00	0.52								0.00	0.00
0.45	0.01	0.75	0.05	0.05	0.12	0.00	0.01	0.75	1.50	0.05	0.12	0.75
			3.20								0.18	
	0.02	0.13	0.06	0.11	0.02	0.01	0.00	0.01	0.00	0.11		0.01
2.90	0.03	0.06	0.29	0.06	0.02	0.01	0.00	0.06	0.00	0.06		0.06
0.40	0.02	1.67	0.04		0.01		0.00	0.17	0.00		0.01	1.67
	2.00	0.01	0.01	2.50	2.08	0.25	0.21	0.06	17.86	2.50	2.08	0.01
	0.02	0.00	0.05		0.02		0.00		0.00		0.02	0.00
	0.01	0.08	0.01								0.01	
5	3	3	3	4	4	0	2	2	3	4	3	2

Bed Ash - Ratio of Maximum Concentration to Regulatory Levels

1988 RTC Coal Combustion	1990 RTC Mineral Processing			1993 RTC CKD						1993 Regultory Determination		
				Ground Water Pathway		Surface Water Pathway				Ground Water Pathway		Aquatic Ecological Risk
PDWS	Human Health (Ingestion)	Aquatic Ecological	Water Resource Damage	10x Primary MCL	10 x HBL	100 x Primary MCL	100 x HBL	100 * AWQC	Human Fish Ingestion health Factor	10x Primary MCL	10 x HBL	100 * AWQC
		2.41	0.42					2.41				2.41
	3.71	0.00	0.00	8.67	3.71	0.87	0.37	0.02	0.00	8.67		0.00
1.20	30.00	0.05	0.12	0.12	30.00	0.01	3.00	0.00	0.03	0.12	30.00	0.01
8.40	0.47	15.85	70.00	0.42	0.34	0.04	0.03		0.00	0.42	0.34	0.00
	0.16	0.00	0.04	7.00	345.68	0.70	34.57	2.56	671	7.00	345.68	0.53
	0.08	0.01	0.35								0.08	
5.00	0.28	0.45	0.50	1.00	0.28	0.10	0.03	0.45	0.05	1.00	0.28	0.45
6.40	0.18	0.29	0.64	0.32	0.18	0.03	0.02	0.29	0.00	0.32	0.18	0.29
			0.28									
	0.01	0.04	0.01							0.01		0.11
		0.03	1.07									0.03
6.00	1.43	0.94	6.00	2.00		0.20		0.94		2.00		0.94
	0.01	0.01	1.08								0.01	0.01
1.25	0.03	2.08	0.13	0.13	0.32	0.01	0.03	2.08	4.17	0.13	0.32	2.08
			6.10								0.34	
	0.02	0.19	0.08	0.16	0.02	0.02	0.00	0.01	0.00	0.16		0.01
10.00	0.09	0.20	1.00	0.20	0.06	0.02	0.01	0.20	0.00	0.20		0.20
1.00	0.05	4.17	0.10		0.03		0.00	0.42	0.00		0.03	4.17
	2.00	0.01	0.01	2.50	2.08	0.25	0.21	0.06	17.86	2.50	2.08	0.01
	0.02	0.00	0.05		0.02		0.00		0.00		0.02	0.00
	0.06	0.52	0.09								0.06	
8	4	4	6	5	4	0	2	3	3	5	3	3

Combination of Bed and Fly Ash - Ratio of Mean Concentration to Regulatory Levels

1988 RTC Coal Combustion	1990 RTC Mineral Processing			1993 RTC CKD						1993 Regultory Determination		
				Ground Water Pathway		Surface Water Pathway				Ground Water Pathway		Aquatic Ecological Risk
PDWS	Human Health (Ingestion)	Aquatic Ecological	Water Resource Damage	10x Primary MCL	10 x HBL	100 x Primary MCL	100 x HBL	100 * AWQC	Human Fish Ingestion health Factor	10x Primary MCL	10 x HBL	100 * AWQC
		0.41	0.07					0.41				0.41
	1.71	0.00	0.00	4.00	1.71	0.40	0.17	0.01	0.00	4.00		0.00
1.46	36.50	0.06	0.15	0.15	36.50	0.01	3.65	0.00	0.03	0.15	36.50	0.02
0.64	0.04	1.21	5.33	0.03	0.03	0.00	0.00		0.00	0.03	0.03	0.00
	-	-	-	-	-	-	-	-	-	-	-	-
	0.05	0.00	0.20								0.05	
1.40	0.08	0.13	0.14	0.28	0.08	0.03	0.01	0.13	0.01	0.28	0.08	0.13
1.30	0.04	0.06	0.13	0.07	0.04	0.01	0.00	0.06	0.00	0.07	0.04	0.06
			0.12									
	0.00	0.01	0.00							0.00		0.04
		0.00	0.07									0.00
1.94	0.46	0.30	1.94	0.65		0.06		0.30		0.65		0.30
	0.00	0.00	0.38								0.00	0.00
0.24	0.00	0.40	0.02	0.02	0.06	0.00	0.01	0.40	0.80	0.02	0.06	0.40
			1.30								0.07	
	0.01	0.11	0.04	0.09	0.01	0.01	0.00	0.01	0.00	0.09		0.01
8.30	0.08	0.17	0.83	0.17	0.05	0.02	0.00	0.17	0.00	0.17		0.17
0.46	0.02	1.92	0.05		0.01		0.00	0.19	0.00		0.01	1.92
	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-		-		-		-		-	-
	0.00	0.02	0.00								0.00	
5	2	2	3	1	2	0	1	0	0	1	1	1

Combination of Bed and Fly Ash - Ratio of Maximum Concentration to Regulatory Levels

1988 RTC Coal Combustion	1990 RTC Mineral Processing			1993 RTC CKD						1993 Regultory Determination		
				Ground Water Pathway		Surface Water Pathway				Ground Water Pathway		Aquatic Ecological Risk
PDWS	Human Health (Ingestion)	Aquatic Ecological	Water Resource Damage	10x Primary MCL	10 x HBL	100 x Primary MCL	100 x HBL	100 * AWQC	Human Fish Ingestion health Factor	10x Primary MCL	10 x HBL	100 * AWQC
		2.18	0.38					2.18				2.18
	8.57	0.01	0.00	20.00	8.57	2.00	0.86	0.04	0.01	20.00		0.01
13.60	340.00	0.52	1.36	1.36	340.00	0.14	34.00	0.04	0.30	[illegible]	340.00	0.14
11.00	0.61	20.75	91.67	0.55	0.44	0.06	0.04		0.00	0.55	0.44	0.00
	-	-	-	-	-	-	-	-	-	-	-	-
	0.84	0.05	3.60								0.84	
9.60	0.53	0.87	0.96	1.92	0.53	0.19	0.05	0.87	0.10	1.92	0.53	0.87
5.00	0.14	0.23	0.50	0.25	0.14	0.03	0.01	0.23	0.00	0.25	0.14	0.23
			0.80									
	0.01	0.04	0.01							0.01		0.11
		0.02	0.67									0.02
20.00	4.76	3.13	20.00	6.67		0.67		3.13		6.67		3.13
	0.01	0.01	1.28								0.01	0.01
2.50	0.05	4.17	0.25	0.25	0.64	0.03	0.06	4.17	8.33	0.25	0.64	4.17
			4.10								0.23	
	0.07	0.55	0.23	0.46	0.07	0.05	0.01	0.03	0.01	0.46		0.03
35.00	0.32	0.70	3.50	0.70	0.19	0.07	0.02	0.70	0.00	0.70		0.70
5.00	0.23	20.83	0.50		0.14		0.01	2.08	0.00		0.14	20.83
	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-		-		-		-		-	-
	0.02	0.16	0.03								0.02	
8	3	5	7	4	2	1	1	4	1	4	1	4

Fly Ash - Ratio of Mean Concentration to Regulatory Levels

1990 RTC MP		1993 RTC CKD		1993 Reg Determination	
Inhalation	Incidental Ingestion	Air Release Offsite Exposure Pathway	On-site Direct Contact	Inhalation	Incidental Ingestion
	0.29	0.37	0.48		0.32
	8.50	17.00	14.17	1.00	4.00
	0.02	0.24	0.02	0.08	0.01
	0.00	2.46	3.30	0.02	0.00
	0.00				0.00
	0.00	0.04	0.01	0.01	0.00
	0.01	8.00	0.11	1.25	0.02
	0.00				0.00
	0.08		0.07	0.00	0.08
	0.03			0.12	0.04
	0.08	0.10	0.13		0.08
	0.01	0.44	0.02	0.17	0.01
	0.01	0.00	0.01	0.15	0.00
	0.00	0.00	0.00		0.00
	0.18	0.23	0.31		0.18
	0.08	0.09	0.13		0.08
	0.00				0.00
0	1	3	2	2	1

Fly Ash - Ratio of Maximum Concentration to Regulatory Levels

1990 RTC MP		1993 RTC CKD		1993 Reg Determination	
Inhalation	Incidental Ingestion	Air Release Offsite Exposure Pathway	On-site Direct Contact	Inhalation	Incidental Ingestion
	5.00	6.36	8.24		5.47
	45.00	90.00	75.00	5.29	21.18
	0.22	3.08	0.30	1.10	0.17
	0.00	9.23	12.37	0.06	0.00
	0.04				0.04
	0.04	0.30	0.06	0.05	0.02
	0.04	21.54	0.29	3.37	0.04
	0.00				0.00
	0.26		0.22	0.00	0.26
	0.41			1.99	0.65
	1.81	2.38	3.17		1.98
	0.07	3.13	0.12	1.20	0.08
	0.08	0.06	0.08	2.13	0.05
	0.02	0.01	0.02		0.01
	0.80	1.00	1.34		0.76
	0.33	0.41	0.55		0.36
	0.00				0.00
0	3	8	5	6	3

Bed Ash - Ratio of Mean Concentration to Regulatory Levels

1990 RTC MP		1993 RTC CKD		1993 Reg Determination	
Inhalation	Incidental Ingestion	Air Release Offsite Exposure Pathway	On-site Direct Contact	Inhalation	Incidental Ingestion
	0.34	0.44	0.56		0.38
	6.75	19.50	11.25	0.79	3.18
	0.00	0.06	0.01	0.02	0.00
	0.00	1.77	2.37	0.01	0.00
	0.00				0.00
	0.01	0.05	0.01	0.01	0.00
	0.01	6.00	0.08	0.94	0.01
	0.00				0.00
	0.06		0.05	0.00	0.06
	0.00			0.01	0.00
	0.22	0.29	0.38		0.24
	0.01	0.44	0.02	0.17	0.01
	0.00	0.00	0.00	0.06	0.00
	0.01	0.01	0.01		0.00
	0.27	0.33	0.45		0.25
	0.10	0.12	0.16		0.10
	0.00				0.00
0	1	3	2	0	1

Bed Ash - Ratio of Maximum Concentration to Regulatory Levels

1990 RTC MP		1993 RTC CKD		1993 Reg Determination	
Inhalation	Incidental Ingestion	Air Release Offsite Exposure Pathway	On-site Direct Contact	Inhalation	Incidental Ingestion
	6.43	8.18	10.59		7.03
[illegible]	30.00	60.00	50.00	3.53	14.12
	0.01	0.18	0.02	0.06	0.01
	0.00	6.15	8.25	0.04	0.00
	0.00				0.01
	0.04	0.32	0.07	0.05	0.02
[illegible]	0.02	13.23	0.18	2.07	0.03
	0.00				0.00
	0.20		0.16	0.00	0.20
	0.01			0.03	0.01
	1.00	1.31	1.75		1.09
[illegible]	0.10	4.38	0.17	1.68	0.11
	0.02	0.02	0.02	0.56	0.01
	0.16	0.12	0.16		0.11
	1.02	1.28	1.72		0.98
	0.31	0.38	0.52		0.33
	0.00				0.00
0	4	7	5	3	3

Comb. of Bed and Fly Ash - Ratio of Mean Concentration to Reg. Levels

1990 RTC MP		1993 RTC CKD		1993 Reg Determination	
Inhalation	Incidental Ingestion	Air Release Offsite Exposure Pathway	On-site Direct Contact	Inhalation	Incidental Ingestion
	0.06	0.08	0.11		0.07
	16.00	12.00	10.00	0.71	2.82
	0.01	0.08	0.01	0.03	0.00
	0.00	1.46	1.96	0.01	0.00
	0.00				0.00
	0.00	0.02	0.00	0.00	0.00
	0.02	10.46	0.14	1.64	0.02
	0.00				0.00
	0.05		0.05	0.00	0.05
	0.00			0.00	0.00
	0.00	0.00	0.00		0.00
	0.00	0.19	0.01	0.07	0.00
	0.00	0.00	0.00	0.08	0.00
	0.00	0.00	0.00		0.00
	0.22	0.28	0.38		0.22
	0.14	0.18	0.24		0.16
	0.00				0.00
0	1	3	2	1	1

Comb. of Bed and Fly Ash - Ratio of Max. Concentration to Reg. Levels

1990 RTC MP		1993 RTC CKD		1993 Reg Determination	
Inhalation	Incidental Ingestion	Air Release Offsite Exposure Pathway	On-site Direct Contact	Inhalation	Incidental Ingestion
	0.50	0.64	0.82		0.55
	30.00	60.00	50.00	3.53	14.12
	0.02	0.28	0.03	0.10	0.02
	0.00	3.85	5.15	0.02	0.00
	0.03				0.03
	0.02	0.13	0.03	0.02	0.01
	0.54	292.31	3.88	45.78	0.59
	0.01				0.02
	0.14		0.12	0.00	0.14
	0.01			0.03	0.01
	0.02	0.03	0.04		0.03
	0.07	3.09	0.12	1.19	0.08
	0.01	0.01	0.01	0.34	0.01
	0.01	0.01	0.01		0.01
	0.51	0.64	0.86		0.49
	1.02	1.28	1.72		1.12
	0.01				0.01
0	2	5	4	3	2

APPENDIX H

CIBO SPECIAL PROJECT SURVEY OF STATE WASTE MANAGEMENT CONTROLS

CIBO SPECIAL PROJECT ON FOSSIL FUEL ASH CLASSIFICATION

SURVEY OF STATE DISPOSAL REGULATIONS
January 24, 1997

State Name: ___________________________

Name of Regulatory Agency : ____

Name of person completing survey: ____

Title: ____

Mailing Address: ____

____

Phone Number: ___________________________ **FAX Number:** ________________________________

1. **In your state, are coal combustion wastes (fly ash, bottom ash, boiler slag, and flue gas desulfurization sludge) exempt from regulation as a hazardous waste?** **Yes** **No**

2. **If the response to question 1 is No, does your state have regulations that specify testing to determine if the wastes are to be managed as a hazardous or solid waste?**

Yes **No** **Not applicable**

3. **Is the disposal of coal combustion wastes exempt from regulation as a solid waste?**

Yes **Yes, under special circumstances (described in comments section)** **No**

4. **Is a permit or other approval required for disposal of coal combustion wastes in a generator-controlled:**

	Landfill		Impoundment	
A. On the facility (plant) site?	Yes	No	Yes	No
B. Off the facility (plant) site?	Yes	No	Yes	No

5. **Do the state's regulations impose siting restrictions on the location of a coal combustion waste disposal facility?**

Landfill:	Yes	No	Case-by-case review required
Impoundment:	Yes	No	Case-by-case review required

6. **Do the state's regulations require the use of a liner in the coal combustion waste disposal facility?**

Landfill:	**Yes**	**No**	**Case-by-case review required**
Impoundment:	**Yes**	**No**	**Case-by-case review required**

7. If a liner is required, what types are required (check all that are applicable)?

	Landfill	**Impoundment**
Compacted clay liner		
Single synthetic liner		
Double synthetic liner		
Composite liner		

8. Do the state's regulations require a leachate collection and treatment system at coal combustion waste disposal sites?

Landfill:	**Yes**	**No**	**Case-by-case review required**
Impoundment:	**Yes**	**No**	**Case-by-case review required**

9. Do the state's regulations require groundwater monitoring at coal combustion waste disposal sites?

Landfill:	**Yes**	**No**	**Case-by-case review required**
Impoundment:	**Yes**	**No**	**Case-by-case review required**

10. Do the state's regulations impose disposal site closure conditions at coal combustion waste disposal sites?

Landfill:	**Yes**	**No**	**Case-by-case review required**
Impoundment:	**Yes**	**No**	**Case-by-case review required**

11. Do the state's regulations require financial assurance for site closure and ongoing maintenance at coal combustion waste disposal sites?

Landfill:	**Yes**	**No**	**Case-by-case review required**
Impoundment:	**Yes**	**No**	**Case-by-case review required**

12. Do the state's regulations require analysis of the coal combustion waste:

A. Prior to placement in the disposal unit?

Landfill:	**Yes**	**No**	**Case-by-case review required**
Impoundment:	**Yes**	**No**	**Case-by-case review required**

B. After placement in the disposal unit?

Landfill:	**Yes**	**No**	**Case-by-case review required**
Impoundment:	**Yes**	**No**	**Case-by-case review required**

C. **When mixed with other wastes, prior to placement in the disposal unit (combined waste)?**

Landfill:	**Yes**	**No**	**Case-by-case review required**
Impoundment:	**Yes**	**No**	**Case-by-case review required**

D. **When mixed with other wastes, after placement in the disposal unit (combined waste)?**

Landfill:	**Yes**	**No**	**Case-by-case review required**
Impoundment:	**Yes**	**No**	**Case-by-case review required**

E. **Please indicate what testing of coal combustion waste is required by the state's regulations (check all that are applicable):**

Land-fill	**Impound-ment**	
		Toxic Characteristic Leaching Procedure (TCLP) [U. S. EPA Method 1311]
		Extraction Procedure Toxicity (EP Tox.) [U. S. EPA Method 1310]
		Synthetic Precipitation Leaching Procedure (SPLP) [U. S. EPA Method 1312]
		Multiple Extraction Procedure (MEP) [U. S. EPA Method 1320]
		Synthetic Groundwater Leaching Procedure (SGLP)
		Long-Term Leaching Procedure (LTL)
		RCRA Total Metals
		California Waste Extraction Test (WET)
		California Soluble Threshold Limit Concentration (STLC) [CAM-17]
		California Total Threshold Limit Concentration (TTLC) [CAM-17]
		ASTM C-311 (Fly Ash for Use As A Mineral Admixture in Portland Cement Concrete)
		Other (describe) ______________________________
		Other (describe) ______________________________

F. **What is the frequency of the testing described above?**

Landfill:

Daily **Weekly** **Monthly** **Semi-annually** **Annually**

Other (describe) ______________________________

Other (describe) ______________________________

Impoundment:

Daily **Weekly** **Monthly** **Semi-annually** **Annually**

Other (describe) ____

Other (describe) ____

13. Do the state's regulations require that the test results be reported to the state?

Landfill:	**Yes**	**No**	**Case-by-case review required**
Impoundment:	**Yes**	**No**	**Case-by-case review required**

14. Does the state perform periodic inspection of coal combustion waste disposal sites?

Landfill:	**Yes**	**No**	**Case-by-case determination**
Impoundment:	**Yes**	**No**	**Case-by-case determination**

15. Does the state perform periodic sampling and testing of coal combustion wastes at coal combustion waste disposal sites?

Landfill:	**Yes**	**No**	**Case-by-case determination**
Impoundment:	**Yes**	**No**	**Case-by-case determination**

16. Do the state's regulations impose other requirements for disposal of combustion wastes from 100% use of other fossil fuels, for instance:

A: Petroleum coke, coal coke, or other similar solid fossil fuel derivatives?

Yes No Case-by-case review required

B: Oil?

Yes No Case-by-case review required

17. Do the state's regulations impose other requirements for disposal of combustion wastes if coal is the principal fuel and another fossil fuel is co-fired, for instance 80% coal and 20% petroleum coke?

Yes No Case-by-case review required

18. Do the state's regulations impose other requirements for disposal of combustion wastes if coal is the principal fuel and another non-fossil fuel is co-fired, for instance 80% coal and 20% wood?

Yes No Case-by-case review required

19. Do the state's regulations for disposal of coal combustion wastes impose different requirements based on the combustion technology used (e.g., stoker, pulverized fuel, fluidized bed)?

Yes No Case-by-case review required

20. Do the state's regulations for disposal and management of combustion wastes require control of fugitive dust?

Yes No Case-by-case review required

21. **Do the state's regulations, by approved use listing or petition, allow for the beneficial use of coal combustion wastes?** **Yes** **No**

22. **If coal combustion wastes are beneficially used are they then exempt from other state regulations for coal combustion waste management?** **Yes** **No**

23. **Are there any proposed revisions to the regulations for the disposal of coal combustion wastes?**

Yes **No**

If Yes, please briefly explain the planned revisions in the comments section below.

24. **Please provide a copy of the current applicable state regulations for the disposal of coal combustion wastes and indicate by checking the box below if attached.**

Copy of regulations are attached

25. **Comments:** ____

Thank you for your time in completing this survey, please return the completed survey to:

Robert D. Bessette
President
Council of Industrial Boiler Owners
6035 Burke Centre Parkway, No. 360
Burke, VA 22015
(703) 250-9042, FAX (703) 239-9042

append.wpd

APPENDIX I

TABULATED RESULTS OF CIBO SPECIAL PROJECT SURVEY OF STATE WASTE MANAGEMENT CONTROLS

CIBO Special Project on Non-utility Fossil Fuel Ash Classification
Survey of State Disposal Regulations
Landfill Disposal
September 30, 1997

State	Exempt from HW Regulations	Testing For Determination	Exempt from SW Regulations	Permit Required	Siting Restrictions	Liner Required	Type of Liner Required	Leachate Collection
1 Arizona	No, Note AZ1	N/A	No	On & Off Site	Yes	CBC		CBC
2 California	CBC	Yes	No	On & Off Site	No, Note CA1	Note CA2		Note CA2
3 Colardo	Yes		Yes, SC	On & Off Site	CBC	CBC	CBC	CBC
4 Connecticut	No	No	No	On & Off Site	Yes	No		No
5 Delaware	No	Yes	No	On & Off Site	Yes	Yes	CC, SSL, DSL, CL	Yes
6 Florida	Yes		No	On & Off Site	Yes	CBC	CC, SSL, CL	CBC
7 Georgia	No	Yes	No	On & Off Site	Yes	No		No
8 Hawaii	No	Yes	No	On & Off Site	Yes	Yes	CC, SSL, DSL, CL	CBC
9 Illinois	Yes		Yes, SC	Off Site	CBC	Yes	CC, SSL, DSL, CL	Yes
10 Iowa	No, Note IA 1	Not Applicable	No	On & Off Site	Yes	Yes	CC	Yes
11 Kentucky	No	Yes	Yes, SC Note KY1	On & Off Site	Yes	CBC	CC, SSL, CL	CBC
12 Maryland	Yes		Yes, SC	On & Off Site	Yes	Yes	CC, SSL	CBC
13 Michigan	No	Yes	No	On & Off Site	Yes	CBC	CC, SSL	Yes
14 Minnesota	No	Yes	No	On & Off Site	Yes	CBC	CC, CL	CBC
15 Nebraska	Yes		No	On & Off Site	Yes	CBC	CL, Note NE 1	CBC
16 Nevada	Yes		No	On & Off Site	CBC	CBC		CBC
17 New Hampshire	Yes, Note NH1		No	On & Off Site	Yes	Yes	DSL/C	Yes
18 North Dakota	Yes		No	On & Off Site	Yes	Yes	CC	CBC
19 Ohio	Yes		Yes, SC	On & Off Site	Yes	CBC	CC, CL	CBC
20 Pennsylvania	No	Yes, Note PA1	No	On & Off Site	Yes	CBC	CC, DSL, CL	CBC

CIBO Special Project on Non-utility Fossil Fuel Ash Classification
Survey of State Disposal Regulations
Landfill Disposal
September 30, 1997

	State	Exempt from HW Regulations	Testing For Determination	Exempt from SW Regulations	Permit Required	Siting Restrictions	Liner Required	Type of Liner Required	Leachate Collection
21	South Carolina	Yes		No	On & Off Site	CBC	CBC		CBC
22	South Dakota	Yes		No	On & Off Site	Yes	CBC	CC, SSL	CBC
23	Tennessee	No	Yes	No	On & Off Site	Yes	CBC		CBC
24	Texas	No	Yes	No	Off Site	No	Note TX1	CC, SSL, CL	Note TX2
25	Utah	Yes		Yes	Note UT1	No	No		No
26	Vermont	Yes		No	On & Off Site	Yes	CBC	DSL	CBC
27	Virginia	No	Yes	Yes, SC	Off Site	Yes, CBC		CC, SSL, DSL, CL	No, CBC
28	Washington	No	Yes	No	On & Off Site	Yes	Yes, Note WA1	CC, CL	Yes
29	West Virginia	Yes		No	On Site, Off NR	Yes	Yes	CC, CL	Yes
30	Wyoming	Yes		No	On & Off Site	Yes	CBC	CC, SSL, DSL, CL	CBC

CIBO Special Project on Non-utility Fossil Fuel Ash Classification
Survey of State Disposal Regulations
Landfill Disposal
September 30, 1997

				Analysis of CCBs				
				CCB only		CCB & other wastes		
State	Groundwater Monitoring	Closure Conditions	Financial Assurance	Prior to Disposal	After Disposal	Prior to Disposal	After Disposal	Required Analysis
1 Arizona	CBC	Yes	Yes	Yes	No	Yes	No	CBC
2 California	Note CA2	Yes	No	Yes	No	CBC	CBC	Note CA 3
3 Colardo	CBC	Yes	CBC	Yes	No	Yes	No	TCLP
4 Connecticut	Yes	Yes	Yes	Yes	No	CBC	CBC	TCLP, RCRA TM , Note CT
5 Delaware	Yes	Yes	Yes	Yes	Yes	Yes	Yes	TCLP, RCRA TM
6 Florida	Yes	CBC	CBC	CBC	CBC	CBC	CBC	Note FL1
7 Georgia	CBC	Yes	Yes	No	No	No	No	TCLP
8 Hawaii	CBC	CBC	CBC	CBC	CBC	CBC	CBC	TCLP. MEP, SW-846
9 Illinois	Yes	Yes	Yes	Yes	CBC	CBC	CBC	TCLP
10 Iowa	Yes	Yes	No	Yes	No	Yes	No	TCLP, RCRA TM
11 Kentucky	Yes	Yes	Yes	Yes	No	Yes	No	TCLP, RCRA TM
12 Maryland	CBC	CBC	No	No	No	CBC	No	ASTM C-618 Note MD1
13 Michigan	Yes	Yes	Yes	Yes	CBC	Yes	CBC	TCLP, SPLP, Note MI1
14 Minnesota		Yes	CBC	Yes	No	Yes	No	TCLP. SPLP
15 Nebraska	CBC	Yes	Yes	Yes	No	Not Applicable	Not Applicable	TCLP, SPLP, LTL, RTCA T
16 Nevada	CBC	CBC	CBC	Yes	No	Yes	No	TCLP
17 New Hampshire	Yes	Yes	Yes	Yes	CBC	Yes	CBC	Note NH2
18 North Dakota	Yes	Yes	Yes	Yes	CBC	CBC	CBC	TCLP, ASTM 3987
19 Ohio	CBC	Yes	Yes	Yes	No	Yes	No	TCLP
20 Pennsylvania	Yes	Yes	Yes	Yes	No	Yes	No	TCLP, RCRA TM, Note PA2

CIBO Special Project on Non-utility Fossil Fuel Ash Classification
Survey of State Disposal Regulations
Landfill Disposal
September 30, 1997

				Analysis of CCBs				
				CCB only		CCB & other wastes		
State	Groundwater Monitoring	Closure Conditions	Financial Assurance	Prior to Disposal	After Disposal	Prior to Disposal	After Disposal	Required Analysis
21 South Carolina	CBC	CBC	No	Yes	No	Yes	No	TCLP
22 South Dakota	CBC	Yes	CBC	CBC	No	CBC	CBC	SGLP
23 Tennessee	CBC	CBC	Yes					
24 Texas	Note TX2	Yes	No	No, Note TX3	No	No, Note TX3	No	
25 Utah	CBC	CBC	No	No	No	CBC	CBC	None, unless comanaged
26 Vermont	CBC	CBC	Yes	CBC	No	Yes	No	
27 Virginia	No, CBC	Yes, CBC	Yes, CBC	No	No	No	No	TCLP
28 Washington	Yes	Yes	Yes	No, Note WA2	No	No, Note WA2	No	TCLP, Note WA 3
29 West Virginia	Yes	Yes	Yes	Yes	No	CBC	CBC	TCLP
30 Wyoming	CBC	Yes	No	Yes				TCLP. RCRA TM

CIBO Special Project on Non-utility Fossil Fuel Ash Classification
Survey of State Disposal Regulations
Landfill Disposal
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					State Regulations impose different req.. 100% other fossil fuel		State Regulations impose different req.. co-firing		Different Requirements based on
State	Testing Frequency	Reporting of Testing to State	State Inspection	State Sampling	Pet Coke/ other solid	Oil	Other Fossil fuel	Non- Fossil Fuel	Combustion Technology
1 Arizona	CBC	Yes	Yes	No	No	No	No	No	No
2 California	Note CA3	Yes	Yes	Note CA3	Note CA4	Note CA4	Note CA4	Note CA4	Note CA4
3 Colardo	CBC	Yes	CBC	No	CBC	Yes	CBC	CBC	CBC
4 Connecticut	At Initial Application	Yes	Yes	Yes	Yes	Yes	No	No	No
5 Delaware	Semi-annually	Yes	Yes	CBC	CBC	CBC	No	No	No
6 Florida	CBC	Yes	Yes	CBC	CBC	CBC	CBC	CBC	CBC
7 Georgia	Prior to permitting	CBC	Yes	No	CBC	CBC	CBC	CBC	CBC
8 Hawaii	Semi-annually Note HI1	Yes	Yes	CBC	Yes	Yes	Yes	Yes	No
9 Illinois	Annual	CBC	Yes	No	No	No	No	No	No
10 Iowa	Prior to disposal	Yes	Yes	No	No	No	No	No	No
11 Kentucky	Prior to disposal	Yes	Yes	CBC	CBC	CBC	No	No	No
12 Maryland	Note MD2	CBC	CBC	No	CBC	CBC	CBC	CBC	CBC
13 Michigan	Annual	CBC	Yes	No	CBC	CBC	CBC	CBC	No
14 Minnesota	CBC	Yes	Yes	No					No
15 Nebraska	At Initial Application	Yes	Yes	No	Not Appl.	Not Appl.	CBC	CBC	No
16 Nevada	Not Specified	Yes	CBC	No	CBC	CBC	CBC	CBC	CBC
17 New Hampshire	CBC	Yes	Yes	CBC	CBC	CBC	No	No	No
18 North Dakota	During permitting	Yes	Yes	CBC	CBC	CBC	CBC	CBC	No
19 Ohio	Annual	Yes	Yes	CBC	No	No	No	CBC	No
20 Pennsylvania	Annually, Note PA3	Yes	Yes	CBC	CBC	CBC	Yes	Yes	Yes

CIBO Special Project on Non-utility Fossil Fuel Ash Classification
Survey of State Disposal Regulations
Landfill Disposal
September 30, 1997

					State Regulations impose different req.. 100% other fossil fuel		State Regulations impose different req.. co-firing		Different Requirements based on
State	Testing Frequency	Reporting of Testing to State	State Inspection	State Sampling	Pet Coke/ other solid	Oil	Other Fossil fuel	Non-Fossil Fuel	Combustion Technology
21 South Carolina	Note SC1	Yes	Yes	No	CBC	CBC	CBC	CBC	No
22 South Dakota	At Permit Renewal	CBC	Yes	CBC	CBC	CBC	CBC	CBC	CBC
23 Tennessee			Yes	No	No	Yes	No	No	No
24 Texas		CBC	CBC	CBC	No	No	No	No	No
25 Utah			No	No	Yes	Yes	CBC	CBC	No
26 Vermont			No	No	No	No	CBC	CBC	CBC
27 Virginia	State discretion	No	Yes	No	Yes	Yes	CBC	CBC	CBC
28 Washington	Initial gen., Note WA4	CBC	No	No	No	No	No	Yes, Note WA5	No
29 West Virginia	At Initial Application	Yes	Yes	No	Yes	CBC	CBC	CBC	No
30 Wyoming	1 time, Note WY1	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes

CIBO Special Project on Non-utility Fossil Fuel Ash Classification
Survey of State Disposal Regulations
Landfill Disposal
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	State	Regulations Require Control of Fugitive Dust	Approved Listing of CCB Beneficial Use or Petition Process	Beneficial Use Exempts from other waste regs.	Proposed Revisions to State Regulations	Comments	Percent of 1995 Coal Consumption
1	Arizona	Yes	No	No	No		1.84
2	California	Yes	?	No	Yes	Note CA5	0.29
3	Colardo	Yes	Yes		No		1.87
4	Connecticut	Yes	Yes	No	No		0.10
5	Delaware	Yes	Yes	No	No		0.22
6	Florida	Yes	No, Note FL2	No	No		2.92
7	Georgia	CBC	Yes	Yes	No		3.45
8	Hawaii	Yes	No		No		0.00
9	Illinois	Yes	Yes	No	No		4.12
10	Iowa	Yes	Yes	Yes	Yes	Note IA 2	2.27
11	Kentucky	Yes	Yes	Yes	No		4.20
12	Maryland	Yes	Yes	No, Note MD3	No		1.23
13	Michigan	Yes	Yes	No	No		3.77
14	Minnesota	Yes	Yes		No		2.09
15	Nebraska		Yes	No	No		1.14
16	Nevada	Yes	Yes	Yes	No		0.81
17	New Hampshire	Yes	Yes	Yes, Note NH3	No		0.15
18	North Dakota	Yes	Yes	Yes	No	Some synthetic liners used	3.32
19	Ohio	Yes	No, Note OH1	No	Yes, Note OH2		5.93
20	Pennsylvania	Yes	Yes	Yes	Yes	Note PA4	4.90

CIBO Special Project on Non-utility Fossil Fuel Ash Classification
Survey of State Disposal Regulations
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State	Regulations Require Control of Fugitive Dust	Approved Listing of CCB Beneficial Use or Petition Process	Beneficial Use Exempts from other waste regs.	Proposed Revisions to State Regulations	Comments	Percent of 1995 Coal Consumption
21 South Carolina	Yes	No	Yes	Yes	Note SC2	1.35
22 South Dakota	CBC	Yes	Yes	Yes	Note SD1	0.27
23 Tennessee	CBC	Yes	Yes	No	Note TN1	3.02
24 Texas	Yes, Note TX4	Yes	Yes & No	Yes	Note TX5	10.21
25 Utah	Yes	Yes	Yes	No		1.58
26 Vermont	CBC	Yes	Yes	No	Note VT1	0.00
27 Virginia	Yes	Yes	Yes			1.37
28 Washington	No	No	No	Yes, Note WA6		0.46
29 West Virginia	CBC	Yes	Yes	No		3.62
30 Wyoming	Yes	Yes	Yes	No		2.86
					Total Percent of Coal Consumption	69.36

CIBO Special Project on Non-utility Fossil Fuel Ash Classification
Survey of State Disposal Regulations
Landfill Disposal
September 30, 1997

Notes

AZ1 Arizona has adopted RCRA Subtitle C Regulations by reference, and has no other regulation addressing classification of these wastes

CA1 Regulations do not impose a sitting restriction, treated as a local land use decision.

CA2 Covered by Regional Water Quality Control Board located in each region of the state.

CA3 Testing requirements are determined by Department of Toxic Substances Control.

CA4 Regional Water Quality Control Board, Air Quality Management District and Department of Toxic Substances Control may impose additional requirements.

CA5 An ash monofill would typically require a full solid waste facility permit but have been slotted in the Standardized permit tier in the draft regulations. Local enforcement agency must make determination that facility meets exemption criteria.

CT1 Also require testing for major leachable constituents (salts, CA, SO4, FE, Mn, etc.) and dry weight for other major constituents

FL1 State reviews TCLP, SPLP and RCRA Total Metals data, not required by State regulations

FL2 State regulations do not state beneficial use procedures, if facility wants a letter from State presents a package demonstrating no human health or environmental problems.

HI1 Or as determined by the director

IA 1 Iowa does not adminsiter RCRA Subtitle D program

IA 2 State regulations are identical for a municipal solid waste landfill and a coal ash landfill. Regulations are being revised to reflect the need for different requirements for coal ash than for MSW.

KY1 State statutes classify Utility CCBs as "Special Waste" and Non-utility CCBs as "Solid Waste"

MD1 ASTM C-618 used to demonstrate if material is a "Pozzolan"

MD2 Waste may be required to be described as part of permit process

MD3 When used beneficially must comply with fugitive dust and other nuisance requirements

MI1 In addition to TCLP & SPLP require leaching tests on Al, Fe, B, Cu & Zn

NE1 An alternative liner designs including no liner design ma;y be approved based on a performace standard of no MCL exceedence

NH1 Non-utility/non-power units are note exempt, case-by-case QA/QC plans are required

NH2 TCLP and EP Tox. or just TCLP, RCRA Total Metals, ASTM C-311, others as required by QA/QC plan

NH3 Certificate of Reuse will set requirements

OH1 Ohio uses a "policy" developed by Ohio Environmental Protection Agency for beneficial use listing

OH2 Ohio EPA is looking at statutory & rule changes and expect to make a proposal in 1998

PA1 State regulations specify testing to determine if the wastes are to be managed as a hazardous or residual waste.

CIBO Special Project on Non-utility Fossil Fuel Ash Classification
Survey of State Disposal Regulations
Landfill Disposal
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PA2 May also require EPA SW846, EPA 600/A-79-020

PA3 Or when there is a change in the operations

PA4 Completed survey indicated proposed revisions are being considered with no explanation.

SC1 At time of permit application and generally at five (5) year intervals thereafter

SC2 In October 1996 draft regulations for Industrial Solid Waste Landfills were proposed. State is also planning to draft beneficial re-use regulations

SD1 State Administrative Rules are being updated. Some updates may affect some facilities.

TN1 The State regulations prescribe the requirements for MSW landfills (Class I Landfill), Industrial landfills (Class II Landfill) are negotiated downward from Class I requ'ts.

TX1 Liner is not specifically required by regulations, recommended for on-site, generally required by permit for off site disposal

TX2 Recommended but not requried for on-site disposal, would be required by permit for off-site disposal.

TX3 Required by permit for off-site disposal.

TX4 General prohibition on creating a nuissance.

TX5 Proposed regulations governing design, construction and operation of commercial, industrial, non-hazardous waste landfills.

UT1 No solid waste permit required, may require a ground water discharge permit or permit from Division of Oil, Gas & Mining

VT1 To State's knowledge no large coal fired boilers, therefore some questions answered as "what if?"

WA1 In areas with greater than 12 inches of precipitation annually

WA2 Testing required to demonstrate that waste is non-hazardous

WA3 Acute Toxicity, fish and rat, organics and persistent compounds if insufficient chemical information available to assure that that waste is non-hazardous.

WA4 Initial testing required and then whenever a process change has occurred

WA5 If refuse derived fuel is co-fired combustion byproduct may be subject to Special Incinerator Ash Management Rule.

WA6 Investigating ways to clarify the waste/commodity boundary to exclude true commmodities/products and to develop regulatory strategies for "waste materials" that have properties of waste and materials.

WY1 One time testing unless coal quality or source changes

stsurv_7.wk4

Special Project on Non-utility Fossil Fuel Ash Classification
Survey of State Disposal Regulations
Impoundment Disposal
September 30, 1997

	State	Permit Required	Siting Restrictions	Liner	Type of Liner Required	Leachate Collection	Groundwater Monitoring	Closure Conditions	Financial Assurance
1	Arizona	On & Off Site	Yes	CBC		CBC	CBC	Yes	Yes
2	California	Not applicable	No, Note CA1	Note CA2		Note CA2	Note CA2	Not Applicable	Note CA2
3	Colorado	On & Off Site	CBC	CBC	CBC	CBC	CBC	Yes	CBC
4	Connecticut	On & Off Site	Yes	No		No	Yes	Yes	Yes
5	Delaware	On & Off Site	Yes	Yes	CC, SSL, DSL, CL	Yes	Yes	Yes	Yes
6	Florida	On & Off Site	Yes	CBC	CC, SSL, CL	CBC	Yes	CBC	CBC
7	Georgia	On & Off Site	CBC	CBC	CC	No	No	No	No
8	Hawaii	On & Off site	Y:es	Yes	CC, SL, DSL, CL	CBC	CBC	CBC	CBC
9	Illinois	On & Off Site	CBC	CBC	CC, SSL, DSL, CL	CBC	CBC	Yes	Yes
10	Iowa	On & Off site	No	Yes	CC	No	No	No	No
11	Kentucky	On & Off Site	CBC	CBC	CC, SSL	CBC	CBC	Yes	No
12	Maryland	On & Off Site	CBC	CBC	CC, SSL	CBC	CBC	CBC	No
13	Michigan	On & Off Site	Yes	CBC	CC	CBC	Yes	Yes	Yes
14	Minnesota	On & Off Site	Yes	CBC		CBC		Yes	CBC
15	Nebraska								
16	Nevada	On & Off Site	CBC	CBC		CBC	CBC	CBC	CBC
17	New Hampshire	On & Off Site	Yes	Yes		Yes	Yes	Yes	Yes
18	North Dakota	On & Off Site	Yes	Yes	CC	CBC	Yes	Yes	Yes
19	Ohio	On & Off Site	CBC	CBC	CC, SSL, DSL, CL	CBC	CBC	CBC	CBC
20	Pennsylvania	On & Off Site	Yes	CBC	CC, DSL, CL	CBC	Yes	Yes	Yes

Special Project on Non-utility Fossil Fuel Ash Classification
Survey of State Disposal Regulations
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	State	Permit Required	Siting Restrictions	Liner	Type of Liner Required	Leachate Collection	Groundwater Monitoring	Closure Conditions	Financial Assurance
21	South Carolina	On & Off Site	CBC	CBC		CBC	Yes	Yes	No
22	South Dakota	On & Off Site		CBC	CC, SSL	CBC	CBC	Yes	CBC
23	Tennessee	On & Off Site	CBC	CBC	TN1	TN1	TN1	TN1	TN1
24	Texas	Off Site	No	No, Note TX1		No, Note TX2	No, Note TX2	Yes	No
25	Utah	No, Note UT1	No	No		No	CBC	CBC	No
26	Vermont	On & Off Site	Yes	CBC		CBC	CBC	CBC	Yes
27	Virginia	?	CBC	No, CBC		No, CBC	No, CBC		
28	Washington	On & Off Site	Yes	Yes	CC, SSL	Yes, Note WA1	Yes	Yes, Note WA2	No
29	West Virginia	On Site Off NR	Yes	Yes	CC, CL		Yes	Yes	Yes
30	Wyoming	On & Off Site	No	CBC	CC, SSL, DSL, CL	CBC	CBC	No	No

CIBO Special Project on Non-utility Fossil Fuel Ash Classification
Survey of State Disposal Regulations
Impoundment Disposal
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	Analysis of CCBs						
	CCB only		CCB & other wastes				Reporting
	Prior to	After	Prior to	After	Required	Testing	of Testing
State	Disposal	Disposal	Disposal	Disposal	Analysis	Frequency	to State
1 Arizona	Yes	No	Yes	No	CBC	CBC	Yes
2 California	Yes	No	Not Applicable	Not Applicable	Note CA3	Note CA3	Not Applicable
3 Colorado	Yes	No	Yes	No	TCLP	CBC	Yes
4 Connecticut	Yes	No	CBC	CBC	TCLP, RCRA TM, Note CT1	CBC	CBC
5 Delaware	Yes	Yes	Yes	Yes	TCLP, RCRA TM	Semi-annually	Yes
6 Florida	CBC	CBC	CBC	CBC	Note FL1	CBC	Yes
7 Georgia	No	No	No	No			CBC
8 Hawaii	CBC	CBC	CBC	CBC	TCLP		Yes
9 Illinois	CBC	CBC	CBC	CBC			CBC
10 Iowa	No	No	No	No	Note IA 1		Yes
11 Kentucky	Yes	No	Yes	No	TCLP. RCRA TM	Prior to disp. Note KY1	Yes
12 Maryland	No	No	CBC	No		Note MD1	CBC
13 Michigan	Yes	CBC	Yes	CBC	TCLP. SPLP, Note MI1	Annual	CBC
14 Minnesota	CBC	No	CBC	No		CBC	Yes
15 Nebraska							
16 Nevada	Yes	No	Yes	No	TCLP	Not specified	Yes
17 New Hampshire	Yes	CBC	Yes	CBC	Note NH1	CBC	Yes
18 North Dakota	Yes	CBC	CBC	CBC	TLCP, ASTM 3987	During permitting	Yes
19 Ohio	CBC	CBC	Yes & CBC	Yes & CBC	TCLP, Note OH1	Annual	CBC
20 Pennsylvania	Yes	No	Yes	No	TCLP, RCRA TM, Note PA1	Annually, Note PA2	Yes

CIBO Special Project on Non-utility Fossil Fuel Ash Classification
Survey of State Disposal Regulations
Impoundment Disposal
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	State	Analysis of CCBs: CCB only: Prior to Disposal	CCB only: After Disposal	CCB & other wastes: Prior to Disposal	CCB & other wastes: After Disposal	Required Analysis	Testing Frequency	Reporting of Testing to State
21	South Carolina	CBC	No	CBC	No	?	Annually	Yes
22	South Dakota	CBC	No	CBC	CBC	LTL	At Permit Renewal	CBC
23	Tennessee	TN1	TN1	TN1	TN1	TN1	TN1	TN1
24	Texas	No, Note TX3	No	No, Note TX3	No			CBC
25	Utah	No	No	CBC	CBC	None, unless comanaged		
26	Vermont	CBC	No	Yes	No			
27	Virginia							
28	Washington	No, Note WA3	No	No, Note WA3	No	TCLP, Note WA4	Initial gen., Note WA5	CBC
29	West Virginia	Yes	No	CBC	CBC	TCLP	At Initial Application	Yes
30	Wyoming	CBC				TCLP, RCRA TM	1 time, Note WY1	Yes

CIBO Special Project on Non-utility Fossil Fuel Ash Classification
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State	State Inspection	State Sampling	Comments
1 Arizona	Yes	No	
2 California	Not Applicable	Not Applicable	
3 Colorado	CBC	No	
4 Connecticut	Yes	Yes	
5 Delaware	Yes	CBC	
6 Florida	Yes	CBC	
7 Georgia	Yes	Yes	
8 Hawaii	Yes	CBC	
9 Illinois	Yes	No	
10 Iowa	Yes	No	
11 Kentucky	Yes	CBC	
12 Maryland	CBC	No	
13 Michigan	Yes	No	
14 Minnesota	Yes	No	
15 Nebraska			
16 Nevada	CBC	No	
17 New Hampshire	Yes	CBC	
18 North Dakota	Yes	CBC	Some synthetic liners used
19 Ohio	Yes	Yes	
20 Pennsylvania	Yes	CBC	

CIBO Special Project on Non-utility Fossil Fuel Ash Classification
Survey of State Disposal Regulations
Impoundment Disposal
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	State	State Inspection	State Sampling	Comments
21	South Carolina	Yes	No	
22	South Dakota	Yes	CBC	
23	Tennessee	TN1	TN1	
24	Texas	CBC	CBC	
25	Utah	No	No	
26	Vermont	No	No	Note VT1
27	Virginia			
28	Washington	No	No	
29	West Virginia	Yes	No	
30	Wyoming	No	No	

CIBO Special Project on Non-utility Fossil Fuel Ash Classification
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Impoundment Disposal
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Notes

CA1 Regulations do not impose a sitting restriction, treated as a local land use decision.

CA2 Covered by Regional Water Quality Control Board located in each region of the state.

CA3 Testing requirements are determined by Department of Toxic Substances Control.

CT1 Also require testing for major leachable constituents (salts, CA, SO4, FE, Mn, etc.) and dry weight for other major constituents

FL1 State reviews TCLP, SPLP and RCRA Total Metals data, not required by State regulations

IA1 NPDES sampling and anlaysis of discharge is requried

KY1 Discharge from impoundment is tested monthly

MD1 May require NPDES Permit monitoring

MI1 In addition to TCLP & SPLP require leaching tests on Al, Fe, B, Cu & Zn

NH1 TCLP and EP Tox. or just TCLP, RCRA Total Metals, ASTM C-311, others as required by QA/QC plan

OH1 May require other unspecified testing

PA1 May also require EPA SW846, EPA 600/A-79-020

PA2 Or when there is a change in the operations

TN1 No response was provided for this question. Comment attached to completed survey indicated that an impoundmemtn would be regulated as a Class II (industrial) landfill.

TX1 Liner is not specifically required by regulations, recommended for on-site, generally required by permit for off site disposal

TX2 Recommended but not requried for on-site disposal, would be required by permit for off-site disposal.

TX3 Required by permit for off-site disposal.

UT1 No solid waste permit required, may require a ground water discharge permit or permit from Division of Oil, Gas & Mining

VT1 To State's knowledge no large coal fired boilers, therefore some questions answered as "what if?"

WA1 For impoundments with a capacity greater than two (2) million gallons.

WA2 Either groundwater monitoring or leachate collection and treatment system.

WA3 Testing required to demonstrate that waste is non-hazardous

WA4 Acute Toxicity, fish and rat, organics and persistent compounds if insufficient chemical information available to assure that waste is non-hazardous.

WA5 Initial testing required and then whenever a process change has occurred

WY1 One time testing unless coal quality or source changes

APPENDIX J

ACAA REPORT ON CCB USE REGULATIONS

State Solid Waste Regulations Governing the Use of Coal Combustion Byproducts (CCBs)

ACAA

June 1996

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STATE SOLID WASTE REGULATIONS GOVERNING THE USE OF COAL COMBUSTION BYPRODUCTS (CCBs)

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STATE SOLID WASTE REGULATIONS GOVERNING THE USE OF COAL COMBUSTION BYPRODUCTS (CCBs)

Section 1: Background Information

Introduction

The mission of the American Coal Ash Association (ACAA) is to advance the management and use of coal combustion byproducts (CCBs) in ways that are technically sound, commercially competitive and environmentally safe. ACAA and its members work to gain the recognition and acceptance of specifiers, designers, contractors, legislators, regulators and others for CCBs on par with competing engineering and manufactured materials. ACAA's work in support of its mission also serves the entire "CCB industry" which comprises: producers of CCBs, including coal-burning electric utilities, both within and outside the United States of America (USA), and non-utility producers; marketers of CCBs; and organizations and individuals, including coal companies, allied trade groups, and others with commercial, academic, research and other interests in the management and use of CCBs.

Today, with reliable methods for assessing the quality of CCBs, coal-burning power plants are viewed by marketers and users of CCBs as reliable sources of quality materials. CCBs, including fly ash, bottom ash, boiler slag, and flue gas desulfurization (FGD) material are: produced from the combustion of coal, the principal fuel source for today's energy needs; specified by engineers who rely on the availability of CCBs as mineral resources for today and the 21st century; marketed by companies with knowledge of CCBs as engineering and manufacturing materials; and used in numerous applications.

Federal Regulation of CCBs

The principal federal statute under which hazardous and solid wastes are regulated is the Resource Conservation and Recovery Act, 42 U.S.C. § 6901-6991 (RCRA). RCRA establishes a comprehensive cradle to grave system for regulating hazardous wastes. Specifically, Subtitle C of RCRA and its implementing regulations impose requirements on the generation, transportation, storage, treatment and disposal of hazardous wastes. To trigger these requirements, a material must be a "solid waste" and the solid waste must be "hazardous".

Subtitle D of RCRA pertains to State or Regional Solid Waste Plans. Wastes which are not considered hazardous under Subtitle C fall under Subtitle D and are subject to regulation by the states as solid waste. As originally drafted, RCRA did not specifically address whether CCBs fell under Subtitle C as a hazardous waste or Subtitle D as a solid waste.

In 1980, Congress enacted the Solid Waste Disposal Act amendments to RCRA. Under the amendments, certain wastes, including CCBs, were temporarily excluded from Subtitle C regulation. This regulatory exemption is commonly referred to as the "Bevill Exemption." 42 U.S.C. § 6921(b)(3)(A)(i) As a result, CCBs fell under Subtitle D and became subject to regulation under state law as solid waste.

The amendments further directed that the U.S. Environmental Protection Agency (EPA) produce a report regarding CCBs and recommend appropriate regulation. 42 U.S.C. §6982(n). EPA issued its report to Congress in 1988 titled *Wastes from the Combustion of Coal by Electric Utility Power Plants* (EPA/5-30-SW-88-002). The EPA report concluded that CCBs generally do not exhibit hazardous characteristics and that regulation of CCBs should remain under state Subtitle D authority.

Following litigation against EPA by the Bull Run coalition, a final regulatory determination by the EPA became effective September 2, 1993. 58 *Federal Register* 42, 466 (August 9, 1993) The new regulation states that regulation of CCBs generated by coal-fired electric utilities and independent power producers as hazardous waste is unwarranted and that the EPA will continue to exempt these materials from regulation as a hazardous waste under RCRA.

EPA has narrowly interpreted this final exemption. The final exemption, according to EPA, applies only to coal-fired electric utilities and independent power producers. It does not include CCBs generated at any other industrial activity.
(*In re: Wheland Foundry*, EAB, No. 93-2, 12/22/93)

Fluidized bed combustion wastes, low volume wastes (boiler blowdown, coal pile runoff, cooling tower blowdown, demineralizer regenerant rinses, metal and boiler cleaning wastes, and pyrites and co-managed wastes are outside the rule. EPA determined that more study is needed on these remaining wastes. EPA must complete a study of CCBs co-managed with other low-volume wastes by September 30, 1997 and issue a final regulatory determination by April 1, 1998. These wastes continue to be exempt from hazardous waste regulations until EPA issues the required regulatory determination.

Federal Guidance for Use of CCBs

The federal government has promoted CCB reuse through a variety of initiatives. In 1983, EPA promulgated the first federal procurement guideline that required agencies using federal funds to implement a preference program favoring the purchase of cement and concrete containing fly ash. 40 C.F.R. Part 249. The EPA endorses the use of pozzolans, such as coal ash, as the preferred method for stabilizing certain metal bearing wastes. 52 *Federal Register* 29992.

EPA has also published a summary of information pertaining to CCB use in an "environmental fact sheet," *Guideline for Purchasing Cement and Concrete Containing Fly Ash* [EPA/530-SW-91-086, January 1992].

Most recently, Executive Order No. 12873, *Federal Acquisition, Recycling and Waste Prevention, 58 Federal Register* 54911 (October 22, 1993), signed by President Clinton on October 20, 1993, directs federal agencies to develop affirmative procurement programs for environmentally preferable products and requires EPA to issue guidance on principles agencies should use in making determinations for the preference and purchase of environmentally preferable products. EPA proposed a Comprehensive Procurement Guideline (CPG) designating items that can be made with recovered materials, including fly ash. 59 *Federal Register* 18852 (April 20, 1994)

Utilization efforts have included agency initiatives. The first large volume use of coal ash was by the U.S. Army Corps of Engineers (Army Corps) in construction of the Hungry Horse Dam in 1949. The Army Corps has since built several dams utilizing coal ash and continues to perform research on utilization of coal ash. Many Army Corps specifications for military and civil construction projects provide for fly ash use in concrete. (*U.S. Army Corps of Engineers, Technical Letter 1110-1-127, 17 August 1984*) The Army Corps also allows fly ash use in subgrade stabilization, embankments, flowable fill, soil amendment, and asphalt filler.

Federal Aviation Administration standards allow fly ash use in certain concrete products. (*Standards for Specifying Construction of Supports*, AC 150/5370-10A, February 17, 1989) The U.S. Department of Agriculture is conducting research on the use of coal ash as a soil amendment. The U.S. Bureau of mines has expressed interest in utilization of coal ash in mine reclamation. State and federal departments of transportation have generally actively supported the utilization of CCBs.

According to a 1992 Office of Federal Procurement Policy report, however, agency compliance with guidelines on CCB use has been minimal. (Office of Federal Procurement Policy, Report to Congress, Dec. 1992)

Production and Use of CCBs

ACAA conducts an annual survey of the production and use of CCBs to maintain and it's unique database from which an annual report is issued. The participants in ACAA's annual survey are coal-burning electric utilities from throughout the USA. ACAA's series of annual surveys and reports since the late 1960s have been used extensively by producers and marketers of CCBs, federal- and state-level government agencies, engineers and contractors, allied industry groups and others who have an interest in CCB management and use.

A comprehensive report, *Coal Combustion Byproduct (CCB) Production and Use: 1966 - 1993 [Report for Coal-Burning Electric Utilities in the United States]*, was published by ACAA in April 1995. Annually, some twenty-five percent of the nearly ninety million tons of CCBs produced in the USA is used.

Barriers to the Use of CCBs

The U.S. DOE report to Congress, *Barriers to the Increased Utilization of Coal Combustion/Desulfurization Byproducts by Governmental and Commercial Sectors* [DOE Office of Fossil Energy, July 1994], resulted from Section 1334 of the Energy Policy Act of 1992 [*Public Law No. 102-486*] in which DOE was charged with the task of conducting a detailed and comprehensive study on the "institutional, legal and regulatory barriers to increased utilization of CCBs."

The DOE "barriers report" addresses a network of related barriers which can be overcome only through cooperative efforts among federal and state governments and industry. The DOE report provides positive guidance for improving the management and use of CCBs. Recommendations from the DOE report have been incorporated into ACAA's long-range guidance document, *Strategic Plan: 1995 - 2000.*

Review of State Regulations

During 1996, ACAA updated a review of state solid waste laws, regulations, policies and agency guidance, originally published in 1995, governing the use of CCBs.

Use of this Report

The information in this report provides an overview of state solid waste laws, regulations, policies and agency guidance governing the use of CCBs. This report will be useful to ACAA members and others who are familiar with "beneficial use" regulations for CCBs in their particular state and will assist in the exchange of regulatory guidance to enhance the use of CCBs.

Limitations of this Report

The information presented in this report was obtained from numerous sources through March, 1996. Although the report seeks to accurately describe authorized state CCB uses, the reader is cautioned to seek appropriate technical, environmental and legal advice with respect to any actions that may be undertaken concerning the management and use of CCBs in any state. This report is not intended to advise the reader regarding legal or regulatory requirements applicable to CCB use projects in any state and should not be relied upon for this purpose.

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Section 2: Overview of State Regulations

Introduction

This report summarizes state laws, regulations, policies and/or agency guidance regarding the use of CCBs. It is important for the reader to recognize that information presented in this section is merely a summary overview of various state regulations. The reader should carefully review and understand the briefly stated limitations of this report as well as the formal disclaimer of warranties and limitation of liabilities, which are presented in Section 1 of this report. This report is not intended to advise the reader regarding legal or regulatory requirements applicable to CCB use projects in any state and should not be relied upon for this purpose.

General Summary

Most states exempt CCBs from hazardous waste regulations and regulate these materials as solid, special or industrial wastes. The states that do not exempt CCBs from hazardous waste regulations require testing to determine hazardousness, and if shown to be non-hazardous, the CCBs are regulated as solid waste.

For consistency, this report utilizes the term CCBs. The term is intended to generically refer to fly ash, bottom ash, boiler slag, and FGD material. The reader must recognize that each state has different approaches to classification of CCBs and that these respective classifications may limit or expand allowable uses of CCBs. For example, in Pennsylvania CCBs are referred to as "coal ash" which is defined to include only fly ash, bottom ash and boiler slag. Conversely, some states include within the definition of CCBs, wastes which have been combusted with other materials, such as petroleum coke, tire derived fuel and/or wood. In some cases these distinctions are noted herein. However, the reader should not assume that use of the term CCB infers that all types of CCBs are included within the scope of a particular state's regulations.

Most states currently do not have specific regulations addressing the use of CCBs and requests for CCB uses are handled on a case-by-case basis or under generic state recycling laws or regulations. Many states have adopted "generic" laws and regulations which authorize use and recycling of hazardous and/or solid wastes in certain applications. Some of these generic use laws are described in Section 3. States without formal CCB use regulations or guidelines often encourage the use of coal fly ash use in cement and concrete applications and products. Additionally, state highway departments are required by the Federal Highway Administration (FHWA) to have specifications conforming to federal procurement guidelines for cement and concrete containing coal fly ash for federally funded projects.

Some states have adopted laws and regulations or issued policies and/or guidance regarding CCB use. The CCB uses authorized within these states vary widely. Some states authorize liberal use of CCBs, while others authorize CCB use only in limited applications. In addition, the level of regulatory control and oversight varies significantly. CCB uses presenting the greatest concern to state regulators are those which involve land application such as the use of CCBs in agricultural applications, structural fills, mine applications and embankments. Some states, consider these applications to be waste disposal and not use or recycling.

In summary, laws, regulations, policies and/or guidance authorizing at least limited CCB use have been adopted in the following states: Alabama, Arkansas, California, Georgia, Illinois, Indiana, Iowa, Kentucky, Maryland, Massachusetts, Michigan, Nebraska, New Jersey, New Mexico, New York, North Carolina, North Dakota, Ohio, Oklahoma, Pennsylvania, South Carolina, Tennessee, Texas, Vermont, Virginia, West Virginia, and Wisconsin. The following table summarizes uses of CCBs that are “authorized” (●) or “allowed” (❑) on a state-by-state basis as presented in the remainder of this report.

Uses of CCBs by State

	AL	AK	AZ	AR	CA	CO	CT	DE	FL	GA	HI	ID	IL	IN	IA	KS	KY	LA	ME	MD	MA	MI	MN	MS	MO
Cement/Concrete Products	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	●	❑	●	❑	●	❑	❑	❑	❑	●	❑	❑	❑
Flowable Fill													●	●							●	●			
Structural Fills		❑											●	●			●			●	●	●			
Road Base/Subbase													●	●	●		●				●	●			
Mineral Filler in Asphalt															●							●			
Snow and Ice Control													●	●			●								
Roofing Shingles													●				●								
Blasting Grit																	●								
Grouting						❑																●			
Mining Applications													●	●			●								
Wallboard										❑					●										
Waste Stabilization																									
Plastics/Paints/Metals													●		●		●								
Mineral Recovery													●	●	●										
Soil Amendment	●												●							●					
Ingredient in Product				●	●					●				●			●				●				
Aggregate																					●	●			
Ice Control (Rivers)																									
Landfill Cover		❑																			●				
Walking/Driving Surface																									
Concrete Block																					●				
Bricks/Ceramics/Insulation																									
Artificial Reefs																									

❑ : Allowed

● : Authorized

Uses of CCBs by State (continued)

	MT	NE	NV	NH	NJ	NM	NY	NC	ND	OH	OK	OR	PA	RI	SC	SD	TN	TX	UT	VT	VA	WA	WV	WI	WY
Cement/Concrete Products	❑	●	❑	❑	❑	❑	●	●	❑	●	❑	❑	●	❑	●	❑	❑	●	❑	❑	❑	❑	●	●	❑
Flowable Fill		●					●	●		●								●					●	●	
Structural Fills		●					●	●		●			●		●		●				●				
Road Base/Subbase		●						●		●			●				●	●			●		●	●	
Mineral Filler in Asphalt		●					●			●								●						●	
Snow and Ice Control							●	●		●			●								●		●	●	
Roofing Shingles							●	●		●					●			●					●		
Blasting Grit		●						●		●					●			●					●		
Grouting										●								●							
Mining Applications					●				●	●	●		●								●				
Wallboard							●											●							
Waste Stabilization		●								●								●					●		
Plastics/Paints/Metals								●		●								●					●		
Mineral Recovery								●		●			●								●		●		
Soil Amendment								●		●			●								●				
Ingredient in Product							●	●		●			●		●			●		●			●		
Aggregate		●				●	●	●		●			●		●		●	●					●		
Ice Control		●																							
Landfill Cover																							●		
Walking/Driving Surface										●								●			●				
Concrete Block										●								●					●		
Bricks/Ceramics/Insulation							●			●								●							
Artificial Reefs																		●							

❑ : Allowed

● : Authorized

Section 3: State-by-State Summaries of Solid Waste Regulations

Introduction

This section provides a summary of state laws, regulations, policies, and agency guidance. Laws and regulations may be generically referred to as laws. The reader must recognize that this section contains only a brief synopsis of the state laws, regulations and/or policies. The reader should carefully review and understand the briefly stated limitations of this report as well as the formal disclaimer of warranties and limitation of liabilities, which are presented in Section 1 of this report.

State-by-State Summary:

ALABAMA

Under Alabama regulations, fly ash, bottom ash, slag and flue gas emission control waste generated primarily from the combustion of coal or other fossil fuels are exempt from regulation as hazardous waste or industrial solid waste. ALA.ADMIN.CODE R.335-13-1-.03; 335-14-2-.01. According to the Alabama Department of Environmental Management (DEM), fly ash, bottom ash, boiler slag or flue gas emission control waste which result from the combustion of coal at electric generating plants are not regulated wastes pursuant to ALA.CODE § 22-27-3.

Currently, reuse of CCBs is not specifically authorized under Alabama law or regulations. CCB reuse may, however, be permitted under generic waste reuse regulations. Under these regulations, materials are not considered solid wastes when they can be recycled by being:

- Used or reused as ingredients in an industrial process to make a product, provided the materials are not being reclaimed;
- Used or reused as effective substitutes for commercial products; or
- Returned to the original process from which they are generated, without first being reclaimed. The materials must be returned as a substitute for raw materials feedstock, and the process must use raw materials as principal feedstocks.

The following materials remain regulated solid wastes, even if the recycling involves use, reuse or return to the original process:

- Materials used in a manner constituting disposal, or used to produce products that are applied to the land;
- Materials burned for energy recovery, used to produce a fuel or contained in fuels;
- Materials accumulated speculatively; or
- Inherently waste-like materials.

Appropriate documentation must be maintained regarding all waste recycling documenting that the material is exempt from regulation (eg. contracts showing that the material was used as an ingredient in a production process).
ALA.ADMIN.CODE R.335-14-2-.01

CCB reuse may also be authorized pursuant to the DEM interpretation of CCBs as non-regulated solid wastes.

Alabama Department of Environmental Management contact: Ben Norman (334) 271-7700

ALASKA

Alaska regulations adopt by reference the federal regulation which exempts CCBs from classification as hazardous waste. Exempt from hazardous waste regulation are fly ash, bottom ash, slag, and flue gas emission control waste generated primarily from the combustion of coal. ALASKA ADMIN. CODE tit. 18 §62.020(a); 40 CFR 261.4.

Currently, reuse of CCBs is not specifically authorized under Alaska law or regulations. According to the Alaska Department of Environmental Conservation, coal ash has been allowed as fill and as landfill cover under permit.

Alaska Department of Environmental Conservation contact: Kris McCumby (907)451-2134

ARIZONA

Arizona regulations adopt by reference the federal regulation which exempts CCBs from classification as hazardous waste. Exempt from hazardous waste regulation are fly ash, bottom ash, slag, and flue gas emission control waste generated primarily from the combustion of coal. ARIZ. COMP. ADMIN. R & REGS. 18-8-261; 40 CFR 261.4.

Currently, reuse of CCBs is not specifically authorized under Arizona law or regulations.

Arizona Environmental Quality Department: (602) 207-4132

ARKANSAS

Arkansas regulations adopt by reference the federal regulation which exempts CCBs from classification as hazardous waste. Exempt from hazardous waste regulation are fly ash, bottom ash, slag, and flue gas emission control waste generated primarily from the combustion of coal. Ark. Reg. 23-2-261.4; 40 CFR 261.4.

Currently, reuse of CCBs is not specifically authorized under Arkansas law or regulations. Arkansas has adopted generic regulations under its hazardous waste and solid waste programs which exclude from regulation recovered materials that are used, reused, or recycled.

To be exempt from regulation, the material must be used, reused, or recycled in one of the following ways:

- As an ingredient in a process to make a product;
- In the same or different fashion as its original intended purpose without physically changing its composition; or
- As an effective substitute for a commercial product as long as the substitution does not pose a threat to human health or the environment and the facility is not a solid waste thermal treatment facility.

The following materials remain regulated as solid wastes, even if the recycling involves use, reuse or return to the original process:

- Materials used in a manner constituting disposal, or used to produce products that are applied to the land;
- Materials burned for energy recovery, used to produce a fuel or contained in fuels;
- Materials accumulated speculatively; or
- Inherently waste-like materials.

Ark. Reg. 23-2-261.2

Arkansas Department of Pollution Control: (501) 682-0601.

CALIFORNIA

Under California law, fly ash and bottom ash are presumed to be hazardous waste unless the ash satisfies certain testing requirements and does not exhibit a characteristic of hazardous waste. CAL.CODE REGS. tit. 22 §66261.126, Appendix X; CAL.CODE REGS. tit. 22 §66261.4.

Fly ash and bottom ash which contain metals at certain levels has been prohibited from land disposal since January 1, 1991. CAL.CODE REGS. tit. 22 §66268.100(8),106

Ash from the combustion of fossil fuels may be classified and managed as a special waste following department approval of an application for such classification. CAL.CODE REGS. tit. 22 §66261.120, 122. Special waste may be disposed in non-hazardous waste landfills under certain conditions. CAL.CODE REGS. tit. 22 §66261.126.

Currently, reuse of CCBs is not specifically authorized under California law or regulations. CCB reuse may, however, be permitted under certain conditions pursuant to generic waste reuse regulations. Under these regulations, solid wastes may be recycled by being:

- Used or reused as ingredients in an industrial process to make a product, provided the materials are not being reclaimed;
- Used or reused as effective substitutes for commercial products; or
- Returned to the original process from which they are generated, without first being reclaimed. The materials must be returned as a substitute for raw materials feedstock, and the process must use raw materials as principal feedstocks.

Permitting, restrictions and other requirements may apply. CAL.HEALTH & SAFETY CODE §25143.2.

COLORADO

Under Colorado regulations, fly ash, bottom ash, slag and flue gas emission control waste generated primarily from the combustion of coal or other fossil fuels are exempt from regulation as hazardous waste. 6 COLO.CODE REGS. §1007-3.261.4.

Currently, reuse of CCBs is not specifically authorized under Colorado law or regulations, however, fly ash may be blended with portland cement for grouting wells. 2 COLO.CODE REGS. §402-2.122.

Colorado Environmental office: (303) 692-3099

CONNECTICUT

Connecticut regulations adopt by reference the federal regulation which exempts CCBs from classification as hazardous waste. Exempt from hazardous waste regulation are fly ash, bottom ash, slag, and flue gas emission control waste generated primarily from the combustion of coal. CONN. AGENCIES REGS. §22a-449(c)-101; 40 CFR 261.4.

Currently, reuse of CCBs is not specifically authorized under Connecticut law or regulations. No CCB reuse proposals have reportedly been made to the state.

Connecticut Department of Environmental Protection: (860)424-3365

DELAWARE

Under Delaware regulations, fly ash, bottom ash, slag waste, and flue gas emission control waste, generated primarily from the combustion of coal or other fossil fuels are exempt from regulation as hazardous waste. Del. Reg. 261.4

Currently, reuse of CCBs is not specifically authorized under Delaware law or regulations.

Delaware Department of Natural Resources and Environmental Control: (302) 739-3694

FLORIDA

Under Florida regulations, fly ash, bottom ash, slag waste and flue gas emission control waste, generated primarily from the combustion of coal or other fossil fuels are exempt from regulation as hazardous waste.

Currently, reuse of CCBs is not specifically authorized under Florida law or regulations.

Florida Department of Environmental Regulation: (904)922-6104

GEORGIA

Georgia regulations adopt by reference the federal regulation which exempts CCBs from classification as hazardous waste. Exempt from hazardous waste regulation are fly ash, bottom ash, slag, and flue gas emission control waste generated primarily from the combustion of coal. GA.COMP.R.& REGS. r. 391-3-11-.07; 40 CFR 261.4. CCBs are classified under Georgia law as industrial solid waste. GA.CODE ANN. 10-12-8-22(12.1).

Currently, reuse of CCBs is not specifically authorized under Georgia law or regulations. Georgia has adopted generic regulations which exclude from regulation recovered materials that are used, reused, or recycled.

To be exempt from regulation, the material must be used, reused, or recycled in one of the following ways:

- As an ingredient in a process to make a product;
- In the same or different fashion as its original intended purpose without physically changing its composition; or
- As an effective substitute for a commercial product as long as the substitution does not pose a threat to human health or the environment and the facility is not a solid waste thermal treatment facility.

These recycling exemptions do not apply when the material is applied to or placed on the land in a manner that constitutes disposal.

Ash reuse applications appear to primarily involve concrete and gypsum wallboard applications. The Department of Transportation has reportedly been conducting experimental asphalt projects including the use of ash.

Georgia Department of Natural Resources contact: Barbara Howard (404) 362-2572

HAWAII

Under Hawaii regulations, fly ash, bottom ash, slag waste and flue gas emission control waste, generated primarily from the combustion of coal or other fossil fuels are exempt from regulation as hazardous waste. HAWAII REGS. §11-261-4

Currently, reuse of CCBs is not specifically authorized under Hawaii law or regulations. Land and Natural Resources Department: 808-587-0360.

IDAHO

Idaho regulations adopt by reference the federal regulation which exempts CCBs from classification as hazardous waste. Exempt from hazardous waste regulation are fly ash, bottom ash, slag, and flue gas emission control waste generated primarily from the combustion of coal. IDAPA tit.1 5-.005; 40 CFR 261.4.

Currently, reuse of CCBs is not specifically authorized under Idaho law or regulations.

Idaho Department of Environmental Quality: (208) 373-0502

ILLINOIS

Under Illinois regulations, fly ash, bottom ash, slag waste and flue gas emission control waste, generated primarily from the combustion of coal or other fossil fuels are exempt from regulation as hazardous waste. 35 ILL. ADMIN. CODE §721.104.

In 1995, Illinois enacted legislation specifically authorizing reuse of coal combustion waste. 415 ILCS 5/3.94. Under Illinois law, the term coal combustion waste includes fly ash, bottom ash, slag or flue gas or fluid bed desulfurization byproducts generated through combustion of coal. The term also includes waste from coal combusted with the following:

- Fuel grade petroleum coke, other fossil fuel, both fuel grade petroleum coke and other fossil fuel, or

- Fuel grade petroleum coke, other fossil fuel, or both fuel grade petroleum coke and other fossil fuel in combination with no more than 20% tire derived fuel or wood or other materials by weight of the material combusted. Note: An Agency determination is required that storage and disposal of the resultant wastes will not result in an environmental impact greater than waste from the combustion of coal alone and that the storage and disposal of the resultant wastes will not violate federal law.

Under the recently enacted legislation, coal combustion waste can be classified as coal combustion byproduct (CCB) under certain conditions. CCB may be reused as follows:

- For the extraction and recovery of materials and compounds within the ash;
- As a raw material in the manufacture of cement, concrete, concrete products and concrete mortars;
- For asphalt or cement based roofing shingles;
- In plastic products, paints and metal alloys;
- In conformance with the specifications and under the approval of the Department of Transportation ("IDOT");
- As anti-skid material, athletic tracks or foot paths (Bottom Ash);
- As a lime substitute in the lime modification of soils so long as the CCBs meet the IDOT specifications for byproduct limes, and the functional equivalent for agricultural lime as a soil conditioner;
- In non-IDOT pavement base, pipe bedding, or foundation backfill (Bottom Ash);
- As structural fill when used in an engineered application or combined with cement, sand or water to produce a controlled strength fill material and covered with 12 inches of soil unless infiltration is prevented by the material itself or other cover material; and
- For mine subsidence, mine fire control, mine sealing and mine reclamation.

Certain restrictions apply to reuse of CCBs. The user of CCBs in certain applications must notify the Illinois Environmental Protection Agency (IEPA) of each project utilizing CCBs, document the quantity of CCBs that will be utilized and certify that the CCBs have not been mixed with hazardous waste prior to use and that the CCBs do not exceed Class I groundwater quality standards for metals when tested utilizing ASTM method D 3987-85. Dust generation in fly ash applications must be minimized. CCBs may not be accumulated speculatively. Note: CCBs are not accumulated speculatively if 75% of the CCBs accumulated at the beginning of a calendar year are used during the calendar year.

Mine applications of coal combustion waste and/or CCBs must meet the requirements specified in 415 ILCS 5/21(r) and certain guidance memorandum issued by the Illinois Department of Mines and Minerals (IDMM) and IEPA. IDMM and IEPA have dual jurisdiction over mine disposal of CCBs. IDMM and IEPA have issued joint memorandums detailing the procedures and requirements for mine disposal of CCBs. (Land Reclamation Memorandum 92-11 and Land Reclamation Memorandum 95-9). Groundwater monitoring and liners may be required by IDMM and IEPA in certain applications.

Other CCB applications may be authorized upon IEPA's written determination that the proposed use has no greater adverse environmental impact that the beneficial uses specified in the law.

Illinois Environmental Protection Agency contact: James B. Park (217)785-0748

INDIANA

Under Indiana law, fly ash, bottom ash, or such ash when mixed with flue gas desulfurization byproducts may not be regulated if the material is not hazardous and is disposed in a properly permitted and approved facility. Additionally, fly ash, bottom ash, or such ash when mixed with flue gas desulfurization byproducts or boiler slag may not be regulated when used in the following manner:

- For the extraction and recovery of materials and compounds within the ash;
- As an anti-skid material (bottom ash);
- As raw material in manufacturing another product;
- For mine subsidence, mine fire control, and mine sealing (Note: restrictions may apply under the laws and regulations applicable to mining);
- As structural fill when combined with cement, sand or water to produce a controlled strength fill material; and
- As a base in road construction.

IND. CODE 13-1-12-9.

In July, 1993, the Indiana Department of Environmental Management (IDEM) prepared Coal Ash Classification Guidelines specifying testing and other requirements for CCBs proposed for reuse in ways other than those specified above. These Guidelines are currently in the process of being revised. Under the current guidelines and Indiana law, CCBs may be disposed at Type I restricted waste sites (generally a site designed as a sanitary landfill) without specific testing. CCBs may be disposed of at other waste sites (Types II, III, IV) only if:

- EP toxicity results for arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver are within specified limits,
- TCLP results for barium, boron, chlorides, total cyanide, fluoride, pH, sodium, sulfate, total sulfide and total dissolved solids are within specified limits, and

- Resampling is conducted every five years, whenever the characteristics of the coal change, whenever the process generating the waste changes or as otherwise required by the Indiana Department of Environmental Management.

Note: According to the IDEM, some facilities have been authorized to conduct an "Indiana groundwater leachate test" in lieu of the EP toxicity test and the TCLP test.

329 IAC 2-9-3, 1993 IDEM Guidelines.

Indiana Department of Environmental Management contact: George Ritschotte (317) 232-5976

IOWA

Iowa regulations adopt by reference the federal regulation which exempts CCBs from classification as hazardous waste. Exempt from hazardous waste regulation are fly ash, bottom ash, slag, and flue gas emission control waste generated primarily from the combustion of coal. IOWA ADMIN. CODE r. 567-141.2 (455B); 40 CFR 261.4.

Under Iowa regulations, coal combustion residue includes bottom ash, fly ash, slag and flue gas desulfurization sludge produced through the combustion of coal, by itself or in combination with natural gas and other fuels. Coal combustion residues may be reused under permit by rule regulation as follows:

- As a raw material in cement or concrete, filler in asphalt or plastic, and any other similar use where the coal combustion residue is bound up in cementitious material so that leaching and dusting do not occur. Use as a raw material does not include pretreating coal combustion residue for the purpose of disposal.
- As a fill base for roads, parking lots, and any other similar use, not to exceed an average of one ton for each twenty-five (25) square feet of area covered or an average thickness of twelve (12) inches.
- As a raw material to be used in mineral recovery.
- As a source of gypsum in wallboard, plaster or similar uses.
- Any single use of 500 dry tons or less.

General conditions for reuse of CCBs include:

- Coal combustion residue must be stored and used in a manner that will not significantly degrade ground or surface water, create a public health hazard or create a nuisance.

- Coal combustion residue may not be placed or stored on any wetland or in any water of the state.

IOWA ADMIN. CODE R. 455-108.1-.2

Iowa Department of Natural Resources contact: Lavoy Haage (515) 281-4968

KANSAS

Under Kansas law, fly ash, bottom ash, slag and flue gas emission control wastes generated primarily from the combustion of coal or other fossil fuels are exempt from regulation as hazardous waste, but may be regulated as an industrial solid waste.
KAN. STAT. ANN. §65-3430; KAN.ADMIN.REGS.28-29-3.

Currently, reuse of CCBs is not specifically authorized under Kansas law or regulations.

Kansas Department of Health and Environment contact: Ken Powell (913) 296-1600

KENTUCKY

Under Kentucky regulations, CCBs are exempt from regulation as hazardous waste but are classified as special waste. Specifically included within the definition of coal combustion byproducts classified as special waste is fly ash, bottom ash, and scrubber sludge produced by coal-fired electrical generating units. Excluded is boiler slag, and residues of refuse derived fuels such as municipal waste, tires and solvents.

KY. REV.STAT. ANN.§224.50-760; 401 KY.ADMIN.REGS. 45:010(4)

Under Kentucky law, CCBs (as defined above) may be reused under permit by rule regulation as follows:

- As an ingredient in manufacturing a product;
- As an ingredient in cement, concrete, paint and plastics;
- As anti-skid material;
- As highway base course;
- As structural fill;
- As blasting grit;
- As roofing granules; and
- For mine stabilization and reclamation (in accord with the requirements of KY.REV. STAT.ANN. §350.270).

Specific conditions for reuse of CCBs apply. These conditions include:

- The CCB reuse may not create a nuisance;
- Erosion and sediment controls must be undertaken;
- The CCB reuse must be 100 feet from a stream and 300 feet from wells, wetlands or flood plains;
- The ash must be "non-hazardous"; and
- The generator must submit an annual report identifying the type and amount of waste released for reuse, the name and address of the recipient of the waste intended for reuse, and the specific use, if known, each waste recipient made of the CCB.

KY. REV. STAT. ANN. §§350-350.010(22); 401 KAR 45:060

Mine applications must be specifically permitted by the Department for Surface Mining, Reclamation and Enforcement. An application must be submitted demonstrating that the operator has the legal right to dispose of the ash and that indicates analytical testing that the ash is not hazardous. Extensive hydrological information is also required in the application. Requirements for mine disposal of CCBs can be found at KY.REV. STAT.ANN. §350.270.

In summary, non-hazardous fly ash, bottom ash, scrubber sludge and fluidized bed combustion wastes may be disposed in the mine pit or coal excavation area. Co-managed wastes may not be reused in mine applications. Records documenting the source and amount of ash shipment must be maintained. Ash handling requirements are designed to minimize contact with water. Ash must be placed at least four feet above the groundwater table and may not exceed a forty foot thickness. No ash may be placed within four feet horizontally of a final high wall, exposed coal seam or coal outcrop. The volume of ash to be disposed cannot exceed the original volume of coal removed from the area which produced the ash. Semi-annual groundwater monitoring and reporting is required. Public notice and comment takes place prior to approval of the application.

Kentucky Natural Resources and Environmental Protection Cabinet: (502) 564-6716

LOUISIANA

Under Louisiana regulations fly ash, bottom ash, slag waste, and flue emission control waste generated solely from the combustion of coal, or other fossil fuels are exempt from regulation as hazardous waste. LA.ADMIN.CODE tit. 33 §105.

These materials are, however, considered special wastes. LA.REV. STAT. ANN. 30-2241.

Currently, reuse of CCBs is not specifically authorized under Louisiana law or regulations.

Louisiana Department of Environmental Quality: (504) 342-1234

MAINE

Under Maine regulations fly ash, bottom ash, slag waste, and flue emission control waste generated solely from the combustion of coal, other fossil fuels, or from the combustion of coal and other fossil fuels and wood are exempt from regulation as hazardous waste only if the CCBs do not exhibit any characteristic for ignitability, corrosivity, reactivity, or toxicity. Code Me. R. §6-096-850(3). Under Maine regulations, coal ash is regulated as a special waste. Special wastes require special handling, transportation and disposal procedures.
Code Me. R. §6-096-400-1(KKK).

Currently, reuse of CCBs is not specifically authorized under Maine law or regulations. Ash or ash derived products may be used as a raw material substitution in concrete block manufacturing under specified circumstances. Code Me. R. §6-096-409-1(B)(2).

Maine Department of Environmental Protection: (207) 287-7688

MARYLAND

Under Maryland law, fly ash, bottom ash, slag, and flue gas emission control waste generated primarily from the combustion of coal or other fuels are not regulated as a hazardous waste. 26.13.02.04-1

Maryland law authorizes certain beneficial reuses of "pozzolans". Pozzolans are defined as "the finely divided residue which results from combustion of ground or powdered coal and is released by combustion gases, as defined by the test methods published by the American Society for Testing Materials." MD. ANN. CODE §15-407 (formerly MD. ANN. CODE §7-464)(ASTM class fly ash). Under Maryland law, pozzolans may be used as follows:

- For landfill in a manner which complies with sound engineering practices and applicable permit requirements.

- As structural building, soil improvement, agriculture soil conditioning, or land reclamation in compliance with all silt control regulations and permit requirements of the Department of the Environment. Dust and erosion minimization is required.

MD. ANN. CODE §15-407 (formerly MD. ANN. CODE §7-464).

Maryland Department of the Environment: (410) 631-3000

MASSACHUSETTS

Under Massachusetts law, fly ash, bottom ash, slag, and flue gas emission control waste generated primarily from the combustion of coal or other fossil fuels are exempt from regulation as a hazardous waste.

MASS.REGS.CODE tit.310§30.104

In Massachusetts, ash produced from the combustion of coal including fly ash, bottom ash, and boiler slag, and economizer ash are exempt from regulation as waste if beneficially reused:

- As a raw material for concrete block manufacture,
- As aggregate,
- As fill,
- As a base for road construction,or
- In other approved commercial or industrial purposes (flash fill has been approved)

General conditions for use include:

The ash storage location for these reuses may be constructed, established, maintained and operated without being construed as a refuse disposal facility and no approval from the Board of Health or the Department is required. However, the Department has jurisdiction to determine that the facility has created a nuisance condition due to odor, dust, fires, smoke, or other conditions and order the abatement of these conditions.

Except for CCB reuse as base for road construction or fill, land application of CCBs is prohibited, unless the place where the disposal is proposed to occur has been assigned for such disposal by the board of health and plans for such disposal have been approved by the Department.

CCBs may be used as intermediate cover material over rubbish at a landfill with the approval of the Department.

MASS.REGS.CODE tit.310§19.006; MASS. GEN.LAWS ANN. ch.111 §150A.

Massachusetts Department of Environmental Protection: (617) 292-5980

MICHIGAN

Under Michigan regulations, fly ash, bottom ash, slag and flue gas emission control waste generated primarily from the combustion of coal or other fossil fuels are exempt from regulation as hazardous waste. MICH.ADMIN.CODE r.299.9204. These materials are, however, considered low hazard industrial wastes. MICH.ADMIN.CODE r.299.4122.

Under Michigan law, CCBs are not considered solid waste and may be reused:

- With a maximum of 6% of unburned carbon as a component of concrete, grout, mortar, or casting molds.
- With a maximum of 12% unburned carbon passing M.D.O.T. test method MTM 101 when used as a raw material in asphalt for road construction.
- As aggregate, road, or building material which in ultimate use will be stabilized or bonded by cement, limes, or asphalt.
- As a road base or construction fill which is covered with asphalt, concrete, or other material approved by the director and which is placed at least 4 feet above the seasonal groundwater table.
- As the sole material in a depository designed to reclaim, develop, or otherwise enhance land, subject to the approval of the director. (See Rule 299.4113 for conditions regarding approval for land reclamation)

MICH.COMP.LAWS ANN. §324.11506(1)(k)

Under Michigan regulations, coal ash may be used to reclaim, develop, or enhance land following submission of a plan and approval of the plan by the Michigan Department of Environmental Quality ("DEQ"). The plan submitted to the DEQ must describe how the proposed use will reclaim, develop,or enhance the land and must demonstrate that the coal ash is inert (Note: Rules 299.4114-4117 specify the criteria a waste must satisfy in order to be classified as inert), that the site conditions are sufficient to prevent the migration of ash constituents, or that the plan is otherwise protective of human health and the environment. The plan must also include topographic maps, a closure plan, documentation of landowner authorization, post closure restrictions and other information specified in the regulations.

MICH.ADMIN.CODE r.299.4113.

Michigan Department of Environmental Quality: (800) 662-9278

MINNESOTA

Under Minnesota regulations, fly ash, bottom ash, slag and flue gas emission control waste generated from the combustion of fuels which are at least 51% coal or other fossil fuels and the balance of the fuel does not contain hazardous waste is exempt from regulation as hazardous waste. MINN. R. 7045.0120.

Currently, reuse of CCBs is not specifically authorized under Minnesota law or regulations.

Minnesota Pollution Control Agency contact: Lanny Peissig (612)297-1781

MISSISSIPPI

Mississippi regulations adopt by reference the federal regulation which exempts CCBs from classification as hazardous waste. Exempt from hazardous waste regulation are fly ash, bottom ash, slag, and flue gas emission control waste generated primarily from the combustion of coal. Miss. Reg. Part 261; 40 CFR 261.4.

Currently, reuse of CCBs is not specifically authorized under Mississippi law or regulations.

State of Mississippi Department of Environmental Quality Special Wastes Section contact: Mark Williams (601) 961-5171

MISSOURI

Missouri regulations adopt by reference the federal regulations which exempt CCBs from classification as hazardous waste, however, fly ash that is not beneficially reused and fails TCLP must be disposed in a hazardous waste landfill.
MO. CODE REGS tit.10, § 25-4.261.

Missouri regulations exempt CCB "disposal areas" from solid waste permitting requirements provided that beneficial use and/or reclamation can be demonstrated. In addition, it must be shown that pollution, a public nuisance or a health hazard will not occur. The exemption must be requested in writing from the state. The request must include:

- an explanation of the beneficial use or reclamation;
- an operational plan identifying the area involved;
- an estimate of the quantity of waste to be disposed and the time required for disposal procedures;

- a description of the physical and chemical characteristics of the waste;
- a description of the soil and bedrock conditions that are expected to prevent groundwater and surface water contamination;
- a description of the proposed operational procedures for waste disposal and complications; and
- provisions for closing the area.

MO.CODE REGS tit.10 §80-2.020(9)

MONTANA

Under Montana regulations, fly ash, bottom ash, slag and flue gas emission control waste generated primarily from the combustion of coal or other fossil fuels are exempt from regulation as hazardous waste. MONTANA ADMIN.R. 17.54.307. These materials are, however, classified as an industrial solid waste. MONTANA.ADMIN.R. 17.50.502. Industrial solid wastes are considered "Group II" wastes. MONTANA ADMIN.R. 17.50.503. Under Montana regulations, byproducts or materials which have economic value and may be used by the person producing the material or sold to another person for resource recovery or use in a beneficial manner are not wastes.
MONTANA ADMIN. R. 17.50.502(50).

Currently, reuse of CCBs is not specifically authorized under Montana law or regulations. A task force is evaluating the possibility of promulgating CCB reuse regulations or policies.

Montana Department of Health and Environmental Sciences Solid Waste Program contact:
Edward Thamke (406)444-1430

NEBRASKA

Under Nebraska regulations fly ash, bottom ash, slag and flue gas emission control waste generated primarily from the combustion of coal or other fossil fuels are exempt from regulation as hazardous waste. NEB. ADMIN. R. & REGS. 128-2-9.02.

On October 10, 1995, the Nebraska Department of Environmental Quality issued a policy on CCB reuse titled, "Guidance for Alternative Use of Coal Combustion Byproducts and Other Similar Materials". Under the guidance, CCBs may be reused:

- In the construction or manufacture of products (i.e. concrete, aggregate) or hazardous waste stabilization,

- Ice control (ice jams) in rivers. Note: an NPDES permit is required for this application,

- As stabilizing agents and soil modification (i.e. base/subbase/subgrade under concrete, asphalt, armor coat, sand-gravel/limestone surfaces and roads, parking lots, or building sites),

- As aggregate for roads, including armor coat and chip seal aggregate,

- As structural fill including backfill of utility trenches and behind foundation walls, buildup of grade or as an embankment for roadways/overpasses,

- As controlled density/slurry fill for closure of pipelines, tanks, and sewers,

- Blasting grit. Note: The grit, after use, may not be used for any other purpose and must be managed in accordance with applicable waste applications.

The use of CCBs in feedlot applications and other applications may be approved by the DEQ on a case-by-case basis.

State of Nebraska Department of Environmental Quality contact: Dave Johnson (402) 471-4210.

NEVADA

Under Nevada regulations, fly ash, bottom ash, slag and flue gas emission control waste generated primarily from the combustion of coal or other fossil fuels are exempt from regulation as hazardous waste. NEV. REV. STAT. §459.465

Currently, reuse of CCBs is not specifically authorized under Nevada law or regulations.

Nevada Department of Conservation and Natural Resources: (702) 687-4360

NEW HAMPSHIRE

Under New Hampshire regulations, fly ash, bottom ash, slag and flue gas emission control waste generated primarily from the combustion of coal or other fossil fuels are exempt from regulation as hazardous waste.

N.H.CODE ADMIN. R Env-Wm 401.03(b)(4)

Currently, reuse of CCBs is not specifically authorized under New Hampshire law or regulations, however, CCBs may be exempt from regulation as a solid waste if the CCBs are reused. To reuse the CCBs, the generator must apply for a Direct Reuse Certificate and demonstrate:

- The CCBs are produced by a process which is consistent and uniform in nature;
- Analytical tests demonstrate that the CCBs are characteristically and analytically consistent;
- A buyer and market have been identified;
- Disposal of the recycled product will not pose a risk to human health or the environment which is greater than the risk posed by direct disposal of the CCBs; and
- If the CCBs are to be used without processing, the use will not pose a threat to human health or the environment.

Land applications are subject to additional requirements.
N.H. CODE ADMIN. R. Env-Wm Part 318.08

Other ash specific management regulations can be found at Env.-Wm 2602.

New Hampshire Department of Environmental Services: (603) 271-3503

NEW JERSEY

CCBs are not automatically exempt from regulation as hazardous waste.

Currently, reuse of CCBs is not specifically authorized under New Jersey law or regulations. According to correspondence issued by the State of New Jersey Department of Environmental Protection, CCBs determined to be non-hazardous may, on a case-by-case basis, be considered exempt from regulation, when used for reclamation of pits where coal has previously been extracted.

New Jersey Department of Environmental Protection contact: (609) 530-8000

NEW MEXICO

Under New Mexico regulations, fly ash, bottom ash, slag and flue gas emission control waste generated primarily from the combustion of coal or other fossil fuels are exempt from regulation as hazardous waste. N.M. Reg. EIB-SWMR-41-105.

Currently, reuse of CCBs is not specifically authorized under New Mexico law or regulations.

New Mexico Environment Department: (505) 827-2775

NEW YORK

Under New York regulations, fly ash, bottom ash, slag and flue gas emission control waste generated primarily from the combustion of coal or other fossil fuels are exempt from regulation as hazardous waste.

N.Y. COMP. CODES R. & REGS. tit. 6, §371.1

Under New York regulations, CCBs may be reused in the following manner:

- Bottom ash may be used as a component in the manufacture of roofing shingles or asphalt products, or as a traction agent on roadways, parking lots and other driving surfaces,
- Fly ash or "gas scrubbing products" may be used as an ingredient in producing lightweight block, lightweight aggregate, low strength backfill material, manufactured gypsum or manufactured calcium chloride (fly ash or FGD material),
- Fly ash or bottom ash may be used as a cement or aggregate substitute in concrete or concrete products, as raw feed in the manufacturing of cement or as structural fill within building foundations when placed above the seasonal high groundwater table (fly ash or bottom ash).

Other proposed beneficial reuses may be approved on a case-by-case basis. To request approval for a proposed beneficial reuse project not included in the foregoing, a written petition must be submitted to the New York Department of Environmental Conservation containing specified information regarding the proposed reuse. The Department will determine whether the proposal constitutes a beneficial reuse based on a showing that all the following criteria have been met:

- The proposal constitutes a reuse rather than a disposal,
- The proposal is consistent with solid waste management philosophy,
- The material under review is intended to function or serve as an effective substitute or fuel,
- Decontamination of the material must not be required,
- A market must exist or be reasonably certain to develop for the proposed use of the material or the product into which the material is proposed to be incorporated,
- Any other criteria established by the department.

Annual reporting requirements apply. No later than 60 days after each January 1, CCB generators must submit a report to the New York Department of Environmental Conservation identifying the quantities of fly ash, bottom ash and gas scrubbing products it generated during the year. The generator must also specify how much bottom ash and fly ash was sent for reuse and in what manner.

6 N.Y. COMP. CODES R. & REGS.360-1.15)

New York State Department of Environmental Conservation: (518) 474-2121

NORTH CAROLINA

North Carolina regulations adopt by reference the federal regulation which exempts CCBs from classification as hazardous waste. Exempt from hazardous waste regulation are fly ash, bottom ash, slag, and flue gas emission control waste generated primarily from the combustion of coal. N.C.ADMIN.CODE tit.15A r.13A.0006

Under North Carolina regulations, CCBs which may be reused are defined to include fly ash, bottom ash, boiler slag and flue gas desulfurization residue produced by coal-fired electrical or steam generation units. These CCBs may generally be beneficially reused as an ingredient in an industrial process to make a product, as an effective substitute for a commercial product or natural resource, and in structural fill. North Carolina regulations specify the following permissible CCB reuses:

- In structural fill applications which comply with substantive requirements set forth in the regulations. Substantive regulatory requirements for structural fill applications include:

    - Written notice to the state at least 30 days prior to commencement of structural fill projects containing: (1) a description of the nature, purpose, and location of the project, the location of the project on USGS maps, and a DOT map or topographic map showing the project; (2) the estimated start and completion dates for the project; (3) an estimate of the volume of CCBs to be used in the project; (4) TCLP analysis from a sample of each CCB intended for use in the project; (5) a statement by the owner agreeing to comply with the County Recorder of Deed recording requirements in §1707; and (6) specified information regarding the CCB generator;

    - Compliance with location restrictions. CCBs used in structural fills may not be located within 50 feet of a jurisdictional wetland (absent additional regulatory approvals), a perennial stream or other water body, within 25 feet of any property boundary or bedrock outcrop, within 2 feet of the seasonal high groundwater table, within 100 feet of any drinking water source, or within a 100 year floodplain (absent additional regulatory approvals);

    - Compliance with design, construction and operational requirements;

    - Compliance with closure requirements; and

    - Filing with the Register of Deeds within 90 days of completion of any CCB structural fill project utilizing more than 1,000 cubic yards of CCBs, a statement signed and acknowledged by the landowners identifying the parcel of land. Transfers of such property must contain in the body of the deed, a statement that CCBs have been used as fill material on the property.

- As soil nutrient additive or other agricultural purpose under the authority of the North Carolina Department of Agriculture;

- Bottom ash or boiler slag as traction control material or road surface material if the use is approved by the North Carolina Department of Transportation;

- As material in the manufacturing of another product, such as concrete products, lightweight aggregate, roofing materials, plastics, paint, flowable fill and roller compacted concrete;

- As a substitute for a product or material resource, including but not limited to, blasting grit, roofing granules, filter cloth, precoat for sludge dewatering and pipe bedding;

- As a structural fill for the base or subbase under a structure, paved road, parking lot, sidewalk, walkway or similar structure;

- For the extraction or recovery of materials and compounds contained within the CCBs. (Note: residuals from the processing operations remain solid waste and are subject to regulation); and

- As a stabilized structural fill product when processed with a cementitious binder and spread and compacted for the construction of a project with a planned end use.

CCBs may not be accumulated speculatively. CCBs are not considered to be accumulated for speculative purposes when a minimum of 75% of the CCBs are removed from the facility and beneficially reused annually. Compliance with CCB beneficial reuse regulations does not exempt the owner from other potentially applicable laws and regulations such as the North Carolina Water Pollution Control regulations.

Annual reporting is required. By October 1 of each year, generators of CCBs must submit an annual report summarizing the volume of CCBs produced, disposed, reused in structural fill and reused in other applications.

N.C. ADMIN. CODE tit.15A r.13B.1700-.1710

North Carolina Department of Environment, Health and Natural Resources: (919) 733-4996

NORTH DAKOTA

Under North Dakota law and rules, fly ash, bottom ash, slag and flue gas emission control waste generated primarily from the combustion of coal or other fossil fuels are exempt from regulation as hazardous waste.

N.D. Century Code §23.20.3-10; and N.D. ADMIN. CODE § 33-24-02-04.

Currently, reuse of CCBs is not specifically addressed under North Dakota law or rules. However, North Dakota water laws and rules apply. The North Dakota Department of Health has approved specific mix designs for use of fly ash as a controlled low-strength material in underground mines.

North Dakota Department of Health contact: Steven J. Tillotson (701)328-5166

OHIO

Under Ohio regulations, fly ash, bottom ash, slag and flue gas emission control waste generated primarily from the combustion of coal or other fossil fuels are exempt from regulation as hazardous waste. OHIO ADMIN.CODE §3745-51-04

Currently, reuse of CCBs is not specifically authorized under Ohio law or regulations, however, reuse of "non-toxic" CCBs is authorized under policy documents issued by the Ohio Environmental Protection Agency ("OEPA"). Under OEPA policy, non-toxic CCBs may be reused:

- As a raw material in manufacturing a final product (eg. grout, flowable fill, lightweight aggregate, concrete block, bricks, asphalt, roofing materials, plastics, paint, glass, fiberglass, ceramics, blasting grit and other non-land application products;

- As a stabilization/solidification agent, for other wastes which will be disposed;

- As part of a composting process when the process is performed in accordance with applicable regulations;

- In uses subject to US EPA Procurement Guidelines;

- For the extraction or recovery of materials and compounds in CCBs;

- As an anti-skid material or road preparation material, if such use is consistent with Ohio Department of Transportation specifications;

- For use in mine subsidence stabilization, mine fire control, and mine sealing when authorized by the Ohio Department of Natural Resources (Note: mine reclamation is not pre-authorized);

- As an additive in commercial soil blending operations, when the waste constitutes no more than 50% of the mixture, and if the waste does not meet 5 times Ohio's primary drinking water standards, the mixture may not be applied to grazed pastures, home/vegetable/fruit gardens, or used for growing crops or fruit trees;

- As daily cover at a landfill if approved by OEPA in the landfill permit;

- As structural fill, defined as an engineered use of waste material as a building or equipment supportive base or foundation and does not include valley fills or filling of open pits from coal or industrial mineral mining;

- As pipe bedding, for uses other than transport of potable water. Materials used in sanitary sewer projects must comply with OEPA Policy DSW 400.001;

- As a construction material for roads or parking lots (subbase or final cover), if approved by a professional engineer, the property owner and the Department of Transportation where necessary; and

- Other single beneficial uses of less than 200 tons.

Certain guidelines apply. For example, written notice must be submitted to OEPA before commencement of a beneficial use project involving structural fill applications. An annual report must be submitted by April 1 of each year summarizing each beneficial use project involving structural fill, road base, and pipe bedding applications completed during the prior calendar year, including a description of the nature, purpose, and location of the project, the type and volume of wastes used, and leachate test results.
OEPA Policy No. 4.07/400.007/Ohio Environmental Practice Agency contact: (614) 644-3020

OKLAHOMA

Oklahoma regulations adopt by reference the federal regulation which exempts CCBs from classification as hazardous waste. Exempt from hazardous waste regulation are fly ash, bottom ash, slag, and flue gas emission control waste generated primarily from the combustion of coal. Okla. Reg. 252:200-3-2; 40 CFR 261.4.

Currently, reuse of CCBs is not specifically authorized under Oklahoma law or regulations.

Note: Fly ash and bottom ash generated outside the state must be constructively reutilized or disposed only in active or inactive mining operations subject to state laws and regulations. OKLA. STAT. tit. 27A §2-10-801(F).

OREGON

Oregon regulations adopt by reference the federal regulation which exempts CCBs from classification as hazardous waste. Exempt from hazardous waste regulation are fly ash, bottom ash, slag, and flue gas emission control waste generated primarily from the combustion of coal. OR. ADMIN. R. 340-100-002; 40 CFR 261.4.

Currently, reuse of CCBs is not specifically authorized under Oregon law or regulations. Draft guidelines and policy memoranda have been produced by the Oregon Department of Environmental Quality regarding use of solid waste as fill and land application of solid industrial wastes.

Oregon Department of Environmental Quality contact: Deanna Mueller-Crispin (503)229-5696 or Terrence Hollins (503)229-6922.

PENNSYLVANIA

Under Pennsylvania regulations, fly ash, bottom ash, slag and flue gas emission control waste generated primarily from the combustion of coal or other fossil fuels are exempt from regulation as hazardous waste. 25 PA. CODE §261.4.

Under Pennsylvania regulations, fly ash, bottom ash and boiler slag are classified as "coal ash" subject to reuse regulations. Other coal ash is treated as "residual waste" outside of the reuse regulations. Pennsylvania regulations provide that coal ash may be reused:

- As a structural fill upon approval from the Department if the person proposing the use complies with specified requirements. (Any other use as a structural fill requires a disposal permit);
- As a soil substitute or soil additive without a permit from the Department if the person proposing the use complies with specified requirements;
- For reclamation at an active or abandoned surface coal mining site if the person proposing the use complies with all specified requirements, The Clean Streams Law and regulations promulgated thereunder, and other specified requirements;
- At surface coal mining sites in compliance with specified requirements;
- In the manufacture of concrete;
- For the extraction or recovery of one or more materials and compounds contained within the coal ash;
- As a stabilized product;
- Other uses of fly ash in which physical or chemical characteristics are altered prior to use or during placement are considered a beneficial use if the following conditions are met:
  - The person or municipality proposing the use has first given advance written notice to the Department;
  - The coal ash is not mixed with solid waste, unless otherwise approved in writing by the Department prior to the use; and
  - The use of coal ash results in a demonstrated reduction of the potential of the coal ash to leach constituents into the environment;

- As an anti-skid material or road surface preparation material, if the use is consistent with Department of Transportation specifications or other applicable specifications. (This use applies to bottom ash or boiler slag only. The use of fly ash as an anti-skid material or road surface preparation material is not deemed to be a beneficial use).

- As raw material for a product with commercial value, including the use of bottom ash in construction aggregate. (Storage of coal ash prior to processing is subject to specific requirements);

- For mine subsidence control, mine fire control and mine sealing, if the person or municipality proposing the use gives advance written notice to the Department, the pH of the coal ash is in a range that will not cause or allow the ash to contribute to water pollution, and use of the coal ash in projects funded by or through the Department is consistent with applicable Department requirements; and

- As a drainage material or pipe bedding, if the person or municipality proposing the use has first given advance written notice to the Department, and has provided to the Department an evaluation of the pH of the coal ash and a chemical analysis of the coal ash that meets the specific chemical waste analysis requirements.

Coal refuse disposal operations are not considered a beneficial use unless the following conditions are met:

- The combined ash and coal refuse disposal operation is in full compliance with all requirements;

- The volume of the ash does not exceed 50% of the total volume of material to be disposed;

- The ash has a pH between 7.0 and 12.5;

- The ash has physical or chemical characteristics which improve compaction within the fill and improve the quality of leachate generated by the coal refuse, and is placed in a manner which will achieve the intended purpose; and
- The coal ash are returned to the coal refuse disposal area used by the coal preparation activity that supplies the coal to the ash generator.

25 P.A. CODE §287.661-665

Pennsylvania Department of Environmental Resources: (717) 787-5027

RHODE ISLAND

CCBs are not automatically exempt from Rhode Island hazardous waste regulations. Rhode Island Regs. HWM §3.25.

Currently, reuse of CCBs is not specifically authorized under Rhode Island law or regulations. Additionally, under Rhode Island regulations, recycled or reused wastes may remain subject to regulation. Rhode Island Regs. HWM §3.25.

Rhode Island Department of Environmental Management: (401) 277-3070

SOUTH CAROLINA

Under South Carolina regulations, fly ash, bottom ash, slag and flue gas emission control waste generated primarily from the combustion of coal or other fossil fuels are exempt from regulation as hazardous waste. S.C. CODE REGS. 161-79.261.4.

Regulations authorizing reuse of CCBs were drafted by the South Carolina Department of Health and Environmental Control. The draft regulations have not been formally proposed, which is the first step in formal regulation promulgation.

The proposed May 10, 1994 draft rule defines CCBs to include fly ash, bottom ash, boiler slag, and flue gas desulfurization residue produced by coal-fired electric or steam generation units, which are used in a manner considered beneficial. The draft rule provides that CCBs may be reused:

- As material in the manufacturing of another product, such as concrete products and lightweight aggregate
- As a substitute for a product or material resource including, but not limited to blasting grit or roofing granules
- As a structural fill for the base, subbase, under the structure or footprint of a paved road, a parking lot, sidewalk or similar structure under specified conditions. Structural fill is defined as an engineered fill with a beneficial end use, constructed using less than 35,000 cubic yards of CCBs properly placed and compacted. Registration requirements apply to structural fill applications. Siting and operational criteria also apply. Note: A solid waste landfill permit must be obtained if the conditions are not satisfied.
- Other proposed beneficial uses may be approved on a case-by-case basis.

S.C. CODE REGS. 44-96-260-, 290, 450.
South Carolina Department of Health and Environmental Control contact: Ellen Jennings (803) 896-4000

SOUTH DAKOTA

South Dakota regulations adopt by reference the federal regulation which exempts CCBs from classification as hazardous waste. Exempt from hazardous waste regulation are fly ash, bottom ash, slag, and flue gas emission control waste generated primarily from the combustion of coal. S.D. ADMIN. R. 74:28:22; 40 CFR 261.4.

Currently, reuse of CCBs is not specifically authorized under South Dakota law or regulations.

South Dakota Department of Environment and Natural Resources: (605) 773-3151

TENNESSEE

Under Tennessee law, fly ash and bottom ash are not exempt from hazardous waste classification. Fly ash, bottom ash and flue gas emission control waste generated from the combustion of coal or other fossil fuels must be tested for a hazardous waste determination. If determined to be hazardous certain hazardous waste generator requirements apply. TENN.COMP. R. & REGS. 1200-1-11-.02. Upon testing confirmation that the material is not hazardous, fly ash and bottom ash may be reused under permit by rule regulation as follows:

- As lightweight aggregate,
- As road base and subbase materials,
- In engineered structures including, but not limited to, structural fill, embankment fill, and soil stabilization, and
- In other proposed beneficial uses approved on a case-by-case basis.

Certain restrictions and requirements apply. Written notification must be submitted. The project may not be located in wetland, sinkholes or caves, or in a 100-year flood plain unless certain conditions are met. The potential for releases must be minimized and the project may not cause or contribute to the taking of any threatened or endangered species of plants, fish or wildlife or result in the destruction or modification. Until development is complete, the area must have a barrier to control unauthorized entry. A geologic buffer must be in place of at least three feet with a maximum saturated hydraulic conductivity of 1×10^{-6} cm/sec between the fill and the seasonal high groundwater table. Within 90 days of completion of the project, at least two feet of compacted soil cover must be in place. Final surface grading requirements apply. Dust must be minimized and there must be equipment present capable of spreading and compacting the coal ash at the time it is received.

TENN.COMP. R. & REGS. 1200-1-7-.02

Tennessee Department of Public Health: (615) 862-8620

TEXAS

Texas regulations adopt by reference the federal regulation which exempts CCBs from classification as hazardous waste. Exempt from hazardous waste regulation are fly ash, bottom ash, slag, and flue gas emission control waste generated primarily from the combustion of coal. TEXAS ADMIN. CODE tit. 30 §330.2; 40 CFR 261.4.

Under Texas regulations, CCBs may be classified as industrial solid wastes resulting from industrial processes. Texas regulations establish three different classes of industrial solid wastes under which CCBs may be classified. Class I industrial solid wastes are those wastes or mixtures of wastes that, because of their concentration or physical or chemical characteristics, are toxic, corrosive, flammable, pose a substantial danger to human health or the environment or meet other similar characteristics. Class II wastes are those wastes which are not hazardous, are not Class I wastes or are not sufficiently inert to be classified as Class III wastes. Class III wastes are those wastes which are inert and essentially insoluble and which pose no threat to human health or the environment.

TEXAS ADMIN. CODE tit. 30 §330.2, §§335.505, 335.506, 335.507

Currently, reuse of CCBs is not specifically authorized, nor is it prohibited, under Texas law or regulations. Texas has adopted certain recycling regulations which may be applicable to certain beneficial reuses of CCBs.

These regulations exclude from regulation solid wastes that are used, reused or recycled. Under these regulations, solid wastes may generally be recycled by being:

- Used or reused as ingredients in an industrial process to make a product, provided the materials are not being reclaimed; or
- Used or reused as effective substitutes for commercial products; or
- Returned to the original process from which they are generated, without first being reclaimed. The materials must be returned as a substitute for raw materials feedstock, and the process must use raw materials as principal feedstocks.

The following materials remain regulated as solid wastes, even if the recycling involves use, reuse or return to the original process:

- Materials used in a manner constituting disposal, or used to produce products that are applied to the land; or
- Materials burned for energy recovery, used to produce a fuel or contained in fuels; or
- Materials accumulated speculatively; or

- Inherently waste-like materials.

Prior notification to the state is required (90 days). Reuse which threatens waters of the state, endangers public health and welfare or which creates a nuisance is prohibited.

TEXAS ADMIN. CODE tit. 30 §335.1,335.17-18,24; 330.2;

The Texas Natural Resource Conservation Commission (TNRCC) issued guidance on the reuse of CCBs on August 25, 1995. The Texas Coal Ash Utilization Group was instrumental in promoting this guidance. Under the guidance, the following types of CCBs are designated as "co-products" when used in the specified manner. Co-products are not subject to solid waste regulations.

- Fly ash/bottom ash: In concrete, concrete products, cement/fly ash blends, pre-cast concrete products, lightweight and concrete aggregate, roller compacted concrete, soil cement, flowable fill, roofing material, insulation material, artificial reefs, and as mineral filler (plastics, paints, rubber matting, carpet backing, bricks and asphalt)

- Fly ash/bottom ash/FGD material: As raw feed for concrete manufacture and in masonry

- Fly ash: In oil well cementing and waste stabilization and solidification

- Fly ash/bottom ash/FGD material: As roadbase when covered by a wear surface

- Bottom ash: As an unsurfaced road construction material, road surface traction material, and blasting grit

- FGD material: In wallboard and sheetrock

Texas Natural Resource Conservation Commission contact: Minor Hibbs (512) 239-6592 or Nancy Worst (512) 239-6090

Patty L. Akers serves as the Chair of the Texas Coal Ash Utilization Group's Regulatory Task Force: (512) 473-4006

UTAH

Under Utah regulations, fly ash, bottom ash, slag waste and flue gas emission control waste are exempt from regulation as hazardous waste. UTAH ADMIN.R. 315-2-4.

Under Utah law, fly ash, bottom ash, slag, and flue gas emission control waste are also exempt from regulation as solid waste unless the waste causes a public nuisance or public health hazard or is hazardous. UTAH CODE ANN. § 19-6-102.

Currently, reuse of CCBs is not specifically authorized under Utah law or regulations.

Utah Department of Environmental Quality contact: Ralph T. Bohn (801)538-6170

VERMONT

Under Vermont regulations, fly ash, bottom ash, slag waste and flue gas emission control waste are exempt from regulation as hazardous waste. Vt. Regs. HWM §7-203

Currently, reuse of CCBs is not specifically authorized under Vermont law or regulations. Vermont has adopted generic recycling regulations, however, these regulations may not exempt a material from regulation. Under these regulations a material is recycled if it is:

- Employed as an ingredient in an industrial process to make a product,
- Employed as an effective substitute for a commercial product,
- Reclaimed by being processed to recover a usable product or if it is regenerated.

Vt. Regs. HWM §7-602

State of Vermont Agency of Natural Resources contact: Eldon Morrison (802) 241-3444

VIRGINIA

Under Virginia regulations, fly ash, bottom ash, slag and flue gas emission control waste generated primarily from the combustion of coal or other fossil fuels are exempt from regulation as hazardous waste. Va. Regs. Reg.672-10-1-3.1

Under Virginia regulations, CCBs are exempt from regulation as a solid waste if beneficially reused in the following manner:

- For mine reclamation or mine refuse disposal on a mine site permitted by the Virginia Department of Mines, Minerals and Energy when used in accordance with the standards developed by the Department of Waste Management;
- For soil nutrient additive, stabilization agent, structural improvement or other agricultural purposes under the authority of the Virginia Department of Agriculture and Consumer Services;
- As a traction control material or road surface material if the use is consistent with Virginia Department of Transportation specifications (bottom ash or boiler slag).
- As a base, subbase or fill material under a paved road, the footprint of a structure, a paved parking lot, sidewalk, walkway or similar structure;

- When processed with a cementitious binder to produce a stabilized structural fill product which is spread and compacted with proper equipment for the construction of a project with a specified end use; and

- For the extraction or recovery of materials and compounds contained within the CCBs.

Va. Regs. Reg. 672-20-10-3.3(A)(3))

Virginia promulgated a regulation specifying the terms and conditions under which CCBs may be reused through land application such as structural fills, mine reclamation or mine refuse disposal (in conjunction with Virginia Surface Mining regulations), which became effective February 22, 1995 (11 Va. Reg. 1470, January 23, 1995). The regulation allows for the use of CCBs in structural fills and mine reclamation projects. The regulation also provides for the siting of such projects, the design and construction of runoff and cover systems, the closure of projects, and establishes minimum operational requirements.

CCBs managed under this regulation are not subject to solid waste facility permitting, however, at least 30 days prior to initial placement of CCBs the facility owner must:

- Submit certification that the owner has legal control over the proposed site for the project life and closure period, that the location and operation of the site will be in compliance with all local ordinances, and that the owner will allow Department inspections to ensure compliance with applicable regulations,

- Provide a description of the intended use, reuse, or reclamation of the CCBs including a description of the site, the estimated beginning and ending dates of the operation, an estimate of the volume of CCBs to be used, and the physical and chemical characteristics of the CCBs including TCLP analyses for specified characteristics,

- Certification by a professional engineer that locational restrictions have been satisfied and that the project has been designed in accordance with specified standards, and;

- An operational and closure plan.

Various location restrictions apply. For example, CCBs may not be placed:

- In areas subject to base floods unless it can be shown that the CCBs can be protected from inundation or washout and that the flow of water is not restricted,

- Less than 2 feet above bedrock separating the CCBs from the maximum seasonal water table,

- Closer than 100 feet from any perennial stream, water well, sinkhole or 25 feet from a bedrock outcrop (unless the outcrop is treated to minimize infiltration into fractured zones) or property boundaries,

- In wetlands, unless applicable federal, state and local permits are obtained,

- At the site of an active or inactive dump, unpermitted landfill, lagoon or similar facility, even if closed.

Va. Regs. Reg. 672-20-20.

Virginia, Department of Environmental Quality contact: Cindy Berndt (804) 762-4378

WASHINGTON

CCBs are not automatically exempt from regulation as hazardous waste.

Currently, reuse of CCBs is not specifically authorized under Washington law or regulations.

State of Washington Department of Ecology contact: Thomas Cusak (360) 407-6000

WEST VIRGINIA

West Virginia regulations adopt by reference the federal regulation which exempts CCBs from classification as hazardous waste. Exempt from hazardous waste regulation are fly ash, bottom ash, slag, and flue gas emission control waste generated primarily from the combustion of coal. W.VA.REGS. §47-35-3.

Under West Virginia solid waste management regulations, CCBs may be beneficially used in the following manner:

- As a material in manufacturing another product (e.g. concrete, flowable fill, lightweight aggregate, concrete block, roofing materials, plastics, paint) or as a substitute for a product or natural resource (e.g. blasting grit, filter cloth precoat for sludge dewatering);

- For the extraction or recovery of materials and compounds contained within the CCBs;

- As a stabilization/solidification agent for other wastes if used singly or in combination with other additives or agents to stabilize or solidify another waste product. Advance written notice must be submitted to the state and the use must result in altered physical or chemical characteristics of the other waste and a reduction of the potential for the resulting established mixture to leach constituents into the environment.

- Under the authority of the West Virginia Department of Energy,

- As pipe bedding or as a composite liner drainage layer;

- As an anti-skid material (bottom ash, boiler slag) if such use is consistent with Department of Highways specifications. The use of fly ash as an anti-skid material is not deemed to be a beneficial use; and

- As a daily or intermediate cover for certain solid waste facilities if the permit allows for such use,

- As a construction base for roads or parking lots that have asphalt or concrete wearing surfaces, if approved by the West Virginia Department of Highways or the project owner.

W.VA.REGS. §47-38-5.

West Virginia regulations note that beneficial reuse of CCBs for structural fills and as soil amendment will be addressed in future rule makings.

West Virginia Division of Environmental Protection: (304) 558-5929

WISCONSIN

Under Wisconsin regulations, fly ash, bottom ash, slag waste and flue gas emission control waste are exempt from regulation as hazardous waste. WIS.ADMIN. CODE § NR 605.05

In Wisconsin, fly ash and bottom ash are generally considered high volume industrial wastes. Wisconsin law promotes recycling of high volume industrial wastes and allows the state to approve requests for high volume industrial waste uses pending an environmental review of chemical and physical data provided by the waste generator. WIS. STAT. § 144.44. Approved recycling applications of CCBs have included:

- Concrete additive

- Asphalt fine aggregate

- Flowable fill or Controlled Low Strength Material (CLSM)

- Seal coat slurry

- Parking lot/Roadway subbase

- Airport runway
- Anti-skid material
- Building subbase
- Subbase sand substitute

State of Wisconsin Department of Natural Resources: (608) 266-2111

The Wisconsin DNR is currently working with an external Technical Advisory Committee on the development of self-implementing byproduct reuse rules for industrial materials such as CCBs, foundry sand and slag, and paper mill sludge. The rules should be finalized by Fall, 1996.

Draft NR 538 rules governing beneficial use.

WYOMING

Wyoming regulations adopt by reference the federal regulation which exempts CCBs from classification as hazardous waste. Exempt from hazardous waste regulation are fly ash, bottom ash, slag, and flue gas emission control waste generated primarily from the combustion of coal. WY ADMIN. CODE HWM ch. 2 §1; 40 CFR 261.4.

Currently, reuse of CCBs is not specifically authorized under Wyoming law or regulations.

Wyoming Environmental Quality Department: (307) 777-7937

APPENDIX K

NEW YORK STATE BENEFICIAL USE DETERMINATION

New York State Department of Environmental Conservation
50 Wolf Road, Albany, New York 12233

Thomas C. Jorling
Commissioner

JUN 2 2 1992

Mr. Thomas L. Nickeson
Consulting Geologist
Stony Fork Road
R.D. #6, Box 138
Wellsboro, PA 16901

CORRECTED 7-1-92

Dear Mr. Nickeson:

BUD 207-6-23

Re: Beneficial Use Determination (BUD #204-5-17) IN ERROR
Use of Ash as an Agricultural Liming Agent

This is in response to your May 26, 1992 letter to Mr. John Kenna, of the Department's Region 6 Office, regarding the referenced beneficial use determination (BUD) petition. The Black River Limited Partnership proposes to use ash from incineration of coal, wood chips and limestone at the Fort Drum HTW Cogeneration Plant Fort Drum, New York, as an agricultural liming agent.

We have reviewed this petition and agree that the use of the ash as an agricultural/liming agent constitutes a beneficial use and is exempt from regulation as a solid waste under 6 NYCRR Part 360-1.2(a)(5).

The BUD, however, is subject to the following conditions:

- The facility may only incinerate coal, limestone and unadulterated wood chips. Unadulterated wood chips are defined as wood chips that have not been contaminated by paints or chemicals and results from lumber manufacturing operations, tree trimming, and land clearing, including bark, scrap wood, branches, stumps and brush.

- The ash is limited to uses as detailed in the BUD petition. The application rate of the ash is limited to the liming need of land for the crop grown.

- By December 31 of each year, an annual report must be submitted to the Bureau of Facility Management, Division of Solid Waste, in Albany, that contains at a minimum, the following information:

  a. The total quantity of ash produced, location and amount of use and/or disposal.

  b. The analyses for total metals, TCLP and calcium carbonate equivalency as described in the BUD petition.

c. A description of any problems or complaints involving ash use.

- The Department reserves the right to modify, suspend or revoke this approval at any time, should conditions warrant. Additionally, this approval does not exempt the operation from any other local, state or federal requirements. This approval must be renewed upon revisions to 6 NYCRR Part 360.

If you have any questions regarding this determination, please contact Edward Hampston, of my staff, at (518) 457-2051.

Sincerely,

Norman H. Nosenchuck, P.E.
Director
Division of Solid Waste

cc: J. Kenna, Region 6

COPIES FOR - KOELLING
- NICKESON

NYS Department of Environmental Conservation
317 Washington Street, Watertown, NY 13601-3787
315-785-2513

Langdon Marsh
Commissioner

November 28, 1994

Mr. Robert L. Svendsen
AHLSTROM DEVELOPMENT ASH CORP.
7806 Sudley Road, Suite 210
Manassas, VA 22110

RE: FORT DRUM ASH- B.U.D. #207-6-23

Dear Mr. Svendsen:

On August 12, 1994 Ahlstrom's requested a modification to the above beneficial use determination (B.U.D.). The request was for permission to operate under the same B.U.D. with CCE between 30% and 70% as opposed to 50% to 70%. It has been determined that this represented no significant problem. The loading rate of 22 tons per acre per year maximum remains in effect as well as the other conditions in the original B.U.D. Also, Ahlstrom should be sure to meet all requirements of the New York State Department of Agriculture and Markets.

Sincerely,

John P. Kenna

John P. Kenna, P.E.
Regional Solid Waste Engineer
Region 6

JPK:kw

cc: Richard Koelling
Peter Taylor

THOMAS L. NICKESON
CONSULTING GEOLOGIST

717-724-5451

Stony Fork Rd.
R.D. #6, Box 138
Wellsboro, PA. 16901

1993/1994 DEMONSTRATION PLOTS
AGRICULTURAL USE OF FORT DRUM ASH

Bill Stout and Tom Nickeson set out 24 - 6' X 12' demonstration plots on November 11, 1993 on the Richard Brown farm northeast of Ellisburg, Jefferson County, New York. Plots were set out and field applied after the last cutting of alfalfa on nearly level Madrid sandy loam and sampled 5-20-94 just before the first cutting. The first number in the sample ID is one of four replications. The second number is the treatment as follows.

1 - check lime
2 - 1 ton/acre agricultural limestone
3 - 2 tons/acre " "
4 - check ash
5 - 3 tons/acre Fort Drum Ash
6 - 6 tons/acre " " "
Ash CCE was 38.75%

An individual plant analysis was performed for each test plot including arsenic (reported separately). An individual soil test was performed for each test plot and soil samples were combined for arsenic analysis grouped by 1).all checks, 2).all commercial ag limestones and 3).all ash applications.

Arsenic was highest on the checks, but these low level numbers are not significantly different. All plant analysis show below detection limits for arsenic.

Sample B10A is a 10 acre alfalfa field of mostly Madrid sandy loam that had received 6 tons of ash per acre the previous fall and was sampled the same day as the 24 test plots.

The rates of arsenic application via the ash are so low in pounds per acre that changes in arsenic levels were not observed in the demonstration.

FROM : TOM NICKESON PHONE NO. : 717 724 5451

Agricultural Analytical Services Laboratory
Penn State University
University Park, PA 16802 814-863-0841

Plant Analysis Program

Bill Stout
2325 West Gatesburg Road
Warriors Mark, PA 16877

June 23, 1994

Alfalfa

ID	P	K	Ca	Mg	Mn	Fe	Cu	B	Al	Zn	Na
	(PER CENT)				(micrograms per gram)						
1-1	0.50	3.60	1.36	0.21	35	132	8	31	97	29	37
1-2	0.50	3.82	1.39	0.23	34	108	8	32	60	32	39
1-3	0.49	3.68	1.40	0.21	26	104	8	33	59	26	34
1-4	0.49	3.48	1.48	0.20	34	115	8	34	61	28	28
1-5	0.52	3.89	1.38	0.21	34	119	9	30	100	33	32
1-6	0.46	3.53	1.68	0.20	35	138	8	36	190	30	44
2-1	0.48	3.71	1.34	0.21	33	121	9	33	72	31	49
2-2	0.50	3.60	1.45	0.22	28	124	9	34	72	28	39
2-3	0.50	3.47	1.57	0.22	28	97	9	35	41	28	36
2-4	0.49	3.63	1.42	0.21	30	111	9	33	59	29	36
2-5	0.51	3.54	1.66	0.20	32	132	17	37	139	30	38
2-6	0.48	3.72	1.69	0.20	29	109	9	39	97	29	41
3-1	0.52	3.87	1.13	0.21	37	123	8	27	82	35	31
3-2	0.52	3.74	1.30	0.21	28	98	6	31	46	30	27
3-3	0.54	3.81	1.31	0.23	32	116	8	32	64	33	33
3-4	0.53	3.79	1.30	0.20	35	117	10	32	66	34	33
3-5	0.51	3.81	1.38	0.20	34	167	13	33	167	36	36
3-6	0.48	3.60	1.48	0.20	35	188	8	35	192	32	33
4-1	0.51	3.50	1.49	0.18	26	106	8	35	60	28	30
4-2	0.51	3.59	1.43	0.20	28	115	7	33	65	29	34
4-3	0.52	3.65	1.35	0.20	23	90	7	33	41	27	25
4-4	0.49	3.54	1.32	0.18	24	84	6	30	38	26	26
4-5	0.49	3.53	1.52	0.17	26	96	8	36	57	26	31
4-6	0.50	3.62	1.51	0.18	28	99	8	35	79	28	28
B10A	0.40	1.90	1.32	0.19	29	69	9	31	22	33	76

Agricultural Analytical Services Laboratory
Penn State University
University Park, PA 16802 814-863-0841

Plant Analysis Program

ill Stout
325 West Gatesburg Road
arriors Mark, PA 16877

une 23, 1994

lfalfa

ample ID	As (micrograms per gram)
-1	<0.50
-2	<0.50
-3	<0.50
-4	<0.50
-5	<0.50
-6	<0.50
-1	<0.50
2-2	<0.50
2-3	<0.50
-4	<0.50
2-5	<0.50
2 6	<0.50
3-1	<0.50
3-2	<0.50
3-3	<0.50
3-4	<0.50
3-5	<0.50
3 6	<0.50
4-1	<0.50
4-2	<0.50
4-3	<0.50
4-4	<0.50
4-5	<0.50
5 6	<0.50
B10A	<0.50

PENNSTATE

(814) 863-0841 Fax (814) 863-4540
Agricultural Analytical Services Laboratory
The Pennsylvania State University
University Park PA 16802

May 27, 1994

Bill Stout
2325 Old Gatesburg Rd
Warriors Mark PA 16877

Test Results

Lab ID	Customer ID	As ug/g on dry weight basis
MS-7	B10A	2.05
MS-8	Lime	1.66
MS-9	Check	1.79
MS-10	Ash	1.74

THOMAS L. NICKESON
CONSULTING GEOLOGIST

717-724-5451

Stony Fork Rd.
R.D. #6, Box 138
Wellsboro, PA. 16901

July 30, 1994

REGULATING ARSENIC IN ALKALINE COGENERATION ASHES

EPA regulates land application of sewage sludges under Part 503, Standards for the Use or Disposal of Sewage Sludge, Subpart B-Land Application.(40 CFR Part 503, Federal Register, Vol. 58, No. 32, Friday Feb. 19, 1993. Note: all referenced page numbers are for the Federal Register).

These regs established standards for sludge quality and field loading rates for land applied sewage sludges. Although these rules do not apply to ash use, regulators have begun to judge ash quality against the 503 quality guidelines, particularly 503.13, Table 3, Pollutant Concentration Limits that define "clean" sludges. These "clean" concentration limits are probably used because of the implied safety factor and also for lack of any other guidelines classifying ashes. The toxic or hazardous thresholds for metals do not apply as these ashes fall far below these values.

Although 503 was developed specifically for and only for sewage sludges, its regulatory application to beneficial ash uses will probably increase throughout the Nation until national ash specific regulations are developed (unlikely in the near future). In addition to the implied safety factor, the "clean" concentration limits are probably used because they are simple, prominent and easily applied. Careful reading of 503 reveals that the "clean" values are not a primary standard , rather they are derivative from the primary standards which are expressed as loadings (weight applied per acre) not quality or concentration. The land and its crops are not sensitive to the concentration of arsenic evenly applied but, are sensitive to the actual amount (pounds or kilograms per acre or hectare) of arsenic evenly applied.

The EPA 503 "clean" concentration table was derived from the important regulatory issue of total loading expressed in Table 2 as "Cumulative Pollutant Loading Rate" (CPLR) and Table 4 as "Annual Pollutant Loading Rate" (APLR) (Federal Register pg. #9392).

EPA derived APLR as one-twentieth of CPLR which was developed from risk assessment procedures. The "clean" concentration limits were developed from these loading rate limits using an assumed Annual Whole Sludge Application Rate (AWSAR) of 10 dry metric tons per hectare for 100 consecutive years without allowance for any pollutant loss. This assumed sludge application rate is far above the normal maximum long term ash application rate of approximately 3 tons per acre every 4 years (1.7 metric tons of ash per hectare per year).

The real purpose of developing "clean" concentration limits is discussed by EPA on pages 9282 and 9283. The "clean" values were promulgated to encourage sewage treatment plants to maintain high quality sludges and to help prevent sludge quality deterioration. "Clean" establishes a quality standard that sewage sludges could reasonably meet, as determined, in part, from a 40 city sludge quality survey. The "clean" values only have real world environmental implications with respect to sewage sludges applied often at high loading rates.

Whereas sewage sludge can reasonably meet the EPA "clean" limit of 41 mg/kg, ashes often can not because of higher arsenic levels in some of the coals burned. However, these ashes can easily meet the real standard - Cumulative Pollutant Loading Rate (CPLR) for arsenic of 41 kilograms per hectare and the derivative Annual Pollutant Loading Rate (APLR) for arsenic of 2 kilograms per hectare per year. EPA 503.13(2)(i) (pg.#9391) regulates land application limited by the CPLR as the alternate to using "clean" concentration.

The Fort Drum, New York field applied ash is currently 23mg/kg As, but has exhibited arsenic concentrations of 50mg/kg which is above the "clean" concentration of 41 mg/kg. Other coal ashes are often higher. At the current maximum application rate of 6 tons per acre, 50mg/kg ash will result in a one time loading of .67 kg/ha. Since this ash application would not be repeated for 4 years the actual annual loading rate is .17kg/ha per year, far below the APLR of 2kg/hectare/year.

The normal ash application to agricultural lands to maintain soil alkalinity is 3 tons per acre every 4 years which at the current arsenic level of 23 mg/kg is an annual loading rate of .04kg/ha per year or 2% of the allowable annual maximum.

EPA 503 also assumes all applied arsenic remains and builds up in the topsoil horizon, but Woolson (1) reports total arsenic losses in soil at 14% to 15% per year mostly through volatilization with some minor migration to subsoil. With this volatilization loss and the annual application rate of .04kg/hectare/year the maximum equilibrium level of soil arsenic cumulative loading will be .28 kg/hectare verses the allowable CPLR of 41kg/ha, a very considerable safety margin.

In conclusion, arsenic levels common in alkaline cogeneration coal ashes at field application rates needed to neutralize soil acidity are well below EPA 503 maximum application rates.

#1 Woolson, E.A. and A.R. Isensee. 1981 Weed Sci 29:17-21

APPENDIX L

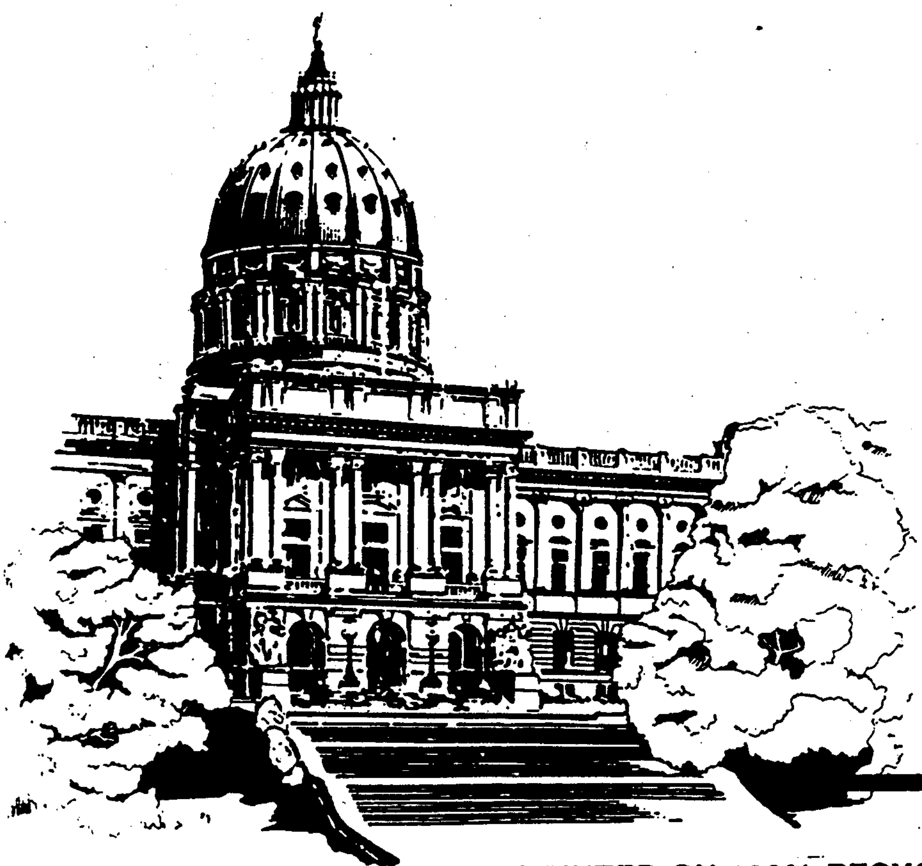
1/25/97 PENNSYLVANIA BULLETIN

PENNSYLVANIA BULLETIN

Volume 27 Number 4
Saturday, January 25, 1997 • Harrisburg, Pa.

Part II

This part contains the
Environmental Quality Board
Sewage Sludge; Municipal Waste; and Residual Waste



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§ 287.644. (Reserved).

COMPLIANCE

§ 287.651. Investigations and corrective action.

(a) Upon notification by a person beneficially using or processing residual waste under a general permit that there has been a change in the physical or chemical properties of the residual waste being beneficially used or processed, including leachability, the Department will conduct an investigation and order necessary corrective action. Notice to the Department under this section does not, by itself, suspend continued beneficial use or processing after a change has occurred.

(b) Upon receipt of a signed, written complaint of a person whose health, safety or welfare may be adversely affected by a physical or chemical change in the properties of the residual waste to be beneficially used or processed under a general permit, including leachability, the Department will determine the validity of the complaint and take appropriate action.

§ 287.652. Compliance with permit conditions, regulations and laws.

A person or municipality that beneficially uses or processes residual waste under a general permit shall comply with the terms and conditions of the general permit, with this article and with the environmental protection acts to the same extent as if the activity were covered by an individual permit.

BENEFICIAL USE OF COAL ASH

§ 287.662. Use of coal ash as a soil substitute or soil additive.

(a) Coal ash may be beneficially used as a soil substitute or soil additive without a permit from the Department under the act if the person or municipality proposing the use complies with this section.

(b) At least 60 days before using coal ash as a soil substitute or soil additive, the person or municipality proposing the use shall submit a written notice to the Department. The notice shall contain, at a minimum:

(1) A description of the nature, purpose and location of the project, including a topographic map showing the project area and available soils maps of the project area. The description shall include an explanation of how coal ash will be stored prior to use, how the soil will be prepared for the application of coal ash, how coal ash will be spread and, when necessary, how coal ash will be incorporated into the soil.

(2) The estimated beginning and ending dates for the project.

(3) An estimate of the volume of coal ash to be used for the project, the proposed application rate and a justification for the proposed application rate.

(4) A chemical and leaching analysis for the coal ash to be used in the project. If the coal ash was generated at a facility for which the Department has previously approved a chemical and leaching analysis, the person or municipality may submit a copy of the analysis that was approved.

(5) A chemical analysis of the soil on which the coal ash is proposed to be placed.

(6) An analysis showing how the application of coal ash will be beneficial to the productivity or properties of the soil to which it is proposed to be applied. The analysis shall be prepared and signed by an expert in soils science.

(7) A signed statement by the owner of the land on which the coal ash is to be placed, acknowledging and consenting to the use of coal ash as a soil substitute or soil additive.

(c) After receiving the information required by subsection (b), the Department may inform the person or municipality that provided the information whether the proposed use of coal ash as a soil substitute or soil additive is consistent with this section.

(d) Coal ash used as a soil substitute or soil additive may not be considered a beneficial use unless the following requirements are met:

(1) The person or municipality has provided to the Department the information required by subsection (b) at least 60 days before using coal ash as a soil substitute or soil additive.

(2) The pH of the coal ash and the pH of the soil shall be in the range of 6.5 to 8.0 when mixed together in the manner required by the project, as shown by field and laboratory testing. Lime addition may be used to raise pH.

(3) Surface runoff from the project area shall be controlled during the project. Collection of surface runoff shall be controlled in accordance with The Clean Streams Law and the regulations promulgated thereunder.

(4) Diversion ditches, terraces and other runoff control structures shall be utilized to control erosion on the disturbed area of the project.

(5) The person or municipality conducting the activity shall have a Department-approved erosion and sedimentation control plan under Chapter 102 (relating to erosion control).

(6) Coal ash may not be placed within 4 feet of the seasonal high water table.

(7) Coal ash may not be placed within 8 feet of the regional groundwater table.

(8) Coal ash may not be used in a way that causes water pollution.

(9) Coal ash shall be incorporated into the soil within 48 hours of application, unless otherwise approved by the Department. The coal ash shall be incorporated into the top 1-foot layer of surface soil. If 1 foot of surface soil is not present, coal ash may be combined with the surface soil that is present until the layer of combined surface soil and coal ash is 1 foot. The coal ash required for the beneficial use is limited to the amount necessary to enhance soil properties or plant growth.

(10) Coal ash shall be applied at a rate per acre that will protect public health, public safety and the environment.

(11) Coal ash may not be applied to soil being used for agriculture where the soil pH is less than 5.5.

(12) Coal ash may not be applied if resultant chemicals or physical soil conditions would be detrimental to biota.

(f) Coal ash may not be used as a soil substitute or soil additive:

(1) Within 100 feet of an intermittent or perennial stream, or a wetland other than an exceptional value wetland.

(2) Within 300 feet of a groundwater source.

(3) Within 500 feet upgradient of a surface drinking water source.

(4) Within 100 feet of a sinkhole or area draining into a sinkhole.

(5) Within 300 feet measured horizontally from an occupied dwelling, unless the current owner thereof has provided a written waiver consenting to the activities closer than 300 feet. The waiver shall be knowingly made and separate from a lease or deed unless the lease or deed contains an explicit waiver from the current owner.

(6) In or within 300 feet of an exceptional value wetland.

§ 287.663. Beneficial use of coal ash at coal mining activity sites as coal mining activities are defined in § 86.1.

(a) *Coal ash approval at coal mining activity sites.* Coal ash approval at coal mining activity sites shall, at a minimum, be based on the following:

(1) Coal ash may be used for beneficial use at coal mining activity sites if the use complies with this section, The Clean Streams Law and the regulations promulgated thereunder, the Surface Mining Conservation and Reclamation Act (52 P. S. §§ 1396.1—1396.19a), the Coal Refuse Disposal Control Act (52 P. S. §§ 30.51—30.66), the applicable provisions of Chapters 86—90, the Coal Ash Certification Guidelines (Certificate Guidelines) developed under this section and other applicable environmental statutes and regulations promulgated thereunder.

(2) The Department will develop Certification Guidelines that identify the acceptable physical and chemical characteristics of coal ash for beneficial uses. A generator of coal ash shall demonstrate that the coal ash quality meets the chemical and physical characteristics identified in the Certification Guidelines for the intended uses. The demonstration shall be reviewed and approved by the Department prior to a beneficial use.

(3) The Department will develop a technical guidance document to facilitate review of beneficial uses of coal ash at coal mining activities.

(b) *Request.* The request for use at coal mining activity sites shall be addressed in the reclamation plan of the mining activities permit and shall contain the following and shall be reviewed and approved by the Department:

(1) A narrative description of the project, including an explanation of how coal ash will be placed, where and how coal ash will be stored prior to placement, identification of the sources of coal ash and an estimate of the cubic yards of coal ash to be used. For the beneficial use of coal ash as a soil substitute or additive, the proposed application rate and justification for the application rate shall also be included.

(2) If the coal ash has not been certified under subsection (a)(2) by the Department, a statement signed by the generator of the coal ash including supporting data which demonstrates that the coal ash quality meets the chemical and physical characteristics identified in the Certification Guidelines for the intended use. If the coal ash has been certified in accordance with subsection (a)(2), information that identifies the generator and the certification number.

(3) A signed statement by the owner of the land on which the coal ash is to be placed, acknowledging and consenting to the placement of coal ash.

(c) *Operating requirements.* The use of coal ash as part of the mining reclamation activity shall be designed to achieve an overall improvement in water quality or shall be designed to prevent the degradation of water quality. Coal ash may be beneficially used for reclamation in the following situations:

(1) The pit or area from which coal is extracted under a surface coal mining permit.

(2) Abandoned coal mining areas located within the surface coal mining permit area.

(3) Coal refuse disposal sites.

(4) Other beneficial uses that are part of the approved reclamation plan of the coal mining activity.

(d) *Additional operating requirements for the placement of coal ash at coal surface mining and coal refuse reprocessing sites.* The following applies to placement of coal ash at coal surface mining and coal refuse reprocessing sites:

(1) Coal ash placed at a coal mining activity site may not exceed the volume of coal, coal refuse, culm or silt removed from the site by the active mining operation on a cubic yard basis unless more coal ash is needed to complete the reclamation plan of the surface mining activity permit.

(2) Placement of coal ash can be accomplished by mixing with spoil material or by spreading in horizontal layers. The reclamation plan of the approved permit shall address the placement of the coal ash.

(3) Groundwater monitoring at coal mining activity sites for the coal ash shall be in accordance with applicable provisions of Chapters 86—90.

(4) For coal refuse pile reprocessing sites where refuse material is presently deposited in large surface piles, the piles may not be rebuilt with coal ash. The placement of coal ash shall be accomplished in a manner which blends into the general surface configuration, and complements the surface drainage pattern of the surrounding landscape.

(5) For multiple refuse pile reprocessing projects, the Department may allow at an individual refuse pile reprocessing site more coal ash used than coal refuse removed if:

(i) A single operator will control a project involving the coordinated use of multiple coal refuse sites.

(ii) A reclamation plan is approved for each of the sites and identifies the total cubic yards of coal ash that may be placed at each site.

(iii) The total cubic yards of coal ash placed on the sites is less than the total cubic yards of refuse, culm or silt removed from the sites. Only coal ash from the integrated project can be used.

(iv) The integrated project shall be designed to achieve an overall improvement of surface water or groundwater quality at each site, where acid mine drainage is evident. For instances in which there is no acid mine drainage, the project will be so designed to achieve no degradation of the surface or groundwater quality.

(v) The integrated project shall be accomplished in a manner which blends into the general surface configuration and complements the surface drainage pattern of the surrounding landscape.

(6) The coal ash may not be placed within 8 feet of the regional groundwater table unless the Department approves placement within 8 feet based upon a demonstration that groundwater contamination will not occur or

that the Department approves this placement as part of a mine drainage abatement project.

(7) The coal ash shall meet the physical and chemical characteristics identified in the Certification Guidelines for the intended use.

(8) The operator shall maintain information concerning the sources and the cubic yards of coal ash used.

(e) *Additional operating requirements for the beneficial use of coal ash as a soil substitute or soil additive.* The following apply to the beneficial use of coal ash as a soil substitute or soil additive:

(1) Coal ash shall be applied at a rate per acre that will protect public health, safety and the environment.

(2) The coal ash that is applied will be part of the approved reclamation plan of the coal mining activity in order to increase the productivity or properties of the soil.

(f) *Additional operating requirements for the beneficial use of coal ash at coal refuse disposal sites.* The following apply to the beneficial use of coal ash at coal refuse disposal sites:

(1) Placement of coal ash as part of coal refuse disposal operations which are permitted under Chapters 86—90 shall be considered beneficial use if the following conditions are met:

(i) The cubic yards of coal ash does not exceed the total cubic yards of coal refuse to be disposed based on uncompacted volumes of materials received at the site, and only amounts necessary to meet subparagraph (iii) may be used.

(ii) The Department may allow cubic yards of coal ash to exceed the cubic yards of coal refuse to be disposed if the approved reclamation plan would require the additional cubic yards of coal ash to improve the quality of leachate generated by the coal refuse.

(iii) The coal ash has physical and chemical characteristics which:

(A) Improve compaction and stability within the fill.

(B) Reduce infiltration of water into coal refuse.

(C) Improve the quality of leachate generated by the coal refuse.

(iv) Groundwater monitoring shall be in accordance with the applicable provisions of Chapters 86—90.

(v) The coal ash may not be placed within 8 feet of the regional groundwater table, unless the Department approves placement within 8 feet based upon a demonstration that groundwater contamination will not occur.

§ 287.664. Coal ash beneficial use at abandoned coal and abandoned noncoal surface mine sites.

(a) *Approval by Department.* Coal ash may be beneficially used at abandoned coal and abandoned noncoal surface mine sites if the reclamation work is approved by the Department or is performed under a contract with the Department. Coal ash approval shall, at a minimum, be based on the following:

(1) Beneficial use of the coal ash shall comply with this section, and the applicable environmental statutes and regulations promulgated thereunder.

(2) The Department will develop Coal Ash Certification Guidelines (Certification Guidelines) that identify the acceptable physical and chemical characteristics for beneficial uses of coal ash. A generator of coal ash shall demonstrate that the coal ash quality meets the chemical and physical characteristics identified in the Certification Guidelines for the intended uses. The demonstration shall be reviewed and approved by the Department prior to a beneficial use.

(3) The Department will develop a technical guidance document to facilitate review of beneficial uses of coal ash at abandoned mine sites.

(b) *Request.* The request for the use of coal ash at abandoned mine sites shall be addressed in the reclamation plan submitted to the Department and shall contain the following:

(1) A narrative description of the project, including an explanation of how coal ash will be placed, where and how coal ash will be stored prior to placement, identification of the sources of coal ash and an estimate of the cubic yards of coal ash to be used. For the beneficial use of coal ash as a soil substitute or additive, the proposed application rate and justification for the application rate shall also be included.

(2) If the coal ash has not been certified under subsection (a)(2) by the Department, a statement signed by the generator of the coal ash including supporting data which demonstrates that the coal ash quality meets the chemical and physical characteristics identified in the certification guidelines for the intended use. If the coal ash has been certified in accordance with subsection (a)(2) information that identifies the generator and the certification number.

(3) A signed statement by the owner of the land on which the coal ash is to be placed, acknowledging and consenting to the placement of coal ash.

(c) *Operating requirements.* The use of coal ash as part of the reclamation activity shall be designed to achieve an overall improvement in water quality or shall be designed to prevent the degradation of water quality or be designed to treat mine drainage or function as a soil substitute or soil additive.

(1) The cubic yards of coal ash to be used at any reclamation activity at an abandoned mine site will be determined by the Department. Consideration may be given to using up to the total volume needed to accomplish reclamation of the entire affected site, so that the final contours resulting from the project blend with the surrounding topography, promote positive surface water runoff and protect surface and groundwater quality.

(2) The necessity for water quality monitoring will be determined by the Department where the information is needed to evaluate the success of the reclamation project.

(3) The coal ash will not be placed within 8 feet of the regional groundwater table, unless the Department approves placement within 8 feet based upon a demonstration that groundwater contamination will not occur.

(4) For use of coal ash as a soil substitute or soil additive, the coal ash shall be applied at the rate per acre in order to increase the productivity or properties of the soil and to protect public health, safety and the environment.

§ 287.665. Other beneficial uses of coal ash.

(a) This section sets forth beneficial uses of coal ash other than use as a structural fill, soil substitute or soil additive.

(b) The following uses of coal ash are deemed to be beneficial and do not require a permit from the Department under the act as long as the uses are consistent with the requirements of this section:

(1) The use of coal ash in the manufacture of concrete.

(2) The extraction or recovery of one or more materials and compounds contained within the coal ash.

(i) Storage of coal ash before and after extraction or recovery shall be subject to Chapter 299 (relating to storage and transportation of residual waste).

(ii) Disposal of the unrecovered fraction of coal ash shall be subject to the applicable requirements for residual waste.

(3) The use of fly ash as a stabilized product. Other uses of fly ash in which physical or chemical characteristics are altered prior to use or during placement shall be considered a beneficial use under this section if the following are met:

(i) The person or municipality proposing the use has first given advance written notice to the Department.

(ii) The coal ash is not mixed with solid waste, unless otherwise approved in writing by the Department prior to the use.

(iii) The use of the coal ash results in a demonstrated reduction of the potential of the coal ash to leach constituents into the environment.

(4) The use of bottom ash or boiler slag as an antiskid material or road surface preparation material, if the use is consistent with Department of Transportation specifications or other applicable specifications. The use of fly ash as an antiskid material or road surface preparation material is not deemed to be a beneficial use.

(5) The use of coal ash as raw material for a product with commercial value, including the use of bottom ash in construction aggregate. Storage of coal ash prior to processing is subject to § 299.153 (relating to storage and containment of coal ash).

(6) The use of coal ash for mine subsidence control, mine fire control and mine sealing, if the following requirements are met:

(i) The person or municipality proposing the use gives advance written notice to the Department.

(ii) The pH of the coal ash is in a range that will not cause or allow the ash to contribute to water pollution.

(iii) Use of the coal ash in projects funded by or through the Department is consistent with applicable Departmental requirements and contracts.

(7) The use of coal ash as a drainage material or pipe bedding, if the person or municipality proposing the use has first given advance written notice to the Department, and has provided to the Department an evaluation of the pH of the coal ash and a chemical analysis of the coal ash that meets the requirements of § 287.132 (relating to chemical analysis of waste).

[Pa.B. Doc. No. 97-141. Filed for public inspection January 24, 1997, 9:00 a.m.]

APPENDIX M

DRAFT PENNSYLVANIA CERTIFICATION GUIDELINES FOR BENEFICIAL USES OF COAL ASH

DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF MINING AND RECLAMATION

DOCUMENT NUMBER: 563-2112-224

TITLE: Certification Guidelines for Beneficial Uses of Coal Ash

AUTHORITY: Pennsylvania's Solid Waste Management Act (35 P. S. §§6018.101 et. seq.) and 25 Pa. Code Chapter 287

EFFECTIVE DATE: May 30, 1997

POLICY:

It is the Department's policy and practice to certify coal ash for beneficial uses at active coal mine sites, abandoned coal mine sites, and abandoned noncoal (industrial mineral) mine sites.

PURPOSE:

It is the purpose of this document to provide the guidelines for certifying coal ash for beneficial uses and the forms with instructions that are necessary for the Department to certify coal ash for beneficial uses.

APPLICABILITY:

This guidance will apply to generators of coal ash, mine operators, consultants, and Department staff who are involved in the beneficial use of coal ash at active coal mine sites or abandoned coal and noncoal (industrial mineral) mine sites.

DISCLAIMER:

The policies and procedures outlined in this guidance document are intended to supplement existing requirements. Nothing in the policies or procedures shall affect more stringent regulatory requirements.

The policies and procedures herein are not an adjudication or a regulation. There is no intent on the part of the Department to give these rules that weight or deference. This document establishes the framework, within which DEP will exercise its administrative discretion in the future. DEP reserves the discretion to deviate from this policy statement if circumstances warrant.

PAGE LENGTH: 9

LOCATION: Vol. 12, Tab 59A (BMR/PGM Section II, Part 2, Subpart 24)

DEFINITIONS: See 25 Pa. Code Chapter 287

TECHNICAL GUIDANCE:

BACKGROUND

The PA Solid Waste Management Act of 1980 was amended in December 1986 to allow the beneficial use of coal ash. In July 1992 provisions allowing the beneficial use of coal ash were placed in the residual waste management regulations. Although some use of coal ash occurred under these regulations, the regulations were generally considered by the coal mining industry to be too restrictive and prescriptive for beneficial use at active coal mine sites. Therefore regulatory changes were proposed as revisions to the beneficial use of coal ash. They were adopted by the EQB on October 15, 1996, and became effective on January 25, 1997. The revised beneficial use coal ash regulations, §§287.663 and 287.664, required the development of this Certification Guidelines for Beneficial Uses of Coal Ash (hereinafter referred to as "Certification Guidelines"), and the Technical Guidance Document for Beneficial Uses of Coal Ash (hereinafter referred to as "Technical Guidance Document") for the review of the beneficial uses of coal ash at active coal mining sites, abandoned coal mine sites, and abandoned noncoal (industrial mineral) mine sites (hereinafter collectively referred to as "active coal mine and abandoned mine sites"). The Certification Guidelines and Technical Guidance Document are to be used in conjunction with these beneficial use of coal ash regulations.

INTRODUCTION

This document provides detailed instructions for certification by the Department for the different beneficial uses of coal ash at active coal mine and abandoned mine sites. The Certification Guidelines do not address the beneficial use of coal ash at underground mining activities or at coal preparation activities at this time.

This guidance describes four beneficial uses of coal ash. These four beneficial uses are: coal ash placement, coal ash alkaline addition, coal ash as soil additive or soil substitute, and coal ash as low permeable material. However, this is not intended to limit consideration of other coal ash beneficial uses at active coal mine and abandoned mine sites that are not addressed under §§287.663 and 287.664. As different beneficial uses of coal ash are identified for active coal mine and abandoned mine sites, the Department will include them in this document. Coal ash must be certified for beneficial uses by the Department or the applicant must demonstrate to the Department the coal ash meets the chemical and physical characteristics in the Certification Guidelines, before the coal ash can be used beneficially at active coal mine or abandoned mine sites.

Also, the Technical Guidance Document which address technical information concerning the different beneficial uses is being developed under a separate guidance document. The Certification Guidelines and the Technical Guidance Document, guidance number BMR/PGM Section II, Part 2, Subpart 6, Coal Ash Beneficial Uses at Coal Surface Mines and Refuse Disposal Sites, and Modules 25 and/or 27 of the Bituminous Surface Mine Permit Application must be followed to obtain approval for coal ash beneficial use at active coal mine sites. To obtain approval for coal ash beneficial use at abandoned mine sites, the Certification Guidelines, the Technical Guidance Document, and the specific contracts with the Department must be followed.

COAL ASH BENEFICIAL USE CERTIFICATION

PART A- PROCEDURES FOR COAL ASH BENEFICIAL USE CERTIFICATION

1. The generator of the coal ash shall complete the Part C-Coal Ash Generator and Coal Ash Quality Information (hereinafter called "Part C"). The generator of the coal ash must have completed the Part D-Coal Ash and Leachate Analyses (hereinafter called "Part D"). This information is to be submitted to the Bureau of Mining and Reclamation, Division of Permits, Rachel Carson State Office Building, P. O. Box 8461, Harrisburg, PA 17105-8461. (The telephone number is 717-783-8845.)

2. If the information is incomplete, the Department will, within 30 days of receipt of the information, return the submittal to the applicant with a description of the information necessary to complete the application. When the information is complete the Department will notify the coal ash generator concerning its decision on the coal ash certification and approved beneficial uses within 60 days of the receipt of the complete application. If approval is granted, a notification letter from the Department will include the certification number and the beneficial uses that are approved for that coal ash.

3. After certification the coal ash generator must submit the Part C and Part D information every six months or whenever there is a change in operation of the combustion unit generating the coal ash. This information should be sent to Bureau of Mining and Reclamation, Division of Permits, Rachel Carson State Office Building, P. O. Box 8461, Harrisburg, PA 17105-8461. The Department may require additional Part C and Part D information at the sites of its use if the Department believes that the coal ash may differ from the coal ash that is certified.

PART B- COAL ASH CERTIFICATION REQUIREMENTS

I. General Requirements

For coal ash to be certified for beneficial use at active coal mine or abandoned mine sites the maximum acceptable leachate concentration for each constituent listed in the Part D can not be exceeded. The maximum acceptable leachate concentration is normally either 25 times the groundwater parameters for metals and other cations or up to 10 times the groundwater parameters for nonmetals. However if the maximum leachate concentration of a constituent is exceeded and the constituent's groundwater parameter is based on a secondary maximum contaminant level (i.e. aluminum, iron, manganese, sulfate, and zinc), certification may be contingent upon the beneficial use at a specific mine site where approval would be on a case-by-case basis. The leachate test method which must be used is EPA's Test Methods for Evaluating Solid Waste, SW-846, Method 1312; Synthetic Precipitation Leaching Procedure (SPLP).

II. Additional Requirements for Beneficial Uses

A. Coal Ash Placement

For coal ash to be certified for beneficial use as coal ash placement, the pH of the coal ash must be in the range of 7.0 to 12.5 at the generator's site.

B. Coal Ash as Soil Substitute or Soil Additive

For coal ash to be certified for beneficial use as a liming agent, the equivalent calcium carbonate percentage of the coal ash must be at least 15% by dry weight. The calcium carbonate equilvance is to be determined by the Neutralization Potential Test in accordance with DEP's Overburden Sampling and Test Manual, or by the Methods of Soil Analysis Part II Chemical and Biological Properties, published by the Agronomy Society of America, Inc., and Soil Scientist Society of America, Inc., Madison, WI.

If the coal ash is to be beneficially used as a soil substitute or soil additive for purposes other than as a liming agent, the applicant must provide a description and justification for the intended use. Any certification for coal ash as a soil substitute or soil additive for these purposes will be on a contingent basis and approval at the active coal mine or abandoned mine sites will be on case-by-case basis.

C. Coal Ash Alkaline Addition

For coal ash to be certified for beneficial use as alkaline addition the equivalent calcium carbonate must be at least 100 parts per thousand (i.e. 100 tons of Ca CO_3 equivalent/1000 tons of material) or 10% by dry weight. The calcium carbonate equivalence is to be determined by the Neutralization Potential Test in accordance with DEP's Overburden Sampling and Testing Manual or by the Methods of Soil Analysis Part II Chemical and Biological Properties, published by the Agronomy Society of America, Inc. and Soil Scientist Society of America, Inc., Madison, WI.

D. Coal Ash as Low Permeable Material

For coal ash to be certified for beneficial use as a low permeable material, the permeability must be $1.0x10^{-6}$ cm/sec or less based upon laboratory testing (i.e. ASTM D 2434-68: Standard Test Method for Permeability of Granular Soils, ASTM D 5084-90: Standard Test

Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Perimeter, or other test approved by the Department) and using compaction and other preparation techniques that will be duplicated at the site of the beneficial use. If an additive is used, the mixture of coal ash and the additive must have a permeability of $1.0x10^{-6}$ cm/sec or less based upon laboratory testing and using compaction and other preparation techniques that will be duplicated at the site of the beneficial use. However if the permeability of the coal ash mixture of coal ash and additive is slightly greater than $1.0x10^{-6}$ cm/sec, the certification may be contingent upon the beneficial use at a specific active coal mine or abandoned mine site where approval would be on a case-by-case basis.

PART C- COAL ASH GENERATION AND COAL ASH QUALITY INFORMATION

1. Generator of Coal Ash
   Name of Ash Generator________________________________
   Mailing Address________________________________
   Name of Generating Facility________________________________
   Location of Generating Facility
   Municipality____________________ County__________ State______

2. Coal Ash Generation Process

   Provide a narrative description of the combustion and pollution control processes utilized to generate coal ash and indicate the expected percentage of fly ash and bottom ash (e.g. 80% fly ash, 20% bottom ash). Provide diagrams, charts, and tables as necessary to supplement this narrative description.

3. Physical and Chemical Analysis of Coal Ash for Coal Ash Quality and Testing Requirements

   a. Provide a description of the procedures used to obtain representative samples of coal ash for analytical purposes (including location of sampling).

   b. If coal ash's pH is adjusted at the generation site, the coal ash and leachate must be tested and reported only after pH adjustment. Describe the extent and methods by which coal ash is mixed with other materials (such as pH control chemicals) prior to leaving the generation site. Describe the physical and chemical characteristics of such materials.

   c. The coal ash is required to have a chemical analysis of its constituents based upon EPA's Test Methods for Evaluating Solid Waste, SW-846 or a comparable test method approved by EPA or the Department. The following constituents of the coal ash must be determined: pH, aluminum, arsenic, antimony, barium, boron, cadmium, chromium, copper, iron, lead, manganese, mercury, molybdenum, nickel, selenium, and zinc.

      Synthetic Precipitation Leaching Procedure (SPLP), EPA's Test Methods for Evaluating Solid Waste, SW-846 Method 1312 must be used to obtain the coal ash leachate. The following constituents of the coal ash's leachate must be determined: pH (initial and final), total organic halides, aluminum, arsenic, antimony, barium, boron, cadmium, chromium, copper, iron, lead, manganese, mercury, molybdenum, nickel, selenium, zinc, sulfate, chloride, and sodium. The constituent results shall be reported on the Part D-Coal Ash and Leachate Analyses and the laboratory reports must be attached.

4. Certification of Coal Ash Generator

I certify under penalty of law that I have personally examined and am familiar with the information submitted in the Part C and Part D and attached analytical results, and that based upon my inquiry of those individuals immediately responsible for obtaining the information, I believe the submitted information is true, accurate and complete to the best of my knowledge and belief. I am aware there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

Name of Generator____________________________________

Name of Responsible Official______________________________

Title__________________________ Phone ____________

Signature _________________________ Date____________

Taken, sworn and subscribed before me, this___day of ____________________
(month) (year)

Notary____

Seal____

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF MINING AND RECLAMATION

For Department Use Only
Cert. No ________

PART D — COAL ASH AND LEACHATE ANALYSES

Name of Ash Generator ____________________

Ash Sample No. ____________________ Collection Date ____________________

Sampling Location and Method ____________________

____

Contact Person ____________________ Telephone No. ____________________

Analytical Laboratory Name, Address ____________________ Analyst(s) Name(s) ____________________

____

____________________ Telephone No. ____________________

RESULTS OF ANALYSIS ☐ No pH Adjustment ☐ After pH Adjustment

Constituents	Acceptable Methods of Analysis Indicate Method Used		Ash Dry Wt. Concentration (mg/kg)	Leachate Concentration (mg/L)	Maximum Acceptable Leachate Concentration (mg/L)
	EPA SW-846	Other Acceptable			
pH	9045				
Aluminum	6010A, 7020,				5.0
Antimony	6010A, 7040, 7041				0.15
Arsenic	6010A, 7060A, 7061A				1.25
Barium	6010A, 7080A				50
Boron		EPA 600/A-79-020			78.75
Cadmium	6010A, 7130, 7131A				0.13
Chromium	6010A, 7190, 7191				2.5
Copper	6010A, 7210, 7211				32.5
Iron	6010A, 7380, 7381				7.5
Lead	6010A, 7420, 7421				1.25
Manganese	6010A, 7460, 7461				1.25
Mercury	7470, 7471A				0.05

Constituents	Acceptable Methods of Analysis Indicate Method Used		Ash Dry Wt. Concentration (mg/kg)	Leachate Concentration (mg/L)	Maximum Acceptable Leachate Concentration (mg/L)
	EPA SW-846	Other Acceptable			
Molybdenum	6010A, 7480, 7481				4.38
Nickel	6010A, 7520				2.5
Selenium	6010A, 7740, 7741				1.00
Zinc	6010A, 7950, 7951				125
Sulfate	9035A, 9036A, 38A				2500
Chloride	9250, 9251A, 9252				2500
Sodium	6010A, 7770				
Total Organic Halides	9020A, 9022A				

APPENDIX N

DRAFT PENNSYLVANIA GUIDANCE FOR BENEFICIAL USES OF COAL ASH

DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF MINING AND RECLAMATION

DOCUMENT NUMBER: 563-2112-225

TITLE: Technical Guidance for Beneficial Uses of Coal Ash

AUTHORITY: Pennsylvania's Solid Waste Management Act (35 P. S. §§6018.101 et. seq.) and 25 Pa. Code Chapter 287.

EFFECTIVE DATE: May 30, 1997

POLICY:

It is the Department's policy to provide guidance for the different beneficial uses of coal ash at active coal mine sites, abandoned coal mine sites, and abandoned noncoal (industrial mineral) mine sites.

PURPOSE:

This document describes the four beneficial uses of coal ash that can be approved in active coal mine permits or that can be approved as part of the Department's contract for reclamation at abandoned mines.

APPLICABILITY:

This guidance will apply to generators of coal ash, mine operators, consultants, and Department staff who are involved in the beneficial use of coal ash at active coal mine sites or abandoned coal and noncoal (industrial mineral) mine sites.

DISCLAIMER:

The policies and procedures outlined in this guidance document are intended to supplement existing requirements. Nothing in the policies or procedures shall affect more stringent regulatory requirements.

The policies and procedures herein are not an adjudication or a regulation. There is no intent on the part of the Department to give these rules that weight or deference. This document establishes the framework, within which DEP will exercise its administrative discretion in the future. DEP reserves the discretion to deviate from this policy statement if circumstances warrant.

PAGE LENGTH: 10

LOCATION: Vol. 12, Tab 59B (BMR/PGM Section II, Part 2, Subpart 25)

DEFINITIONS: See 25 Pa. Code Chapter 287

TECHNICAL GUIDANCE:

BACKGROUND

The PA Solid Waste Management Act of 1980 was amended in December 1986 to allow the beneficial use of coal ash. In July 1992 provisions allowing the beneficial use of coal ash were placed in the residual waste management regulations. Although some beneficial use of coal ash occurred under these regulations, the regulations were generally considered by the mining industry to be too restrictive and prescriptive for beneficial use at active coal mine sites. Therefore regulatory changes were proposed as revisions to the beneficial use of coal ash. They were adopted by the EQB on October 15, 1996, and became effective on January 25, 1997. The revised coal ash regulations required the development of this Technical Guidance Document for Beneficial Uses of Coal Ash (hereinafter "Technical Guidance Document") and Certification Guidelines for Beneficial Uses of Coal Ash (hereinafter referred to as "Certification Guidelines") for the review of the beneficial uses of coal ash at active coal mine sites, abandoned coal mine sites and abandoned noncoal (industrial mineral) mine sites (hereinafter collectively referred to as "active coal mine and abandoned mine sites"). The Technical Guidance Document and the Certification Guidelines are to be used in conjunction with the beneficial use of coal ash regulations.

INTRODUCTION

This Technical Guidance Document provides the technical information that is needed to approve the different beneficial uses of coal ash at active coal mine and at abandoned mine sites. The Technical Guidance Document does not address the beneficial use of coal ash at underground mining activities or at coal preparation activities at this time.

Four beneficial uses of coal ash are discussed in this guidance document. However, this does not limit other coal ash beneficial uses not addressed under §§287.663 and 287.664 at active coal mine and abandoned mine sites. As different beneficial use of coal ash are identified for active coal mine and abandoned mine sites, the Department will include them in this document. These four beneficial uses are: coal ash placement, coal ash alkaline addition, coal ash as soil additive or soil substitute, and coal ash as low permeable material. Coal ash must be certified for a beneficial use by the Department or it must be demonstrated to the Department that the coal ash meets the chemical and physical characteristics in the Certification Guidelines before coal ash can be used beneficially at active coal mine or abandoned mine sites. The Certification Guidelines are being developed as a separate document.

The Certification Guidelines, the Technical Guidance Document, guidance document number BMR/PGM Section II, Part 2, Subpart 6, Coal Ash Beneficial Uses at Coal Surface Mines and Refuse Disposal Sites, and Modules 25 and/or 27 of the Bituminous Surface Mine Application must be followed to obtain approval for coal ash beneficial use at active coal mine sites. To obtain approval for coal ash beneficial use at abandoned mine sites, the Certification Guidelines, the Technical Guidance Document, and specific contracts with the Department must be followed.

A. COAL ASH PLACEMENT

Coal ash placement for beneficial use at active coal mine sites and abandoned mine sites must improve water quality or prevent groundwater degradation. In addition coal ash placement can eliminate public health and safety hazards.

1. Placement Method

Coal ash placement at active coal mine sites can occur through either mixing the coal ash with spoil material, placing it in layers, or placing it at desirable locations in the backfill. Coal ash placement at coal refuse disposal sites can occur through either placement of the coal ash in layers and compacting it or by mixing the coal ash with coal refuse which is then compacted.

For active coal mine sites, coal ash placement must be described as part of the reclamation plan in the mine permit application. For abandoned mine sites, coal ash placement must be described in the reclamation plan as part of the mine reclamation project. The reclamation plan must consider coal ash content, compaction of coal ash, extent of coal ash placement at the mine site, surrounding site topography, and the plan must insure that on-site or off-site operating problems, such as dust, do not occur.

2. Water Quality Monitoring

Groundwater monitoring is required in §287.663 for coal ash placement at active coal mine sites in accordance with the applicable provisions of Chapters 86-90. Water quality monitoring is required in §287.664 for coal ash placement at abandoned mine sites only where such information is needed to evaluate the success of the reclamation project. Groundwater monitoring can be helpful in determining the impacts of coal ash placement and to provide the basic information needed for improving coal ash placement techniques. Water quality monitoring which includes groundwater monitoring may be useful for determining optimum placement conditions or designs using coal ash at abandoned mine sites.

Monitoring points typically associated with coal mining permits are, in most instances, capable of monitoring coal ash placement. However, groundwater monitoring points should be discussed and approved by the Department prior to placement of coal ash. Monitoring points normally associated with active coal mine and abandoned mine sites include monitoring wells, springs, seeps, mine discharges, and abandoned mine shafts. Upgradient groundwater monitoring points from active coal mine and abandoned placement sites are not required unless there is a need to characterize the groundwater coming on to the placement sites because of concerns unrelated to the mine sites being monitored. For example, there may be other activities that could impact groundwater quality which are located in close proximity to the mine site. There must be at least one downgradient groundwater monitoring point from the active coal mine site. The actual number of downgradient monitoring points and their locations will depend upon the configuration of the coal ash placement area, the volume of coal ash placed, and the groundwater conditions at the mine site. Sufficient groundwater monitoring must be performed in order to provide an assessment of the impact of coal ash to the groundwater. The assessment must address its areal extent as well as any changes to water quality.

At active coal mine sites, six background samples from each monitoring point taken monthly are normally necessary to adequately characterize groundwater quality prior to coal ash placement. The Department may reduce this amount of background data depending on the size and the scope of the coal ash placement activity. Some background sampling may be necessary to characterize groundwater quality prior to coal ash placement for abandoned mine reclamation projects.

All sample collections and analyses will be in accordance with EPA's Test Methods for Evaluating Solid Waste, SW-846. The information must be submitted on forms supplied by the Department. The required data from all monitoring points shall be obtained monthly prior to coal ash placement and shall include the following parameters: static water elevation (for monitoring wells), pH (field and laboratory), specific conductance, alkalinity, acidity, iron, manganese, sulfate, chloride, sodium, total dissolved solids, total suspended solids, aluminum, arsenic, cadmium, calcium, chromium, copper, lead, magnesium, mercury, nickel, selenium, and zinc.

Once coal ash placement begins at active mine sites, groundwater monitoring must be performed quarterly for the following parameters: static water elevation (for monitoring wells), pH (field and laboratory), specific conductance, alkalinity, acidity, iron, manganese, sulfate, chloride, sodium, total dissolved solids and total suspended solids. Groundwater monitoring must be performed annually for the following parameters: aluminum, arsenic, cadmium, calcium, copper, lead, magnesium, mercury, nickel, selenium, and zinc.

The Department may require groundwater monitoring to be performed for abandoned mine sites once coal ash placement begins, at a sampling frequency determined by the Department, to include to following parameters: static water elevation (for monitoring wells), pH (field laboratory), specific conductance, alkalinity, acidity, iron, manganese, sulfate, chloride, sodium, total dissolved solids, total suspended solids, aluminum, arsenic, cadmium, calcium, chromium, copper, lead, magnesium, mercury, nickel, selenium, and zinc.

3. Depth to Regional Groundwater Table

The regulations addressing the beneficial use of coal ash, §§287.663 and 287.664, require that an isolation distance between the bottom of coal ash and the regional groundwater table (defined in §287.1) to be at least eight feet (2.44 meters) unless otherwise approved by the Department. If the coal ash is to be placed within eight feet (2.44 meters) of regional groundwater table, a study shall be submitted to the Department which demonstrates that there will be no groundwater pollution or that there will be an improvement to water quality. At a minimum, this demonstration should address the proposed distance between the coal ash and the regional groundwater table, the volume of coal ash to be placed, the location of the downgradient wells or springs, and the modeling or research that justify the design. It is suggested that the elements of the demonstration be discussed with the appropriate Departmental staff before proceeding with the demonstration.

B. Coal Ash as Soil Substitute or Soil Additive

Coal ash may be used as a soil substitute or as a soil additive to improve vegetative growth or to improve soil nutrients.

1. Application Method

The final pH of the coal ash and soil/spoil mixture must be in the range 6.5 to 8.5 unless approved by the Department on a case-by-case basis. However, the applicant must demonstrate that coal ash constituents will not cause pollution (e.g. aluminum at the higher pH). If coal ash is used as a lime substitute or other nutrient substitute, the calcium carbonate or other nutrient of the coal ash should be used in accordance with the volume that would be needed to substitute for lime or other constituents. This should be addressed in the reclamation plan of the mine permit or in the contract for the abandoned mine reclamation project.

If coal ash is used as a soil substitute, it must be mixed with other vegetative supporting material. The depth of this soil substitution should not exceed three feet (0.91 meters) unless approved by the Department on a case-by-case basis. This should be addressed in the reclamation plan of the mine permit or in the contract for the abandoned mine reclamation project.

If coal ash is used as a soil additive, the depth of the coal ash and soil mixture should not exceed one foot (0.30 meters) unless approved by the Department on a case-by-case basis. This should be addressed in the reclamation plan of the mine permit or in the contract for the abandoned mine reclamation project.

The soil or spoil top cover must be sampled and analyzed before any coal ash can be added as a soil substitute or soil additive. The background analysis is needed to determine the quantity of coal ash which can be applied without exceeding certain metal limits. The samples must be analyzed in accordance with EPA's Test Methods for Evaluating Solid Waste, SW-846. The following constituents must be analyzed: arsenic, cadmium, copper, lead, mercury, nickel, selenium, zinc, and boron.

The coal ash used as a soil substitute or soil additive and the soil or spoil top cover together can not exceed any of the following maximum contaminant loading rates.

Contaminant	Cumulative Contaminant Loading Rate			
arsenic	36	lbs/acre	(41	kg/hectare)
cadmium	34	lbs/acre	(39	kg/hectare)
copper	1320	lbs/acre	(1500	kg/hectare)
lead	264	lbs/acre	(300	kg/hectare)
mercury	15	lbs/acre	(17	kg/hectare)
nickel	370	lbs/acre	(420	kg/hectare)
selenium	88	lbs/acre	(100	kg/hectare)
zinc	2464	lbs/acre	(2800	kg/hectare)

2. Water Quality Monitoring

Normally no special water quality monitoring is required for this use at an active coal mine or abandoned mine site. However the Department may require water quality monitoring if there is a concern regarding groundwater degradation.

3. Depth to Regional Groundwater Table

The beneficial use of coal ash regulations, §§287.663, and 287.664, require that an isolation distance between the bottom of coal ash and the regional water table to be at least eight feet (2.44 meters) unless otherwise approved by the Department. If the coal ash is to be used within eight feet (2.44 meters) of regional groundwater table, a study shall be submitted to the Department which demonstrates that there will be no groundwater pollution or that there will be an improvement to water quality. At a minimum, this demonstration should address the proposed distance between the coal ash and the regional groundwater table, the volume of coal ash to be used, the location of the downgradient springs or wells, and the modeling or research that justify the design. It is suggested that the elements of the demonstration be discussed with the appropriate Departmental staff before proceeding with the demonstration.

C. ALKALINE ADDITION

Coal ash may be used at active coal mine and abandoned mine sites as alkaline addition for the purpose of neutralizing or treating acid-forming materials. Alkaline addition is a form of coal ash placement.

1. Application Method

The beneficial use of coal ash as alkaline addition must be approved as part by the Department of the reclamation plan of the mining permit or in the contract for the abandoned mine reclamation project. The volume of coal ash used will depend on the amount of neutralization needed at the mine site, but this volume of coal ash can not exceed the quantity of coal ash needed for reclamation of the mine site. The location and method of application of the coal ash will depend upon the location of the acid-forming materials. The pH of the coal ash must be in the range from 7.0 to 12.5.

2. Water Quality Monitoring

Groundwater monitoring of coal ash used for alkaline addition is necessary as part of the reclamation plan of the mine permit. Groundwater monitoring should be done in accordance with the Department's alkaline addition guidelines, BMR/PGM Section II, Part 2, Subpart 17.

In some instances, the Department may require water quality monitoring at abandoned mine sites. Water quality monitoring should be considered if a large volume of coal ash is being used beneficially, if the location of coal ash being used beneficially within the backfill is critical, or as a means to evaluate the success of the alkalinity derived from the coal ash. The monitoring points should be discussed with the Department and agreed upon prior to the use of coal ash.

The monitoring points associated with active coal mine and abandoned mine sites are monitoring wells, springs, seeps, mine discharges, and abandoned mine shafts. Upgradient groundwater monitoring points from the mine site are not required, unless there is a need to characterize the groundwater coming onto the mine site because of concerns unrelated to the site being monitored. For example there may be other activities which could impact groundwater quality which are located in close proximity to the mine site. There must be at least one downgradient groundwater monitoring point from the active and abandoned mine sites. The actual number will depend upon the configuration of the coal ash placement area, volume of coal ash placed, and the groundwater conditions at the mine sites. Sufficient groundwater monitoring must be performed in order to provide an assessment of the impact of groundwater. The assessment must address its areal extent as well as any changes to water quality.

At active mine sites six background samples from each monitoring point taken monthly are normally necessary to adequately characterize groundwater quality prior to alkaline addition. The Department may reduce this amount of background data depending on the size and scope of the alkaline addition activity. Some background sampling to characterize groundwater prior to coal ash placement may be necessary for abandoned mine reclamation projects.

All sample collections and analyses will be in accordance with EPA's Test Methods for Evaluating Solid Waste, SW-846. The information must be submitted on forms supplied by the Department. Prior to alkaline addition, groundwater monitoring is to be performed monthly at all the monitoring points for the following parameters: static water elevation (for monitoring wells), pH (field and laboratory), specific conductance, alkalinity, acidity, iron, manganese, sulfate, chloride, sodium, total dissolved solids, total suspended solids, aluminum, arsenic, cadmium, calcium, chromium, copper, lead, magnesium, mercury, nickel, selenium, and zinc.

Once alkaline addition begins at active mine sites, groundwater monitoring is to be performed quarterly for the following parameters: static water elevation (for monitoring wells), pH (field and laboratory), specific conductance, alkalinity, acidity, iron, manganese, sulfate, chloride, sodium, total dissolved solids and total suspended solids. Groundwater monitoring is to be performed annually for the following parameters: aluminum, arsenic, cadmium, calcium, copper, lead, magnesium, mercury, nickel, selenium, and zinc.

The Department may require groundwater monitoring for abandoned mine sites once coal ash alkaline addition begins, at a sampling frequency determined by the Department, and to includes the following parameters: static water elevation (for monitoring wells), pH (field laboratory), specific conductance, alkalinity, acidity, iron, manganese, sulfate, chloride, sodium, total dissolved solids, total suspended solids, aluminum, arsenic, cadmium calcium, chromium, copper, lead, magnesium, mercury, nickel, selenium, and zinc.

3. Depth to Regional Groundwater Table

The beneficial use of coal ash regulations, §§287.663 and 287.664, require that an isolation distance between the bottom of coal ash and the regional groundwater table be at least eight feet (2.44 meters) unless otherwise approved by the Department. If the coal ash is to be used within eight feet (2.44 meters) of regional groundwater table, a study is to be submitted to the Department which demonstrates that there will be no groundwater pollution or that there will be an improvement to water quality. At a minimum, this demonstration should address the proposed from the coal ash regional groundwater table, the volume of coal ash to be used, the location of the downgradient wells and springs, and the modeling or research that justify the design. It is suggested that the elements of the demonstration be discussed with the appropriate Departmental staff before proceeding with the demonstration.

D. COAL ASH AS LOW PERMEABLE MATERIAL

Coal ash can be used as low permeable material to isolate by sealing or preventing infiltration at active coal mine and abandoned mine sites in order to improve water quality or prevent groundwater degradation.

1. Installation Method

Coal ash used beneficially as low permeable material at active coal mine sites has to be approved in the reclamation plan of the mining permit. Coal ash that is used beneficially as low permeable material at abandoned mine sites must be approved in the contract with the Department.

The coal ash used beneficially to provide a low permeable layer must have a minimum thickness of 2 feet (0.61 meters) unless Department approves a lesser thickness on a case-by-case basis. The volume of coal ash and method of application have to be approved by the Department. The pH of the coal ash must be in the range of 7.0 to 12.5 at the generator's site or an additive must be blended with the coal ash to achieve a pH in the range of 7.0 to 12.5 at the active coal mine site.

2. Water Quality Monitoring

Groundwater monitoring at active coal mine sites, where coal ash is used as low permeable material, is necessary in order to evaluate the success of the project. The monitoring points associated with the coal mine permits are in most instances capable of monitoring coal ash placement. These groundwater monitoring points should be discussed and approved prior to the use of coal ash. In some instances the Department may require water quality monitoring (which includes groundwater) at abandoned mine sites for coal ash used as low permeable material. Water quality monitoring may be necessary to evaluate the success of the abandoned mine reclamation project. These monitoring points should discussed with the Department and agreed upon prior to the use of coal ash.

The monitoring points associated with active coal mine and abandoned mine sites include monitoring wells, springs, seeps, mine discharges, and abandoned mine shafts. Hydraulically upgradient groundwater monitoring points from the active coal mine and abandoned mine sites are not required, unless there is a need to characterize the groundwater coming onto the mine sites because of concerns unrelated to the mine sites being monitored. For example there may be other activities that could impact groundwater quality which are located in close proximity to the mine site. There must be at least one hydraulically downgradient groundwater monitoring point from the active and abandoned mine sites, but this number will depend upon the configuration of the placement area, volume of coal ash placed, and the groundwater conditions at the mines sites. Sufficient groundwater monitoring must be performed in order to provide an assessment of the impact of coal ash to groundwater. The assessment must address its areal extent as well as the changes to water quality.

At active coal mine sites normally, six background samples from each monitoring point taken monthly are necessary to adequately characterize groundwater quality prior to coal ash used as low permeable material. The Department may reduce this amount of background data depending on the size and scope of the coal ash installation activity. Some background sampling to characterize groundwater quality prior to coal ash used may be necessary for abandoned mine reclamation projects.

All sample collections and analyses shall be in accordance with EPA's Test Methods for Evaluating Solid Waste, SW-846. This information must be submitted on forms supplied by the Department. Prior to the use of coal ash used as low permeable material groundwater monitoring shall be performed at all the monitoring points for the following parameters: static water elevation (for monitoring wells), pH (field and laboratory), specific conductance, alkalinity, acidity, iron, manganese, sulfate, chloride, sodium, total dissolved solids, total suspended solids, aluminum, arsenic, cadmium, calcium, chromium, copper, lead, magnesium, mercury, nickel, selenium, and zinc.

Once the use of coal ash as low permeable material begins at active coal mine sites, groundwater monitoring must performed quarterly for the following parameters: static water elevation (for monitoring wells), pH (field and laboratory), specific conductance, alkalinity, acidity, iron, manganese, sulfate, chloride, sodium, total dissolved solids and total suspended solids. Groundwater monitoring, shall be performed annually for the following parameters: aluminum, arsenic, cadmium, calcium, copper, lead, magnesium, mercury, nickel, selenium, and zinc.

The Department may require groundwater monitoring to be performed for abandoned mine sites once coal ash as low permeable material begins, at a sampling frequency determined by the Department, and include the following parameters: static water elevation (for monitoring wells), pH (field laboratory), specific conductance, alkalinity, acidity, iron, manganese, sulfate, chloride, sodium, total dissolved solids, total suspended solids, aluminum, arsenic, cadmium, calcium, chromium, copper, lead, magnesium, mercury, nickel, selenium, and zinc.

3. Depth to Regional Groundwater Table

The beneficial use of coal ash regulations, §§287.663, and 287.664, require that an isolation distance between the bottom of coal ash and the regional groundwater table be at least eight feet (2.44 meters) unless otherwise approved by the Department. If the coal ash is to be used within eight feet (2.44 meters) of regional groundwater table, a study is to be submitted to the Department which demonstrates that there will be no groundwater pollution or that there will be an improvement to water quality. At a minimum, this demonstration should address the proposed distance between the coal ash and the regional groundwater table, the volume of coal ash to be used, the location of the downgradient well and springs, and the modeling or research that justify the design. It is suggested that the elements of the demonstration be discussed with the appropriate Departmental staff before proceeding with the demonstration.

APPENDIX O

DRAFT PENNSYLVANIA REPORT ON BENEFICIAL USE OF COAL ASH AT COAL MINE SITES

DRAFT

Beneficial Use of Coal Ash at Coal Mine Sites in Pennsylvania

Introduction

In Pennsylvania, coal ash is regulated under the Solid Waste Management Act and the residual waste management regulations. In December 1986, this act was amended to authorize the beneficial use of coal ash. Beneficial use of coal ash was implemented through Department of Environmental Protection (Department) guidelines until the residual waste management regulations, 25 PA Code Chapter 287, were amended in July 1992 to include the beneficial use of coal ash, Sections 287.661-287.666. On January 25, 1997, the beneficial use of coal ash regulations, Sections 287.663 and 287.664 were amended to change the requirements concerning groundwater monitoring, reporting to the Department, coal ash beneficial uses, and the amounts of coal ash that could be used at active coal mine and abandoned mine sites. These amendments require the Department to develop certification guidelines and technical guidance for the beneficial use of coal ash. Certification guidelines allow generators of coal ash to obtain certification for their coal ash by meeting the chemical and physical characteristics that are appropriate for the different beneficial uses. The technical guidance deals with the review and approval of the beneficial uses of coal ash at active coal mine sites and at abandoned mine sites.

Background

Coal ash is defined in Pennsylvania's Solid Waste Management Act as flyash, bottom ash or boiler slag resulting from the combustion of coal. Ash generated from burning waste material (e.g. petroleum coke) with coal would not generally be considered coal ash under this definition. The addition of waste from pollution control devices (e.g. wet scrubber sludge) to the coal ash would generally exclude that ash under this definition.

The beneficial use of coal ash at active coal mine and abandoned mine sites is the main focus of this paper. Other beneficial uses recognized by Pennsylvania are: structural fill, as a material in the manufacture of concrete; as construction aggregate; and in mine subsidence and mine fire control.

Beneficial Use Certification

Coal ash may be certified by the Department for the following beneficial uses: coal ash placement, coal ash as a soil substitute or soil additive, coal ash alkaline addition, and coal ash as low permeability material. These options are discussed in the Beneficial Uses section of this document. All coal ash must meet the maximum acceptable leachate limits for contaminants. These limits are based on the minimum requirements for an acceptable waste at a Class III residual waste landfill, Section 288.623. The Department may grant a contingent certification if the coal ash exceeds the maximum acceptable leachate concentration for aluminum, iron, manganese, sulfate and zinc. This approval would be granted for use at a specific mine site on a case-by-case basis.

There are additional requirements for certification for specific uses. For coal ash placement, the pH must be in the range of 7.0 to 12.5 at the generator's site. For use as a soil additive instead of lime or for use of coal ash as alkaline addition, the calcium carbonate equivalence must be no less than 10% by dry weight. For use as low permeability material, the ash must be able to meet a hydraulic conductivity (permeability) of 1×10^{-6} cm/sec or less.

After a generator's coal ash is certified for beneficial use, it is re-evaluated every six months thereafter, or whenever there is a significant operational change in the combustion unit. These changes, such as a major repair or the addition of an air pollution control device, are likely to cause changes in the quality of the coal ash. Re-evaluation is therefore necessary to determine if the coal ash still meets the certification guidelines for beneficial use. The Department may use its discretion to obtain and analyze coal ash samples at the generation site or at the mine site, to determine if the coal ash meets the certification guidelines for its beneficial use.

Beneficial Use Approvals

Water quality monitoring is necessary to obtain approval for coal ash placement, as well as groundwater monitoring is needed for evaluating its effect. Monitoring points may be wells, springs, seeps, mine discharges and abandoned mine shafts. Monitoring points must be approved by the Department. The number of monitoring points downgradient of the coal ash area must be sufficient to determine its impact. Upgradient monitoring points are not required unless there is a concern about pollution which is unrelated to the mine site. Six background samples for each monitoring point taken monthly, or at six-week intervals, are required to determine background water quality unless justification is provided for fewer samples.

All sample collections and analyses are in accordance with EPA's Test Methods for Evaluating Solid Waste, SW-846. The information is submitted on forms supplied by the Department. The required data from all monitoring points includes the following parameters: static water elevation (for monitoring wells), flow (for discharges), pH (field and laboratory), specific conductance, alkalinity, acidity, iron, manganese, sulfate, total dissolved solids, total suspended solids, aluminum, arsenic, cadmium, calcium, chromium, chloride, copper, lead, magnesium, mercury, nickel, potassium, selenium, sodium and zinc. Once placement begins at active mine sites, groundwater monitoring is performed quarterly for the following parameters: static water elevation (for monitoring wells), flow (for discharges), pH (field and laboratory), specific conductance, alkalinity, acidity, iron, manganese, sulfate, total dissolved solids and total suspended solids. Groundwater monitoring is performed annually for aluminum, arsenic, cadmium, calcium, chloride, copper, lead, magnesium, mercury, nickel, potassium, selenium, sodium and zinc.

Beneficial Uses

Coal ash placement is the mixing of coal ash with spoil or the placing in horizontal layers for use as backfill. Its purpose is to improve groundwater quality or prevent groundwater degradation.

When coal ash is used as a soil substitute or a soil additive at coal mine sites it is applied at a rate that improves the productivity and properties of the soil and does not cause a public health, safety, or environmental pollution problem. The technical guidance requires a coal ash and soil/spoil mixture to have a pH which is normally between 6.5 and 8.0. If coal ash is used as a soil substitute, the volume of coal ash must be in an appropriate ratio with other material to create a final vegetation-supporting layer. Coal ash, if used as a soil substitute, normally should not exceed a three feet (0.91 meters) thickness in order to establish vegetation. The soil or spoil must be sampled and analyzed for contaminants before any coal ash is used. Maximum contaminant loading rates for arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, and zinc are established.

Coal ash may be beneficially used as alkaline material to neutralize mine spoil acidity. The amount of coal ash used will depend on the amount of neutralization that is required at the mine site. The manner of placement and the volume of coal ash used at various locations is determined by the amount of neutralization required. The groundwater monitoring is usually more extensive for alkaline addition than coal ash placement because the success of alkaline addition has to be evaluated.

Coal ash may be used to create a layer of low permeability in the backfilled spoil to prevent or reduce surface water infiltration. This type of use is an integral part of the pollution prevention plan for the mining operation. The pH range for either the coal ash or the coal ash with additive must be 7.0 to 12.5. Normally, the layer of low permeability must be at least two feet (0.61 meters) thick. The groundwater monitoring requirements are similar to the groundwater monitoring for coal ash placement.

Coal Ash Beneficial Use Results

As of 1995, coal ash had been approved for placement at seventy-five coal mine sites and nine coal refuse disposal sites. At some of these sites, coal ash placement has been completed. The Department estimates that over 6,700,000 tons (6,083,600 metric tons) of coal ash were used beneficially in coal ash placement in 1995. During that year, over 6,500 tons (5,902 metric tons) of coal ash were used as a soil substitute or additive to revegetate over 600 acres (243 hectares) of mined lands. In the anthracite coal region of Pennsylvania, where nine fluidized bed combustion units are located, 6200 acres (2511 hectares) of abandoned mine lands and coal refuse piles are permitted to be reclaimed in conjunction with the beneficial use of coal ash.

An important statistic is that over one-quarter of all the coal ash placement mine sites are reprocessing abandoned coal refuse piles. The reprocessing of the abandoned coal refuse piles is only possible because the very low energy material in the piles can be burned in fluidized bed combustion units for the generation of electricity. The removal of the refuse material eliminates the hazardous conditions associated with refuse piles, and the reclamation changes the area into useable land. Further, the refuse pile is no longer a source of acid mine drainage and silt-laden runoff. Finally, the coal ash from fluidized bed combustion units is very alkaline. This alkalinity neutralizes acidic spoil material and provides overall improvement in water quality. This is important for the reclamation of coal mine and abandoned mine sites.

Pennsylvania has a good compliance record associated with the beneficial use of coal ash. The most useful measure of compliance is derived from a review of the beneficial use of coal ash from fluidized bed combustion units. Since 1990, the record shows a total of 37 violations at 14 different combustion units - an overall average of one violation every three years per combustion unit. All of these 37 violations have been corrected.

In the anthracite coal region, there are nine electric power generating fluidized bed combustion units whose operations go back to 1990. The coal mine sites receiving coal ash from these combustion units have, since 1990, had a total of 31 violations at four different sites related to the use of coal ash. It is important to note that most violations occurred in the early years of the beneficial use program. There were eight violations for fugitive dust, seven for failure to properly compact the coal ash, seven due to contact of coal ash with water, four for lack of groundwater monitoring, and one each for lack of cover over the coal ash, improper placement of coal ash, failure to construct a sump in the coal ash area (permit condition), failure to remove silt accumulations, and failure to submit coal ash mapping information. In the bituminous coal region, there are five fluidized bed combustion units. Since 1990, coal mine sites receiving coal ash from these combustion units have had a total of six violations at three different sites related to the beneficial use of coal ash. There were three for fugitive dust, two for lack of groundwater monitoring, and one for lack of erosion and sediment controls in the coal ash area.

9/24/97

APPENDIX P

CIWMB MEETING MINUTES

CALIFORNIA INTEGRATED WASTE MANAGEMENT BOARD

Board Meeting
May 28, 1997

AGENDA ITEM 42

ITEM: CONSIDERATION OF THE ADOPTION OF THE NEGATIVE DECLARATION (SCH #97042061) AND THE PROPOSED REGULATIONS FOR NONHAZARDOUS ASH OPERATIONS AND FACILITIES (CALIFORNIA CODE OF REGULATIONS, TITLE 14, DIVISION 7, CHAPTER 3, ARTICLE 5.8, CHAPTER 5, ARTICLE 5.8, SECTIONS 17375 THROUGH 17379.1, AND CHAPTER 5, ARTICLE 3.2, SECTION 18226)

I. SUMMARY

Under current regulations, nonhazardous ash operations can only be issued a full solid waste facilities permit. This "one-size-fits-all" permit has not provided the California Integrated Waste Management Board (CIWMB) and enforcement agencies flexibility in overseeing these types of operations, resulting in the perception of overregulation by some operators. Under the proposed regulations, the level of CIWMB review and oversight for these operations and facilities would be reduced to a regulatory tier level that is more commensurate with the amount of oversight necessary to achieve mitigation of potential impacts these operations may pose to public health, safety and the environment. The proposed regulations define nonhazardous ash operations and facilities, place the operations into the regulatory tiers, and establish permitting requirements and minimum operating standards to protect public health, safety and the environment.

The purpose of this item is to bring forward for consideration by the Board, approval for adoption of the proposed nonhazardous ash regulations and consideration of the adoption of the Negative Declaration (SCH #97042061).

II. PREVIOUS COMMITTEE AND CIWMB ACTION

The Committee, at its April 1994 meeting, directed staff to develop a comprehensive tiered permitting structure for solid waste facilities and explore the possibility of a non-permit approach concept.

The Committee and CIWMB approved the regulatory tier regulations at the November, 1994 meetings.

At the January 1995 meetings, the Committee and CIWMB approved a schedule for placement of solid waste operations/facilities into the regulatory tier structure.

In March 1995, the Committee and CIWMB approved a process for determining CIWMB authority for types of operations and a general methodology for determining placement of those operations where the CIWMB has authority. Contaminated soil was identified by the CIWMB as the first type of operation to be considered for CIWMB authority and placement. Small volume transfer stations were the second type of operation to be slotted into the regulatory tiers. In between these two final actions, the Committee and Board considered legal authority issues regarding the regulation of recycling facilities.

In August 1996, the Committee considered draft regulations for nonhazardous ash operations and facilities and directed staff to obtain additional input from interested parties. At its September 1996 meeting, the Committee directed staff to: 1) make specified changes in the draft regulations regarding acceptable levels of Molybdenum (Mo) and Selenium (Se); 2) to begin a "peer review" process of Dr. Meyer's proposed acceptable levels of Mo and Se in order to consider if a proposed tightening of those levels was appropriate; and, 3) to begin the formal rulemaking process on the draft regulations to avoid additional time delays in developing the regulations. At that meeting, the Committee also expressed an interest in having a more formal consideration of issues revolving around the Board's legal authority for regulating nonhazardous ash operations and facilities.

At the November meeting, the Committee made a preliminary determination that the CIWMB had the authority to regulate nonhazardous ash operations and facilities. The Committee forwarded the item to the December Committee and Board for consideration. The Committee also found that where ash is used beneficially, it should be placed into the excluded tier. The Committee directed board staff to define ash facilities and the type of ash that would fall within the excluded tier and to accommodate some registration of products with the Department of Food and Agriculture (CDFA). The item was forwarded to the December Committee meeting for further input from the ash industry and local enforcement agencies regarding the line between beneficial use and disposal.

During the December public hearing for the 45 day comment period, the Committee heard testimony from interested parties. The staff recommendation for a 15 day comment period was held over until the January Committee meeting in order to allow more time to gather information regarding documents received on the day of the public hearing. Specifically, the Committee members wanted staff to meet with representatives of CDFA and the Farm Bureau. Direction was made not to begin a 15 day public comment period until after the January Committee meeting. During the January meeting, the CIWMB concurred to a request by CDFA for a delay in subsequent noticing of the proposed nonhazardous ash regulations until April 15, 1997.

At the March 19, 1997 P&E meeting following discussion of the March 11, 1997 letter from CDFA, the Committee directed staff to bring an updated version of the regulations to the committee in April for consideration of approval to notice a 15 day comment period. During the April 15, 1997 Committee meeting, direction was given by the

Committee to notice the proposed regulations for an additional 15 day public review and comment period.

III. OPTIONS FOR THE BOARD

Committee members may decide to:

1. Approve the proposed negative declaration and regulations.

2. Provide staff with guidance and direct staff to modify the proposed negative declaration and/or regulations, and to notice the proposed regulations for an additional 15 day public review and comment period.

3. Direct staff to obtain additional input.

IV. STAFF RECOMMENDATION

Staff recommends that the Board approve the proposed negative declaration and regulations.

V. ANALYSIS

Background

For the past 18 years, CIWMB regulation has been limited to a full solid waste facilities permit, regardless of the operation's impact on public health, safety and the environment. Applying this "one-size-fits-all" permit to a wide range of solid waste operations has resulted in confusion among the regulated community and enforcement agencies, creating uneven application of statutory and regulatory requirements throughout the state. In some cases a solid waste facilities permit has been issued, in others it has not. To remedy the problems associated with a "one-size-fits-all" permit system, the Board adopted regulations which establish a new flexible regulatory tier structure. These regulations did not place any solid waste operations into a tier; instead, placement into the regulatory tiers is to be undertaken through separate rulemakings for different types of operations.

To ensure that placement of different types of operations or facilities into the regulatory tiers is treated consistently statewide and addresses the diversity of operations that fall under CIWMB jurisdiction, a public advisory body was convened to assist in the development of a general methodology. At its March 29, 1995 general business meeting, the CIWMB approved a process for determining CIWMB authority for types of operations and a general methodology for determining placement of those operations where the CIWMB has authority. The methodology uses environmental indicators and their associated mitigation measures to help determine placement within the regulatory tiers, and addresses existing levels of regulatory oversight by other agencies to reduce overlap and duplication. Contaminated soil operations were identified by the CIWMB as the first type of operations where the methodology would be used for determining placement into the regulatory tiers. Small volume transfer stations were the second type of operation to be slotted into the regulatory tiers. In between these two final actions, the Committee and Board considered legal authority issues regarding the regulation of recycling facilities.

In March 1996, staff conducted public workshops in Northern and Southern California to solicit input from nonhazardous ash operators, industry representatives, local jurisdictions, local and state regulators, and other affected parties on the informal regulations. The regulations were developed to reflect written comments, comments received at core workgroup meetings, and the September 11, 1996 Committee meeting. The regulations were then submitted to the Office of Administrative Law for formal public notice on October 25, 1996. On December 3, 1996 a workgroup meeting was held with industry representatives, LEA's, and other interested parties to determine threshold levels between beneficial reuse and disposal. A draft updated version of the regulations was discussed at the meeting. The updated version of the regulations was provided at the December Committee/Public Hearing which was also the conclusion of the 45 day comment period. Direction was made not to begin a 15 day public comment period until after the January Committee meeting. During the January meeting, the CIWMB concurred to a request by CDFA for a delay in subsequent noticing of the proposed nonhazardous ash regulations until April 15, 1997.

At the March 19, 1997 P&E meeting following discussion of the March 11, 1997 letter from CDFA, the Committee directed staff to bring an updated version of the regulations to the Committee on April 15, 1997 for consideration of approval to notice a 15 day comment period. During the April Committee meeting, direction was given by the Committee to notice the proposed regulations for an additional 15 day public review and comment period. The 15 day comment period began on April 17, 1997 and concluded on May 2, 1997. The current draft regulations address manufacturing, transfer/processing operations, and monofill facilities, and define land application operations when in compliance with CDFA requirements and define reclamation projects when in compliance with the requirements of the Office of Mine Reclamation of the Department of Conservation. A Nonhazardous Ash Operations and Facilities Placement into the Regulatory Tiers Chart will be included in the regulations (see Attachment #2) through a section 100 change which does not require an additional 15 day comment period. The enclosed chart provides a quick tiering reference for the regulations.

Contents of Regulation Package

The proposed regulations make clear that the regulations apply to operations that handle and dispose of nonhazardous ash, and define, for purposes of CIWMB regulation, the operations and facilities that are affected by the regulations. These include operations and facilities that treat the ash to reduce the concentrations of contaminants, dispose of nonhazardous ash, serve as a temporary storage site, and serve as a transfer site. The regulations place these operations into the CIWMB's regulatory tiers framework. The level of CIWMB review and oversight for these operations and facilities would be reduced from what is currently required under a full solid waste facilities permit to that provided under the following lower tiers: Excluded, Enforcement Agency Notification, and Standardized Permit. The regulations make clear what operations qualify for each tier, and set out what the owner or operator must do to be permitted under the Standardized tiers, or to qualify under the Enforcement Agency Notification, or Excluded tiers. The regulations also explain requirements for the design and construction of an operation or facility, minimum operating standards, record keeping, and restoration of the operations area once the operation or facility closes.

Beneficial land applications are now defined as being "outside of the permit tiers" and do not constitute disposal if the product is being used in accordance with CDFA requirements. Reclamation projects have been defined as not constituting disposal if the nonhazardous ash is used in accordance with the requirements of the Office of Mine Reclamation of the Department of Conservation. Should the enforcement agency have reason to believe that nonhazardous ash has been disposed of, the burden of proof shall be on the land owner or operator to demonstrate that disposal has not occurred.

Rulemaking Process

The proposed regulations were noticed on October 25, 1996, in the *California Regulatory Notice Register*. This action initiated the formal 45 day comment period which closed on December 11, 1996, the day of the Committee meeting. An additional comment period of 15 days began on April 17, 1997 and concluded on May 2, 1997. A California Environmental Quality Act (CEQA) Notice, Initial Study, and proposed Negative Declaration (SCH# 97042061) were submitted to the Governor's Office of Planning and Research on April 15, 1997, and noticed to the public in the Los Angeles Times and the Sacramento Bee on April 16, 1997. This initiated a 30 day comment period, which closed on May 15, 1997. Over 300 copies of the latest draft regulations package were distributed to interested parties. A public hearing on the regulations was held at the May 13, 1997 Committee meeting to receive oral comments.

Summary of Comments

All comments received during the formal public comment period will be addressed as part of the rulemaking record, including those that are outside the scope of the nonhazardous ash regulations.

Since distribution of the regulations package, staff has received eleven written comments. In general, the comments fall into three broad categories:

- Comments outside the scope of the nonhazardous ash regulations that are related to other regulatory areas, such as regulatory tiers or CDFA issues.
- Comments requesting technical, clarifying changes.
- Comments requesting more significant changes.

A summary of comments to date on the negative declaration will be presented at the Board meeting.

Direction by Committee Requesting More Significant Changes

Pursuant to direction from the Committee, the proposed regulations were revised to place land applications and reclamation projects into the excluded tier rather than the enforcement agency notification tier. Amendments were made to sections 17378.3 Operating Standards, and 1737?.0 General Record Keeping Requirements. Subsequent legal review defined that these activities should be written as operating "outside of the permit tiers". For land application activities to be classified as a beneficial reuse and not disposal, an operator must comply with CDFA regulations.

The specific requirements for land application that had previously been included in the regulations have been deleted. These included heavy metals testing, setting of agronomic rates, and related recordkeeping requirements. These changes were made based upon CDFA's interpretation of the scope of its authority to regulate agricultural practices. This interpretation was communicated to the Board in a letter dated March 11, 1997. In that letter CDFA specifically indicated that "[i]t [was] CDFA's role to define a beneficial agricultural use." and that "CDFA believes that when a recycled material is being proposed for use in agriculture, the existing food and agriculture code and regulations [should] be used as the determinant for beneficial agricultural use." Based on its statutory authority (Food and Agricultural code sections 401 and 14501), CDFA's position is that if nonhazardous ash is being used in compliance with its requirements, then it is a beneficial agricultural use and should not be subjected to the CIWMB's regulations.

Reclamation projects would be treated much the same as land application by locating them "outside of the permit tiers" and adding the appropriate references to the Office of Mine Reclamation in the Department of Conservation.

Fiscal Impacts

CIWMB staff has determined that the proposed regulations will create no costs to any federal or state agency and no reimbursable costs to any local agency. The proposed regulations would place nonhazardous ash operations and facilities into regulatory tiers that would require less review and oversight by the local enforcement agency than is currently required by the full solid waste facilities permit. The reduction in regulatory overlap and duplication with other agencies would also decrease the level of review and oversight by local enforcement agencies. The reduced review and oversight should provide a cost savings to operators and state and local agencies. The proposed minimum operating standards, while more specific to concerns associated with nonhazardous ash operations, are consistent with current CIWMB operating standards, except where the standards have been changed or deleted to reduce overlap and duplication with other agencies.

VI. APPROVALS

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Reviewed By:	Dorothy Rice	Phone:	255-2431
Legal Review:	Elliot Block EB	Date/Time:	5/12/97

ATTACHMENTS:

1. Nonhazardous Ash Operations and Facilities Regulations and Notice.

2. Nonhazardous Ash Operations and Facilities Placement into the Regulatory Tiers Chart.

3. Resolution 97-179, Adoption of the Negative Declaration (SCH #97042061) for the Adoption of Proposed Nonhazardous Ash Operations and Facilities Regulatory Requirements.

4. Resolution 97-180, Adoption of the Proposed Nonhazardous Ash Regulations (Regulations Title 14, California Code of Regulations, Division 7, Chapter 3, Article 5.8, Sections 17375 through 17379.1, and Chapter 5, Article 3.2, Section 18226).

Chapter 3. Minimum Standards for Solid Waste Handling and Disposal

Article 5.8. Nonhazardous Ash Regulatory Tier Requirements

Section 17375. Authority and Scope.

(a) This Article sets forth permitting requirements and minimum operating standards for operations and facilities that handle and/or dispose of ~~only~~ nonhazardous ash, as specified. This Article is not applicable to Class II or III landfills that handle and/or dispose of other waste types in addition to nonhazardous ash.

(b) This Article is adopted pursuant to and for the purpose of implementing the California Integrated Waste Management Act of 1989 (Act) commencing with section 40000 of the Public Resources Code, as amended. These regulations should be read together with the Act.

(c) This Article implements those provisions of the Act relating to the handling and/or disposal of nonhazardous ash. Nothing in this Article is intended to limit the power of any federal, state, or local agency to enforce any provision of law that it is authorized or required to enforce or administer.

(d) Nothing in this Article shall be construed as relieving any owner, operator, or designee from the obligation of obtaining all required permits, licenses, or other clearances and complying with all orders, laws, regulations, ~~(or)~~reports, or other requirements of other regulatory or enforcement agencies, including but not limited to, local health entities, regional water quality control boards, air quality management districts or air pollution control districts, local land use authorities, and fire authorities.

(e) These regulations are intended to provide a sufficient level of information and oversight to ensure that the ~~land application, land reclamation,~~ transfer and processing, or monofilling of nonhazardous ash will be conducted in a manner which meets the purposes of the Act while protecting public health, safety and the environment. Materials that may otherwise be disposed to landfills may be, among other things, processed to reduce, reuse, and recycle the material to the maximum extent feasible in an efficient and cost-effective manner to conserve water, energy and other natural resources.

(f) Operations and facilities subject to this Article shall be in compliance with the provisions of this Article within 90 days after the effective date of this Article.

NOTE: Authority cited: Sections 40502, 43020, and 43021 of the Public Resources Code. Reference: Sections 43020 and 43021 of the Public Resources Code.

Section 17376. Definitions.

For the purposes of this Article:

~~(a) "Agricultural Professional" means any person who:~~
~~(1) is a certified agronomist, certified crop advisor, or certified soil scientist possessing a valid Certification of Qualification from the American Registry of Certified Professionals in Agronomy, Crops and Soils ("ARCPACS") or, who possesses a similar certification obtained from an agency that the CIWMB determines to be equivalent, or~~
~~(2) has a minimum of five years of experience in the development, implementation and/or maintenance of agricultural crop fertility programs.~~
~~(b) "Agronomic Rate" means the rate of application of nonhazardous ash to land that promotes plant growth or improves the quality of crops by conditioning soils through chemical and physical means. Agronomic rates of application are determined through soil analysis, consideration of the nutrient needs of the crop planned for the area of application, and analysis of the nutrient and heavy metals content of the material to be applied to the land. Nonhazardous ash heavy metals shall not exceed the environmental health standards as identified in section 17378.3 (h) (6).~~
~~(1) Agronomic rates shall be determined by an agricultural professional, as defined in section 17376 (a).~~
(a~~c~~) "Air District" means Air Pollution Control District or Air Quality Management District.
~~(d) "Applicator" means the person who spreads and/or incorporates the nonhazardous ash to land.~~
~~(e) "Ceiling Concentration" means the maximum allowable concentration of an inorganic pollutant in the material that can be applied to an area of land.~~
~~(f) "Cumulative Metals Loading Rate" means the maximum amount of an inorganic pollutant that can be applied to an area of land.~~
(b~~g~~) "Disposal"~~ as defined for purposes of the Article,~~ means:
(1) final deposition of nonhazardous ash onto land~~, at greater than agronomic rates as determined by an agricultural professional as defined in section 17376 (a); or,~~
(2) stockpiling of nonhazardous ash onto land for a combined period of time greater than six months when located for use at the site of at a transfer/processing operation(s)~~, reclamation project, or land application site;~~
~~(3) notwithstanding subdivision (g)(2) of this section, stockpiling of nonhazardous ash onto land shall not constitute disposal if~~ unless the RWQCB in consultation with the enforcement agency authorizes nonhazardous ash to remain within the operations area for a period of time greater than six months~~ for the purpose of transfer or processing.~~
(3~~4~~) disposal does not include the use of nonhazardous ash for cover material at a solid waste landfill. Notwithstanding this section, use of nonhazardous ash as a

cover material shall still require approval for use pursuant to sections 17682 and 17258.21 and may require additional approvals from other governmental agencies, including, but not limited to RWQCB and Air Districts.

(4~~5~~) disposal does not include the use of nonhazardous ash for a reclamation project as defined in section 17376 (m~~v~~).

(5~~6~~) disposal does not include the use of nonhazardous ash for snow and ice control, roadbase/subbase, walk areas, parking areas, airport runways, trails, dairy or feedlot soil stabilization, ~~material storage areas,~~ structural fill, sludge/manure/waste stabilizing material, compost mineral filler, smelter flux, blending in a soil product, and similar uses. Nonhazardous ash used for these purposes is not subject to the requirements of this Article. Nothing in this section precludes the enforcement agency or the CIWMB from inspecting any of the activities listed in this subdivision to verify that the activity qualifies for this exception from the definition of disposal.

(6) disposal does not include land application of nonhazardous ash as defined in section 17376(e).

(7) Should the enforcement agency have information that a nonhazardous ash handler is engaging in other activities that are subject to this Article, the burden of proof shall be on the land owner or operator to demonstrate otherwise.

~~(h) "Dry Weight Basis" means calculated on the basis of having been dried at 105 degrees Celsius until reaching a constant mass (i.e., essentially 100 percent solids content).~~

~~(i) "Facility" means for the purpose of this Article, a nonhazardous ash disposal/monofill facility.~~

(c~~j~~) "Fully Enclosed Structure" means either a building with a roof and walls that prevent rain and wind from affecting the material, or covered container.

(d~~k~~) "Generator" means the nonhazardous ash producer.

~~(l) "Good Agronomic Practice", means application of nonhazardous ash for the purpose of nutrient needs of the crop planned for the area of application, mineral additions, pH adjustment, water infiltration improvement, soil porosity, or other beneficial uses relating to improving soil conditions or plant growth as determined by the agricultural professional.~~

(e~~m~~) "Land Application" means the application of nonhazardous ash to forest, agricultural, and range land in accordance with California Department of Food and Agriculture requirements~~the soil at agronomic rates~~ for a beneficial use. ~~It~~Land application does not constitute disposal{ and is not subject to the requirements of this Article}.

(f~~n~~) "Manufacturing" means using nonhazardous ash as a raw material in making a finished product that is distinct from nonhazardous ash. Such finished products include but are not limited to cement and concrete products, asphalt, blasting grit, roofing granules and tiles, wallboard, bricks, vitrified clay pipe, stucco and decorative rock. Nonhazardous ash used in manufacturing is ~~not disposal and is~~ not subject to the requirements of this Article. Should the enforcement agency have information that a nonhazardous ash manufacturer is engaging in other activities that are subject to this Article, the burden of proof shall be on the land owner or operator to demonstrate otherwise.

(g~~e~~) "Nonhazardous Ash" means the nonhazardous residue from the combustion of any nonhazardous solid or liquid materials pursuant to the California Code of Regulations, Title 22 or which may be managed as a nonhazardous waste as approved by the Department of Toxic Substances Control.

(h~~e~~) "Nonhazardous Ash Disposal/Monofill Facility" or "Facility" means a facility that handles only nonhazardous ash for purposes of disposal and is not a landfill pursuant to California Code of Regulations, Title 14, Division 7, Chapter 5, Article 3.4, section 18251(a)(8) ~~40195.1 of the Public Resources Code~~.

(i~~q~~) "Nonhazardous Ash Transfer/Processing Operation" or "Operation" means an operation that handles only nonhazardous ash for purposes of transfer, treatment, or storage ~~and is not a generator of such ash~~. This definition does not include transformation, biomass conversion, or other incineration facilities.

~~(r) "Operation" for the purposes of this Article, means a nonhazardous ash land application at an agronomic rate, a reclamation project, and a nonhazardous ash transfer/processing operation which is located on land not owned by the generator.~~

(j~~s~~) "Operations Area" means the following areas within the boundary of an operation or facility that are subject to this Article, although the boundary may or may not be the same as the property boundary:

(1) equipment management area, including cleaning, maintenance, and storage areas;

(2) stockpiling areas for nonhazardous ash;

(3) transfer and/or processing and/or disposal areas.~~;~~

~~(4) the land application area;~~

~~(5) the reclamation project area.~~

(k~~t~~) "Operator" means the ~~applicator or nonhazardous ash generator or~~ land owner or other person who, through a lease, franchise agreement or other contract with the land owner~~, or generator~~ is legally responsible for all of the following:

(1) ~~the reclamation project; land application of nonhazardous ash;~~ transfer/processing operations~~;~~ or disposal;

(2) complying with all applicable federal, state and local requirements relating to the operation;

(3) the design, construction, and physical operation of a transfer/processing operation or disposal/monofill facility;

(4) operations site restoration of a transfer/processing operation or disposal/monofill facility.

(l~~u~~) "Owner" means the person or persons who own, in whole or in part, a nonhazardous ash transfer/processing operation, ~~reclamation project operation,~~ disposal/monofill facility, or the land on which it is located~~, or the land on which nonhazardous ash is applied at agronomic rates.~~

(m~~v~~) "Reclamation Project" means the use of nonhazardous ash in accordance with the requirements of the Office of Mine Reclamation of the Department of Conservation. Reclamation projects do not constitute disposal{ and is not subject to the requirements of this Article}. ~~a temporary operation for the application to soil of nonhazardous ash which benefits soil conditions, but not necessarily plant growth or crop quality, on mined lands to be reclaimed to a usable condition that is readily adaptable for alternate land uses and creates no danger to public health, safety and the environment. The process may extend to affected lands surrounding mined lands, and may require grading, revegetation, soil compaction, stabilization, or other measures.~~

~~(1) In order to be considered a "reclamation project" for the purposes of this Article, the nonhazardous ash operation must be consistent with the approved reclamation plan pursuant to the Surface Mining and Reclamation Act of 1975 (Public Resources Code, commencing with section 2710) if the lands have been mined after 1/19/76.~~

~~(2) The reclamation project must be in compliance with the waste discharge requirements or waiver conditions as set by the RWQCB.~~

(n~~w~~) "RWQCB" means the Regional Water Quality Control Board.

(o~~x~~) "Site" means the operations area.

(p~~y~~) "Treatment" means any method, technique, or process which changes or is designed to change the physical, chemical, or biological character or composition of nonhazardous ash. Treatment may also include the removal or reduction of harmful properties or characteristics for any purpose including, but not limited to, material recovery or reduction in volume. ~~Treatment methods may include chemical fixation by mixing with cement for the purposes of disposal.~~

NOTE: Authority cited: Sections 40502, 43020, and 43021 of the Public Resources Code. Reference: Sections 43020 and 43021 of the Public Resources Code.

Section 17377.0. Regulatory Tiers for Nonhazardous Ash Operations and Facilities.

Sections 17377.1 through 17377.34 set forth the regulatory tier requirements (commencing with section 18100) that apply to specified types of nonhazardous ash operations and facilities.{ These requirements are summarized in Table 1.}

NOTE: Authority cited: Sections 40502, 43020, and 43021 of the Public Resources Code. Reference: Sections 43020 and 43021 of the Public Resources Code.

{Table 1

Nonhazardous Ash Operations and Facilities Placement into the Regulatory Tiers

Not Subject to Article 5.6	Excluded Tier	Enforcement Agency Notification Tier	Standardized Tier
Manufacturing	Transfer/Processing Specified in Section 17377.1	Transfer/Processing Operations	Disposal/Monofill
Uses Specified in Section 17376(b)(5)	Weathertight Storage		
Stockpiling as Specified in Section 17376(b)(2)			
Daily Cover			

There are no operations or facilities placed within the Registration and Full Permit tiers within this Article.}

Section 17377.1. Excluded Operations.

~~(a)~~ The solid waste handling operations and facilities listed in this section do not constitute nonhazardous ash transfer/processing operations, or disposal/monofill facilities~~, land application sites, or reclamation projects~~ for the purposes of this Article, and are not required to meet the requirements set forth herein.

(a) Transfer/processing operations of nonhazardous ash are excluded from the requirements of this Article when the only activity is:

(1) the transfer/processing from land owned by a single nonhazardous ash generator source or leased by the generator, its parent, or subsidiary, to property owned or leased by the same generator, its parent, or subsidiary; or,

(2) storage within a fully enclosed weathertight structure.

(b) Nothing in this section precludes the enforcement agency or the CIWMB from inspecting an excluded operation or facility to verify that the operation or facility is being conducted in a manner that qualifies as an excluded operation or facility{,} or from taking any appropriate enforcement action.

(c) Should the enforcement agency have information that a nonhazardous ash operation is not excluded in accordance with this section, the burden of proof shall be on the land owner or operator to demonstrate otherwise.

NOTE: Authority cited: Sections 40502, 43020, and 43021 of the Public Resources Code. Reference: Sections 43020 and 43021 of the Public Resources Code.

~~**Section 17377.2. Nonhazardous Ash Land Applications at Agronomic Rates & Reclamation Projects**~~

~~(a) All operators of nonhazardous ash agronomic land application operations and reclamation projects shall comply with the Enforcement Agency Notification requirements set forth in the California Code of Regulations, Title 14, Division 7, Chapter 5.0, Article 3.0 (commencing with section 18103 and excepting sections 18103.1(a)(2) and 18103.3).~~

~~(1) Any person proposing to engage in operations subject to this Article pursuant to an enforcement agency notification shall notify the enforcement agency of its intent to operate prior to commencement of operations.~~

~~(2) Enforcement Agency Notifications shall be submitted to the enforcement agency at least two weeks prior to start of the land application or reclamation project.~~

~~(b) Enforcement Agency Notifications for agronomic land applications and reclamation projects shall be legible and include the following:~~

~~(1) a statement that a courtesy copy of the Enforcement Agency Notification was also forwarded to the local County Agricultural Commissioner;~~

~~(2) operations area in acres;~~

~~(3) an estimate (can use range from low to high) of the tons/cubic yards to be applied per acre;~~

~~(4) the scheduled dates of application and/or operation (may be approximate to within +/- 90 days of the application and/or operation);~~

~~(5) the location, by either street address or section, township and range; operators may include a list of operation areas for which land application of nonhazardous ash may be made and shall include information for each operations area as prescribed in this section;~~

~~(6) the name, address and telephone number of generator, operator, and land owner;~~

~~(7) a copy of the American Society of Agronomy certification of qualification or a similar certification of qualification that the CIWMB determines to be equivalent as specified in section 17376 (a)(1) for verifying agricultural professional credentials, or a~~

~~written submittal of proof that the agricultural professional meets the qualifications pursuant to section 17376 (a)(2). The submittal of proof must contain a minimum of three (3) references of past crop fertility employment and provide a resume of experience in the crop fertility field, and, provide a signed statement by the agricultural professional that the information provided is true and correct to the best of his or her knowledge.~~

~~(8) the following statement shall be signed by the operator: "The undersigned certify under penalty of perjury that the information in this document and all attachments are true and correct to the best of my knowledge, and is being executed in accordance with the requirements of the California Code of Regulations, Title 14, Division 7, Chapter 3, Article 5.8 (commencing with section 17375). I certify that the ash as represented in this document is nonhazardous as defined in section 17376 (o) to be applied in accordance with this notification. I am aware that there are significant penalties for submitting false or misleading information in this certification, including the possibility of fine or imprisonment, or both."~~

~~(c) A new Enforcement Agency Notification is required any time there are changes to section 17377.2(b)(1)-(8).~~

~~(d) All nonhazardous ash agronomic land application operations and reclamation projects may be inspected by the enforcement agency as necessary for the protection of public health, safety and the environment.~~

~~NOTE: Authority cited: Sections 40502, 43020, and 43021 of the Public Resources Code. Reference: Sections 43020 and 43021 of the Public Resources Code.~~

Section 17377.2~~3~~. Nonhazardous Ash Transfer/Processing Operations.

(a) All operators of nonhazardous ash transfer/processing operations, except as otherwise provided in this Article, shall comply with the Enforcement Agency Notification requirements set forth in the California Code of Regulations, Title 14, Division 7, Chapter 5.0, Article 3.0 (commencing with section 18103).

(b) In addition to the requirements to subdivision (a), the following statement shall be included in the enforcement agency notification and signed by the operator: "The undersigned certify under penalty of perjury that the information in this document and all attachments are true and correct to the best of my knowledge, and is being executed in accordance with the requirements of the California Code of Regulations, Title 14, Division 7, Chapter 3, Article 5.8 (commencing with section 17375). I certify that the ash as represented in this document is nonhazardous and from a nonhazardous feedstock as defined in section 17376 (q) and is to be managed in accordance with this notification. I am aware that there are significant penalties for submitting false or misleading information in this certification, including the possibility of fine or imprisonment, or both."

~~(b) Enforcement Agency Notifications for transfer/processing shall also contain the information identified in section 17377.2 (b)(2), (4), (5), (6), (8).~~

(c) A new Enforcement Agency Notification is required any time there are changes to information required by this section.

(de) These operations may be inspected by the enforcement agency as necessary for the protection of public health, safety and the environment.

NOTE: Authority cited: Sections 40502, 43020, and 43021 of the Public Resources Code. Reference: Sections 43020 and 43021 of the Public Resources Code.

Section 17377.34. Nonhazardous Ash Disposal/Monofill Facilities.

(a) All nonhazardous ash disposal/monofill facilities, shall obtain a Standardized Nonhazardous Ash Solid Waste Facility Permit pursuant to the requirements of the California Code of Regulations, Title 14, Division 7, Chapter 5.0, Article 3.0 (commencing with section 18105).

(b) The enforcement agency shall include only those terms and conditions, and no others, contained in CIWMB Form 98 (new 7/96) Standardized Nonhazardous Ash Solid Waste Facility Permit, set forth in Appendix A in this Division.

NOTE: Authority cited: Sections 40502, 43020, and 43021 of the Public Resources Code. Reference: Sections 43020 and 43021 of the Public Resources Code.

Section 17378.0. Applicability of State Minimum Standards for Nonhazardous Ash Operations and Facilities.

Sections 17378.1 through 17378.3 set forth the minimum standards that apply to all types of nonhazardous ash operations and facilities. Approvals, determinations and other requirements which the enforcement agency is authorized to make under Article 5.8 shall be provided in writing to the operator. The operator shall maintain a copy of these approvals in addition to those records identified in section 17379.

NOTE: Authority cited: Sections 40502, 43020, and 43021 of the Public Resources Code. Reference: Sections 43020 and 43021 of the Public Resources Code.

Section 17378.1. Siting On Landfills.

(a) Nonhazardous ash operations and facilities or portions thereof, located atop closed solid waste landfills shall meet postclosure land use requirements pursuant to the California Code of Regulations, Title 14, Division 7, Chapter 3, Article 7.8, section 17796.

(b) Operations and facilities or portions thereof, located on intermediate cover on a solid waste landfill shall locate operations areas on foundation substrate that is stabilized, either by natural or mechanical compaction, to minimize differential settlement, ponding, soil liquefaction, or failure of pads or structural foundations.

(c) Operations and facilities or portions thereof, located on intermediate cover {on a solid waste landfill} shall be operated in a manner that will not interfere with the operations of the landfill or with the closure {or postclosure maintenance} of the landfill.

NOTE: Authority cited: Sections 40502, 43020, and 43021 of the Public Resources Code. Reference: Sections 43020 and 43021 of the Public Resources Code.

Section 17378.2. General Design Requirements.

(a) The design of a new nonhazardous ash transfer/processing operation or disposal/monofill facility shall utilize expert advice, as appropriate, from persons competent in engineering, architecture, landscape design, traffic engineering, air quality control, and design of structures.

(b) Each nonhazardous ash transfer/processing operation or nonhazardous ash disposal/monofill facility design shall be based on appropriate data regarding the expected service area, anticipated nature and quantity of nonhazardous ash to be received, climatological factors, physical settings, adjacent land use (existing and planned), types and number of vehicles anticipated to enter the operation or facility, adequate off-street parking facilities for transfer vehicles, drainage control, the hours of operation and other pertinent information. If the operation or facility is to be used by the general public, the design shall take account of {safety} features that may be needed to accommodate such public use.

(c) The operation or facility shall be designed in such a manner as to restrict the unloading area to as small an area as practicable, provide adequate control of windblown material, and minimize the creation of nuisances at the operation or facility. Other factors that shall be taken into consideration are: dust control, noise control, public safety, and other pertinent matters related to the protection of public health.

(d) Nonhazardous ash storage containers that are considered weathertight shall be durable, easily cleanable, ~~weathertight,~~ designed for safe handling, and constructed to prevent loss of wastes from the equipment during storage. Such equipment shall be nonabsorbent and leak-resistant. Unloading areas shall be easily cleanable, designed for safe handling and constructed to prevent loss of nonhazardous ash.

NOTE: Authority cited: Sections 40502, 43020, and 43021 of the Public Resources Code. Reference: Sections 43020 and 43021 of the Public Resources Code.

Section 17378.3. Operating Standards

Each operator of a nonhazardous ash transfer/processing operation or disposal/monofill facility shall meet the following requirements: ~~Standards (a) through (d) apply to all active operations and facilities:~~

(a) All activities at the operation or facility shall be conducted in a manner that minimizes nuisances, noise impacts, or other public health, safety and environmental hazards.

(b) Unauthorized human or animal access to the operation or facility shall be prevented.

(c) Traffic flow into, on, and out of the operation ~~and~~or facility shall be controlled in a safe manner.

(d) The operator shall take adequate measures to minimize and prevent safety hazards due to obscured visibility at the operation or facility. ~~prevent the creation of excessive dust. Dust is excessive when it results in any of the following:~~

~~(1) safety hazards due to obscured visibility~~

~~(2) irritation of the eyes~~

~~(3) hampered breathing~~

(e) Drainage shall be controlled at ~~transfer/processing~~ operations and ~~disposal/monofill~~ facilities to protect the public health and safety and to prevent interference with the operation.

(f) All ~~transfer/processing~~ operations and ~~disposal/monofill~~ facilities open for public business shall post legible signs at all public entrances that include the following:

(1) name of operation or facility,

(2) name of the operator,

(3) hours of operation,

(4) a statement that only nonhazardous ash will be accepted, and

(5) phone number where operator or designee can be reached in case of an emergency.

(g) The operator ~~of an transfer/processing operation or disposal/monofill facility~~ shall provide telephone or radio communication capability for emergency purposes.

~~(h) All nonhazardous ash land application operations shall:~~

~~(1) be applied in accordance with good agronomic practices and at agronomic rates for the soil and crops at each operations area.~~

~~(2) be located and maintained so as to prevent the offsite migration of nonhazardous ash.~~

~~(3) not be applied during excessively windy conditions.~~

~~(4) not remain spread over bare ground more than four days prior to incorporation and should not be applied to areas with physical constraints that would severely limit incorporation such as shallow hardpan, large rocks, or boggy conditions that could limit equipment access.~~

~~(5) have a ground slope of less than 25 percent.~~

~~(6) not result in any heavy metals additions exceeding the maximum acceptable metal loadings shown in the following Table and item (A):~~

~~Cumulative Metals Loading Rates~~	~~Kilograms per Hectare*~~	~~Pounds per Acre*~~
~~Arsenic (As)~~	~~41~~	~~36.5~~
~~Cadmium (Cd)~~	~~39~~	~~34.8~~
~~Copper (Cu)~~	~~1500~~	~~1338.3~~
~~Lead (Pb)~~	~~300~~	~~267.7~~
~~Mercury (Hg)~~	~~17~~	~~15.2~~
~~Nickel (Ni)~~	~~420~~	~~374.7~~
~~Selenium (Se)~~	~~100~~	~~89.2~~
~~Zinc (Zn)~~	~~2800~~	~~2498.2~~

~~* Dry weight basis~~

~~(A) Molybdenum (Mo) ceiling concentration limit levels on a dry weight basis not to exceed 75 milligrams per kilogram.~~

~~(7) show proof of compliance with California Department of Food and Agriculture regulations relating to licensed manufacturers or distributors of fertilizing materials.~~

~~(8) not stockpile nonhazardous ash at an operations area for more than one month unless the nonhazardous ash is covered, or the surface of the stockpile has been conditioned to prevent the spread of airborne particles.~~

~~(i) Beneficial rates of application for reclamation projects shall be determined through soil analysis and analysis of the nutrient and mineral content of the material to be applied to the land. Analysis of beneficial rates of application must be determined by an agricultural professional as defined in section 17376 (a), or, for other uses as specified in section 17376 (v), a certified engineering geologist or registered civil engineer under the California Department of Consumer Affairs certification of qualification and registration programs. Heavy metal soil concentration limits shall not exceed the limits pursuant to section 17378.3 (h)(6).~~

~~(j) All nonhazardous ash reclamation projects shall ensure compliance with subsections 17378.3 (h) (2),(3),(4),(8).~~

~~(k) Once the enforcement agency has reason to believe that nonhazardous ash has been disposed of because no attestation has been provided by an agricultural professional or because nonhazardous ash has been stockpiled longer than the time periods set forth in section 17376 (g) (2) or (3), the burden of proof shall be on the land owner or operator to demonstrate that disposal has not occurred.~~

NOTE: Authority cited: Sections 40502, 43020, and 43021 of the Public Resources Code. Reference: Sections 43020 and 43021 of the Public Resources Code.

Section 17379.0. General Record Keeping Requirements.

Each operator of a nonhazardous ash transfer/processing operation or disposal/monofill facility shall meet the following requirements:

(a) All records required by this Article shall be kept by the operator in one location and be accessible for five (5) years and shall be made available for inspection by authorized representatives of the CIWMB, enforcement agency, and other duly authorized regulatory and enforcement agencies during normal working hours. The operator shall submit copies of records to the enforcement agency upon request. An alternative schedule of record submittal may be approved by the enforcement agency.

(b) The operator shall maintain a daily log or file of special occurrences encountered during operations and methods used to resolve problems arising from these events, including details of all incidents that required implementing emergency procedures. Special occurrences may include: fires, injury and property damage, accidents, explosions, discharge of hazardous or other wastes not permitted, flooding and other unusual occurrences.

(c) The operator shall record any written public complaints received by the operator, including:

(1) the nature of the complaint,

(2) the date the complaint was received,

(3) if available, the name, address, and telephone number of the person or persons making the complaint,

(4) any actions taken to respond to the complaint.

(d) The operator shall record the date, generator source, and quantity of nonhazardous ash accepted.

(e) The ~~transfer/processing and disposal/monofill~~ operator shall maintain records of weights or volumes handled in a manner and form approved by the enforcement agency so as to be sufficiently accurate for overall planning and control purposes.

(f) Transfer/processing facility operators shall record the quantity of nonhazardous ash leaving the operations.

(g) The disposal/monofill facility operator shall also record the name of all transfer/processing operations where the nonhazardous ash was located prior to receipt by the operator and the dates the nonhazardous ash was received at each of these operations and removed.

~~(h) For land application operations, the operator shall maintain records for each operations area where nonhazardous ash is applied including the location and acreage of the area where nonhazardous ash was applied, the determination by an~~

~~agricultural professional as required by sections 17376(b) or 17378.3 (i) of this Article, and the dates and amounts of ash applied per acre;~~

~~(i) Reclamation project and land application operators shall record the nonhazardous ash compositions, feedstock source, and current (no more than one year old) heavy metals test results for metals listed in section 17378.3(h)(6), or current (no more than one year old) chemical analyses from samples collected and analyzed in accordance with the methods specified in the California Code of Regulations, Title 22, Division 4.5, Chapter 11 or an equivalent method.~~

NOTE: Authority cited: Sections 40502, 43020, and 43021 of the Public Resources Code. Reference: Sections 43020 and 43021 of the Public Resources Code.

Section 17379.1. Nonhazardous Ash Operation and Facility Restoration

All nonhazardous ash transfer/processing operations and disposal/monofill facilities shall meet the following requirements:

(a) The operator shall provide the enforcement agency written notice of intent to perform site restoration, at least 30 days prior to beginning site restoration.

(b) The operator(s) and owner(s) shall provide site restoration necessary to protect public health, safety, and the environment.

(c) The operator shall ensure that the following site restoration procedures are performed upon completion of operation and termination of service:

(1) the operation or disposal/monofill facility grounds, excluding the disposal area, shall be cleaned of all nonhazardous ash, construction scraps, and other materials related to the operation or disposal/monofill facility, and these materials legally recycled, reused, or disposed of;

(2) all machinery shall be cleaned of nonhazardous ash prior to removal from the facility;

(3) all remaining structures shall be cleaned of nonhazardous ash.

NOTE: Authority cited: Sections 40502, 43020, and 43021 of the Public Resources Code. Reference: Sections 43020 and 43021 of the Public Resources Code.

Chapter 5. Enforcement of Solid Waste Standards and Administration of Solid Waste Facility~~ies~~ Permits; Loan Guarantees

Article 3.2. Reports of Facility Information

Section 18226. Report of Nonhazardous Ash Disposal Site Information.

(a) Each operator of a nonhazardous ash disposal/monofill facility that is required to obtain a Standardized Solid Waste Facility~~ies~~ Permit, as set forth in section 17377.34, shall, at the time of application, file a Report of Nonhazardous Ash Disposal Site Information with the enforcement agency. A Report of Nonhazardous Ash Disposal Site Information shall contain all of the information required in Title 27, California Code of Regulations, section 21600 with the exception of ~~the following:~~ subsections: (b)(3)(A), (b)(4)(E), and (b)(8)(B).

~~(1) the name(s) of the operator, owner, and the company they represent, if applicable.~~

~~(2) plans for the facility, to include: a site location map, a site map, and identification of adjacent land uses and distances to nearby residences or structures.~~

~~(3) a schematic drawing of buildings and other structures showing layout and general dimensions of the disposal operations area, including, but not limited to, unloading, storage, disposal, and parking areas.~~

~~(4) a descriptive statement of the manner in which the disposal operation is to be conducted at the facility.~~

~~(5) the days and hours of disposal operation. For facilities with continuous operations, indicate the start of the operating day for purpose of calculating amount of waste received per operating day.~~

~~(6) the total acreage contained within the operating area and either the total estimated capacity in tons or cubic yards with the conversion factor used for expression in tons. Indicate in-place densities assumed, or the capacity in cubic yards. Also include a projection of the life expectancy of the facility based on current and/or anticipated loadings.~~

~~(7) information showing the chemical and physical properties of the ash, and the quantities of nonhazardous ash to be received. If tonnage was figured from records of cubic yards, include the conversion factor used.~~

~~(8) a description of the proposed methods used by the facility to comply with all applicable state minimum standards commencing with the California Code of Regulations, Title 14, section 17378.0 and as referenced in section 17378.3.~~

~~(9) the general location of the proposed disposal/monofill facility shown on a map of at least the scale size equivalent to a 1:24,000 USGS topographical quadrangle. Such map shall show points of access to the facility.~~

~~(10) a plot plan that delineates the legal boundaries for which clear title is held by the applicant and/or any parcels that are leased. Copies of lease agreements shall be submitted and substantiation shall be shown that the disposal/monofill facility owner is cognizant of the disposal operations and the responsibilities assigned to the facility owner by the standards.~~

~~(11) identification on the plot plan of the specific limits of the existing and planned disposal area(s) showing relationships to the property boundary lines and adjacent land uses surrounding the facility, distances to the nearest structures shall be identified.~~

~~(12) a description of the sequence of developmental stages of the disposal/monofill facility, giving tentative implementation schedules for development.~~

~~usage, site completion and closure. Describe the extent of change that will occur in areas that will be excavated for the placement of nonhazardous ash.~~

~~(13) a map showing the existing topographical contours of the property and proposed final elevations of the completed disposal/monofill facility.~~

~~(14) if known, a description of the uses of the facility after termination of disposal operations, including the time frame for implementation of such use.~~

~~(15) resume of management organization that will operate the disposal/monofill facility.~~

~~(16) a listing of permits already obtained and the date obtained or last revised.~~

NOTE: Authority cited: Sections 40502, 43020, and 43021 of the Public Resources Code. Reference: Sections 43020 and 43021 of the Public Resources Code.

APPENDIX A

State of California CIWMB FORM 98 (new 7/96)	California Integrated Waste Management Board

STANDARDIZED NONHAZARDOUS ASH SOLID WASTE FACILITYIES PERMIT

1. Facility/Permit Number (SWIS):	
2. Facility Name and Address/Location:	3. Operator Name and Mailing Address:
3. Owner Name and Mailing Address:	5. Enforcement Agency and Address:
6. Signature of Enforcement Agency Approving Officer: 7. Please Print or Type Name and Title of Approving Officer:	8. Date Signed:
9. Date Received by CIWMB: 10. CIWMB Concurrence Date:	
11. Signature of CIWMB Approving Officer: 12. Please Print or Type Name and Title of Approving Officer:	13. Date Signed:
14. Date of Permit Issuance:	15. Permit Review Due Date:

The facility for which this permit has been issued shall only be operated in accordance with the description provided in the application pursuant to Section 18105.1 and Report of Nonhazardous Ash Disposal Site Information pursuant to Section 18226. (Applicants may use the Standardized Permit Application CIWMB 92).

16. Legal Description of Facility: (description may be attached)

17. Findings:

a. This permit is consistent with standards adopted by the California Integrated Waste Management Board, pursuant to Public Resources Code Section 44010.

b. [ ] A CEQA exemption (state the type, and identify section of exemption, or N/A), ________________), or [ ] a (state type of environmental document, date, and SCH#) has been filed with the State Clearinghouse and adopted or certified. Where mitigation measures have been identified, a Mitigation Reporting or Monitoring Program has been adopted as part of the project pursuant to Public Resources Code Section 21081.6.

c. The following authorized agent ________________ has made the determination that the facility is consistent with the applicable general plan, as required by Public Resources Code, Section 50000.5(a).

d. The operation of this facility is consistent with the [ ] County Solid Waste Management Plan (50000), or the [ ] County Integrated Waste Management Plan (50001).

e. The design of the proposed facility or the design and operation of an existing facility, as appropriate, is in compliance with State Minimum Standards for Nonhazardous Ash Operations and Facility Regulatory Requirements, Title 14, Division 7, Chapter 3, Article 5.8 of the California Code of Regulations.

f. Public Resources Code Section 44009 has been complied with.

18. In addition to this permit, the facility may have one or more of the following permits or restrictions on its operations. Persons seeking information regarding these items should contact the appropriate regulatory agency.

- ______ Report of Nonhazardous Ash Disposal Site Information
- ______ State Water Resources Control Board/Regional Water Quality Control Board Waste Discharge Requirements or Waiver
- ______ National Pollutant Discharge Elimination System (Stormwater) Permit
- ______ Fire Protection District Findings
- ______ Mitigation and Monitoring Measures (pursuant to the California Environmental Quality Act)
- ______ Conditional Use Permit/Land Use Permit
- ______ California Environmental Quality Act Environmental Impact Report or Negative Declaration
- ______ Air Pollution Permits and Variances
- ______ Coastal Commission Restrictions
- ______ Other Permits may also apply

19. Terms and Conditions:

a. The operator shall comply with applicable state minimum standards set forth in Title 14, Division 7, Chapter 3, Article 5.8 of the California Code of Regulations.

b. The operator shall comply with all applicable mitigation and monitoring measures that are to be implemented with the enforcement agency. ~~developed in accordance with a certified environmental document filed pursuant to Public Resources Code Section 21081.6.~~

c. The operator shall maintain a copy of this standardized permit at the facility or at a location agreed upon by enforcement agency, to be available at all times to facility, enforcement agency, and CIWMB personnel.

d. The operator shall maintain and make available for inspection by the enforcement agency and CIWMB all correspondence and reports provided to other regulatory agencies that have jurisdiction over the facility.

e. The design capacity of ____ tons or cubic-yards (circle one) per day of nonhazardous ash being disposed of shall not be exceeded.

f. The facility has a total operating area of ____________ acres.

g. The maximum quantity of nonhazardous ash that can be received per ~~on~~ any operating day is __________ cubic yards/tons (circle one).

h. The days and hours of operation shall be ______________. For facilities with continuous operations, indicate the start of the operating day for purpose of calculating amount of nonhazardous ash received per day.

i. Additional clarifying information concerning the design and operation of the nonhazardous ash facility shall be furnished upon written request of the enforcement agency or the CIWMB.

j. Unless specifically permitted or allowed under Title 14, Division 7, Chapter 3, Article 5.8 of the California Code of Regulations, the facility shall only accept nonhazardous ash.

k. Migration of wastes, leachate, or dust off-site are prohibited.

l. The facility, if located outside of a city, shall be maintained in compliance with the flammable clearance provisions, pursuant to Public Resources Code Section 44151.

NONHAZARDOUS ASH OPERATIONS AND FACILITIES PLACEMENT INTO THE REGULATORY TIERS

[illegible]	[illegible]	[illegible] Notification [illegible]	Standardized [illegible]
Manufacturing	Transfer/Processing Specified in Section 17377.1	Transfer/Processing Operations	Disposal/Monofill
Uses Specified in Section 17376(b)(5)	Weathertight Storage		
Stockpiling as Specified in Section 17376(b)(2)			
Daily Cover			

There are no operations or facilities placed within the Registration and Full Permit tiers within this Article.

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California Integrated Waste Management Board
Resolution 97-179
May 28, 1997

Adoption of the Negative Declaration (SCH #97042061) for the Adoption of Proposed Nonhazardous Ash Operations and Facilities Regulatory Requirements

WHEREAS, Board staff has completed a thorough environmental analysis and prepared an initial study indicating the proposed nonhazardous ash regulations will not have a significant effect on the environment; and

WHEREAS, the California Environmental Quality Act (Public Resources Code Sections 21000 et. seq.), and State CEQA Guidelines, [Title 14, 15074(b)] require that prior to approval of a proposed project the decision-making body of the Board, as Lead Agency, shall consider the proposed Negative Declaration for the adoption of the proposed regulations, together with any comments received during the public review process. The decision-making body shall approve the Negative Declaration if it finds on the basis of the Initial Study and any comments received that there is no substantial evidence that the project will have a significant effect on the environment; and

WHEREAS, the Board has circulated the proposed Negative Declaration to public agencies through the state Clearinghouse, and has made the document available to the public as announced in two newspapers of general circulation throughout the State of California for the required time period as required by the State CEQA Guidelines, Section 15072(a); and

WHEREAS, the Board has reviewed and considered all comments received during the State agency and public review period.

NOW, THEREFORE, BE IT RESOLVED that the Board hereby deems the proposed Negative Declaration complete.

BE IT FURTHER RESOLVED that the Board has determined that the project as proposed will not have a significant adverse effect on the environment.

BE IT FURTHER RESOLVED that the Board adopts the Negative Declaration, State Clearinghouse Number 97042061.

BE IT FURTHER RESOLVED that the Board directs staff to prepare and submit a Notice of Determination of the project; approved to the State Clearinghouse for filing as required by the State CEQA Guidelines (Title 14, California Code of Regulations Section 15075).

CERTIFICATION

The undersigned Executive Director of the California Integrated Waste Management Board does hereby certify that the forgoing is a full, true and correct copy of a resolution duly and regularly adopted at a meeting of the California Integrated Waste Management Board held on May 28, 1997.

Dated:

Ralph E. Chandler
Executive Director

California Integrated Waste Management Board
Resolution 97-180
May 28, 1997

Adoption of the Proposed Nonhazardous Ash Regulations (Regulations Title 14, California Code of Regulations, Division 7, Chapter 3, Article 5.8, Sections 17375 through 17379.1, and Chapter 5, Article 3.2, Section 18226)

WHEREAS, Section 43020 of the Public Resources Code requires the Board to adopt regulations for solid waste handling, transfer, composting, transformation, and disposal; and

WHEREAS, Section 43021 of the Public Resources Code requires the regulations adopted pursuant to Section 43020 of the Public Resources Code to include standards for the design, operation, maintenance, and ultimate reuse of solid waste facilities; and

WHEREAS, the Board as part of its effort to streamline permitting and apply the appropriate level of regulatory control for different types of solid waste handling, has decided to establish new regulations setting forth permitting requirements and State minimum standards for nonhazardous ash operations; and

WHEREAS, formal notice of the rulemaking activity was published on October 25, 1996, in the California Regulatory Notice Register 96, Volume No. 43-Z; and

WHEREAS, the Board held a 45-day comment period, a public hearing, and an additional 15-day comment period for substantially related changes; and

WHEREAS, the Board has taken all public comments under consideration; and

WHEREAS, the Board has fulfilled all of the requirements of Government Code Sections 11340 et. seq.; and Title 1 of the California Code of Regulations, Section 1 et. seq; and

WHEREAS, the Board has maintained a rulemaking file which shall be deemed to be the record for the rulemaking proceeding pursuant to Government Code Section 11347.3; and

WHEREAS, the Board has determined that the adoption of the proposed regulations do not impose a mandate on school districts, nor do they impose any non-discretionary costs or savings on them; and

WHEREAS, the Board has determined that the regulations do affect the local mandate already imposed on local government agencies by decreasing levels of service now required. There are no reimbursable costs; and

WHEREAS, the Board has determined that the proposed regulations will create no costs or savings to any state agency or to federal funding to the State; and

WHEREAS, the Board has determined that the proposed regulations will have no significant adverse impact on housing costs; and

WHEREAS, the Board has determined that the proposed regulations, rather than having an adverse economic impact, may provide economic relief to solid waste operations classified as small business, which might otherwise have the burden of obtaining a costly full solid waste facilities permit; and

WHEREAS, the Board has determined that the adoption of the proposed regulations will not have a cost impact on private persons or enterprises. The simplified regulatory process would reduce costs for private persons or enterprises; and

WHEREAS, the Board has determined that the proposed regulations will not have an adverse economic impact upon California businesses' ability to compete with out-of-state business; and

WHEREAS, the Board has determined that the proposed regulatory action, rather than eliminating jobs, may positively affect the creation of jobs within the State of California. It may also positively stimulate the creation or expansion of new businesses within California because there may be an indeterminate savings resulting from the proposed simplified regulatory process; and

WHEREAS, the Board has determined that no alternative considered would be more effective in carrying out the purposes for which this action is proposed or would be as effective and less burdensome to affected private persons than the proposed action.

NOW, THEREFORE, BE IT RESOLVED that the Board hereby adopts the proposed nonhazardous ash regulations (Title 14, California Code of Regulations, Division 7, Chapter 3, Article 5.8, Sections 17375 through 17379.1, and Chapter 5, Article 3.2, Section 18226), and directs staff to submit the regulations to the Office of Administrative Law for review and approval.

CERTIFICATION

The undersigned Executive Director of the California Integrated Waste Management Board does hereby certify that the forgoing is a full, true and correct copy of a resolution duly and regularly adopted at a meeting of the California Integrated Waste Management Board held on May 28, 1997.

Dated:

Ralph E. Chandler
Executive Director

APPENDIX Q

TABULATED COST ANALYSIS RESULTS

Cost of Managing All FFCBs as Waste

Facility ID	SIC	1993 Disp.	1994 Disp.	1995 Disp.	Avg. Disp	Baseline Disposal	
						Cost ($000	Cost/ton
Plant #08	2075	121302	138734	139545	133,194	530	3.98
Plant #12	2075	441849	492905	431905	455,553	1,800	3.95
Plant #13	2075	3837	7414	8019	6,423	26	4.05
Plant #28	2075	3060	2980	200	2,080	8	3.99
Plant #30	2075	3500	3500	4225	3,742	15	4.01
Plant #20	2621	64500	64500	64500	64,500	260	4.03
Plant #35	2621	88700	98400	95000	94,033	380	4.04
Plant #07	4910	7000	6000	6800	6,600	26	3.94
Plant #39	4910	42213	45507	48698	45,473	180	3.96
Plant #06	4911	415006	371355	380256	388,872	1,600	4.11
Plant #09	4911	165055	159116	166504	163,558	650	3.97
Plant #10	4911	0	11123	10086.4	10,605	42	3.96
Plant #11	4911	0	0	298255	298,255	1,200	4.02
Plant #15	4911	0	264093.5	287395.5	275,745	1,100	3.99
Plant #16	4911	488866	488866	488866	488,866	2,000	4.09
Plant #19	4911	221220	265462	274150	253,611	1,000	3.94
Plant #24	4911	240140	290000	291409	273,850	1,100	4.02
Plant #25	4911	38031	45788	41317	41,712	170	4.08
Plant #26	4911	244436	343395	326320	304,717	1,200	3.94
Plant #29	4911	59248	49672	29597	46,172	180	3.90
Plant #31	4911	296120	231800	391204	306,375	1,200	3.92
Plant #32	4911	0	0	147000	147,000	590	4.01
Plant #33	4911	479837	494517	532407	502,254	2,000	3.98
Plant #36	4911	33000	33000	30000	32,000	130	4.06
Plant #38	4911	0	264100	246277	255,189	1,000	3.92
Plant #40	4911	163002	142257	165317	156,859	630	4.02
Plant #42	4911	183664	331519	192437	235,873	940	3.99
Plant #01	4931	143650	147253	120986	137,296	550	4.01
Plant #02	4931	28722	29655.4	29531	29,303	120	4.10
Plant #03	4931	19534	28275	29000	25,603	100	3.91
Plant #04	4931	29622	31999	28243	29,955	120	4.01
Plant #17	4931	39384	43804	38810	40,666	160	3.93
Plant #18	4931	365080	364906	317497	349,161	1,400	4.01
Plant #23	4931	0	156657	220185	188,421	750	3.98
Plant #37	4931	0	0	23000	23,000	92	4.00
Plant #14	8221	1900	14500	10200	8,867	35	3.95
Plant #22	8221	1337	535	0	936	4	3.95
Plant #41	8221	20000	0	24120	22,060	88	3.99
Plant #43	9199	0	0	9800	9,800	39	3.98

Cost of Managing All FFCBs as Waste

Facility ID	SIC	Subtitle C landfill						
		Capital	Annual Cap	O & M	Closure	Post Closure	Cover Replac.	off-site
Plant #08	2075	8,225,120	5,611,953	718,024	1,442,315	529,412	3,489,846	-
Plant #12	2075	15,140,604	12,328,476	1,230,883	2,907,178	979,087	7,209,397	-
Plant #13	2075	-	-	-	-	-	-	723,845
Plant #28	2075	-	-	-	-	-	-	234,395
Plant #30	2075	-	-	-	-	-	-	421,648
Plant #20	2621	5,749,102	3,528,278	534,399	954,012	368,410	2,275,104	-
Plant #35	2621	6,924,328	4,491,019	621,555	1,182,702	444,829	2,841,825	-
Plant #07	4910	-	-	-	-	-	-	743,753
Plant #39	4910	4,840,571	2,821,011	467,022	781,668	309,334	1,851,117	-
Plant #06	4911	13,995,041	11,140,918	1,145,927	2,656,407	904,597	6,566,699	-
Plant #09	4911	9,105,566	6,400,222	783,318	1,621,429	586,662	3,939,380	-
Plant #10	4911	-	-	-	-	-	-	1,195,043
Plant #11	4911	12,266,803	9,401,143	1,017,759	2,283,597	792,220	5,615,232	-
Plant #15	4911	11,798,018	8,940,646	982,993	2,183,702	761,737	5,361,175	-
Plant #16	4911	15,681,432	12,898,107	1,270,991	3,026,514	1,014,254	7,515,934	-
Plant #19	4911	11,318,021	8,474,453	947,396	2,081,997	730,526	5,102,932	-
Plant #24	4911	11,757,699	8,901,277	980,003	2,175,136	759,115	5,339,409	-
Plant #25	4911	4,639,612	2,669,387	452,119	744,138	296,267	1,759,199	-
Plant #26	4911	12,398,079	9,530,998	1,027,495	2,311,669	800,756	5,686,696	-
Plant #29	4911	4,877,029	2,848,714	469,726	788,501	311,704	1,867,869	-
Plant #31	4911	12,431,529	9,564,149	1,029,975	2,318,829	802,931	5,704,928	-
Plant #32	4911	8,636,688	5,977,610	748,546	1,525,722	556,174	3,698,948	-
Plant #33	4911	15,893,567	13,123,065	1,286,724	3,073,482	1,028,048	7,636,698	-
Plant #36	4911	4,074,091	2,252,893	410,179	639,794	259,494	1,504,526	-
Plant #38	4911	11,352,915	8,508,159	949,984	2,089,370	732,795	5,121,640	-
Plant #40	4911	8,918,851	6,231,175	769,471	1,583,232	574,521	3,843,360	-
Plant #42	4911	10,918,029	8,090,194	917,733	1,997,706	704,516	4,889,242	-
Plant #01	4931	8,349,561	5,721,979	727,252	1,467,473	537,504	3,552,874	-
Plant #02	4931	3,902,206	2,129,445	397,432	608,475	248,317	1,428,359	-
Plant #03	4931	3,652,990	1,953,218	378,950	563,418	232,112	1,319,024	-
Plant #04	4931	3,944,449	2,159,642	400,565	616,154	251,064	1,447,022	-
Plant #17	4931	4,582,122	2,626,350	447,855	733,444	292,528	1,733,036	-
Plant #18	4931	13,265,593	10,398,746	1,091,830	2,498,211	857,165	6,162,347	-
Plant #23	4931	9,767,052	7,006,921	832,375	1,757,633	629,675	4,282,400	-
Plant #37	4931	-	-	-	-	-	-	2,591,868
Plant #14	8221	-	-	-	-	-	-	999,184
Plant #22	8221	-	-	-	-	-	-	105,478
Plant #41	8221	-	-	-	-	-	-	2,485,940
Plant #43	9199	-	-	-	-	-	-	1,104,361

Cost of Managing All FFCBs as Waste

		Subtitle C landfill		Subtitle D	
Facility ID	SIC	AnnualizedTotal ($000)	cost/ton	Cost ($000)	cost/ton
Plant #08	2075	7,300	54.81	2,900	21.77
Plant #12	2075	15,000	32.93	8,700	19.10
Plant #13	2075	720	112.09	290	45.15
Plant #28	2075	230	110.58	95	45.67
Plant #30	2075	420	112.25	170	45.43
Plant #20	2621	4,800	74.42	1,500	23.26
Plant #35	2621	6,000	63.81	2,100	22.33
Plant #07	4910	740	112.12	300	45.45
Plant #39	4910	3,900	85.77	1,100	24.19
Plant #06	4911	14,000	36.00	7,600	19.54
Plant #09	4911	8,300	50.75	3,500	21.40
Plant #10	4911	1,200	113.16	390	36.78
Plant #11	4911	12,000	40.23	6,000	20.12
Plant #15	4911	11,000	39.89	5,600	20.31
Plant #16	4911	16,000	32.73	9,200	18.82
Plant #19	4911	11,000	43.37	5,200	20.50
Plant #24	4911	11,000	40.17	5,600	20.45
Plant #25	4911	3,700	88.70	1,000	23.97
Plant #26	4911	12,000	39.38	6,100	20.02
Plant #29	4911	3,900	84.47	1,100	23.82
Plant #31	4911	12,000	39.17	6,200	20.24
Plant #32	4911	7,800	53.06	3,200	21.77
Plant #33	4911	16,000	31.86	9,400	18.72
Plant #36	4911	3,200	100.00	840	26.25
Plant #38	4911	11,000	43.11	5,200	20.38
Plant #40	4911	8,100	51.64	3,400	21.68
Plant #42	4911	10,000	42.40	4,900	20.77
Plant #01	4931	7,500	54.63	3,000	21.85
Plant #02	4931	3,000	102.38	780	26.62
Plant #03	4931	2,800	109.36	700	27.34
Plant #04	4931	3,000	100.15	800	26.71
Plant #17	4931	3,600	88.53	1,000	24.59
Plant #18	4931	13,000	37.23	6,900	19.76
Plant #23	4931	9,100	48.30	4,000	21.23
Plant #37	4931	2,600	113.04	650	28.26
Plant #14	8221	1,000	112.78	350	39.47
Plant #22	8221	110	117.52	43	45.94
Plant #41	8221	2,500	113.33	630	28.56
Plant #43	9199	1,100	112.24	370	37.76

Costs of Managing Discarded FFCBs as Waste

Facility ID	SIC	1993 Disp.	1994 Disp.	1995 Disp.	Avg. Disp	Baseline Disposal Cost ($000	Baseline Disposal Cost/ton
Plant #08	2075	99086	130350	137910	122,449	490	4.00
Plant #12	2075	441849	492905	359751	431,502	1,700	3.94
Plant #13	2075	3837	7414	8019	6,423	26	4.05
Plant #30	2075	1000	1200	800	1,000	4	4.00
Plant #20	2621	64500	64500	64500	64,500	260	4.03
Plant #35	2621	88700	98400	95000	94,033	380	4.04
Plant #07	4910	7000	6000	6400	6,467	26	4.02
Plant #39	4910	42213	45507	48698	45,473	180	3.96
Plant #06	4911	253124	40285.46	210730	168,046	670	3.99
Plant #29	4911	59248	49672	29597	46,172	180	3.90
Plant #36	4911	17646	17646	17246	17,513	70	4.00
Plant #38	4911	0	264100	246277	255,189	1,000	3.92
Plant #42	4911	166394	70835	23907	87,045	350	4.02
Plant #01	4931	31568	0	22112	26,840	110	4.10
Plant #23	4931	0	156657	220185	188,421	750	3.98
Plant #37	4931	0	0	2185	2,185	9	3.98
Plant #14	8221	1900	14500	10200	8,867	35	3.95
Plant #22	8221	1337	535	0	936	4	3.95
Plant #43	9199	0	0	4800	4,800	19	3.96

Costs of Managing Discarded FFCBs as Waste

Facility ID	SIC	Subtitle C landfill						
		Capital	Annual Cap	O & M	Closure	Post Closure	Cover Replac.	off-site
Plant #08	2075	7,889,810	5,317,838	693,157	1,374,796	507,608	3,320,885	-
Plant #12	2075	14,737,734	11,907,848	1,201,006	2,818,672	952,890	6,982,334	-
Plant #13	2075	-	-	-	-	-	-	723,845
Plant #30	2075	-	-	-	-	-	-	112,690
Plant #20	2621	5,749,102	3,528,278	534,399	954,012	368,410	2,275,104	-
Plant #35	2621	6,924,328	4,491,019	621,555	1,182,702	444,829	2,841,825	-
Plant #07	4910	-	-	-	-	-	-	728,728
Plant #39	4910	4,840,571	2,821,011	467,022	781,668	309,334	1,851,117	-
Plant #06	4911	9,228,516	6,512,074	792,436	1,646,643	594,657	4,002,804	-
Plant #29	4911	4,877,029	2,848,714	469,726	788,501	311,704	1,867,869	-
Plant #36	4911	-	-	-	-	-	-	1,973,501
Plant #38	4911	11,352,915	8,508,159	949,984	2,089,370	732,795	5,121,640	-
Plant #42	4911	6,665,232	4,274,464	602,341	1,131,774	427,981	2,715,256	-
Plant #01	4931	3,738,205	2,013,100	385,269	578,776	237,653	1,356,259	-
Plant #23	4931	9,767,052	7,006,921	832,375	1,757,633	629,675	4,282,400	-
Plant #37	4931	-	-	-	-	-	-	246,227
Plant #14	8221	-	-	-	-	-	-	999,184
Plant #22	8221	-	-	-	-	-	-	105,478
Plant #43	9199	-	-	-	-	-	-	540,912

Costs of Managing Discarded FFCBs as Waste

Facility ID	SIC	Subtitle C landfill		Subtitle D	
		AnnualizedTotal ($000)	cost/ton	Cost ($000)	cost/ton
Plant #08	2075	7,000	57.17	2,700	22.05
Plant #12	2075	15,000	34.76	8,300	19.24
Plant #13	2075	720	112.09	290	45.15
Plant #30	2075	110	110.00	45	45.00
Plant #20	2621	4,800	74.42	1,500	23.26
Plant #35	2621	6,000	63.81	2,100	22.33
Plant #07	4910	730	112.89	290	44.85
Plant #39	4910	3,900	85.77	1,100	24.19
Plant #06	4911	8,500	50.58	3,600	21.42
Plant #29	4911	3,900	84.47	1,100	23.82
Plant #36	4911	2,000	114.20	530	30.26
Plant #38	4911	11,000	43.11	5,200	20.38
Plant #42	4911	5,700	65.48	2,000	22.98
Plant #01	4931	2,900	108.05	730	27.20
Plant #23	4931	9,100	48.30	4,000	21.23
Plant #37	4931	250	114.42	99	45.31
Plant #14	8221	1,000	112.78	350	39.47
Plant #22	8221	110	117.52	43	45.94
Plant #43	9199	540	112.50	220	45.83