TIDD PFBC DEMONSTRATION PROJECT TECHNICAL PROGRESS REPORT FIRST QUARTER 1993

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**TIDD PFBC DEMONSTRATION PROJECT
TECHNICAL PROGRESS REPORT**

FIRST QUARTER, CY 1993

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April 1993

MASTER

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GLOSSARY OF ACRONYMS AND ABBREVIATIONS USED IN THIS REPORT

AARP	Annunciator Alarm Response Procedures
AB	ASEA Babcock - A business partnership between a subsidiary of ABBC and the Babcock & Wilcox Company (USA)
AEP	American Electric Power Company, Inc.
AEPS	American Electric Power Service Corporation - A subsidiary of AEP
AFC	Approved for Construction
AFL	Approved for Layout
ABBC	ABB Carbon - A subsidiary of ASEA-Brown Boveri (subcontractor)
AOP	Abnormal Operating Procedure
B&W	The Babcock & Wilcox Company (subcontractor)
BWCC	The Babcock & Wilcox Construction Company (subcontractor)
BOP	Balance of Plant
CBI	Chicago Bridge and Iron, Inc. (subcontractor)
CSWD	Cable Schematics Wiring Drawings
DOE	Department of Energy (United States)
DRC	Design Review Committee
E&SC	Electrical Equipment Service Corporation (subcontractor)
ECP	Engineering Control Procedure
EMP	Environmental Monitoring Plan
EOP	Emergency Operating Procedure
EPA	Environmental Protection Agency
ESP	Electrostatic Precipitator
FAT	Net 90 - Factory Acceptance Test
GSU	Generator Step-Up Transformer
HVAC	Heating, Ventilating & Air Conditioning
I&C	Instrumentation & Control
IOI	Initial Operating Instructions
MCR	Material Control Record
MCS	Management Command System

GLOSSARY OF ACRONYMS AND ABBREVIATIONS USED IN THIS REPORT

MCC	Motor Control Center
MED	Mechanical Engineering Division
NDE	Nondestructive Examination
NEMA	National Electric Manufacturers Association
NOP	Normal Operating Procedure
NOVAA	North Ohio Valley Air Authority
NPDES	National Pollutant Discharge Elimination System
OEPA	Ohio Environmental Protection Agency
OCDO	Ohio Coal Development Office - A part of Ohio Department of Development
OPCo	Ohio Power Company
PES	Plant Electrical Systems
PFBC	Pressurized Fluidized Bed Combustion
PMP	Project Management Plan
POPS	Plant Operations and Performance System
ppb	Parts Per Billion
PTI	Permit to Install
PTO	Permit to Operate
PWHT	Post-Weld Heat Treatment
RDR	Request for Drawing Revision
RFQ	Request for Quotation
SD-0	System Description (Rev. 0)
SD-1	System Description (Rev. 1)
SD-2	System Description (Rev. 2)
SD-2.5	System Description (Rev. 2.5)
SD-3.0	System Description (Final)
SPCC	Spill Prevention Control & Countermeasures

I. INTRODUCTION AND SUMMARY

This is the 24th Technical Progress Report submitted to the Department of Energy in connection with the cooperative agreement between the DOE and the Ohio Power Company for the Tidd PFBC Demonstration Plant. This report covers the period from January 1, 1993 to March 31, 1993.

Major activities during this period involve:

- The unit was operated for a total of 331 hours (including gas turbine air prewarming). There were three gas turbine starts, five bed preheater starts, and two operating periods with coal fire. The peak gross output of 61 MWH was achieved for the period of 2200 to 2300 hours on January 20, 1993. The longest coal fire was 273 hours beginning at 0605 hours on January 20, 1993.
- During the quarter, total gross generation was 13,453 MWH, and coal consumption was 6,481 tons.
- The sorbent fines injection system was installed and is ready for use.
- A totally new secondary ash removal system was designed.
- New sparge ducts are being fabricated to replace the existing ducts.
- The Ohio EPA performed a hazardous waste compliance inspection on March 29, 1993. No violations were noted and the plant was in compliance with applicable regulations.
- The unit has been out of service since early February due to the failure of the gas turbine. Replacement parts for the gas turbine repair are being fabricated by ABB in Sweden.

Major items planned for the next period include:

- Continuation with the fabrication of replacement parts for the gas turbine and completion of reinstallation by the end of July 1993.
- Installation of the new secondary ash system during the gas turbine outage.
- Installation of new sparge ducts to replace the existing ducts and new active end fluidization system during the current outage.
- Continuation with the operation and testing of the unit after the GT outage is complete and unit is started up.

II. DESIGN AND PERMITTING

A. Mechanical Engineering Division

1. Engineering and Design

The Mechanical Engineering Division has been involved in the following engineering and design activities during this reporting period:

- **Secondary Ash Removal System:**

As the quarter began, problems were still encountered with the secondary ash removal system and its frequent ash line pluggage.

At the beginning of the gas turbine outage, the decision was made to totally replace the secondary ash system with a larger more reliable system. As such, a new system is currently being designed and installed during this outage.

The new system will consist of six individual ash lines, each routed separately from the secondary cyclone dip leg out to the economizer discharge duct. The current 1/2" diameter lines will be replaced by a staged line starting out at 3/4" diameter at the cyclone dip leg. As the line proceeds out to the economizer, the line is staged to increase to 1" and finally 1-1/4" diameter just prior to the economizer duct.

The new lines will also include various blowdown and blowback valve stations to assist the plant staff in unplugging the lines in case the lines do plug during service.

● Sparge Duct:

Due to excessive permanent distortion caused by restrained thermal growth, a decision was made to replace a total of 54 - 9 foot long sparge duct arms that make up the majority of the bed bottom. The duct sections at the center of the boiler that contain the expansion compensating slip joints were not damaged and will be reused. The new duct arms will be installed during the GT repair outage, which is expected to be completed by July 1993. The new active end fluidization, which is expected to solve the thermal growth restraint problem, will also be installed during the outage.

● Gas Turbine:

The gas turbine developed a leak at the HPT drain plug flange on January 27, 1993. The leak consisted of HPC discharge air and HPT inlet gas. The HPT No. 1 disk outlet temperature increased 25°F to its maximum allowable temperature of 840°F, due to the leak. This would have prevented any load increases beyond 115 inch bed level. The leak was sealed externally by Leak Tech on January 28.

The gas turbine tripped from service on February 9, 1993, due to a catastrophic failure of two LP turbine blades. The extremely high vibration from the failure caused the combined Nos. 3/4 bearing to break free from the intermediate casing. The damage to the gas turbine was extensive and is summarized as follows:

1. The intermediate casing had an internal oil fire following the tripout. The fire could not be put out until the lube oil system was shut down.
2. The LPT outlet shaft seal box broke free causing extensive rubbing damage to the LPT shaft, disc, and blades.

3. The debris from the failed LPT blades damaged eight LPT inlet guide vanes and caused significant impact damage to the LPT inlet guide vane ring and outlet duct.
4. All of the LPT blades were damaged either by impacts or rubbing and required replacement. One additional blade was found with a crack at the same location as the initiation point of the two blades that failed.
5. The LPC blade tips were rubbed.
6. The HPC blade tips and guide vanes were heavily rubbed and required replacement.
7. The HPT blade tips and interstage seal disks were heavily rubbed and required replacement.
8. The Nos. 2, 3, 4, and 5 bearings were damaged and required replacement.
9. All oil seals and gas seals in the turbines and compressors were damaged and required repair or replacement.

The LPT, HPT, HPC and intermediate casing were sent to ABB Stal in Finspong, Sweden, for repairs and balancing. The repairs are expected to be completed by June 18, 1993. Final assembly and commissioning are expected to be completed at the Tidd Plant site by July 30, 1993.

The following modifications will be completed during this outage:

- The intercept valves will be modified to provide positive sealing bypass valve seats. This should help reduce the internal air leakage.

- The new HPT inlet shaft seal will be added to help reduce the internal air leakage.
- An external HPT shell seal air line will be installed and the old internal supply will be plugged. This should stop the internal erosion of the HPT shell.
- A manhole is being installed in the LPT outlet flow guide to allow close inspection of the LPT blading.
- The LPT guide vane positioning ring is being modified with a better grade bolt material and bushing design.
- The LPT blading will be modified to reduce the stress concentration in the blade roots at the crack initiation site.

2. Meetings

The Tidd Test Committee met on the following date:

January 20, 1993.

3. Phase III - Testing and Data Collection

A series of tests were conducted in January 1993 to evaluate the effect of bed height on sorbent utilization and to establish a broader baseline of sorbent utilization data. Data from these tests--carried out with dry pneumatic feed of -4 mesh Plum Run Greenfield dolomite via two points--will be used for comparison to data from the future tests incorporating changes to sorbent supply, sizing, and feed methods. Originally, the tests were planned to be conducted at 70" (just above once-through), 115" and 140" (full load) nominal bed heights with Ohio No. 6A coal, and then repeated with Pittsburgh No. 8 coal. However, due to coal crushing capacity limitations with No. 6A coal, only the lower bed

height test (81" and 117" actual) were completed before switching to No. 8 coal. Only one test at 9" bed level was completed with the No. 8 coal before the unit tripped on January 31, 1993 when the Network 90 system detected a communications fault. On the subsequent run, no data was collected since the unit had not yet stabilized when the GT tripped due to LPT blade failure.

Test results are summarized below:

DATE	01/22/93	01/25/93	01/27/93	01/29/93
COAL	Ohio 6A	Ohio 6A	Ohio 6A	Pitts. 8
SORBENT	Plum Run	Plum Run	Plum Run	Plum Run
Bed Level, Inches	117	81	117	119
Bed Temperature, °F	1540	1540	1541	1539
Excess Air, %	28.7	60.3	30.1	27.5
Firing Rate, MW	162	108	159	163
Firing Rate, %	79.6	53.1	77.9	79.8
Gas Turbine, MW	10.5	4.2	10.1	10.4
Steam Turbine, MW	41.7	25.8	40.7	41.8
Steam Flow, KLB/H	349	236	343	350
Ambient Temp., °F	37.1	29.7	34.3	21.8
Sulfur Retention, %	89.7	88.0	91.1	88.9
Ca/S	2.3	2.5	2.4	2.5
Ca/S for 90% Sulfur Retention	2.3	2.7	2.3	2.7

These results are consistent with earlier tests. At a given bed level, Ca/S for 90% sulfur capture is lower when firing Ohio 6A coal than when firing Pittsburgh 8, the spec coal. These tests validated the results of tests conducted during the Third and Fourth Quarters of 1992.

B. Instrumentation and Controls Division

No major instrumentation activities pertinent to this plant were performed during the period from January 1 through March 31, 1993.

C. Environmental and Technical Assessment Division

- All monthly and quarterly environmental monitoring reports were filed with the North Ohio Valley Air Authority and Ohio EPA, as required.
- The DOE's Environmental Monitoring Plan (EMP) requires quarterly reports be filed within 60 days of the quarter's end. In compliance with that requirement, the EMP quarterly report for the Fourth Quarter (October - December), 1992 was submitted to DOE in late February.
- The EMP annual report for 1992 was submitted to DOE at the end of March. The annual report is a summary of the four quarterly monitoring reports for 1992 and is required to be submitted within 90 days of the year's end.
- On March 29, 1993, the Ohio EPA performed a hazardous waste compliance inspection. The Tidd PFBC is a small quantity generator (<1000 kg/month). The hazardous waste storage area and records were inspected. No violations were noted and the plant was in compliance with applicable regulations.

D. Electrical Engineering Division

- Completed Plant Electrical Systems portion of work related to HGCU heat trace for expansion joints (EDCA TI-00-002).

E. Civil Engineering Division

The sorbent fines unloading and handling system has been installed and is ready for use. This system will allow the mixing of sorbent fines with coal water paste contributing to higher sulfur capture capacity.

III. PROJECT MANAGEMENT AND CONSTRUCTION

A. Construction Activities

The major construction activities performed at the Tidd Plant relate to installation of the Sorbent Fines Admission System and performance of major outage related work.

1. Sorbent Fines Admission System

Installation of this system was completed in February and initial operation was conducted on March 18. The system was installed in accordance with the Cooperative Agreement DE-FC21-90MC26304 as part of the PFBC Utility Demonstration Project. Operation of the system will be incorporated in the Tidd Phase III Demonstration Program to verify improved overall sorbent utilization.

2. Major Outage-Related Work

● Gas Turbine:

The unit has been out of service since early February due to failure of the gas turbine. Fabrication of replacement parts for the gas turbine is in progress and completion of reinstallation is scheduled for the end of July 1993. This outage window allows other work items to proceed.

● Sparge Ducts:

New sparge ducts are being fabricated to replace the existing ducts. Completion of reinstallation is targeted for early July.

- **Expansion Joint Heat Tracing System:**

This work is being performed for the Hot Gas Clean Up Project under Cooperative Agreement DE-FC21-89MC26042. Separate quarterly reports are submitted to the DOE covering the project details.

IV. TIDD PFBC PLANT OPERATIONS

A. Operations

The following is a summary of accumulated operating data for the period January 1, 1993 through March 31, 1993.

Steam Turbine Generation	10,934 MWH
Gas Turbine Generation	2,519 MWH
Total Gross Generation	13,453 MWH
Peak Generation for 1 Hour	61 MWH
Total Oil Fire Operating Time	12 Hours
Total Coal Fire Operating Time	295 Hours
Total Coal Injected	6,481 Tons
Total Sorbent Injected	4,537 XLB

The unit was operated for a total of 331 hours (including gas turbine air warming). There were three gas turbine starts, five bed preheater starts, and two operating periods with coal fire. The peak gross output of 61 MWH was for the period of 2200 - 2300 hours on January 20, 1993. The longest coal fire was 273 hours, beginning at 0605 hours on January 20, 1993.

The HGCU system was isolated last quarter and all operations this quarter were with six cyclone strings.

1. Start-Up TD-SU-93-01-01 - January 18-31, 1993

The combustor was released by the Maintenance Department at 1930 hours on January 18, 1993. Air warming was accomplished and the gas turbine rolled at 1024 hours, paralleled at 1043 hours, and air flow established through the combustor at 1049 hours on January 19, 1993.

Problems were experienced with the needle valves sticking on the bed preheater.

An oil fire was established at 2356 hours on January 19, 1993. Coal fire was initiated at 0605 hours and bed level increased. Once-through boiler operation was achieved at 1040 hours. The No. 23 secondary cyclone plugged during this time period.

Bed level was increased to the 115 inch level for a sorbent utilization test with Harrison Mine No. 6A coal. This test was completed on January 23, 1993.

The fuel preparation system crusher throughput was limited at 44 kpph with this No. 6A coal. This prohibited conducting a sorbent utilization test at a higher bed level with this coal.

The precipitator controls were upgraded during this run.

Bed level was lowered to approximately 80 inches for a sorbent utilization test. This test was completed at 1200 hours on January 26, 1993.

Bed level was then increased to 115 inches for a second test at this level. This test was completed at 0800 hours on January 28, 1993.

One of the gas turbine LPC inlet pressure transmitters failed during this test period. It was repaired and both LPC inlet pressure transmitters were relocated to structural steel instead of the inlet duct to reduce vibration on the instruments.

During this test period, a leak developed on the gas turbine HPT test plug. This leak was temporarily repaired by pumping a high pressure sealant into the test plug.

Following the 115 inch bed level test on No. 6A coal, the fuel was switched to Pittsburgh No. 8. This test was completed at 0800 hours on January 29, 1993.

Throughput on the fuel preparation system crusher was much improved on the No. 8 coal (65 kpph was achieved).

Unit conditions were held steady in anticipation of increasing to full load following the weekend.

At 1540 hours on January 31, 1993, a combustor trip was suffered when the Network 90 system detected a communications fault with the safety node.

The steam turbine tripped at 1544 hours.

Inadvertent switching of reserve power resulted in a temporary loss of auxiliary power. Loss of AC power caused the preheater bypass damper to close, activating the boiler protection system rupture disc.

At 1629 hours, the gas turbine tripped on high fictive disc temperature.

The bed material was cooled and removed. The combustor was further cooled and released for maintenance outage work.

2. Start-Up TD-SU-93-02-01 - February 5-6, 1993

The combustor was released by the Maintenance Department at 2028 hours on February 5, 1993.

Air warming was accomplished and the gas turbine rolled at 1333 hours, paralleled at 1347 hours, and air flow established through the combustor at 1400 hours on February 6, 1993.

A successful oil fire was not achieved. Problems developed with sticking needle valves on the preheater.

The gas turbine was removed from service at 2239 hours on February 6, 1993 for maintenance work on the bed preheater.

3. Start-Up TD-SU-93-03-01 - February 8-9, 1993

Following the repairs to the bed preheater, the gas turbine was rolled at 0842 hours and paralleled at 0858 hours on February 8, 1993.

A successful oil fire was accomplished on the first attempt at 1111 hours.

Four of the six secondary cyclones (Nos. 22, 25, 26, and 27) were plugged when oil fire was established.

The steam turbine was rolled and paralleled at 1357 hours on February 8, 1993.

A coal fire was established at 1640 hours. The No. 25 secondary cyclone unplugged when air flow was increased.

As bed level was increased, once-through boiler operation was achieved at 2108 hours.

Bed level was maintained at approximately 85 inches, while the bed material matured and the sand was being purged from the bed.

As air flow was increased above 600 kpph, the No. 22 and No. 26 secondary cyclones unplugged.

While maintaining these conditions for the bed to mature, a gas turbine trip occurred at 1428 hours on February 9, 1993. High vibration was experienced on all bearings of the LP shaft. Surge conditions on the LPC initiated the trip.

The bed was inerted and cooled with gas circulation. The bed material was removed and the combustor further cooled for maintenance outage work.

B. Maintenance

1. Outage TD-OT-92-20 - December 31, 1992 - January 18, 1993

Gas Turbine:

Installed 50% of the weather hoods on the air intake.

Cyclone Ash:

Welded the upper and middle bellows box flanges on the primary cyclones to eliminate the potential for leaks.

Sandblasted primary and secondary cyclones.

Revised the secondary cyclone swirl piping arrangement for better support.

Welded No. 24 unused dip leg to the upper cyclone to reduce vibration.

Sandblasted secondary cyclone ash cooler outlet collection header manifolds.

Sorbent Prep:

Lined the cyclone separator with refractory.

Rebuilt crusher rotor and housing.

Miscellaneous:

Repaired No. 17 primary cyclone inlet duct.

Weld-repaired cracks in sparge ducts.

Realigned splitting air tubes on several fuel nozzles.

2. Outage TD-OT-93-01 - January 31 - February 5, 1993

Cyclone Ash:

Relocated the secondary purge air orifices to be attached to the cyclone suction boxes.

Sorbent Prep:

Weld repairs were made on the 200 HP system fan.

Sorbent Injection:

An additional speed reducer was installed on the west rotary feeder to get additional turndown.

Miscellaneous:

Both boiler protection system rupture discs were replaced due to HCV-P100 having gone closed on the trip-out.

A test moisture meter was installed for the coal preparation system.

3. Outage TD-OT-93-02 - February 6-8, 1993

Cleaned and repaired all five bed preheater burners due to sticking.

4. Outage TD-OT-93-03 - Beginning February 9, 1993

This outage is still in progress at the end of the quarter.

Gas Turbine:

The LPC, LPT, HPT, HPC inlet guide vanes and all associated bearings and housing were disassembled and inspected for damage.

LPC - Repairs were made to No. 2 and No. 10 stationary guide vane rings. Cleaned and restacked compressor. Waiting for new stub shaft and No. 2 bearing casing before completing reassembly.

LPT - Two blades were broken off, several had major impact damage, and heavy rubbing damage was seen on all blades. The shaft was damaged at the seal areas. The disc was shipped to ABB for reassembly with new blades and balancing.

Intermediate Bearing Housing - All bearing housing support plates were broken where the plates welded to the bearing housing. This housing was shipped to ABB for repairs.

HPT - Heavy blade tip rubbing and seal damage was found. This component was shipped to ABB for repairs and balancing.

HPC - Heavy blade tip rubbing and stator damage were found. Some bent blades were found. The rotor spacer rings were deformed. This component was shipped to ABB for repair and balancing.

Low Pressure Turbine Inlet Guide Vane - The outer ring and several vanes had severe impact damage. The inner and outer rings were eroded at the base of each vane. The vane and ring assembly were shipped to ABB for repair. The external linkage was modified with new bearings, bushings and bolts.

Cyclone Ash:

Sandblasted all cyclones.

Sorbent Prep:

Replaced the rotor on the 200 HP system fan.

Sorbent Injection:

The isolation valves to the boiler were modified to have the same internal diameter as the piping.

Installed new pick-up pots on both rotary feeders.

Rebuilt both rotary feeder shafts.

Installed additional speed reducer on east rotary feeder.

Miscellaneous:

Removed two evaporator, two primary superheater, and two secondary superheater tubes for inspection. Inspections were negative.

Working on sparge duct and active end fluidization revision.

Replaced the sample line for No. 5 oxygen analyzer.

Installed two test sections of 310 stainless steel boiler tube in secondary superheater.

Removed sparge ducts for replacement.

C. Performance

Installed 12 test thermocouples in the center of the bed.

Installed instrumentation to measure primary dip leg to bed zone differential pressure and secondary cyclone outlet manifold pressure.

Sorbent fines admission system check-out and initial operation was accomplished.

Modified the controls for the HGCU air preheater to allow for gradual heat-up.

V. MANPOWER REPORT

As of March 31, 1993, AEPSC actual work-hours for the Phase III accounted for 29.5% of the total budget of 135,098. Figure 1 represents the budget versus actual work-hours for this phase.

Figure 1

	1Q91	2Q91	3Q91	4Q91	1Q92	2Q92	3Q92	4Q92	1Q93	2Q93	3Q93	4Q93	1Q94	2Q94	3Q94	4Q94
Budget	0.7	3.6	7.1	10.1	14.4	17.8	21.6	25.2	29.5	34.3	39.7	45.5	51.8	58.5	65.5	100.0
Actual	10.6	21.7	31.3	39.4	47.7	54.1	60.4	66.8	73.1	78.7	84.3	89.7	95.3	98.9	99.9	100.0

VI. COST DATA

1. Project Cost Status

The actual cost shared expenditures during the First Quarter 1993 were \$2,721,233 versus \$3,334,000 forecasted. As of March 31, 1993, the cumulative cost shared expenditures for Phases I, II and III were \$166,162,633.

Figure 2 depicts the cumulative expenditure forecast for the project from Calendar Year (CY) 1986 to CY 1994. This cash flow curve represents the entire project, all three phases, including expenditures that are not cost shared with DOE.

Figure 3 is a projection of the quarterly expenditures for all participants. It also identifies the actual quarterly expenditures through the First Quarter 1993.

The following table summarizes the project expenditures as of March 31, 1993 of all participants:

	<u>DOE</u>	<u>OCDO</u>	<u>OPCo</u>	Total Expended as of <u>03/31/93</u>
<u>Phase I</u>				
Design & Permitting	\$ 7,000,000	\$ 5,000,000	\$ 9,539,049	\$ 21,539,049
<u>Phase II</u>				
Construction & Start-Up	\$47,000,000	\$ 5,000,000	\$69,893,668	\$121,893,668
<u>Phase III</u>				
Operation, Data Collection Reporting & Disposition	\$ <u>4,133,287</u>	<u>--</u>	\$18,596,629	\$ <u>22,729,916</u>
TOTAL	\$58,133,287	\$10,000,000	\$98,029,346	\$166,162,633

Figure 4 is the Phase III DOE quarterly actual and projected expenditures.

2. Contracts Awarded During First Quarter 1993

Major contractual commitments were issued during this reporting period totalling \$915,600 and are summarized as follows:

<u>Contract/ Purchase Order</u>	<u>Description (Contractor)</u>	<u>Contracted Costs</u>
	Phase III	
28234-071-3	Tidd Gas Turbine Repair (ASEA Babcock Co.)	\$630,000
28247-071-3	Sparge Duct Arms (CVT, Inc.)	<u>\$285,600</u>
	TOTAL	\$915,600

Figure 2

(in Millions)		1Q88	2Q88	3Q88	4Q88	1Q89	2Q89	3Q89	4Q89	1Q90	2Q90	3Q90	4Q90	1Q91	2Q91	3Q91	4Q91	1Q92	2Q92	3Q92	4Q92	1Q93	2Q93	3Q93	4Q93	1Q94
Forecast		68.7	93.4	115.4	130.7	140.1	146.4	154.8	156.9	163.1	166.5	169.8	173.1	176.5	179.8	183.1	186.5	189.8	193.1	196.5	199.8					
Actual		68.7	73.0	91.1	102.6	116.5	122.5	131.6	137.3	142.2	146.2	149.6	152.7	159.0	161.8	164.4	169.4	173.3	175.4							

Figure 3

(In Millions)		1Q81	2Q81	3Q81	4Q81	1Q82	2Q82	3Q82	4Q82	1Q83	2Q83	3Q83	4Q83	1Q84	To-date
Forecast		6.205	3.334	3.334	3.335	3.334	3.334	3.334	3.335	3.334	3.334	3.334	3.334	2.224	181.314
Actual		4.107	3.373	3.121	5.521	3.659	2.603	4.967	3.402	2.721					166.162

Figure 4

Tidd PFBC Demonstration Plant
Quarterly Expenditures - DOE Share Phase III
Forecast versus Actual

		(in Millions)													
		1Q91	2Q91	3Q91	4Q91	1Q92	2Q92	3Q92	4Q92	1Q93	2Q93	3Q93	4Q93	1Q94	To-date
Forecast		0.203	0.610	0.610	0.610	0.610	0.610	0.610	0.610	0.610	0.610	0.610	0.000	0.000	5.083
Actual		0.080	0.320	0.339	0.918	0.573	0.437	0.486	0.567	0.391		0.507			4.133

END

**DATE
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10 / 12 / 93