MASTER

Technical Notes for the Conceptual Design for an Atmospheric Fluidized-Bed Direct Combustion Power Generating Plant

Volume 4

April 1978

Prepared For
U.S. Department of Energy
Assistant Secretary for Energy Technology
Division of Power Systems

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Prepared By
Stone & Webster Engineering Corporation

For
U.S. Department of Energy
Assistant Secretary for Energy Technology
Division of Power Systems
Washington, DC 20545

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TECHNICAL NOTES FOR THE
CONCEPTUAL DESIGN FOR AN ATMOSPHERIC FLUIDIZED-BED
DIRECT COMBUSTION POWER GENERATING PLANT

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PART IVA

EVALUATION OF MERIT

ATMOSPHERIC FLUIDIZED BED BOILER
VS.
PULVERIZED COAL FIRED BOILER
WITH WET LIMESTONE FLUE GAS
DESULFURIZATION

Objective

This portion of the report is intended to present a comparison of the conceptual designs of a large (570 MWe) pulverized coal (PC) steam generator equipped with a wet limestone flue gas desulfurization (FGD) system and two equivalent sized atmospheric fluidized bed (AFB) steam generators including balance of plants for electric-power generation. The reader is cautioned that this portion of the report compares a zero generation AFB technology to pulverized coal technology which has been operationally and economically optimized for the past half-century. This comparison is intended to be indicative of whether further development of the AFB concept as a viable alternative to the PC/FGD concept for electric-power generation is merited.

The base plant for this comparison is a 570 MWe PC steam power generating unit. The facility, an even numbered unit extension at an existing site, will be built utilizing a pulverized coal boiler with a wet limestone FGD system. Because the unit is an even numbered extension at an existing site, certain services (such as makeup water demineralizer, auxiliary steam, etc.) are not included, as these systems have been provided with the previous odd numbered unit.

Conceptual designs of two AFB steam generators of equivalent boiler rating to the base plant were developed by Babcock & Wilcox (B&W) and the Foster Wheeler Energy Corporation (FWEC). Conceptual designs of the balance of plants for the three boilers for the generation of electric-power were developed by Stone & Webster Engineering Corporation (S&W). As in the base plant, these units are an even numbered extension to an existing site, and certain services (such as makeup water demineralizer, auxiliary steam, etc.) are not included since these have been provided with the previous odd numbered unit.

Process

Unlike a conventional pulverized coal fired plant, the AFB fires crushed coal, either -1 in. for FWEC, or -1/4 in. for B&W. The coal is burned in a bed of limestone which calcines and reacts with sulfur dioxide to form calcium sulfate. Bed material is withdrawn and disposed in a dry state. Some of the solid particles, including unburned coal, elutriate from the bed. The carbon fraction, which is usually the coarser fraction, is collected and returned to the carbon burnup cell or bed. This method of combustion is less efficient than PC firing as represented by boiler efficiencies which range from 85.8 percent for B&W to 86.4 percent for FWEC vs 87.9 percent for the conventional

plant. However, it must be understood, these are estimated efficiencies and should not be considered the ultimate achievable boiler efficiency when the technology matures. Several design factors such as limestone calcination and utilization, optimum bed height, optimum superficial gas velocity, and combustion efficiency are important factors which affect boiler efficiency and have yet to be fully confirmed. In addition, the lower boiler efficiency for AFB is mitigated by eliminating the FGD system with the corresponding reduction in auxiliary power and steam requirements.

Layout

Based on the conceptual designs and arrangements for the conventional plant and those of FWEC and B&W, the PC plant requires less overall plant area. The primary reasons are larger space requirements for material storage and handling, a complex coal feed system, and a complex ash handling system required to collect the higher quantity of fly ash and bed material as well as collection and reinjection of unburned carbon.

Capital Cost

Itemized plant capital cost breakdown for the base plant and two AFB designs are presented in Parts I and III of this report, respectively. Table IVA-1 presents a comparison of the total plant capital cost for the three steam generators including balance of plants for electric-power generation. These figures indicate that the total plant capital cost for the FWEC AFB design is approximately 10 percent less than the base plant, and the B&W AFB design is approximately 10 percent greater than the base plant. Table IVA-2 presents a comparison of capital costs in \$/kw for the three plants. The following are areas of major cost differences which are responsible for the differences in total plant capital cost based on Table IVA-2:

1. The main powerhouse cost for the FWEC unit is approximately 20 percent less than the base plant because of its overall smaller size. The B&W main powerhouse cost is approximately 17 percent more expensive than FWEC due primarily to the external Carbon Burnup Bed (CBB) vs integral Carbon Burnup Cell (CBC) of FWEC.
2. The boiler equipment cost for the base plant and the FWEC design are similar while the B&W boiler equipment cost is approximately 56 percent greater than both. This is due to (1) the external CBB design, (2) convection reheat surface vs in-bed

TABLE IVA-1

TOTAL PLANT CAPITAL COSTS COMPARISON

APRIL 1982

	<u>Base</u>	<u>B&W</u>	<u>FWEC</u>
Total Mat'l, \$	175,517,000	136,986,000	159,595,000
Total Labor, \$	123,695,000	134,537,000	109,858,000
Grand Total, \$	299,212,000	321,528,000	269,453,000
Total Manhours	3,490,000	3,542,000	3,042,000
Net Generation, MWe	526	554	541
\$ / Kw (Net)	569	580.6	498

TABLE IVA - 2

CAPITAL COST COMPARISON
(All figures in \$/kw)

	<u>Base</u>	<u>FWEC</u>	<u>B&W</u>
1. Land and Land Rights	-	-	-
2. Yardwork	0.5	0.5	0.5
3. Main Power House	32.9	26.2	30.6
4. Administration Building	-	-	-
5. Miscellaneous Buildings	-	-	-
6. Boiler Equipment (Vendor)	69.3	62.9	108.2
7a. Balance of Boiler Plant	38	39.8	36.1
7b. Ash Handling	8.3	21.2	20.7
8. Fuel Handling and Storage	3.1	15.7	11.6
9. Stack	4.3	3.9	3.8
10. Precipitator	15.0	17.2	25.4
11. Flue Gas Desulfurization	53.4	0	0
12. Turbine Generator	37.4	36.6	35.8
13. Balance of Turbine Plant	5.9	5.8	5.8
14. Conditioning and Circulating Water System	14.9	14.8	14.5
15. Water Treatment	0.9	0.9	0.9
16. Waste Treatment	7.4	0	0
17. Accessory Electrical	22.3	25.2	25.1
18. Miscellaneous Power Plant Equipment	0.7	0.7	0.7
19. Main Transformers	2.5	2.5	2.4
20. Transmission Lines	-	-	-
Total	<u>316.8</u>	<u>273.0</u>	<u>326.7</u>

reheat surface as FWEC design. In-bed reheat surface has a greater heat transfer coefficient, thus requiring less surface area.

3. The ash handling systems for the AFB boilers are approximately 150 percent more expensive than the base plant. This is due primarily to (1) greater solid waste quantities being handled by the ash handling system (2) the AFB ash must be cooled from 1550 deg F to approximately 250 deg F before conveying (3) the AFB ash conveying medium is air, which results in more expensive and sophisticated equipment than the base plant system whose ash conveying medium is water.
4. The fuel handling and storage cost for the AFB designs are more expensive than the base plant. The primary reasons are larger storage requirements and more complex feed systems. The B&W design conveys coal (-1/4 in.) and limestone together pneumatically to 1:40 distributors in the beds. The FWEC design conveys the coal (-1 in.) to the bed via spreader stokers and feeds the limestone by gravity to the beds. The base plant feeds pulverized coal to the boiler pneumatically.
5. The particulate collection system for the base plant consists of an electrostatic precipitator (ESP). The FWEC system consists of a mechanical collector for carbon collection and reinjection and a baghouse for particulate collection. This system is comparable in cost to the base plant system. The B&W system utilizes two ESPs, one for carbon collection and reinjection and one for particulate collection. This system is approximately 70 percent more expensive than either the base plant or FWEC. If the B&W design were to employ mechanical collectors and a baghouse instead of the two ESPs, there would be a \$5 million savings which would result in a B&W particulate collection system similar in cost to the FWEC and base plant.
6. An FGD system is required for the base plant to satisfy the present Federal EPA New Source Performance Standards (NSPS.) The AFB designs do not require an FGD system to satisfy these standards and therefore a \$28.1 million savings is associated with the AFB units.
7. The base plant requires a waste treatment system for the stabilization and disposal of the scrubber sludge. This system is not required by the AFB

design and is therefore a \$3.9 million savings for the AFB units.

If it is assumed that there is a 20 percent savings associated with the B&W design employing an integral CBB, in-bed reheat surface, and a baghouse particulate collection system, the B&W capital cost would be comparable to the FWEC design and approximately 10 percent less than the base plant.

Operating Costs

A comparison of the operating costs for the three units is presented on Table IVA-3. These figures include an arbitrary 10 percent increase in AFB power plant operating and maintenance cost to compensate for any uncertainties that may be unaccounted for. These figures indicate that the FWEC operating costs are approximately 2.5 mils/kw-hr less than the base plant. The primary reasons for this are: (1) a much lower capital recovery charge resulting from a lower capital investment (2) greater net generation for the FWEC design, 541 MWe vs 526 MWe for the base plant. The B&W boiler operating costs are approximately 0.6 mils/kw-hr greater than base plant due to the higher capital recovery charge associated with the higher capital investment. As discussed previously in the "capital cost" section, if an integral CBB were employed along with in-bed reheat surface and a baghouse for the B&W design, the capital recovery charge for the B&W unit would be reduced by approximately 3.2 mils/kw-hr. This would result in an operating cost of 36.41 mils/kw-hr which is comparable to the FWEC design.

Since the base plant is designed to comply with present EPA New Source Performance Standards (NSPS), the scrubber can be bypassed when down and therefore not affect the boiler operation. Therefore, the 95 percent availability of the FGD system is not detrimental to the operating cost of the base plant. Proposed Federal EPA NSPS for SO₂ will prohibit the bypassing of an FGD system except for start-up and shutdown procedures. This would require a highly available FGD system to satisfactorily operate the plant economically. Based on past industry experiences with FGD systems, numerous operating problems and shutdowns have been experienced. Based on proposed EPA NSPS, these FGD system shutdowns would result in forced boiler shutdowns and consequently decrease the plant capacity factor and increase the plant operating cost. Figure IVA-1 shows the effect of the operating cost of the base plant with decreasing scrubber availability. Literature indicates that FGD systems to date have operated between 70 and 90 percent availability with the majority within the 80's. FGD systems have been operated at 95 percent reliability for extended

TABLE IVA - 3

OPERATING COST COMPARISON
(All figures in mills/kw-hr)

	<u>Base</u>	<u>B&W</u>	<u>FWEC</u>
Capital Recovery (Fixed Charges)	15.64	15.96	13.69
Fuel Cost	17.90	17.76	18.07
Limestone Cost	0.89	2.18	1.84
Operation and Maintenance			
- Power Generating Plant	3.14	3.28*	3.36*
- FGD Plant	0.61	0	0
- Sludge Stabilization Plant	0.29	0	0
- Ash & Sorbent Disposal	0.16	0.11	0.10
- Particulate Emission Control Equipment	<u>0.34</u> 38.97	<u>0.32</u> 39.61	<u>0.33</u> 37.39

*Including Arbitrary 10 percent increase in Power Plant O&M

lengths of time, but this is a result of numerous operating personnel (approximately 50) and spare scrubbing capacity. Each evening one or more modules must be taken out of service for a complete cleaning to avoid possible pluggage and caking and consequential forced downtime.

Since the proposed EPA NSPS for SO₂ prohibit a plant to operate unless the FGD system is available, the effects of the availability of the scrubber on operating costs, as shown on Figure IVA-1, are significant. Assuming optimistically that a 95 percent scrubber availability can be maintained without numerous experienced personnel for the FGD system, the corrected operating cost for the base plant would be approximately 41 mils/kw-hr. This figure represents 5 percent forced boiler downtime due to a down FGD system.

Accurate availability of SO₂ removal for the AFB designs would require parametric analysis which is not in the scope of work at this time. For purposes of this study, the SO₂ removal availability for the AFB designs is assumed to be equivalent to that of the boiler itself and therefore would not affect the operating costs.

Some operating parameters which may be optimized to decrease the operating costs by improving boiler efficiency are lower superficial gas velocity and deeper beds. Optimization of these two parameters would result in higher combustion efficiencies and lower calcium to sulfur molar ratios and consequently lowering the operating costs for the AFB units.

Environmental Considerations

The air quality impact associated with the AFB plant is anticipated to be less than the base plant due to the higher exit temperature of the AFB plant stack gases. The higher temperature of the stack gases from the AFB plant would have greater atmospheric dispersion capability and will consequently result in lesser impact to the surrounding environment. The following sections indicate the major emissions associated with the operation of the three units.

Sulfur Dioxide (SO₂) Emissions

Present Federal EPA NSPS emission limitation for SO₂ is 1.2 lb SO₂ per MM Btu heat input. Sulfur dioxide emissions in a conventional PC plant are reduced to Federal emission levels by use of a wet limestone scrubber. In an AFB plant, sulfur dioxide emissions are controlled to required levels without requiring an FGD system by use of sulfur dioxide sorbent such as limestone as bed material. Both the PC plant and the AFB plants were designed to comply with

present EPA NSPS for SO₂. The PC plant is designed to capture sulfur dioxide with a limestone stoichiometry of approximately 1.2 (i.e., 20 percent excess limestone.) The AFB plant design requires a limestone stoichiometry in the order of 2.1 to 2.5. The low calcium utilization is due to (1) elutriation of limestone fines from the bed prior to sulfation and (2) the formation of a barrier of calcium sulfate on the calcined limestone particle thus preventing further reaction between the limestone and sulfur dioxide. The promulgation of the Clean Air Act Amendments of 1977, in August, 1977, requires that the existing NSPS emission limitation for SO₂ be revised within one year (August, 1978.) These revisions will include: (1) a required percentage reduction in sulfur dioxide emissions (2) a revised weight emission limitation. It is anticipated that in February, 1978 the revised NSPS SO₂ will be proposed based on data from DOE. The revised NSPS will require a 90 percent reduction in SO₂ emissions with a maximum emission limitation of 1.2 lb per million Btu and a minimum of 0.2 lb SO₂ per million Btu. Also, the new standards would prohibit the bypassing of the FGD system other than for start-up and shutdown procedures. This would therefore require an FGD system of high availability to satisfactorily operate the plant economically without forced outages due to FGD system downtime. It is anticipated that both the PC plant with a wet limestone scrubber and an AFB plant can be designed to comply with these revised NSPS for SO₂. The PC plant can achieve a 90 percent SO₂ reduction with an increase in FGD system capacity along with an operating staff of approximately 50 personnel to maintain the FGD system at an economically satisfactory availability of 95 percent. The AFB plant can achieve a 90 percent reduction in SO₂ emissions with the present plant designs by increasing the calcium to sulfur molar ratio to increase SO₂ capture. Other factors which affect SO₂ capture include depth of bed and superficial gas velocity, both directly related to residence time of the gas in the bed of limestone. These factors would be used to optimize the AFB boiler to assure SO₂ emissions which are in compliance with the revised NSPS while minimizing limestone consumption. The SO₂ capture availability for the AFB boilers is assumed to be that of the boiler itself.

Total Suspended Particulate Emissions

Present federal EPA NSPS emission limitation for TSP is 0.1 lb TSP per million Btu heat input. TSP emissions from both the PC plant and the AFB plant are reduced to comply with federal emission levels by use of either electrostatic precipitator (ESP) or a baghouse. Both the PC plant and the AFB plant were designed to comply with present Federal EPA NSPS for TSP. Based on data from DOE, the proposed NSPS for

Figure IV A-1
BASE PLANT OPERATING COST
vs.
FGD SYSTEM AVAILABILITY

TSP will require a 99 percent reduction in TSP emissions with a maximum emission limitation of 0.03 lb TSP per million Btu. It is anticipated that both the PC plant and AFB plant can be designed to achieve these revised NSPS with TSP with either an ESP or a baghouse. Recent enactment of the Clean Air Act Amendments of 1977 calls for a "trade-off" of air pollution caused by existing sources with the new source in nonattainment areas. This trade-off policy requires a greater than 1 to 1 trade-off of air pollution whose ultimate effect is a reduction in the quantity of pollutant in question. To minimize the economic penalties associated with a trade-off of this kind, it is essential that the new source emit the smallest possible amount of pollutant, therefore minimizing the amount of trade-off required.

For the PC plant with wet limestone scrubber, the ESP can reduce the grain loading of TSP in the flue gas to the range of .007 to .01 grains per ACF. The wet limestone scrubber liquor contains 10-15 solids. These solids may be entrained in the flue gas as it passes through the scrubber and possibly not removed in the mist eliminators. Therefore, the flue gas grain loading exiting the scrubber could be greater than the inlet grain loading. If this is the case, the scrubber on a PC plant could be the controlling factor with the TSP emissions and not the particulate collection system.

For the AFB plant with either an ESP or baghouse the TSP outlet grain loading of the flue gas could be significantly below the PC plant with a wet limestone scrubber. Outlet grain loadings of 0.003 grains per ACF can be achieved with a baghouse and consequently emitted from the stack of an AFB plant without possibility of solid reentrainment. From an air pollution viewpoint, the AFB plant has greater potential for plant siting than the PC plant due to the inherent ability to reduce the TSP emissions lower than the PC plant.

Nitrous Oxide (NOx) Emissions

NOx emissions from the PC plant and AFB plant will comply with present Federal EPA NSPS for NOx of 0.7 lb NOx per million Btu heat input. Predicted NOx emissions from the PC plant are 0.7 lb NOx per million Btu. The AFB plant predicts emissions of NOx in the range of 0.3-0.5 lb NOx per million Btu. Revised NSPS will be promulgated by August, 1978. Based on data from DOE, these revised NSPS for NOx will be 0.6 lb NOx per million Btu. The AFB plant emissions will comply with these revised standards with no modifications. The PC plant will require additional combustion modifications to comply with these revised standards such as staged firing, gas recirculation, or

modified burner designs, and may consequently require a greater capital investment cost.

Solid Waste

The major solid waste from the conventional plant consists of FGD sludge, fly ash, and bottom ash. Similarly, for the AFB plant, bed takeoff material and dust collector material represents the major wastes. The most significant difference in the conventional plant waste are largely in a slurry form whereas the AFB plant waste is dry. The PC plant waste will be combined and stabilized and sequentially landfilled. These wastes represent approximately 100,000 lb per hr of dry solids; however, when stabilized, they have approximately 50 percent moisture; thus the waste represents 200,000 lb per hr. The AFB plant solid waste will represent approximately 140,000 lb per hr of dry solids. Assuming water infiltration is minimized in the landfill operation, the overall disposal area for the solid waste should be somewhat less. Based on results of studies conducted under DOE and EPA contracts, land disposal of solid wastes generated from an AFB boiler will not have adverse environmental effects. In fact, studies have shown the material to be both structurally stable and durable for landfilling. Results of leaching tests have also found the materials feasible for landfilling. In addition, several organizations are actively engaged in developing uses for AFB solid waste in both agricultural and commercial applications which may ultimately decrease waste disposal costs substantially.

PART IVB

EVALUATION OF MERIT

COMPARISON OF THE
BABCOCK & WILCOX AND FOSTER WHEELER
AFB PLANT DESIGN

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1.0 OBJECTIVE

The objective of this part (Part IVB) of the Report is to analyze and compare the boiler and plant designs associated with the Foster Wheeler and Babcock & Wilcox AFB boiler described in Parts IIIB and IIIA of this Report. This document represents a portion of an overall report describing the conceptual designs of two atmospheric fluidized bed boilers and balance of plants for the generation of electric power and the analysis and comparison of these conceptual designs to a conventional pulverized coal-fired electric power generation plant equipped with a wet limestone flue gas desulfurization system. Conclusions regarding the various aspects of this effort are presented in this part or Part V of this Report.

2.0 CONCLUSIONS

2.1 General

After review of the Foster Wheeler (once-through) and the Babcock & Wilcox (drum type) AFB boiler designs, we conclude that both are viable. It must be remembered that both designs represent zero-generation requiring optimization.

2.2 Technical Feasibility

The Foster Wheeler and Babcock & Wilcox AFB designs are technically feasible, but design optimization is required.

2.3 Capital and Operating Costs

The lifetime capital and operating costs for both boilers are essentially comparable.

2.4 Environmental Considerations

Both the FWEC and B&W boiler designs reflect compliance with present federal EPA New Source Performance Standards (NSPS) emission limitations for the following:

1. 1.2 lb SO₂ per million Btu
2. 0.7 lb NO_x per million Btu
3. 0.1 lb TSP per million Btu

2.5 Demonstration Plant Recommendations

Review of both boiler designs reveals that both designs should be considered for future demonstration considerations.

2.6 Features Requiring Additional Development

Review of each boiler design reveals the following areas that need further development:

1. Superficial Velocity
2. Coal and Limestone Feed Systems
3. Bed Letdown Cooling/Unburned Combustibles
4. Calcium Utilization
5. Fluid Bed Combustion Controllability

2.7 Boiler Manufacturers' Final Reports

2.7.1 Babcock & Wilcox Final Report

2.7.1.1 Comments

Refer to Radian Corporation letter of January 9, 1978 to Mr. E. C. Trexler of the Department of Energy.

2.7.1.2 Errata

1. Page 4-13. The Solids flow for streams 13 and 14 should read the same as on stream 12.
2. Pages 6-22 through 6-25. Blowing medium should be air.
3. Pages 6-31 through 6-33, line 15. "77" should read "92." Pages 6-31 through 6-33, line 16. "107" should read "122." Pages 4-10 and 4-13, stream 21. "200" should read "215."
4. Pages 6-39, line 4, "Natural" should read "Assisted."

2.7.1.3 Revisions

There will be no further revisions made to the Babcock & Wilcox Report.

2.7.2 Foster Wheeler Final Report

2.7.2.1 Comments

See Radian Corporation letter of December 21, 1978, to Mr. E. C. Trexler of the Department of Energy.

2.7.2.2 Errata

1. Page 4-4, line 8, "Seven (7)" should read "Eight (8)"
2. Page 4-4, line 3, The word "Gass" should read "Gas"
3. Page 5-26. The last sentence, "This limestone feed only when the outer segments are nonoperational" should be eliminated.
4. Page 5-38, Figure 5.9. Reference is made on Figure 5.9 to a Figure 5.10 which is not included.

2.7.2.3 Revisions

There will be no further revisions made to the Foster Wheeler Report.

3.0 DESIGN FEATURE ANALYSIS AND COMPARISON

3.1 Boiler Design Features

Objective of this section is to assess significant design features of the FWEC and B&W AFB boiler designs. This assessment considers the viability of the design feature and the need for additional testing.

3.1.1 Conclusions

General

The intent of this section is to draw conclusions regarding the design features of the AFB as that design feature impacts the remainder of the plant.

We conclude that the B&W and FWEC AFB offered represents, in general terms, a credible zero-generation definition of a commercial-sized AFB.

In addition, the following general conclusions are drawn regarding the design features of the AFB boilers offered:

1. The coal/limestone distribution and injection system of either manufacturer requires testing.
2. A bed letdown cooler which permits recovering the bed material specific heat is warranted.

Foster Wheeler

We offer the following conclusions regarding the FWEC AFB boiler design:

1. The ability of the front and rear wall of the beds to transfer their share of the boiler weight to the overhead grid structure has been discussed with FWEC. FWEC was requested to perform a stress analysis on the front and rear wall panels, and it was determined that the existing panels could support the weight of the steam generator, bed material, and fluid but could not support this weight in combination with the maximum upset furnace pressure. The stress within the tubes can be reduced to an acceptable level by increasing the tube diameter to 1.875 in. (1.75 in.) with a wall thickness of 0.262 in. (0.2). This would maintain existing tube inside diameter thus not affecting critical pressure

drop. For the purpose of the study, these changes have a negligible cost increase to the boiler.

2. The once-through design for future commercial plants is not only viable but also probable in a supercritical configuration.
3. While the stoker significantly reduces the complexity of the injection system by reducing the bed area per feed point, testing is required to establish the freeboard combustion, carbon elutriation and sulfur capture associated with this feed method. In addition, FWEC extensions to existing plants will suffer a high (\$/kw) penalty for an extensive coal handling system addition due to the height of the coal silos required to achieve gravity feed.

Babcock & Wilcox

We offer the following general conclusions regarding the B&W AFB boiler design:

1. B&W should take advantage of the high in-bed heat transfer coefficient in the reheater design. The modifications to the turbine bypass system and the S&W imposed boiler trip reheater cooling systems would, in our judgement be minor as compared to the reduction in reheat surface.
2. B&W should make an effort to incorporate the CBC integral with the boiler. The main powerhouse penalty for the external location (\$/kw) would appear to justify this modification.
3. Feed system and distribution testing is required to prove the concept.

3.1.2 Once-Through Vs Assisted Circulation

Both boiler manufacturers were instructed to design an AFB boiler to supply the base plant 2400/1000/1000 turbine.

Foster Wheeler chose to design a once-through boiler on the basis that while heat rate credit associated with supercritical once-through boilers would not be accrued, in their opinion once-through design was more representative of the future commercialized AFB market. In addition, FWEC concluded that by undertaking a once-through design over an assisted natural circulation design, the ultimate commercialization of the technology would be better served.

B&W, on the other hand, has stated that with all the complexities of control of an AFB boiler, it was not warranted at this time to have the complexity of a once-through boiler.

In our judgement, the position of both vendors is justified. A greater percentage of new fossil power plants are of the supercritical once-through design due to the improved station heat rate. Until the demonstration AFB is built to confirm the control features, we do not believe that a once-through design will be applied.

While there will be little domestic demand for a subcritical once-through boiler, the FWEC work will not be lost since almost all of the subcritical design is applicable to a supercritical design.

We conclude, therefore, that either design is an acceptable definition of an AFB boiler and commercial size.

3.1.3 Stoker Feed Vs Pneumatic Feed

The stoker feed and pneumatic feed concepts were chosen by Foster Wheeler and B&W respectively, as the fuel feed systems for the fluidized bed boiler. Our analysis addressed three areas of concern within the bed as affected by these systems:

1. Freeboard Combustion

In the Foster Wheeler design, coal is fed by overbed spreader stokers. Combustion of the fines and heat release will tend to occur in the freeboard area above the beds. Production of fines must be minimized in order that combustion occurs in the bed thereby achieving high heat transfer to the in-bed boiler tubes. Obviously, there will be less freeboard combustion in the underfeed system where fuel is injected below the bed.

2. In-Bed Distribution

The use of the spreader stoker feeder will decrease the number of fuel feed points required as compared to the underfeed system. This is because the spreader stoker feeds the coal into a larger area of the bed than a single pipe in the underfeed pneumatic system. Based on a strict interpretation of existing data, a single feed line will adequately feed 9 sq ft of bed area whereas a stoker will feed 110 sq ft.

3. Bed Carbon Content

The unburned carbon content in the bed is required to be minimized at the bed operating temperature. The coal top size in the FWEC design is -1 in. and -1/4 in. the B&W design. As a result, burning rate is slower and the bed carbon content is greater in the FWEC design than in the B&W design.

3.1.4 Stacked Vs Condominium Design

In our opinion, either the stacked or condominium designs of FWEC and B&W are feasible.

However, the stacked FWEC design coupled with their requirement for gravity feed necessitates a high capital cost penalty for a new coal/limestone delivery system (\$/kw) and a larger powerhouse to enclose the elevated storage bunkers (\$/kw). The coal/limestone delivery system penalty would only be incurred on extensions to existing facilities.

The condominium design of B&W on the other hand has a powerhouse capital cost penalty because it is deeper than the FWEC design. In addition, the coal and limestone distribution and injection piping and the bed letdown piping on the B&W designs are more complex due to the front-back and bottom bed locations.

The impact of these designs on gas/gas and gas/solid phase reactions is discussed in Section 4.3.

3.1.5 Superficial Velocity

Choice of a design superficial velocity must be made very early in the design of the boiler because it affects the boiler bed arrangement, steam circuitry, combustion efficiency, sulfur capture, grid plate design, and dust collection equipment. Wide ranges of gas velocities have been studied, 3 to 15 ft/sec, but no specific guidelines have been established.

The design superficial velocity for the B&W boiler was chosen to be 8 ft/sec in both the main beds and in the CBB. Foster Wheeler chose 10 ft/sec in the main beds and 8 ft/sec in the CBC.

Until more detailed economic optimization evaluations are conducted, which include both capital cost and boiler performance, the choice of an optimum superficial velocity cannot be made.

3.1.6 Grid Pressure Drop

One of the largest pressure drops in the FBC system is the grid plate pressure drop. This plate must be designed so that uniform fluidization is obtainable throughout the entire range of operating velocities. This is accomplished, based on accepted industry standards, by designing the plate for a pressure differential of approximately 33 percent of the drop across the bed at the lowest operating velocity.

FWEC specified a minimum operating superficial velocity of 5 ft per sec. At this velocity, the slumped bed height will be approximately 12 in. and the pressure drop across it close to 17 in. W.C. The minimum recommended grid plate pressure drop for this operating condition, therefore, will be at 5.5 in. W.C.

(approximately 33 percent of 17 in. W.C.). At 24 in. slumped bed height and at the specified design velocity of 10 ft per sec, the pressure drop across the bed will be close to 34 in. W.C. with the developed grid pressure drop at $(10/5)^2 (5.5) = 22$ in. W.C. This figure was specified by FWEC in their report.

B&W, in their report, does not indicate velocity and slumped bed height variations. Their logic diagrams indicate, however, that velocity and bed level will be under control. It is reasonable to assume that the same range of pressure drops as specified by FWEC will be required. Therefore, the same design pressure drops of 22 in. W.C. for the grid plate and 34 in. W.C. for the bed should be applicable to the B&W design.

3.1.7 Metallurgy

MBC Air Grid - Stainless steel nozzles on a water-cooled grid are used in the FWEC design. Further development is suggested by FWEC to determine the metallurgy of the air grid. B&W does not address this point. Results from ongoing studies should be used.

Bed Tubes - The materials selected by FWEC have been in accordance with Power Piping standards on the basis of the operating pressures and temperatures in conventional pulverized coal plants.

Corrosion rates exterior to the tubes in the beds may dictate alternate selections. This was beyond the scope of work.

The materials selected by B&W were also in accordance with the ASME code. No allowance was made to account for possible corrosive effects that could occur in the beds in their design.

3.1.8 Structural Integrity

The structural integrity of the FWEC AFB design was subject to question. As stated in 3.1.1, a stress analysis was performed resulting in front and rear wall tube modifications. Because of the result demonstrated by the stress analysis, it can be concluded that the stress can be reduced to an acceptable level.

3.1.9 Finishing Reheater Surface Location

FWEC elected to locate finishing reheater surface in the fluid bed to take advantage of the high heat transfer coefficient. While this necessitates a reheater cooling system (see Section 3.8), the minimal flow requirements of the once-through design coupled with the FWEC experience with the European bypass (see Sections 3.8 and 3.9) did not make reheater cooling a significant penalty.

B&W elected not to locate reheat surface in the fluid bed since this would require a cooling system which would complicate the control system. As noted in Section 3.8, we conclude that the

B&W convection pass reheater will require cooling immediately after a boiler trip while the bed carbon inventory is "burned out."

If our conclusion is valid, then in addition to the B&W turbine bypass system, S&W has imposed a boiler trip reheater cooling system that would permit B&W to take advantage of the higher in-bed heat transfer coefficient without a significant capital cost penalty.

3.1.10 Carbon Burnup Cell (CBC) Location

FWEC elected to design its AFB boiler with an integral CBC, whereas B&W elected to use an external CBC. In our judgement, either design is feasible; however, the B&W design will result in a significant penalty in our powerhouse cost due to the wider boiler room.

3.1.11 Economizer Surface

The B&W economizer surface utilizes bare tubes and the FWEC economizer surface uses extended surface. Pluggage is not expected in this high dust loading area using extended surface due the dust friability. Abrasion was not considered, however, and FWEC advised that sufficient room to install equivalent bare tube surface exists and costs are minimal should this problem exist.

3.2 Coal and Limestone Systems

3.2.1 Coal and Limestone Preparation, Delivery, and Storage

Arrangement

For both designs, the coal and limestone is transported from the yard stock piles to the in-plant storage bunkers by conventional belt conveyors.

The elevation of the Foster Wheeler boiler and the coal storage bunkers did not permit the use of the existing inclined belt conveyors that run from the yard to the tripper conveyors located above the storage bunkers. New storage bunkers were required to be located above the highest level of stokers in order to feed them by gravity.

In the B&W arrangement, it was possible to locate the top of the new storage bunkers at the same elevation as that of the existing bunkers, thus allowing the use of the existing inclined belt conveyors that transport to the tripper conveyors from the yard.

Crushers

The type of coal crushers selected for preparing the coal and limestone were chosen primarily to provide the boiler with an as nearly as possible uniform top size specified by the boiler manufacturer. (Each boiler manufacturer's requirements for the top size selection will be discussed elsewhere in the analysis.) For both B&W and Foster Wheeler's design, a minimization of fines production was a requirement. The limestone top size product of approximately 100 percent - 1/8 in. with a minimum production of fines was required by both designs.

The type of limestone crusher chosen was an "impactor." This type of crusher was chosen because of experience in industry in crushing limestone to similar requirements.

The coal required for the Foster Wheeler design was 100 percent minus 1 in. The coal required for the B&W design was 100 percent minus 1/4 in.

In both cases, the type of crusher chosen was a "cage mill" crusher.

The crusher chosen for the B&W design is required to produce a smaller top size. To control top size for a single crusher, the material must remain in the crushing chamber until all of it is reduced. Since the crusher has a closer setting, this results in an increase in fines.

Laboratory tests on a range of coal samples should be tested, but only after it is well established what the relative effect of fines is on boiler performance. These tests will prove or disprove the merits of various types of crushers in the area of quantity of fines produced. If the quantity of fines produced still needs to be reduced, two stage crushers should be considered.

Both B&W and Foster Wheeler do not require drying of the coal and limestone in the yard.

The belt conveyors and crusher rates are identical for both manufacturer's designs. 900 tph rates were selected to be compatible with existing conveyor operation and bunkering. Normally, crushing and conveying rates are twice the required feed rates.

3.2.2 Coal and Limestone Distribution and Injection

Coal

The coal feed system chosen by Foster Wheeler is an overbed spreader stoker system. This system was chosen as a result of problems that have been encountered with the operation of existing in-bed fluidized bed systems.

The problems that have been associated with the in-bed feed systems are:

1. Large number of feed points
2. Pluggage of pipes
3. Coking in the pipes
4. Erosion

The overbed spreader stoker, by means of a rotary paddle, propels the coal onto the fluid bed. We believe that most of the problems with the in-bed system which were listed will be eliminated with the overbed stoker system. We believe the major problem does not lie in the injection system, the problem is in distributing the coal to the stokers from the bunkers. There are 60 stokers feeding the main beds, 12 per bed level. The current design includes a network of chutes from the bunkers to the stokers. The FWEC coal handling system design needs to be demonstrated to establish if even flow distribution can be maintained for long pipe distances.

The feed system selected by B&W is a pneumatic underbed feed system. This system was chosen on the basis that existing fluidized bed feed systems are in-bed feed. The B&W system incorporates pneumatic conveying from the bunkers to the boiler. Coal and limestone from the bunker is fed by gravimetric feeders into a common discharge hopper. The mixture is then pneumatically conveyed and dried in transport. There are 25 transport lines; each line is split into 40 streams before injection into the fluid bed boiler. Since pneumatic conveying is a commonly used transport system, our skepticism is in the area of each of coal/limestone lines being split into 40 lines. Problems that were stated above for the in-bed feed system on the existing fluidized bed system suggests that this system will not provide a reliable, continuous coal/limestone stream to the boiler. We believe that the injection system proposed by B&W needs to be demonstrated.

Limestone

The limestone feed system chosen by Foster Wheeler is an overbed gravity feed to one area of the bed. Foster Wheeler believes this system would promote greatest limestone utilization in a relatively simple system. Foster Wheeler has addressed matters such as feed point location, elutriation, moisture content, limestone sizing and distribution in the bed, reactions in freeboard, and past operating experience in the selection of limestone feed system.

Limestone is fed by rotary valves at the outlet of the limestone bunkers which feed, by gravity, individual lines which run to the rear of each of the main bed side walls. These locations were chosen because the bed letdown extraction points are located at the front wall and thus would provide thorough circulation of bed material and higher limestone utilization.

The elutriation of limestone fines to the freeboard zone and the amount of reaction with the coal fines in this area is a matter which needs to be demonstrated. Elutriation of unreacted limestone may be a problem in the Foster Wheeler design and must be minimized. We believe that the quantity of the elutriated limestone will be less in the underfeed system proposed by B&W, since reaction would have a greater potential to occur prior to the time the fines reach the bed surface.

We believe that the moisture content in the limestone may cause problems in transport. Bridging and rat holing may occur in the bunkers and pluggage in the feed pipes.

In the B&W design, the limestone is dried in transport; however, hang-ups can still occur in the bunkers.

3.3 Bed Material Letdown Collection and Disposal System

3.3.1 Bed Material Letdown Cooler

To eliminate the necessity of high temperature material handling equipment, the spent bed material at a temperature of 1550 F must be cooled. Foster Wheeler proposes to cool the bed material to 250 F and Babcock & Wilcox to 215 F by the use of a bed material letdown cooler.

Foster Wheeler proposed to use air to cool the bed material using a booster fan which takes suction from the discharge of the forced draft fans. Babcock & Wilcox proposes to use water-cooled screw conveyors to cool the bed material. Each manufacturer will use rotary seals to control bed material flow through its respective cooler.

The Foster Wheeler system has advantages in that spent carbon loss (6 percent of bed weight) is minimized and sensible heat is recovered. This results in higher boiler efficiency. The B&W system does not minimize spent carbon loss or recover sensible heat, resulting in significant heat loss.

However, calculations have shown that with the amount of cooling air specified by Foster Wheeler, the bed material temperature upon leaving the cooler will be greater than when it entered. This is due to the fact that there is additional heat generated upon carbon burnup.

In order for the Foster Wheeler design to function, a greater volume of cooling air is required, which requires larger equipment.

Although water-cooled screws conveyors, as B&W has proposed, have no experience in utility size power plants, application of cooling screws in other fields indicate that such a device is technically feasible. Because of the coal size B&W is feeding, spent carbon loss (1 percent of bed weight) does not severely

affect boiler efficiency. Also, sensible heat losses could be minimized by integrating the screw cooling water discharge to the boiler feed system.

In conclusion, both methods of bed letdown cooling require testing to confirm their adequacy. Based on the above, the Foster Wheeler design requires more development than the B&W.

3.3.2 Bed Material Transport to Disposal

The Foster Wheeler and B&W methods of bed letdown disposal are very similar. The bed letdown material is collected in a holding tank. By the use of air lock devices, it is pneumatically conveyed to silos in the waste treatment area. Both systems have the capability to replenish the carbon burnup bed/cell with main bed spent material. B&W, in addition, has the capability to replenish its main beds with main bed spent material, should any one of the main beds be dumped.

Because of the large amounts of bed material removed and the long distances to transport to disposal areas, continuously running large capacity removal systems are required.

3.4 Carbon Ash Collection and Reinjection System

The function of the High Carbon Ash and Reinjection System is to collect, transport, and feed the unburned combustible material elutriated from the main bed cells into the carbon burnup cell/bed in order to improve the overall boiler efficiency.

The FWEC Carbon Collection and Reinjection System takes ash collected in the main bed mechanical dust collector and economizer hoppers and pneumatically conveys it to the carbon burnup cell (CBC).

The B&W Carbon Collection and Reinjection System takes ash collected in the main bed hot precipitator hoppers to a holding tank and then pneumatically conveys it to the carbon burnup bed (CBB).

3.5 Fly Ash Collection, Transport, and Disposal

The FWEC Fly Ash Collection and Disposal System collects ash from the CBC Mechanical Dust Collector and Fabric Filter Hoppers and pneumatically conveys it to the silos in the ash waste treatment area. Ash is removed from the hoppers by a vacuum system to a primary collector where it is pneumatically conveyed to the silos.

The B&W Fly Ash Collection and Disposal System collects ash from the CBC Dust Collector and CBB Hot Precipitator hoppers and pneumatically conveys it to the silos in the ash waste treatment area. Ash is removed from the hoppers by a vacuum system to a

primary collector where it is pneumatically conveyed to the silos.

Both systems are similar in operation and are commonly used for Fly Ash Removal on other coal-fired plants.

3.6 Combustion Air and Flue Gas Systems

3.6.1 Forced Draft and Induced Draft Fans

The F.D. fans required by both boiler manufacturers are considerably larger than F.D. fans used on a normal pulverized coal (P.C.) boiler of this size, 570 Mw. The larger size fan is necessary due to the higher pressure drop across the grid and through the bed material. The fan manufacturers that B&W and FWEC have received quotes from presently have fans of this size in operation and have not experienced any difficulties.

Due to the short project duration, no attempt was made to optimize the method of drive for the F.D. fans. Any further studies or project work for the AFB should entail an optimization of the type of driver for the F.D. fans.

The I.D. fans are of a size that are commonly used by utilities and should present no problems in the design of an AFB plant.

3.6.2 Baghouse Vs Electrostatic Precipitators

The Foster Wheeler and Babcock & Wilcox designs satisfy the present Federal EPA New Source Performance Standards (NSPS) for total suspended particulate (TSP) with a cold baghouse and a hot electrostatic precipitator (ESP), respectively. Based on information from DOE, revised NSPS for TSP of 0.03 lb TSP per million Btu heat input will be proposed in early 1978. The FWEC design would comply with the revised standard without modifications to the baghouse. The B&W design will comply with the revised standards with an approximate 15 percent increase in plate area.

Based on the assumption that grid plate pluggage due to entrained particulate from the APH into the air side will not occur, there appears to be some economic merit to a baghouse over an ESP. The capital costs of a mechanical collector (for the collection of MBC elutriated char and carbon) and a baghouse (for TSP reductions to meet NSPS) are estimated at approximately 4.9 million dollars less than the two ESPs required by the B&W design. The pressure drop across the baghouse is inherently higher than the ESPs and would, therefore, require larger induced draft (I.D.) fans, resulting in an increase in their capital costs of approximately \$1/4 million. The capital cost for the baghouse system (including baghouse, mechanical collector, and larger I.D. fans) would be \$4.7 million lower than that of the original ESP system. The power requirements for the EPSS are much larger than for the baghouse. The net power requirements

for the baghouse vs the ESPs (including I.D. fan requirements) indicates an approximate 6,700 hp credit for the baghouse system. Fuel and limestone feed rates will be increased in the form of supplemental firing in the CBC due to the lower char and carbon collection efficiency of the mechanical collectors vs the ESP (90 percent versus 99 percent).

In conclusion, the net heat rate for the B&W design would be lowered by approximately 90 Btu/kw-hr with a baghouse/mechanical collector particulate collection system.

3.7 Condensate Polishing System

The base plant, being a fourth extension of an existing station, did not have a separate makeup water treatment system. However, it does have a full flow Powdex condensate polishing system. This system was designed to produce high quality water for return to the boiler. Some concern has been raised about the feasibility of a Powdex system to produce satisfactory condensate water quality for a once-through boiler (base plant is drum type). The condensate water quality will depend not only on impurities from the boiler piping etc., but also from in-leakage of circulating water. The magnitude of the problem, as a result of condensate leaks, depends largely on the quality of circulating water and the condenser integrity. Although we could conceive of conditions where a Powdex system would not be feasible, we do not believe that a Powdex system is generically inadequate for once-through boilers. For a site specific case, a detailed engineering evaluation would be conducted comparing Powdex vs deep bed condensate polishing demineralizers.

3.8 Main Steam, Hot and Cold Reheat Turbine Bypass System

The Foster Wheeler reheater and finishing superheater in-bed tubes necessitate a main steam to cold and hot reheat to condenser bypass system to ensure a minimum flow of 35 percent MCR flow through the superheater and reheater during start-up. On a boiler trip, the turbine bypass system also ensures superheater and reheater cooling as the residual carbon in the bed is burned out.

The Babcock & Wilcox superheater in-bed tubes necessitate a main steam direct to condenser bypass system to ensure a minimum flow of 40 percent MCR flow through the superheater during start-up. The reheater located in the convection pass requires a main steam to cold and hot reheat to condenser bypass system to ensure superheater and reheater cooling during a boiler trip as the residual carbon in-bed is burned out.

It can be concluded that due to the AFB concept of having tubes emersed in the bed a turbine bypass system is required to protect the superheater and reheater both during start-up and boiler trip. It can also be concluded that whether the reheater is in-

bed tubes or convection pass, a turbine bypass system is required to ensure cooling as the residual carbon in bed is burned out.

Refer to Section 5.2.5 for evaluation of the turbine bypass control systems.

Condenser performance has been evaluated for turbine bypass failure.

3.9 Turbine Generator Design Impact

Sizing

Because the steam used for stack gas reheating on the base plant is expanded to the turbine on the AFB plant, this will result in a larger turbine and generator. The larger generation is identified on the heat balances and in Table IVB-1, herein. Increased cost for the larger turbine generators are identified in Block 12 of Tables IIIA-1 and IIIB-1.

Turbine Control

As noted in Section 3.8, a superheat and reheat cooling system is required to prevent tube metal overheating during start-ups, low loads, and/or trips. While the superheater can be protected by venting excess steam to the condenser as in the B&W design, protection of the reheat necessitates introduction of steam into the cold reheat with subsequent venting from the hot reheat to the condenser.

In the Foster Wheeler design as described in Section 3.8, control of steam emission to the high pressure (HP) turbine, high pressure bypass (HP bypass), steam emission to the intermediate pressure (IP) turbine, and intermediate/low pressure turbine bypass (LP bypass necessitates that the IP turbine inlet valves-combined reheat valves (CRV) control circuit be modified to balance the IP-LP turbine flow with the HP turbine flow. This bypass system and turbine control circuit is referred to as the European bypass system. Although the experience of General Electric Co. and Westinghouse Electric Corp. with this design feature is limited, both have reviewed the system and have offered turbine generators for plants incorporating this feature. We conclude, therefore, that while additional coordination between Engineering and Design is required of the architect engineer, boiler manufacturer, and turbine generator manufacturer, this design requirement will not create any undue problems.

The B&W design does not require the initial complexity of the pressure control loop since reheater cooling is only postulated on turbine trip and, therefore, the CRV would be closed.

Difference between the two designs from a turbine generator control point of view is not considered significant.

4.0 PERFORMANCE ANALYSES AND COMPARISONS

4.1 Boiler Efficiency

General

The objective of this section is to review the reported boiler efficiencies to ensure that they are on an equivalent basis and to make any adjustments warranted by our evaluation of the design features offered.

The following design features are significant regarding the comparative efficiencies of the AFB boilers:

- Calcium Utilization
- Unburned Combustibles/Bed Letdown Heat Recovery
- Grid Pressure Drop
- Mixed Stack Gas Temperature

Calcium Utilization

In Section 5.2 of its final report (Appendix IIIB-B), FWEC states that as a result of using a post-calcination shrinking core model and causing calcination to occur in a CO₂ rich atmosphere, calcium utilization will be approximately twice as high as the test data from Alexandria and Rivesville would indicate. The FWEC position is in our judgement a postulation which requires additional tests to substantiate. In terms of boiler efficiency, however, the lower Ca/S mole ratios result in an increase in boiler efficiency, i.e., .0028 percent reduction in dry gas loss and a 0.11 percent reduction in net calcination/sulfation loss.

Since the Westinghouse test data would tend to support the Foster Wheeler postulation regarding improved calcination in a CO₂ rich atmosphere, no adjustment has been made in the Foster Wheeler reported boiler efficiency.

Unburned Combustibles

FWEC has designed on the basis of 10 ft per sec full load superficial velocity, whereas B&W has assumed 8 ft per sec. On the basis of B&W efforts for TVA after its selection of superficial velocity for this effort, B&W has concluded that a 4 ft per sec superficial velocity is warranted on the basis of carbon and calcium utilization, i.e., residence time for reaction prior to elutriation.

No adjustment in either boiler manufacturer's efficiency has been made for a 4 ft per sec superficial velocity; however, this design basis requires additional review.

However, the relative carbon elutriation can be described by the square of the ratio of superficial velocity, i.e., FWEC unburned combustibles should be $(10/8)^2$ x B&W unburned combustibles or

TABLE IVB-1

PLANT PERFORMANCE ADJUSTMENTS

Load	Babcock & Wilcox			Foster Wheeler		
	VWO*	75	50	VWO*	75	50
Reported Gross Generation ¹ , Mw	592.27	441.55	292.67	578.32	433.96	288.41
Reported Auxiliary Power ² , Mw	38.64	24.12	16.47	37.16	20.34	11.29
Reported Net Output ² , Mw	553.63	417.43	276.20	541.16	413.62	277.12
Reported Gross Station Heat Rate ² , Btu/Kw-Hr	9185	9150	9396	9355	9264	9466
Reported Net Station Heat Rate ² , Btu/Kw-Hr	9826	9678	9956	9997	9719	9851
Adjusted Auxiliary Power ³	41.48	26.24	17.87	36.75	20.04	11.10
Adjusted Net Output, Mw	550.79	415.31	274.80	541.57	413.92	277.31
Required Boiler Duty, 10 ⁶ , Btu/Hr	4673	3499	2399	4673	3499	2399
Adjusted Boiler Efficiency ⁴ , %	86.23	86.96	87.55	86.11	86.84	87.43
Adjusted Heat Input, 10 ⁶ , Btu/Hr	5419	4023	2740	5427	4029	2743
Adjusted Net Station Heat Rate, Btu/Kw-Hr	9839	9787	9971	10019	9733	9816

NOTES:

1. VWO is turbine control valves wide open at 5 percent overpressure.
2. See Heat Balances in Parts IIIA and IIIB..
3. See Table IVB-2.
4. See Table IVB-4.

2.42 percent. The reported FWEC unburned combustible loss is 2.1 percent. The difference between the 2.42 and 2.1 boiler heat loss is, in our judgement, due to a combination of the size feed to the bed, the method of feed, both of which affect the carbon elutriation, and the bed letdown carbon content.

No attempt has been made to characterize the quantitative effects of each of these variables.

Bed Letdown Heat Recovery

As noted in Section 3.3, the feasibility of the FWEC bed letdown coolers is subject to question. On this basis, we have assumed that the 0.37 percent FWEC has taken over B&W is not warranted without demonstration of the successful operation of the cooler. We have, therefore, in Table IVB-4 deducted this credit.

Grid Pressure Drop

The B&W design assumes the grid pressure drop of 9 in. H₂O at full load. Experience to date indicates that the forced draft fans for B&W would have to have a higher discharge pressure to accommodate the 22 in. W.C. grid pressure drop as discussed in Section 3.1.6. Adjustment in plant auxiliary load and capital costs have been made in Tables IVB-2 and IVB-3. However, higher discharge pressure will increase the heat of compression against the boiler efficiency. This increase in boiler efficiency is shown in Table IVB-4.

Mixed Stack Gas Temperature

B&W and FWEC assume different mixed stack gas temperatures. This assumption does not alter the turbine design but does alter plant operation. As a result, the FWEC boiler efficiency has been increased in Table IVB-4 to be compatible with the B&W mixed stack gas temperature.

4.2 Cycle Impact

Once-Through Vs Assisted Circulation

Our inspection of Tables IIIA-6, IIIB-6, and heat balances 12919.02A-HBSK-B1 and 12919.02B-HBSK-B1 shows the following:

	<u>B&W (Hp)</u>	<u>FWEC (Hp)</u>
Boiler Circulation Pump Power	1,530	-
Boiler Feed Pump Power (BFP)	<u>13,862</u>	<u>16,060</u>
Total	15,392	16,060

While it had been postulated that the increase in the FWEC boiler feed pump power would be offset by the boiler circulation pump power of B&W, it can be seen that this postulation was incorrect.

The difference, in our judgment, is due to the higher FWEC net pressure drop across the boiler.

Heat Rejection System

The AFB plant, as previously noted, permits the base plant steam used for stack gas reheating to be expanded through the turbine and thereby increase the plant generation for the same main steam flow. This will, however, result in an increase in the heat rejected to the condenser by approximately 4.2 percent. This requires a larger condenser, cooling tower, and circulating water pump and an increase in the auxiliary power requirements for these components. This small deviation was accounted for by increasing affected flows and the auxiliary power linearly and increasing the cost as noted in Section 5.

In addition, B&W elected not to recover the bed materials specific heat but to reject it to the heat rejection system, thereby increasing the heat rejection system flows and auxiliary power requirements by an additional 0.8 percent.

As noted in Sections 3.3.1 and 4.1, the bed material specific heat recovery credit assumed by FWEC has been eliminated based on our judgment of the ability of the cooler to accomplish its design objective. In the end, both the B&W and FWEC AFB plant heat rejection systems include the base plant stack gas reheating steam and the bed material cooling.

Draft Fan Drives

Due to the short project duration, no attempt was made to optimize the method of drive for the forced draft or induced draft fan. Subsequent studies should consider driving at least the F.D. fan by turbine to obtain a plant heat rate credit. This conclusion is based on recent utility industry studies which indicate that auxiliary loads of approximately 10,000 BHP can more economically be driven by turbine than by motor. The Engineering and Design complexity of this feature should not be underestimated, however.

Balance of Plant Optimization

In order to maximize the credibility of the study results, it was decided that no reoptimization of the balance plant components, i.e., feedwater heaters, turbine end size, heat rejection system, etc., would be made. In point of fact, fine tuning of the balance of plant would be of questionable value on the basis that the boiler design and performance is concluded to be 0 generation.

TABLE IVB-2

RUNNING AUXILIARY POWER COMPARISONS AND ADJUSTMENTS¹
 (All Figures in Kilowatts)

<u>Plant Load</u>	<u>Babcock & Wilcox</u>			<u>Foster Wheeler</u>		
	<u>VWO²</u>	<u>75</u>	<u>50</u>	<u>VWO²</u>	<u>75</u>	<u>50</u>
FD Fans	10769	4544	1346	12204	5148	1528
ID Fans	4713	1989	590	9340	3941	1167
PA Fans	1492	630	174	-	-	-
TA Fans/ Bed Letdown Cooling Fans	379	160	47	445	334	222
Carb. Reinj. Fans	189	80	24	189	80	24
Fly Ash Transport Blowers	378	159	47	378	159	47
Bed Material Transport Blowers	378	159	47	378	159	47
Coal and Limestone Conveyors	)					(
Coal and Limestone Crushers	) Included in "margin" below					(
Material Stock-out/Reclaim Equipment	)					(
Circulating Water Pumps	3133	3133	3133	3109	3109	3109
Condensate Pumps	1641	692	205	1641	692	205
Boiler Circulation Pumps	1530	1530	1530	-	-	-
Cooling Tower MUP Pumps	207	155	104	202	151	101
Cooling Tower Fans	1443	1082	721	1432	1074	716
Air Compressors	3357	2518	1679	3357	2518	1679
Precipitator/Baghouse	4500	4500	4500	Included in margin below		
Margin for Intermittent Loads and Other Undefined Loads						
Reported Running Auxiliary Load ¹	<u>3247</u> 38638	<u>2787</u> 24118	<u>2319</u> 16466	<u>3495</u> 37159	<u>2974</u> 20339	<u>2444</u> 11289
Adjustments:						
FD Fan						
Ambient Air Wet Bulb	45	19	6	-	-	-
Grid Pressure Drop	2800	2100	1400	-	-	-
Bed Letdown Specific Heat						
Cooler Fans	-	-	-	(445)	(334)	(222)
Heat Rejection System	-	-	-	40	36	32
Adjusted Auxiliary Power	<u>41483</u>	<u>26237</u>	<u>17872</u>	<u>36754</u>	<u>20041</u>	<u>11099</u>

TABLE IVB-3
COMPARISON AND ADJUSTMENT OF PLANT COSTS

	<u>Babcock & Wilcox</u>			<u>Foster Wheeler</u>		
	<u>Material</u>	<u>Labor</u>	<u>Total</u>	<u>Material</u>	<u>Labor</u>	<u>Total</u>
Reported Direct Costs	118,648,000	68,245,000	186,893,000	97,783,000	53,569,000	151,352,000
Direct Cost Adjustments						
Block 7A FD Fans (+20 Percent)	200,000	0	200,000	-	-	-
Block 6 Bed Letdown Coolers and Fans Versus Water Coolers	-	-	-	0	0	0
Block 14 Heat Rejection System	-	-	-	18,000	9,000	27,000
Adjusted Direct Costs	118,848,000	68,245,000	187,093,000	97,801,000	53,578,000	151,379,000
Indirects and Distributable	16,566,000	10,603,000	27,169,000	16,566,000	10,603,000	27,169,000
Subtotal	135,414,000	78,848,000	214,262,000	114,367,000	64,181,000	178,548,000
Allowance for Indeterminates	13,541,000	7,845,000	21,386,000	11,437,000	6,418,000	17,855,000
Subtotal	148,955,000	86,693,000	235,648,000	125,804,000	69,599,000	196,403,000
Escalation	26,811,000	31,989,000	58,800,000	22,644,000	25,681,000	48,325,000
Subtotal	175,766,000	118,682,000	294,348,000	148,448,000	95,280,000	244,728,000
Allowance for Funds During Construction	24,607,000	16,615,000	41,222,000	20,783,000	13,339,000	34,122,000
Total Plant Cost	200,373,000	135,297,000	335,570,000	169,231,000	108,619,000	278,850,000
Adjusted Unit Cost, \$/Kw (Net)			609			515

TABLE IVB-4

BOILER HEAT LOSS COMPARISON AND ADJUSTMENT
(All figures in percent)

<u>Load</u>	<u>Babcock & Wilcox</u>			<u>Foster Wheeler</u>		
	<u>VWO¹</u>	<u>75</u>	<u>50</u>	<u>VWO²</u>	<u>75</u>	<u>50</u>
Reported Losses: ³						
Dry Gas	5.06	-	-	4.54	-	-
Wet Gas						
Fuel	5.43	-	-	5.42	-	-
Air	0.13	-	-	0.11	-	-
Unburned Combustibles	1.55	-	-	2.10	-	-
Radiation	0.16	-	-	0.17	-	-
Unaccounted and Margin	1.50	-	-	1.50	-	-
Calcination/Sulfation	0.29	-	-	0.18	-	-
Bed Material Specific Heat	<u>0.42</u>	-	-	<u>0.05</u>	-	-
Total Losses	14.54	-	-	14.07	-	-
FD Fan Heat of Compression Over Base Plant	(0.38)			(0.45)		
Reported Boiler Efficiency ³	85.84	86.5	87.16	86.38	87.11	87.70
Adjustments						
Ambient Air Temperature						
Dry Gas	(0.39)	(0.39)	(0.39)	-	-	-
Wet Gas	0.07	0.07	0.07	-	-	-
Grid Pressure Drop	(0.07)	(0.07)	(0.07)	-	-	-
Bed Material Heat	-	-	-	0.37	0.37	0.37
Mixed Stack Gas Temperature				(0.10)	(0.10)	(0.10)
Adjusted Boiler Efficiency Plant	86.23	86.96	87.55	86.11	86.84	87.43

Reheater Drop

As in any utility plant, reheater pressure drop is critical to plant performance. Because of B&Ws use of convection reheat surface, the greater surface has resulted in a lower reheater drop, which thereby increases the IP-LP turbine power generation. The location of reheater surface is a trade-off between surface area and pressure drop.

4.3 Effect of High Freeboard on Gas-Solid Reactions

One characteristic of both the Babcock & Wilcox and Foster Wheeler conceptual designs is the high freeboard specified. The high freeboard along with the length of hot flue provides additional time for freeboard reactions to go to completion. This aspect of the process has not been demonstrated in test units to date since existing test units have small freeboard heights and, therefore, limited hot flue gas residence time. The two areas where this could be important are with respect to combustion efficiency and NOX emissions.

4.3.1 Combustion Efficiency

Combustion will occur in the freeboard as long as the gas temperature exceeds about 800 F. The effects of this combustion compared to test unit performance are expected to be as follows:

1. Reduced hydrocarbons evolution
2. Reduced CO evolution
3. Reduced fly ash production
4. Lower fly ash carbon content
5. Increased sulfur emissions

The existing experimental data which form the basis for the Rivesville MFB design and the two currently proposed conceptual designs are from test units with hot gas residence times of a fraction of a second. The Babcock & Wilcox design leads to hot gas residence times of 2-3 sec, whereas the Foster Wheeler design would yield a range of hot gas residence times of about 1.5 sec for the top bed to nearly 6 sec for the bottom bed.

The characteristics of the fly ash produced may be significantly changed. The residence time of fly ash particles in the combustion region will be determined by their size. The smallest particles, those below 100 microns, will travel at velocities near the gas velocity due to their low terminal (falling) velocities. The larger particles will travel at a velocity equal to the gas velocity minus their terminal velocity. Thus, the largest of these particles will travel very slowly upwards until they burn to a smaller size and gradually pick up speed.

Figure IVB-1 shows predicted results from the Alexandria FBM. The smallest particles completely burn out in their small residence time. The largest particles remain in the bed. An

intermediate size range of about 150 to 400 microns is calculated to be in the hot gas portion of the FBM for less time than the particle burnout time. This prediction shows good agreement with the carbon content of the fly ash actually found in the FBM.

Extension of this calculation method to the longer hot gas residence times, expected in large scale units, yields the result that fly ash production will be decreased and fly ash carbon content will be lower. Furthermore, the sulfur emitted in freeboard combustion will be inefficiently captured due to the low sorbent concentration.

One of the results of the early FBM studies was that carbon monoxide emission was a significant combustion efficiency problem. Hydrocarbon emission was also a problem when the fuel distribution was not adequate. It is expected that the longer hot gas residence time expected in large scale units will yield more complete combustion of these species. Thus, freeboard combustion may compensate for a large part of this type of emission due to fuel maldistribution if the coal feeders do not operate properly. This increased hot gas residence time may, therefore, allow overbed feeders to be used in large scale units, whereas they could not be used in smaller units.

4.3.2 Nitrogen Oxide Production

Early experience with the FBM indicated that nitrogen oxides were destroyed in the freeboard. This is illustrated by the data shown in Figure IVB-2. This can be anticipated from thermodynamic calculations of the following reaction:

This reaction equilibrium constant at bed operating temperatures predicts a nitrogen oxide equilibrium concentration of about 50 ppm. It is expected that the above reaction proceeds during the hot flue gas residence time yielding reduced levels of nitrogen oxides. The conceptual designs proposed by both manufacturers would, therefore, be expected to produce lower NOX emissions than are shown by current test unit results.

FIGURE IVB-1
COAL RESIDENCE TIME AND BURNOUT TIME VERSUS PARTICLE SIZE

KEY

- X N=1.49% NITROGEN IN FUEL-MOISTURE AND ASH FREE BASIS
- O N=2.02% NITROGEN IN FUEL-MOISTURE AND ASH FREE BASIS
- FORMED IN COMBUSTION ZONE
- EMITTED FROM STACK

FIGURE IVB-2
NITROGEN OXIDES IN FLUE GAS OF FBM

5.0 ECONOMIC ANALYSES AND COMPARISONS

5.1 Capital Costs

5.1.1 Bases and Assumptions

The capital cost pricing for the AFB plant consists of the base plant pricing with additions and deletions noted in Tables IIIA-2 and IIIB-2. This alternate pricing was developed in one of the following manners as noted on Table IVB-5 and as identified in subsequent sections:

- Deletion of base plant price
- Adjustment of base plant price using the 0.8 power
- Replacement of base plant price with vendor supplied pricing

5.1.2 Boiler and Related Equipment

The price for equipment for the conventional boiler manufacturers' scope of supply was developed in a manner consistent with the boiler manufacturers' current offerings for conventional equipment. In addition, the pricing assumed that the technology had been demonstrated and, therefore, no margin above that currently used on pulverized coal technology was included for the unknowns of the AFB technology.

While the pricing basis for the AFB boiler was developed on a proprietary basis by both manufacturers, in our judgment, the reported pricing represents the boiler manufacturers' best estimate based on the engineering and design detail permitted by project schedules.

It should be noted that the pricing included in the boiler manufacturers' final report are October, 1977, prices. These data were deescalated by the factors noted in Table I-2 to January, 1976, to permit comparison with the base plant pricing.

5.1.3 Balance of Plant

In general, the balance of plant adjustments were made by deletion of nonapplicable components or specific cost adjustment based on percent change and capacity from base plant raised to the 0.8 power.

The adjustments from the base plant for draft fans, ductwork, and air pollution control equipment were generated by the boiler manufacturers. Boiler manufacturers' price for these components does not include a markup.

The adjustment in turbine generator pricing was developed using then available manufacturer's price book with a 0.71 handbook multiplier.

The heat rejection system cost adjustment was based on a 5 percent increase in capacity which is equivalent to a 4 percent increase in cost.

Increase in boiler feed pump and start-up boiler feed pump pricing was based on a manufacturer's estimate.

The coal handling and preparation equipment costs were submitted by conveyor and crusher manufacturers. The cost for the new crusher house structure was prepared using the base plant costs.

The bed material transport and fly ash transport to disposal system costs were developed in conjunction with material manufacturer.

5.1.4 Allowance for Indeterminants

The allowance for indeterminants in both AFB capital cost estimates is 10 percent of the total direct, and distributable costs. This is consistent with the base plant estimate.

5.1.5 Escalation

In both AFB estimates, a compound escalation of 3.25 percent per year for material and 7.25 percent per year for labor was applied to the total January, 1976, costs through July, 1980. This is consistent with the base plant estimate.

5.1.6 Allowance for Funds Used During Construction

A simple 8 percent per year allowance was included in both AFB capital cost estimates from July, 1980, to April, 1982, to account for funds used during construction. This is consistent with the base plant estimate.

5.2 Operating Costs

5.2.1 Bases

Operating costs have been developed for the AFB designs using the net station output and a capacity factor of 63.74 percent as noted in Table I-2. These costs are segregated into the following categories:

- Capital recovery (fixed charges)
- Fuel costs
- Limestone costs
- Operating and maintenance costs

5.2.2 Capital Recovery (Fixed charges)

The capital recovery portion of the operating costs were developed by multiplying the 1982 plant costs by the fixed charge rate (15.35 percent) and dividing by the levelized annual station

TABLE IVB-5

PLANT COST CHANGE COMPARISON
(All Figures in Millions of Dollars)

<u>Block</u>	<u>Description</u>	<u>B&W Change</u>	<u>FWEC Change</u>
1	Land	N/I	N/I
2	Yard Work	N/C	N/C
3	Main Powerhouse	4.081	(3.099)
6	Boiler by Boiler Mfr.	22.001	(1.040)
7	Boiler Feed Pump and Drive	(0.040)	0.113
7	Turbine Bypass/Reheater Cooling	0.523	0.470
7	FD and ID Fans, Drives, and Ducts	(1,800,003)	(1,322,833)
7	Start-up Boiler Feed Pump	0.897	0.793
7	Flash Tank and Chemical Feed	N/C	(0.064)
7	Ash and Bed Material Transport	7.119	7.119
8	Conveyors, Crushers, and Crusher House	3.718	6.283
8	Coal Bunkers	0.680	0.413
8	Bunker/Boiler Piping, Gates, etc.	0.372	0.172
9	Stack	(0.173)	(0.173)
10	Precipitator/Baghouse	3.919	0.432
10	Structural Steel and Foundations	2.249	0.974
11	Flue Gas Desulfurization	(28.093)	(28.093)
12	Turbine Generator	0.150	0.150
13	Component Cooling Water	0.114	N/C
14	Condenser	0.056	0.056
14	Circulating Water and Pumps	0.030	0.025
14	Cooling Tower	0.120	0.098
15	Water Treatment	N/C	N/C
16	Sludge Stabilization	(3.884)	(3.884)
17	Station Service Transformer	0.535	0.535

<u>Block</u>	<u>Description</u>	<u>B&W</u>	<u>FWEC Change</u>
17	Switchgear and FGD	(0.162)	(0.136)
17	Substations and MCC	0.210	0.141
17	Bus Duct and Cables	0.275	0.267
17	Instrumentation and Control	2.674	0.293
18	Miscellaneous Equipment	N/C	N/C
19	Main Transformer	N/C	N/C
20	Transmission Lines	<u>N/I</u>	<u>N/I</u>
	Total	14.723	-20.813

Notes: N/C - No change
N/I = Not included

output. This is consistent with the methodology used for the base plant.

5.2.3 Fuel Costs

Lifetime fuel costs for each AFB plant were computed using the annual coal used (tons per year) at a fuel cost of \$21.25 per ton (1982) at a 7 percent annual fuel cost escalation. This cost was then levelized using a present worth discount rate of 10.5 percent for each year. The total lifetime fuel cost was then multiplied by the capital recovery factor and then divided by the levelized annual station output (.6374 x VWO net output). Refer to Tables IIIA-3 and IIIB-3 for annual fuel operating costs. This above procedure was performed again using the adjusted coal feed rates noted on Table IVB-6, and the adjusted annual fuel operating costs are noted on Table IVB-7.

5.2.4 Limestone Costs

Lifetime limestone costs for each AFB plant were computed using the annual limestone used (tons per year) at a limestone cost of \$12.75 per ton (1982) at a 5.5 percent annual cost escalation. This cost was then levelized using a present worth discount rate of 10.5 percent for each year. The total lifetime limestone cost was then multiplied by the capital recovery factor and then divided by the levelized annual station output (.6374 x VWO net output). Refer to Tables IIIA-3 and IIIB-3 for annual limestone operating costs. This above procedure was performed again using the adjusted limestone feed rates noted on Table IVB-6, and adjusted annual limestone operating costs are noted on Table IVB-7.

5.2.5 Operation and Maintenance Costs

The operating and maintenance costs for the base plant were reduced by the FGD operation and maintenance cost noted in Appendix I-D. This operating cost was then assumed to be equivalent to a pulverized coal-fired plant without FGD. This cost was then arbitrarily increased to 10 percent for both the FWEC and B&W AFB plants. The results in O&M cost was then adjusted by ratio BWO plant output for that manufacturer as compared to the base plant.

6.0 CONTROL SYSTEMS ANALYSES AND COMPARISONS

6.1 Introduction

Since, at this time, there is neither predictive data from a mathematical model nor experimental data from an operating FBC utilizing the design features of BW and FWEC, it is not possible to critically evaluate the effectiveness of the proposed control systems for the respective boiler designs beyond pointing out differences and areas of concern. The objective of this control system evaluation/comparison will be to identify areas of

uncertainty and differences between the B&W and FWEC controls and to raise questions about the respective control systems. Since a control system does not have to be finalized until late in design, any control system can incorporate recommended changes based on results from computer models and experimental data.

6.2 Boiler Load Control Parameters

6.2.1 Coal Feed

Both vendors utilize modulation of coal feed for load turndown for each segment/compartment. Because of the larger coal size, the response time to change the bed temperature for the FWEC design would be longer than for the B&W design. The FWEC coal-feed controls would have to include a corrective control action to inhibit excessive over- or underfiring while at the same time providing adequate unit responsiveness to load demand.

There is also an additional delay in the FWEC design introduced by the time required to change the stoker feeder speed. However, this delay is not expected to be significant.

Items that would need further clarification, as the design progresses for the respective AFB boilers, are:

1. A recommendation for the start-up and shutdown of the bed compartment sequence for meeting load demands for B&W design
2. The location of digital permissives for tripping and hold points for start-up and shutdown in the FWEC boiler control logic
3. How FWEC would incorporate a Btu correction for coal into their combustion controls

B&W presents a clearer logic picture of how the furnace firing rate demand is split between the boiling bed surface demand and the superheater bed surface demand. B&W also shows how both of these error signals are scaled in sensitivity by the number of compartments in service.

TABLE IVB-6

ADJUSTMENTS TO PLANT MATERIAL BALANCES, TPH
(All Figures in Tons Per Hour)

	<u>Babcock & Wilcox</u>			<u>Foster Wheeler</u>		
	<u>VWO</u>	<u>75</u>	<u>50</u>	<u>VWO</u>	<u>75</u>	<u>50</u>
Reported Coal Flow	245.46	182.30	124.08	244.45	181.40	123.18
Adjustments						
Boiler Efficiency - Grid Pressure Drop	(0.20)	(0.15)	(0.10)	-	-	-
Boiler Efficiency - Bed Material Heat Recovery	-	-	-	1.05	0.77	0.52
Boiler Efficiency - Stack Gas Temperature	-	-	-	(0.28)	(0.21)	(0.14)
Adjusted Coal Flow	245.26	182.15	123.98	245.22	181.96	123.56
Reported Limestone Flow	52.55	38.62	26.29	47.18	35.01	23.77
Adjustments						
Boiler Efficiency - Grid Pressure Drop	(0.04)	(0.03)	(0.02)	-	-	-
Boiler Efficiency - Bed Material Heat Recovery	-	-	-	0.20	0.15	0.10
Boiler Efficiency - Stack Gas Temperature	-	-	-	(0.05)	(0.04)	(0.03)
Adjusted Limestone Flow	52.51	38.59	26.27	47.33	35.12	23.84
Reported Solid Waste	70.89	52.14	35.48	69.5	51.57	35.02
Adjustments						
Boiler Efficiency - Grid Pressure Drop	(0.06)	(0.04)	(0.03)	-	-	-
Boiler Efficiency - Bed Material Heat Recovery	-	-	-	0.30	0.22	0.15
Boiler Efficiency - Stack Gas Temperature	-	-	-	(0.08)	(0.06)	(0.04)
Adjusted Solid Waste	70.83	52.10	35.45	69.72	51.73	35.13

TABLE IVB-7

ADJUSTED ANNUAL OPERATING COSTS, MILLS/KW-HR

	<u>Foster Wheeler</u>	<u>Babcock & Wilcox</u>
Fuel	18.16	17.75
Limestone	1.81	1.95

6.2.2 Bed Temperature

The problems of utilizing bed temperature as a control variable are not insurmountable but would require experimental testing to solve the following problems:

1. Bed material temperature measurement location - Since the bed material temperature varies throughout the bed, the location of temperature measurement devices should be determined to give a representative bed material temperature. The bed temperature monitors would simultaneously have to provide signals to prevent any local hot-spot temperature from exceeding the limits as required for safe operation.
2. Because of the slow response of bed temperature, a degree of undershoot and overshoot of coal and air in excess of a conventional pulverized coal-boiler would be required to adjust the bed temperature, since the bed mass is large and the rate of temperature change would be slow.
3. Since the calcium utilization curve demands more limestone at bed temperatures both higher and lower than 1500-1600 F, the calcination heat losses would increase at bed temperatures above and below this range. These calcination heat losses would tend to inhibit a steady state bed temperature higher or lower than the 1500-1600 F range since the additional limestone would cause the bed temperature to drop on the low side of 1550 F and inhibit bed temperature above 1550 F. The calcination heat losses would further decrease boiler efficiency.

6.2.3 Bed Level

Bed level does not seem to be a controllable variable for load turndown for the following reasons:

1. The horizontal configuration of bed tubes in the B&W and FWEC designs does not provide wide range of bed material height vs steam generation rate to make effective use of a level signal.
2. The effects of exposing bed tubes due to level modulation are not clearly known; overheating of lower submerged tubes may occur.
3. Since the actual bed level is continuously changing due to violent bubble eruptions throughout the bed surface an accurate measurement of the bed material level would not be a meaningful measurement.

4. Air modulation to change bed level would adversely effect combustion efficiency because coal combustion could not respond as quickly.
5. Utilizing the bed letdown system to change the bed level would be slow and inefficient because of the large volume of bed material required to adjust the bed material height.

It is our judgement that at this time it is premature to postulate a bed level control for load turndown with the two designs presented.

However, the alternative to varying the bed level would be to maintain a constant bed level. This means that optimum air/fuel ratio cannot be maintained for all loads since the undergrid secondary air dampers would be positioned to maintain a constant bed material expansion height as the coal feed rate is changed.

6.2.4 Bed Slumping

Bed slumping to achieve load modulation offers the most favorable degree of load turndown capability for the B&W and FWEC designs, however, areas of concern are as follows:

Due to overbed or freeboard combustion, excessive temperatures may result at the surface of the slumped section causing high temperature problems (ash fusion, clinkering, etc.). This would be continuous problem for the B&W design since the center start-up section is always slumped during normal operation. Bed slumping to achieve turndown may require some minor air/fuel modulation of the remaining segments/compartments as a segment is slumped. This can be achieved.

Slumping a bed on a turbine trip may cause problems since a burnout of residual carbon is required. If this residual carbon is burned out at the minimum fluidizing velocity, a reducing atmosphere could possibly be expected to form within the bed. It is not known whether this reducing zone will cause problems during the coal burnout time. If a higher minimum fluidizing velocity is required to avoid any reducing zone problems, the resulting steam generation rate may cause the safety valves to lift.

6.2.5 Turbine Bypass

A turbine bypass sytem is required by the AFB boiler to maintain minimum steam flows at low loads for in-bed cooling and for minimum steam flow for bed cooling after a turbine trip. This means the AFB boiler can never be fired at less than 40-35 percent MCR. The bypass system will require control loops to ensure:

1. Balanced flows between the HP and IP/LP turbines on a start-up and shutdown
2. Minimum flow of steam/water through fired beds on a turbine trip
3. Simultaneous control of:

For the FWEC design:

4 HP bypass valves and 4 IP/LP bypass valves

For the B&W design:

3 HP bypass valves for start-up and shutdown
4 reheater cooling inlet control valves and 4 reheater cooling outlet control valves for a turbine trip condition

However, the advantages of a bypass system are as follows:

1. Smooth warming of the main steam line preventing thermal shocks and stresses.
2. Capability of matching main steam and reheat steam temperature before rolling the turbine.
3. Faster hot restarts since the boiler can be kept on hot standby.
4. Load rejection without the necessity of tripping the boiler.

6.3 Combustion Controls

6.3.1 Main Bed Combustion Controls

Because of the B&W pneumatic underfeed coal system, additional controls are required for the primary and tempering air fans and dampers. It is essential that these controls operate properly to ensure continuous supply of dry coal. FWEC needs no similar system because they utilize overbed stoker feeders that have no requirement for drying.

Although no logic is shown, FWEC utilizes a constant pressure control for the F.D. fan discharge. No mention is made of any interlocks. B&W programs forced draft fan discharge pressure with the boiler load demand to minimize undergrid damper modulation on a change of load. Interlocks with safety features are also incorporated.

B&W incorporates an oxygen trim in the combustion air control, within the limits of fluidizing velocity. FWEC does not mention any oxygen trim. The usefulness of an oxygen trim is doubtful

since the airflow has to be held constant to maintain proper fluidizing velocity. Both designs cross-limit fuel and air modulation to avoid a reducing atmosphere. Both designs provide close control over the I.D. fan dampers. B&W allows the operator to bias the I.D. dampers to achieve balance of gas flow between the two fans.

The differences in I.D. and F.D. fan control are not significant and either design is adequate.

Both vendors provide implosion protection for a main fuel trip. It is not clear how a fuel trip on a fluid bed boiler would cause implosion problems, however, these controls can be easily altered. FWEC provides additional implosion protection by controlling the I.D. fan discharge damper if the I.D. fan inlet damper fails open. B&W shows more clearly than FWEC how the start-up and shutdown interlocks are incorporated in the analog control system.

B&W utilizes a fuel demand signal for a bed level set point. The problems of utilizing a bed level to attain turndown is described in Section 6.2.3.

6.3.2 CBB/CBC Combustion Control

The B&W design for the CBB firing rate demand incorporates a feed forward signal from the boiler load demand. This allows the CBB to adjust the char feed in anticipation of a change in bed temperature; whereas the operation of the FWEC CBC is designed to burn the char as it is produced with the use of supplemental coal feed to maintain CBC bed temperature as required. FWEC does not provide any anticipatory feed forward signal for load changes.

Since the B&W design includes a char feed tank, there is always an available storage of char which is used to meet temperature changes. In comparison with FWEC, the B&W CBB operation would require less supplemental coal and associated limestone feed to maintain the CBB temperature.

6.4 Bed Material Control

B&W does not try to trim limestone feed with the SO₂ measurements but allows the operator to make changes in the sorbent flow ratio. FWEC utilizes a three-element limestone feed control that incorporates an SO₂ trim. It is not clear as to why SO₂ measuring devices should be utilized to provide an SO₂ signal for the analog limestone feed control. It might be desirable to incorporate a workable automatic SO₂ trim in the limestone feed controls; however, in our judgement, it is adequate to utilize an operator adjustable SO₂ trim.

FWEC shows a differential pressure arrangement to determine bed level for the bed letdown devices. B&W does not indicate how a measurement of bed level would be achieved. The B&W limestone

feed and ash rotary seal speed control does not seem to allow for a constant inventory of limestone with a limestone input/output matching loop. FWEC matches the limestone feed and bed letdown with an adjustment for bed level. The following items are questionable with the B&W bed material controls:

1. Why the bed temperature is supposed to affect the ash rotary seal speed.
2. Why an increase in bed temperature increases the coal/limestone feed and decreases the bed letdown.
3. Why the limestone feed and the bed letdown have been decoupled.
4. Why a bed level error has to be sensed before the limestone feed is affected.

6.5 General

Because of the inventory of water contained within the B&W boiler and because of the assisted circulation, it is likely that a loss of feedwater will not cause tubes to overheat. Because of the once-through design, it is necessary to investigate further whether the FWEC boiler can sustain a loss of feedwater and maintain sufficient tube cooling during the required coal burnout time.

Tube leaks in a drum type boiler would be comparatively easier to detect than in a once-through design. The water chemistry requirements within a once-through boiler are so strict that small leaks cannot be detected by sudden changes in the boiler water chemistry as is the case with a drum type boiler. While small leaks would not pose a problem within submerged bed tubes, large leaks could cause the limestone to react with the water to form harmful cementitious compounds. Neither boiler manufacturer at this time, has a suitable method for detecting and correcting large tube leaks.

The B&W boiler control logic shows a turbine control based on throttle pressure error. This means that the turbine-generator output will only be varied after the boiler pressure has been adjusted by a change in the firing rate for the load. With this design, megawatt response is relatively slow since the faster responding pressure control loop does not allow the turbine to borrow energy stored in the boiler during transients.

The FWEC boiler control logic, however, allows the boiler and turbine to respond to load changes simultaneously. This coordinated control is a more conventional, faster responding control system than the controls proposed by B&W.

The question arises as to why B&W imposes a relatively less responsive system on their boiler-turbine controls.

6.6 Conclusions

As was stated earlier, it is not possible to pass judgement on the validity of the control systems presented. However, the effort has been a worthwhile and necessary step toward evolving an effective AFB boiler control system.

It is obvious from the approaches of the two manufacturers that the knowledge of the fluid bed process is limited for this application. The next logical step would be to simulate the control systems to determine the suitability of each design.

With the development of the open loop, S&W AFB system model, Part V of this report, the control strategies for parameters such as bed height and temperature, proper handling of the dynamic effects on the boiler such as coal particle burnup time, co-ordinated unit load control, etc., may be confirmed or modified by applying the proposed control concepts to the model. Thus, the suitability of the once-through unit controls and those of the drum boiler concept, with appropriate model modifications, could be confirmed or recommendations developed for appropriate changes. The systems would be evaluated for normal load range operation, start-up, and fast transients such as load rejections or plant trips. It is recommended that the AFB model work be extended to include these further checks on the control system design.

7.0 ELECTRICAL SYSTEMS ANALYSIS AND COMPARISON

7.1 General

The auxiliary station service systems for the B&W and FWEC AFB plants are similar in size and arrangement. Each system consists of one main and one reserve station service transformer with three voltage levels for feeding major loads; 13.8 kv, 4.16 kv, and 480 v. Load tap changers are provided for the auxiliary station service transformers to improve voltage regulation at the 480 v level.

The factors leading to the design of the station service system arrangement and the major differences between the B&W and FWEC systems are discussed below.

7.2 Technical Feasibility

Several alternative arrangements for the station service systems were considered, including changes in the number of transformers and switchgear buses, and different voltage levels. The final design was chosen based on economic and technical factors. Although not the only possible arrangement, the final design incorporates the best combination of economic and technical factors of all systems studied.

7.2.1 Motor Starting Considerations

The major problem posed by both the B&W and FWEC AFB plants is the starting of the large motors for the F.D. and I.D. fans. A motor during starting draws a large current which in turn causes a drop in voltage. It is desirable to maintain a minimum of 80 percent of full load motor terminal voltage to minimize voltage fluctuations in the rest of the system. Multispeed motors and variable speed drives cause less voltage drop but are technically unproven and economically unfeasible for such large motors.

The FWEC motors are larger than the B&W motors and accordingly present more of a problem. A study of the station service system indicated that the large motors in the FWEC plant would have to be rated at 13.2 kv for satisfactory starting performance.

For the B&W plant, it is technically feasible to use 6.6 kv motors which are less expensive than 13.2 kv motors. However, starting performance is marginal, and this arrangement was rejected for other reasons detailed in Sections 7.2.3 and 7.2.4.

There are no motor starting problems with the 4 kv motors in either the B&W or FWEC plants. Load tap changers are provided for the auxiliary station service transformers to improve voltage regulation at the 480 v level. The load tap changers could be eliminated if the 480 v substations were fed directly from the 13.8 kv switchgear bus, but this would entail additional expense in the switchgear bus and substation transformers. The decision to use the load tap changers was based on economics.

7.2.2 Auxiliary Station Service Load

The expected station service electrical load for B&W is approximately 1 percent higher than for the FWEC plant. Detailed figures are presented elsewhere in this report. Although the totals for both plants are similar, the FWEC plant has a greater 13.8 kv load, and B&W has a greater 4 kv and 480 v load. These differences are reflected primarily in equipment sizes and capital costs for the two plants.

7.2.3 Equipment Sizes and Ratings

The impedances of the unit and reserve station-service transformers are selected to allow 80 percent starting of all motors without exceeding the short circuit withstand capability of the medium voltage switchgear. The 13.8 kv switchgear used in both plants is 750 kva class. In order to use 6.9 kv switchgear for the B&W plant, the load would have to be divided among more switchgear buses and more transformer secondaries to accommodate the lower short circuit withstand capability of this switchgear.

There are a greater number of 4.16 kv breakers for the B&W plant because of the larger 4 kv motor load, and there are more 480

unit substations, primarily because of the large precipitator load.

7.2.4 Capital and Operating Costs

Capital and operating costs are detailed elsewhere in this report. Differences in capital costs for the electrical systems of the two plants arise because of additional cable and 4.16 kv switchgear required for the B&W plant. Operating costs should be approximately the same for the two plants because the total station-service loads are about the same.

8.0 ENVIRONMENTAL ANALYSES AND COMPARISONS

8.1 Air Quality

8.1.1 Sulfur Dioxide Emissions

The sulfur dioxide (SO₂) emissions, predicted by both manufacturers, reflect compliance with present Federal EPA New Source Performance Standards (NSPS) emission limitations for SO₂ of 1.2 lb SO₂ per million Btu. Predicted SO₂ emissions from the B&W and FWEC designed boilers are 1.2 and 1.16 lb SO₂ per million Btu, respectively. For purposes of this evaluation, both SO₂ emission rates are considered equivalent at 1.2 lb SO₂ per million Btu. Achievement of compliance SO₂ emission rates require a calcium-to-sulfur (Ca/s) molar ratio of 2.5 and 2.1 for B&W and FWEC, respectively.

Promulgation of the Clean Air Act Amendments of 1977, in August 1977, proposed that the existing NSPS emission limitations for SO₂ be revised within one year (August 1978). These revisions will include: (1) a required percentage reduction in sulfur dioxide emissions and (2) a revised weight emission limitation. It is anticipated that in February, 1978, the revised NSPS for SO₂ will be proposed. These revised NSPS will require a 90 percent reduction in SO₂ emissions with a maximum emission limitation of 1.2 lb SO₂ per million Btu and a minimum of 0.2 lb SO₂ per million Btu.

It is the opinion of both manufacturers that achievement of a 90 percent reduction in SO₂ emissions is possible with present designs and would require a CA/S molar ratio of approximately 3.9 with existing operating parameters. An increase of Ca/S molar ratio would also generate a larger quantity of solid waste.

Both manufacturers have designed their boilers to attain 1.2 lb SO₂ per million Btu. It is believed that an AFB boiler designed for 90 percent reduction in SO₂ emissions may employ operating parameters different from present design to minimize the high limestone consumption needed with present operating parameters. This area of concern requires additional study with subsequent testing and evaluation.

8.1.2 Oxides of Nitrogen (NOx) Emissions

The boiler manufacturers have designed their boilers to meet New Source Performance Standards (NSPS) emission limitations for NOx of 0.7 lb NOx per million Btu. B&W and FWEC have predicted the NOx emissions from their boilers to be approximately 0.5 and 0.3 lb NOx per million Btu, respectively. Since both boilers have similar operating parameters (i.e., bed height, superficial gas velocity, excess air and temperature) and are firing the same fuel, it would be expected that these emissions should not reflect this great a discrepancy between the two designs. It is our opinion that these emissions differ due to the use of different models utilized in predicting the NOx emissions from their respective boilers. It is, therefore, believed that neither predicted emission is incorrect, but that they reflect the range of NOx emissions (.3-.5 lb NOx/MMBtu) that can be expected from the operation of a 570 Mw AFB boiler.

Promulgation of the Clean Air Act Amendments of 1977, in August 1977, proposed that revised NSPS emission limitations for NOx be promulgated within one year (August 1978). A proposed revised NOx NSPS emission limitation of 0.6 lb NOx per million Btu is anticipated in February 1978 and is expected to be promulgated by August 1978. It is expected that the proposed revised NOx NSPS emission limitations of 0.6 lb NOx per million Btu would be satisfied by both designs.

8.1.3 Total Suspended Particulate (TSP) Emissions

The present Federal EPA New Source Performance Standards (NSPS) emission limitation for TSP is 0.1 lb TSP per million Btu. Both manufacturers have designed their systems to attain 0.06 lb TSP per million Btu, which was specified by Stone & Webster, and is in compliance with NSPS. TSP emission rates are achieved by use of two hot electrostatic precipitators (ESP) for the B&W design and mechanical collectors and a baghouse for the FWEC design. Promulgation of the Clean Air Act Amendments of 1977, in August 1977, requires a revision of NSPS emission limitations for TSP within one year (August, 1978). It is anticipated that a revised TSP NSPS emission limitation of 0.03 lb TSP per million Btu will be proposed by February 1978. This revised NSPS particulate emission limitation can be achieved by the baghouse as currently designed by FWEC. The B&W hot ESP's will require an increase in size (plate area) by approximately 15 percent to satisfy the revised TSP NSPS emission limitation.

At this time, there is some disagreement in the industry as to whether (1) hot ESPs can be designed to effectively collect both high carbon content material and high calcium material and, (2) with the use of a cold baghouse, will high particulate loadings in the air heater cause entrainment of particulate matter in the primary air stream and subsequent pluggage of the air distributor plate.

It is recommended that a test program be initiated to characterize particulate emissions from AFB boilers to establish the most cost effective method for complying with particulate requirements from both environmental and process viewpoints.

8.2 Solid Wastes

Solid wastes from the AFB plant include bed material and elutriated material collected in the particulate collection system. Both of these wastes consist of calcium sulfate, calcium oxide, fly ash, bottom ash, and other inert materials. The quantities of solid waste from the AFB plant designs are approximately 140,000 lb per hour for the B&W design and 125,000 lb per hour for the FWEC design. The discrepancy in the quantity of solid waste generated for the two designs is due to higher CA/S molar ratio predicted for the B&W design (2.5 vs 2.1).

Conceptually, the AFB solid wastes from both designs would be pneumatically conveyed to silos and subsequently trucked to the landfill area being worked. Both designs would use the 120 acre solid waste disposal area with a total required landfill height of approximately 38 and 34 ft for the B&W and Foster Wheeler designs, respectively.

Based on the results of studies conducted under DOE and EPA contracts for AFB solid waste disposal, land disposal of solid wastes generated from an AFB boiler will not have adverse environmental effects. In fact, studies have shown the material to be both structurally stable and durable for landfilling. Results of leaching tests have also found the material feasible for landfilling.

Revisions of NSPS (as discussed in Section 8.1.1, Sulfur Dioxide Emissions) will require greater amounts of limestone and inherently greater quantities of solid wastes. This area of concern requires additional study with subsequent testing and evaluation to minimize limestone consumption and solid waste generation.

8.3 Conclusions

The following are the environmental design criteria that were set by Stone & Webster at the start of this project:

<u>Pollutant</u>	<u>Maximum Emission Rate</u>
SO ₂	1.2 lb per MM Btu
NO _x	0.7 lb per MM Btu
TSP	0.06 lb per MM Btu

For purposes of this evaluation, both the B&W and FWEC designs have predicted meeting the above design criteria. It is also expected that both manufacturers' designs would satisfy

anticipated revised NSPS with minor particulate control equipment modifications. The quantity of solid wastes generated by the B&W design is slightly greater than the FWEC design due to a higher calcium-to-sulfur molar ratio caused by lower limestone utilization. Land disposal of solid wastes generated from an AFB boiler will not have adverse environmental effects. In fact, studies have shown the material to be both structurally stable and durable in landfilling.

In summary, both designs satisfy the environmental design criteria set by S&W.

9.0 CONSTRUCTION SCHEDULE

The Babcock & Wilcox AFB construction schedule is comparable to a conventional pulverized coal plant construction schedule. A Foster Wheeler construction schedule was not received. Since no contradictory information has been indicated, we assume the Foster Wheeler AFB construction schedule is also comparable.

10.0 OTHER ANALYSES AND COMPARISONS

PART V

**ATMOSPHERIC FLUIDIZED BED
PLANT MODEL ANALYSIS
FOR
LOAD-FOLLOWING CAPABILITY**

ABSTRACT

The load-following capability of a once-through Subcritical Atmospheric Fluidized Bed Boiler is analyzed. Digital computer simulation predictions of the plant's response to open loop step changes in firing rate, feedwater flow, governor valve, unit load demand, etc, are made. The predicted response of throttle pressure, steam temperature, unit load, etc, are compared to the response of a conventional coal-fired, once-through, subcritical unit. The load-following capability is assessed through this qualitative comparison. Additional model response predictions are also presented for which no test data are presently available.

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Appendix

- A1. Overall AFB Model Solution Diagram

1.0 INTRODUCTION

1.1 General

There has been a very rapid increase in the size of power systems during the decades of the fifties and sixties, and it is still growing today. If the present trend continues, one can foresee that in the seventies and eighties the power companies will experience an even greater increase in the total peak MW demand. Due to the higher cost of coal, oil, and natural gas total energy consumption will not increase as fast since the price of electric energy will tend to increase. The gap between the daily base load and the daily peak MW load demand will increase. This increase in the magnitude of cycling load demand would necessitate the need for more responsive fossil units.

Furthermore, in the next decade, as more nuclear units with their low incremental operating cost are put into service, the burden of following minute-to-minute load demands will be placed heavily on fossil-fired units.

The Atmospheric Fluidized Bed (AFB) with the ability to burn more abundant high sulfur coal, and with a useful byproduct, may provide such load-following capability with minimum environmental impact. The questions remaining are:

- a. What plant and control system configurations should be employed?
- b. Will its load-following ability be adequate?

This study addresses the second question for a particular plant configuration as explained in the following objective:

1.2 Objective

The objective of this effort is to predict the open loop response characteristics of the Foster Wheeler Energy Corporation Atmospheric Fluidized Bed (AFB) plant to step changes in controlled variables for comparison with typical results for a conventional pulverized coal-fired, once-through, utility unit to ascertain the AFB load-following capabilities.

2.0 DESCRIPTION OF THE ATMOSPHERIC FLUIDIZED BED PLANT

The 570 Mw AFB plant is briefly described in this section to provide a background for the load-following capability study. The AFB plant consists of:

- a. One Foster Wheeler designed subcritical, once-through AFB steam generator, and
- b. The associated balance of plant equipment for power generation.

Figure 1 shows the arrangement of the various elements that would comprise the AFB steam generator. The AFB steam generator consists of five main bed cells (MBC) stacked vertically over one another and a single carbon burnup cell (CBC) which is located to the rear of the MBC stack. Heat transfer surfaces in MBCs are arranged for boiling, superheat, and reheat duty.

Figure 2 shows the simplified water, steam, and air-gas schematic for the AFB steam power plant. Combustion air requirements of the AFB steam generator are furnished by two forced draft (F.D.) fans. Combustion air is preheated through the air preheaters before being introduced to the MBCs and the CBC compartmented plenums beneath each cell. Airflow to each compartment is regulated by individual dampers. Gaseous combustion products from each cell passes through the cell freeboard and the common gas column before being directed over the convection reheater and the primary superheater arranged in the heat recovery area (HRA).

Gas flow through the HRA is biased by means of automatic reheat temperature control dampers. Gases leaving the dampers pass over an extended surface economizer and are cooled prior to entering the dust collector trains. Finally, the gases are discharged to the stack via the regenerative air heaters, baghouse collector, and the induced draft (I.D.) fan.

Feedwater enters the steam generator through the HRA extended surface economizer (ECON1). The feedwater then passes through convection economizer (ECON2) above the CBC bed, and through the CBC in-bed heating surface (ECON3). The feedwater then passes through the CBC walls to the MBC in-bed steam generating surfaces. Transition from water to steam-water mixture occurs within MBC bed BB2. The steam/water mixture leaving BB2 then passes through the steam generator enclosure in the following order: front wall (FW), sidewalls (SW), rear wall (RW), gas pass (GP), heat recovery area (HRA), and roof (ROOF). Transition from a two-phase mixture to superheated steam occurs in the RW pass at full-load conditions.

From the ROOF outlet, superheated steam passes through integral separators which are required during start-up and for low load operation to separate the steam and the water. After passing through the separator, the superheated steam passes through the convection superheater (PR1) in the HRA and then passes through

570 MW AFB
STEAM GENERATOR

FIGURE 1
ONCE THROUGH ATMOSPHERIC FLUIDIZED BED BOILER

LEGEND			
WATER/STEAM		GAS/AIR	
AD	AIR DISTRIBUTION DAMPER	HP	HIGH PRESSURE TURBINE
AH	AIR HEATER	MBC	MAIN BURNUP CELL
CB	CARBON BURNUP CELL (CBC)	PS	PRIMARY SUPERHEATER
EC	ECONOMIZER	RB	REHEAT BED
EB	BOILING BEDS BB 1&2	RH	REHEATER
GD	GAS DAMPER	RT	REHEAT TURBINE
GP	GAS PATH - HRA RECOVERY AREA.	RW	FRONT (FW), SIDE (SW), & REAR (RW). WALLS OF MBC'S
OP	HRA AND ROOF	SB	FINISHING SUPERHEATER BEDS (FSH 1&2)

FIGURE 2
WATER-STEAM AND AIR-GAS PATH SCHEMATIC

the horizontal MBC bed superheating surfaces (FSH1 and FSH2). Feedwater sprays provide control of final steam temperature by desuperheating the superheated steam.

Steam flow leaving the steam generator superheater outlet enters the HP turbine and is regulated by the turbine governor valves. The exhaust from the HP turbine passes through the convection reheater surface in the gas pass before entering the horizontal in-bed MBC reheater surface. The reheated steam then flows through IP/LP turbine.

Figure 3 shows:

- a. The water-steam temperature gradient through the boiler system.
- b. Corresponding gas path temperatures.
- c. Typical above bed combustion temperature profile, and
- d. Relative directions of gas flow to water-steam flow.

This provides a visual perspective for understanding the relationship of the temperature differential with the heat transfer.

3.0 RESULTS

The results section of this report includes the following main points of interest:

Included is a brief discussion of the accuracy of the model relative to reproducing the steady-state conditions.

Comparisons are made of the difference in response between the AFB boiler and the conventional coal-fired boiler for step changes of 5 percent. The results are presented in graphical form for visual comparison and discussion.

Appendix VA gives a general description of the mathematical model used in this study.

The computer program and nomenclature are included in Appendix VB. Also, the dynamic response of other variables are presented in graphical form providing additional system details.

3.1 AFB Steady-State Load Conditions

The AFB model was developed on the basis of manufacturer's design data. The program was run for an equivalent of 36 minutes of plant operation to demonstrate the accuracy of initial steady-state conditions. The steady-state values at the end of 36 minutes were within one-half of 1 percent of the initial starting values. The model was initialized at these stabilized conditions for all step response runs. Running an additional equivalent plant operation time of 36 minutes produced deviations of less than one-tenth of a percent, demonstrating an acceptable starting steady-state condition.

A printout of steady-state results is given in Appendix VB. Also presented is the Computer Program Nomenclature which defines all computer program parameter names and their design values at 100 percent load.

3.2 AFB Open Loop Response for Comparison with PC Plant

The following presents responses to steps in major controlled variables for main steam and reheat temperature, main steam and turbine first stage pressure, and unit load. The results compare the 570 MW AFB boiler with a 200 MW subcritical pulverized coal-fired unit. Response data for megawatts were not available for the conventional plant.

Comparisons are given for 5 percent steps in firing rate, feedwater flow, throttle valve position, and unit load. For individual steps, the other two variables were held constant except for the step in unit load in which all three input variables were stepped at once. Larger steps would require

FIGURE 3
WATER-STEAM AND GAS PATH TEMPERATURES

slumping of individual beds and the model is not currently set up to simulate this phenomenon.

3.2.1 Step in Combustion Rate

Figure 4 shows a step change in the firing rate at 100 percent load. Coal, air, limestone, and spent bed material were all increased 5 percent. Feedwater flow and throttle valve position were held constant.

The results show initial decreases in all AFB model variables for approximately 2 minutes while the conventional plant variables hold or increase over this period of time. AFB main steam pressure crosses zero in 4 minutes while reheat and main steam temperatures take 4 and 8 minutes, respectively, to increase above zero. For the conventional unit, main steam and first stage pressure respond immediately, whereas reheat and main steam temperature begin to respond within 1 to 2 minutes. The above times appear to indicate the difference in dead time between the two units. Plant variables for both units are essentially at their new steady-state conditions in approximately 36 minutes.

The initial decrease in AFB steam temperatures, pressures, and unit load results from the step in airflow before the combustion process releases its energy. The boiler design incorporates a holdup of 6 percent carbon in the beds. This is about 8.6 minutes of full load coal flow. The combustion process was assumed to be exponential with a time constant of 1.7 minutes; thus effectively delaying the energy release due to the combustion of the coal.

During the initial 20 minutes, reheat and main steam temperatures for the conventional subcritical unit are more responsive to firing rate increases, thus providing for quicker megawatt response.

The combustion process, including the combustion burnup time, should be examined more closely because of its influence on temperature response which directly affects the unit load response.

The inherent lag in temperature response of the AFB will lead to problems in unit control. Dead time requires control with low gain, long reset time, and the addition of derivative action. Dynamic feed-forward compensation is also required.

Load-following units move at a 2 to 5 percent per minute ramp rate in response to dispatcher request for power. The AFB would require considerable over and underfiring to meet this response time with subsequent adverse effects on metal temperatures and unit thermal stress.

The AFB is roughly three times the megawatt rating of the conventional unit. It is anticipated that unit size has a

secondary effect on unit response time. However, this assumption should be pursued further as some data indicate that response time increases with size. Under the limited scope of this study, this point could not be pursued further.

Indicated AFB power is slightly higher than expected with the 5 percent step in firing rate. This may be attributed to the simple turbine megawatt calculation used in the model. Also, feedwater flow and temperature were held constant for the AFB while the feedwater temperature increases in the actual unit. Final values for reheat and main steam temperature are slightly higher for the AFB. In general, AFB temperatures and pressures are in agreement with the conventional unit data except for the slower initial response of the AFB.

3.2.2 Step In Feedwater Flow

Figure 5 shows response of the AFB unit to a 5 percent step increase in feedwater flow while holding feedwater temperature constant. Here a quicker response is observed in main steam and reheat temperatures. Note that feedwater flow increases over a period of about 3 minutes for the conventional boiler while it increases instantaneously for the AFB boiler. First stage and throttle pressures responses are similar. The AFB response shows a final megawatt offset of about -2.7 percent. This would not occur in a real plant as increased flow through the turbines would raise extraction pressures, thus increasing feedwater temperature which eventually would increase megawatts.

Main steam temperature increases about 1 percent initially. This is due to rise in main steam pressure caused by the step increase in feedwater flow, i.e., isenthalpic compression process. As cooling takes over, temperatures are reduced as expected.

First stage and throttle pressure comparisons between the AFB and conventional unit are in good agreement once allowances are made for the 3 minute ramp in feedwater flow in the latter.

Dead time in main steam and reheat temperature is greater in the conventional plant than in the AFB model. This is associated with lumped parameter models which could be modified for future studies. Also, the response time of temperature sensor elements is not simulated in the AFB model. Incorporating either or both of the above factors in the model would tend to result in a slower response.

In general, the temperature decays due to an increase in feedwater flow are faster for the AFB, indicating possibly less thermal storage in this unit, i.e., a more compact boiler. The AFB temperature decay is several minutes quicker than the conventional plant when adjustments are made for the initial difference in flow, i.e., ramp vs step increase. The net effect is less integrated megawatts (energy) from the AFB feedwater step than for the conventional unit.

FIGURE 4
OPEN LOOP RESPONSE COMPARISONS AT 100% LOAD
STEP IN COMBUSTION RATE

FIGURE 5
OPEN LOOP RESPONSE COMPARISONS AT 100% LOAD
STEP IN FEEDWATER FLOW

Because the AFB thermal response to firing rate is slower and its response to water flow quicker, more dynamic compensation would be necessary to obtain the desired degree of control for following load demand ramps.

3.2.3 Step in Throttle Valve Position

Figure 6 shows the response of the AFB and conventional subcritical unit to a 5 percent step increase in throttle valve position with other variables held constant. However, for the conventional plant, an additional upset in feedwater flow is induced.

Main steam pressures are in good agreement once allowances are made for the feedwater upset.

First stage pressure response for the AFB model is offset by 3 percent from that of the conventional unit data. This is attributed to the rather simple correlation used to estimate this variable value within the model. All other variables were in good agreement. The apparent difference in first stage pressure is only an offset. The transient shape and magnitude is in agreement with data.

Final hot reheat and main steam temperatures for the conventional boiler do not show the magnitude of upset when compared to the AFB model. Main steam temperature increases while reheat temperature decreases indicating a change in heat absorption within the boiler. This could be due to close coupling of the steam and gas in the primary superheater causing a redistribution of energy due to reduced throttle pressure. The megawatts are only slightly changed as would be expected since input energy is unchanged.

The AFB unit shows temporary negative excursions for both main steam and reheat steam temperature during the first 4 minutes. These are attributed to temporary expansion cooling of main steam on depressurization. This temporary effect also propagates into the reheater. This trend is not apparent for the conventional unit data which may be due to slow response time of the temperature measurement devices.

The ability to increase first stage pressure (steam flow) with opening of the throttle valves is an indication of a unit's initial responsiveness to load demand. The conventional unit is capable of maintaining first stage pressure positive for about 12 minutes with approximately constant throttle and reheat temperatures; and megawatts are supported for this period of time. The AFB, however, supports megawatts for about 3 minutes and appears to have less fluid storage from which to draw initial turbine energy. Thus, the megawatt response of the conventional unit appears to be better for the initial 12-minute time frame.

3.2.4 Step In Unit Load

Figure 7 shows the unit load response of both units brought about by simultaneous 5 percent steps in the three main control variables.

As a first approximation, the respective response variables for the step change in unit load for the conventional unit were derived by adding their magnitudes for the individual responses.

The megawatt response for the conventional unit was not available from the field data; however, first stage pressure corrected for main steam and reheat temperature can be used as an indication of expected megawatts. Based on the above, it is estimated that the conventional unit reaches its new megawatt steady-state value in approximately 8 to 12 minutes. By comparison, the AFB shows megawatts increasing gradually for approximately 36 minutes.

Both main steam and reheat temperature of the AFB unit are lower than for the conventional unit following the unit load step. The AFB does not support load as readily as the conventional unit due to its lagging thermal response caused by the delayed coal combustion rate.

FIGURE 6
OPEN LOOP RESPONSE COMPARISONS AT 100% LOAD
STEP IN THROTTLE VALVE POSITION

FIGURE 7
OPEN LOOP RESPONSE COMPARISONS AT 100% LOAD
STEP IN UNIT LOAD

4.0 CONCLUSIONS

1. The AFB unit represented by this design is not as responsive as a conventional 200 megawatt coal-fired subcritical unit. Assuming unit size does not influence dynamic performance this AFB would not perform as well as the subcritical unit to which it was compared.
2. The AFB unit has more dead time in its initial response which is attributed to coal burnup time and thermal storage. This would require under and overfiring of the unit to meet the 2 to 5 percent per minute load ramp rate desirable for load following application.
3. Considerable under or overfiring required for load following could lead to excessive metal temperature excursions with subsequent thermal stress failures reducing the units availability.

5.0 RECOMMENDATIONS

1. The influence of unit size on thermal responsiveness should be further investigated.
2. The burning process within the model should be refined to predict the consequences of slumping of individual beds on the units dynamic response.
3. The influence of coal burnup time on plant load response should be studied, i.e., curves of different burnup time vs unit load response.
4. The coal burnup time needs to be better correlated with independent variables such as excess air, bed temperature, average particle size, etc, and confirmed with actual test data.
5. With several minor model modification, the proposed control scheme included in the boiler design document could be added to the simulation and checked for adequacy and performance and modifications proposed where necessary.
6. The units response to 2 to 5 percent per minute ramp rates should be studied to further investigate ways of improving unit response.
7. The results in this report should be reviewed to determine whether alternate boiler design configurations or modifications would result in improved boiler response.
8. The response of this unit should be compared to the response of the alternate drum boiler type AFB design.

9. Modifications should be made to this model to assist in evaluating results of experimental operations and their control systems performance. That is, steady-state correlations of bed dynamics, heat transfer, etc, would be checked not only for steady-state prediction accuracy and sensitivity, but also their ability to adequately represent dynamic conditions.

6.0 REFERENCES

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APPENDIX V-A

DESCRIPTION OF MATHEMATICAL MODEL

Description of Mathematical Model

The Foster Wheeler Once-Through Atmospheric Bed Boiler is shown in Figure 1. A schematic of the plant component models is shown in Figure A1 with the flow of information internal to the computer program. Parameters, definitions, and values at full load are given with the computer program on Appendix B. Equations were developed to represent time dependent conservation laws for mass, momentum, and energy balances. A list of general assumptions is given in Table I.

Typical energy and mass balances are listed below for steam, metal, water, gas, and air.

Steam Energy Balances

$$\frac{d H_o M}{dt} = W_i H_i - W_o H_o + Q$$

where:

H = Enthalpy

M = Mass

W = Flow

Q = Heat transfer

Lower Case Letters

i = inlet

o = outlet

t = time

d = derivative

Heat transfer is of the following types:

Convection steam/water/air/gas (Dittus Boelter Correlation)

$$Q = K_c W^{.8} n (T_m - T_s)$$

Radiation gas side (Stefan-Boltzmann Law)

$$Q = K_r [(T_g + 460)^4 - (T_m + 460)^4]$$

Bed Heat Transfer (Modified Vreedenberg Correlation, Ref. 6)

$$Q = K_b (1 - X) G^{.6} p (T_b - T_m)$$

where:

T = Temperature

K = Heat transfer constant

G = Gas flow rate

Q = Heat transfer

X = Void fraction

Lower Case Letters

b = bed

c = convection

n = constant

.8 = predominant
parallel flow

.6 = predominant cross
flow

m = metal

s = steam

g = gas

r = radiant

p = .326

Tube Metal Energy Balance

$$\frac{d T_m}{dt} = (Q_i - Q_o) / C M$$

where: C = Specific heat
M = Mass of metal

Properties

For Gas and Air

$$P = KRT$$

For Steam

$P = f(H, R)$ Bivariate curve fits to 1967 ASME Steam Table Properties

$$T = f(H, R)$$

where: K = Gas constant
P = Pressure
R = Density
H = Enthalpy
T = Temperature

Gas flow is determined from a mass balance assuming constant holdup of material.

$$G = L + A + F - B$$

where: L = Limestone flow
A = Air flow
F = Fuel flow
B = Spent bed material
G = Gas and elutriated solids

Bed Energy Balance

$$\frac{d E_b}{dt} = C_l L T_l + C_a A T_a + C_f F T_f - Q_b - C_g G T_b - C_b B T_{bm}$$

where: T = Temperatures
E = Internal energy
C = Specific heat
Q = Heat flow

Lower Case Letters

l = limestone
a = air
f = fuel
bm = bed material
b = bed

COMPONENTS

AD AIR DISTRIBUTION DAMPERS
 AH AIR HEATER
 CB CARBON BURNUP CELL
 EB BOILING BED
 EC ECONOMIZER
 FW FRONT WALLS
 GD GAS DAMPERS
 GN GENERATOR
 GP GAS PATH
 GV GOVERNOR VALVE
 PS PRIMARY SUPERHEATER
 RB REHEATER BED
 RH REHEATER
 RT REHEAT TURBINE
 SB SUPERHEAT BED
 SL STEAM LINE
 SW SIDE WALLS

SYSTEM VARIABLES

T TEMPERATURE
 G GAS
 A AIR
 L LIMESTONE
 F FUEL
 S STEAM FLOW
 P PRESSURE
 H ENTHALPY
 M POWER
 R DENSITY

FIGURE A1
 OVERALL AFB MODEL SOLUTION DIAGRAM
 (INTERCHANGE OF VARIABLES IN COMPUTER PROGRAM)

Bed or Gas Temperature

$$T_b = \frac{E_b}{M_b C_b}$$

where: M = Mass of bed material

Bed Height (Based on System Geometry)

$$H = (V_t + M/R)/(1 - X)A$$

where: H - Bed height
V_t = Tube volume
R = Density of bed material
M = Mass of bed
X = Void fraction
A = Flow area

Bed Void Fraction (Leva Correlation, Ref. 8)

$$X = (K G^2 (V_t + M/R)/R_g M A)^P$$

where: K = Correlation constant
G = Gas flow
R_g = Gas density
P = .333
Rest are given above

Gas Side Energy Balances

$$\frac{d T_o}{dt} = (C_p G (T_i - T_o) - Q)/C_v M$$

where: C = Specific heat
Q = Heat transfer
M = Mass
T = Temperature

Lower Case Letters
i = inlet
o = outlet
p = constant pressure
v = constant volume

Pressure Drop

$$P_i - P_o = K \text{ ABS}(W) W/R$$

where: W = Water/steam/gas/air flow
R = Density of fluid
P = Pressure
K = Correlation constant
ABS = Absolute valve

Heat Release From Coal

$$\frac{dQ}{dt} = ((1-k) F H - Q)/T$$

where: Q = Heat release
 K = Fraction not burned
 F = Coal flow rate
 H = Heating value of coal
 T = Average burn time

Coal Burn Time (based on 6 percent bed carbon content)

where: T = $0.06 M/5F$
 M = Total bed material weight
 F = Coal flow
 T = Average burn time
 5 = Five time constant process assumed

TABLE I
ASSUMPTIONS

1. Only radial heat conduction occurs.
2. Bed heat transfer may be represented by the modified Vreedenberg Correlation.
3. Average Bed Void Fraction may be represented by the Leva Correlation.
4. Average carbon particle burning time is proportional to the coal residence time.
5. All energy and mass balances are based on lumped average exit conditions.
6. Steam properties may be represented by bivariate fits.
7. Gas side pressure is atmospheric.
8. Gas side density is dependent only on temperature.
9. Heat transfer is based on arithmetic average temperatures.
10. Economizer and boiling bed water, steam, and metal are assumed at a mixed mean temperature because of the high water/steam heat transfer, while separate gas, metal, and water/steam dynamic energy balances are used for the remainder of the system components.
11. Material balance on limestone, coal, and spent bed is maintained keeping material inventory constant.
12. The inertia of boiler gas, air, steam, and water is negligible and changes in flow are due to storage capacity and point-to-point piping steady-state static friction-head losses.
13. Contribution of pressure-volume work to steam energy balances is negligible.
14. Conduction and convection heat transfer may be represented by a constant times a flow dependent term multiplied by temperature difference.
15. Flue gas and air properties are represented by average gas law equations.
16. Gas and elutriated solids travel together through gas path.

17. Total bed pressure drop is equal to bed mass divided by flow area.
18. HP turbine extraction is a constant fraction of governor valve flow.
19. Pressure drops due to density gradient, static heads are neglected.
20. Feedwater flow is constant unless stepped to obtain the system response.
21. Air and gas flows are instantaneous.
22. Main steam spray flow can be neglected.

APPENDIX V-B

COMPUTER PROGRAM AND DETAILED RESULTS

- V-B1 COMPUTER PROGRAM NOMENCLATURE
- V-B2 PARAMETER DEFINITIONS AND DESIGN VALUES
- V-B3 COMPUTER PROGRAM LISTING
- V-B4 STEADY STATE INITIAL CONDITIONS
- V-B5 STEP IN COMBUSTION RATE
- V-B6 STEP IN FEED RATE
- V-B7 STEP IN THROTTLE VALVE POSITION
- V-B8 STEP IN UNIT LOAD

APPENDIX V-B1

COMPUTER PROGRAM NOMENCLATURE

The nomenclature employed in development of the AFB Computer program is presented in this section.

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COMPUTER PROGRAM NOMENCLATURE
COMPUTER VARIABLE FIRST AND FOURTH LETTER DESIGNATIONS
FOR PARAMETER IDENTIFICATION

First or Fourth Letter
for System Parameter

<u>Identi-</u> <u>fication</u>	<u>Parameter</u>	<u>Dimensions</u>
A	Airflow/Area	lb/sec or sq ft
B	Spent Bed Material	lb/sec
C	Elutriated Solids	lb/sec
D	<u>Derivative</u>	-
E	Energy	Btu
F	Coal Flow	lb/sec
G	Gas Flow	lb/sec
H	Enthalpy	Btu/lb
I	<u>Initial Condition</u>	-
K	<u>Constant</u>	-
L	Limestone Flow/Length	lb/sec or ft
M	Weight/Electrical Power	lb or Mw
P	Pressure	lb/sq in.
Q	Heat Flow	Btu/sec
R	Density	lb/cu ft
S	Steam Flow	lb/sec
T	Temperature	°F
V	Volume	cu ft
W	Water Flow	lb/sec
X	Void Fraction	decimal

COMPUTER PROGRAM NOMENCLATURE (CON'T)
COMPUTER VARIABLE SECOND AND THIRD LETTER
DESIGNATIONS FOR COMPONENT IDENTIFICATION

<u>Identi- fication</u>	<u>Parameter</u>
AD	Air Distribution Dampers
AH	Air Heater
BF	Bed Material Feeder (Limestone)
BS	Spent Bed Material Handling
CB	Carbon Burnup Bed
CD	Main Steam Condenser
EB	Boiling (Evaporator) Bed
EC	Economizer in Gas Path
EN	Enclosures
FF	Fuel Feeder
FW	Main Feedwater
GD	Gas Distribution Dampers
GP	Gas Path
GV	Governor Valve
GN	Electrical Generator
HP	High Pressure Turbine
PS	Primary Superheater
RB	Reheat Bed
RH	Reheat in Gas Path
RT	Reheat Turbine
RW	Front, Side and Rear Walls of Main Burnup Cells
SB	Finishing Superheater Beds
SL	Main Steam Line
UN	Universal Constant

6.0 REFERENCES

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APPENDIX V-B2

PARAMETER DEFINITIONS AND DESIGN VALUES

This section lists each of the parameters used in the AFB computer program in alphabetical order. The parameter definitions, steady state values and units are included in the parameter list.

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AAH	AIR HEATER AVERAGE AIR FLOW RATE	1379.4	(LBS/SEC)
AAHI	AIR HEATER INLET AIR FLOW RATE	1465.4	(LBS/SEC)
AAHO	AIR HEATER OUTLET AIR FLOW RATE	1293.3	(LBS/SEC)
AAL	AIR LEAKAGE IN AIR HEATER	172.13	(LBS/SEC)
ACB	AIR FLOW TO CBC	145.06	(LBS/SEC)
ACBI	INITIAL AIR FLOW TO CBC	145.06	(LBS/SEC)
AEB	AIR FLOW INTO THE EVAPORATOR BEDS	483.76	(LBS/SEC)
AEBI	INITIAL FLOW INTO THE EVAPORATOR BEDS	483.76	(LBS/SEC)
AGV	TURBINE EFFECTIVE AREA (STATIC)	40.047	(SQ IN)
AGVF	TURBINE EFFECTIVE AREA (DYNAMIC)	40.047	(SQ IN)
ARB	AIR FLOW INTO REHEAT BED	241.85	(LBS/SEC)
ARBI	INITIAL AIR FLOW INTO REHEAT BED	241.85	(LBS/SEC)
ART	LOW PRESSURE TURBINE GOVERNOR VALVE AREA	182.71	(SQ-IN)
ASB	AIR FLOW INTO THE SUPERHEATER BEDS	483.76	(LBS/SEC)
ASBI	INITIAL FLOW INTO THE SUPERHEATER BEDS	483.76	(LBS/SEC)
BCB	SPENT MAIN BED MATERIAL RECYCLED TO CBC	3.796	(LBS/SEC)
BEB	SPENT BED MATERIAL REMOVED	7.518	(LBS/SEC)
BEBI	INITIAL SPENT BED MATERIAL REMOVED	7.518	(LBS/SEC)
BRB	SPENT MATERIAL REMOVAL	3.759	(LBS/SEC)
BRBI	INITIAL SPENT MATERIAL REMOVED	3.790	(LBS/SEC)
BSB	SPENT BED MATERIAL REMOVED	7.518	(LBS/SEC)
BSBI	INITIAL MATERIAL REMOVED	7.518	(LBS/SEC)
DXEBWF	RATE OF CHANGE OF LIQUID BOUNDARY	0.0	(LBS/SEC)
DXEBWS	RATE OF CHANGE OF BOILING BOUNDARY	0.0	(LBS/SEC)
ECR	ENERGY CONTENT OF CBC MATERIAL	85.3632E06	(BTU)
ECBG	ENERGY IN CBC CELL GAS	30836.	(BTU)
ECBW	ENERGY CONTENT OF METAL AND WATER	9.90380E07	(BTU)
EEBG	ENERGY IN GAS SPACE GAS	307960.	(BTU)
EEBH	ENERGY IN BOILING BEDS, FN, SH, RW OF BEDS	1.1912E+08	(BTU)
EEBT	ENERGY CONTENT OF EVAPORATOR BEDS	1.9534E+08	(BTU)

ERBG	ENERGY CONTENT OF GAS IN GAS SPACE	153963.	(BTU)
ERBS	ENERGY IN STEAM IN REHEAT BED	2.2516E+06	(BTU)
ERBT	ENERGY IN REHEATER BED MATERIAL	9.7667E+07	(BTU)
ESBT	ENERGY CONTENT OF BED	1.9534E+08	(BTU)
FCB	ELUTRIATED COAL AND SOLIDS COLLECTED FOR CBC	24.4	(LBS/SEC)
FCBI	INITIAL COAL AND SOLIDS COLLECTED FOR CBC	24.4	(LBS/SEC)
FEB	COAL FLOW INTO EVAPORATOR BEDS	54.32	(LBS/SEC)
FEBI	INITIAL COAL FLOW INTO EVAPORATOR BEDS	54.32	(LBS/SEC)
FRB	COAL FLOW INTO RB	27.16	(LBS/SEC)
FRBI	INITIAL COAL FLOW INTO REHEAT BED	27.16	(LBS/SEC)
FSB	COAL FLOW INTO SUPERHEATER BEDS	54.32	(LBS/SEC)
FSBI	INITIAL COAL FLOW INTO SUPERHEATER BEDS	54.32	(LBS/SEC)
GAH	AIR HEATER AVERAGE FLOW RATE	1567.	(LBS/SEC)
GAHO	AIR HEATER OUTLET GAS FLOW RATE	1653.6	(LBS/SEC)
GCB	GAS FLOW RATE FROM CARBON BURNUP CELL	172.44	(LBS/SEC)
GCBC	GAS FLOW RATE FROM CBC TO ECONOMIZER	128.0	(LBS/SEC)
GEB	GAS FLOW OUT OF EVAPORATOR BEDS	541.04	(LBS/SEC)
GEC	ECONOMIZER GAS FLOW RATE	1352.6	(LBS/SEC)
GGP	GAS FLOW RATE FROM HRA GAS PATH	1352.6	(LBS/SEC)
GGP1	GAS FLOW RATE AROUND ECONOMIZER	1352.64	(LBS/SEC)
GSP2	AIR HEATER INLET GAS FLOW RATE	1481.4	(LBS/SEC)
GGP1SS	STEADY STATE AIR HEATER INLET GAS FLOW RATE	1352.6	(LBS/SEC)
GPS	GAS PATH FLOW TO PRIMARY SUPERHEATER	903.21	(LBS/SEC)
GPSSS	STEADY STATE MASS FLOW RATE IN GAS MIXTURE 1	901.73	(LBS/SEC)
GRB	GAS FLOW RATE FROM THE REHEAT BED	270.52	(LBS/SEC)
GRH	GAS MASS FLOW RATE THROUGH REHEATER	450.43	(LBS/SEC)
GRHSS	STEADY STATE GAS MASS FLOW THROUGH REHEATER	450.43	(LBS/SEC)
GSB	GAS FLOW RATE FROM TWO SUPERHEATER BEDS	541.05	(LBS/SEC)
HCD	CONDENSER ENTHALPY AT 2 (PSIA)	1050.	(BTU/LBII)
HEBDIF	EVAPORATOR BED INLET ENTHALPY DIFFERENTIAL	442.27	(BTU/LBII)

HEBI	EVAPORATOR BED INLET ENTHALPY	652.	(BTU/LBM)
HEBS	ENTHALPY OF STEAM LEAVING REAR WALL	1095.	(BTU/LBM)
HEBSI	INITIAL ENTHALPY OF STEAM LEAVING REAR WALL	1095.0	(BTU/LBM)
HEBST	ENTHALPY OF STEAM LEAVING REAR WALL	1093.3	(BTU/LBM)
HEBWS	SATURATED LIQUID ENTHALPY	786.25	(BTU/LBM)
HEBWSO	ENTHALPY OF VAPORIZATION	251.75	(BTU/LBM)
HEC	GAS PATH ECONOMIZER DISCHARGE ENTHALPY	537.	(BTU/LBM)
HGPS	ENTHALPY OF GAS PATH STEAM	1190.	(BTU/LBM)
HGPI	INITIAL ENTHALPY OF GAS PATH STEAM	1190.	(BTU/LBM)
HHP	HIGH PRESSURE TURBINE INLET STEAM ENTHALPY	1456.	(BTU/LBM)
HPS	PRIMARY SUPERHEATER OUTLET STEAM ENTHALPY	1255.	(BTU/LBM)
HPS	PRIMARY SUPERHEATERS DISCHARGE ENTHALPY	1258.	(BTU/LBM)
HPSI	INITIAL PRIMARY SUPERHEATER DISCHARGE ENTHALPY	1258.	(BTU/LBM)
HRB	REHEAT BED OUTLET ENTHALPY	1319.	(BTU/LBM)
HRH	REHEATER BED INLET ENTHALPY	1391.0	(BTU/LBM)
HRHI	INITIAL REHEATER BED INLET ENTHALPY	1391.0	(BTU/LBM)
HRHS	REHEATER STEAM OUTLET ENTHALPY	1308.	(BTU/LBM)
HRHSPW	REHEATER SPRAY WATER ENTHALPY	350.	(BTU/LBM)
HRT	ENTHALPY OF STEAM IN REHEAT TURBINE	1519.	(BTU/LBM)
HRTI	INITIAL ENTHALPY OF STEAM IN REHEAT TURBINE	1519.	(BTU/LBM)
HRW	ENTHALPY OF STEAM LEAVING REAR WALL	1093.	(BTU/LBM)
HSB	FINISHING SUPERHEATER DISCHARGE ENTHALPY	1456.	(BTU/LBM)
HSL	STEAM LINE OUTLET ENTHALPY	1456.	(BTU/LBM)
HSLI	INITIAL STEAM LINE OUTLET ENTHALPY	1456.	(BTU/LBM)
IPRRBB	INITIAL REHEAT BED PRESSURE	550.7	(PSIA)
IRGPS	INITIAL GAS PATH STEAM DENSITY	6.0605	(LBS/CU FT)
IRGPSI	INITIAL GAS PATH INLET STEAM DENSITY	5.0	(LBS/CU FT)
IRGS	INITIAL GAS PATH INLET STEAM DENSITY	5.2455	(LBS/CU FT)
IRPSI	INITIAL PRIMARY SUPERHEATER STEAM DENSITY	5.0	(LBS/CU FT)
IRRBBS	INITIAL REHEAT BED STEAM DENSITY	.64906	(LBS/CU FT)

IRRH	INITIAL REHEATER STEAM DENSITY	.81529	(LBS/CU FT)
IRRH1	INITIAL OF INITIAL REHEATER STEAM DENSITY	.8	(LBS/CU FT)
IRRT	INITIAL REHEAT TURBINE STEAM DENSITY	.64906	(LBS/CU FT)
IRRT1	INITIAL OF INITIAL REHEAT TURBINE STEAM DENSITY	8.7247	(LBS/CU FT)
IRRW	INITIAL REAR WALL STEAM DENSITY	4.283	(LBS/CU FT)
IRSB	INITIAL FINISHING SUPERHEATER STEAM DENSITY	3.3206	(LBS/CU FT)
IRSL	INITIAL STEAM LINE DENSITY	3.33	(LBS/CU FT)
IRSL1	INITIAL OF INITIAL STEAM LINE DENSITY	3.33	(LBS/CU FT)
KAH	AIR HEATER LEAKAGE FRACTION	.13310	-----
KAHM	AIR HEATER TUBE METAL MASS	3.62E+05	(LBM)
KAHAHT	AIR HEATER AIR HEAT TRANSFER PARAMETER	9.1301	(BTU/DEG F-SEC)
KAHGHT	AIR HEATER GAS HEAT TRANSFER PARAMETER	9.1314	(BTU/DEG F-SEC)
KAHGS	AIR HEATER GAS SPECIFIC HEAT	.32090	(BTU/LB-F)
KAHTA	AIR HEATER INTERMEDIATE AIR VARIABLE	1676.1	-----
KAHTG	AIR HEATER INTERMEDIATE GAS VARIABLE	2174.4	-----
KCBAR	EMPTY BED FLOW AREA	1200	(SQ FT)
KCBEC2	CONVECTION HEAT TRANSFER CONSTANT	3.1932	-----
KCBF	ELUTRIATED CARBON FROM CBC	0.1	-----
KCBGCB	HEAT TRANSFER CONSTANT	25.77	-----
KCBGHR	RADIATION HEAT TRANSFER CONSTANT	6.0447E-10	-----
KCBX	COEFFICIENT BASED ON DESIGN DATA	2.9917E-02	-----
KDAMP	HEAT RECOVERY AREA GAS FLOW DAMPER	.333333	-----
KEBAR	EMPTY BED CROSS SECTIONAL FLOW AREA	1320.	(SQ FT)
KEBF	CARBON CARRY OVER	.10	-----
KEGBT	BED HEAT TRANSFER COEFFICIENT	104.95	(BTU/SEC)
KEBGR	RADIANT HEAT TRANSFER COEFFICIENT ABOVE WALL	3.38E-09	(BTU/SEC)
KEBHER	EVAPORATOR BED IMPLICIT LOOP ERROR CRITERIA	.01	-----
KEBHV	HEATING VALUE OF COAL	11000.	(BTU/LBM)
KEBRHV	BOILING BEDS AND FW,SH,AND RW FLUID VOLUME	2994.	(CU FT)
KEBSH	SPECIFIC HEAT OF WALLS	.12	(BTU/LB-F)

KEBX	VOID FRACTION CORRELATION CONSTANT	1.0351E-02	-----
KECG	GAS TO METAL HEAT TRANSFER PARAMETER	502.79	(BTU/SEC-F)
KECM	ECONOMIZER TUBE METAL MASS	290150.	(LBS)
KECVH	VOLUME OF WATER IN ECONOMIZER	591.65	(CU FT)
KECH	METAL TO WATER HEAT TRANSFER PARAMETER	6141.42	-----
KEF	OVERALL TURBINE EFFICIENCY	.85676	-----
KGP	NEWTON RAPHSON DENSITY GAIN	.85676	-----
KGPGVT	GAS PATH GAS VOLUME	175140.	(CU FT)
KGPM	GAS PATH, ROOF AND 1/2 HRA METAL MASS	845720.	(CU FT)
KGPMS	METAL TO STEAM HEAT TRANSFER PARAMETER	8402.3	(BTU/SEC-F)
KGPRAD	GAS PATH RADIATION COEFFICIENT	1.2086E-08	(BTU/SEC DEG R**
KGPVT	STEAM VOLUME IN GAS PATH ENCLOSURE WALLS	2809.	(CU FT)
KGV1	FRICTION DROP FOR FIRST STAGE PRESSURE	849870.	(PSIA-SEC**2/LBM
KGP2GV	GAS VOLUME OF GAS PATH 2	41040.	(CU FT)
KHPFR	HIGH PRESSURE TURBINE EXHAUST FRICTION LOSS	1.7423E-05	(PSIA-SEC**2/LBM
KHPS	RATIO OF REHEAT STEAM TO MAIN STEAM	.897	-----
KHPSFR	HIGH PRESSURE TURBINE EXHAUST FLOW FRACTION	.8973	-----
KPS	NEWTON RAPHSON DENSITY GAIN	.8973	-----
KPSCV	PRIMARY SUPERHEATER NODE COMPRESSIBILITY VOL	5443.	(CU FT)
KPSGM	DITUS BOELTER COEFFICIENT FOR CONVECTION HEAT TRANSFER	270.47	-----
KPSH	PRIMARY SUPERHEATER TUBE METAL MASS	798510.4	(LBM)
KPSHG	GAS PATH GAS MASS	867.09	(LBM)
KPSHS	METAL TO STEAM HEAT TRANSFER COEFFICIENT	438.54	(BTU/SEC-F)
KPSV	GAS PATH GAS VOLUME	39600	(CU FT)
KPSVT	PRIMARY SUPERHEATER STEAM VOLUME	8608.94	(CU FT)
KRBAR	EMPTY BED CROSS SECTIONAL FLOW AREA	1320.	(SQ FT)
KRBF	CARBON CARRYOVER	.1	-----
KRBGHR	RADIANT HEAT TRANSFER GAS CONSTANT	1.6922E-09	-----
KRBM	ENERGY CONTENT OF IMMERSED TUBES	33460.	(BTU/LB)

KRBQBT	HEAT TRANSFER CONSTANT	112.86	-----
KRBQTS	HEAT TRANSFER EQUATION COEFFICIENT	8.2552	-----
KRBV	HALF OF REHEATER STEAM LINE VOLUME	5333.	(CU FT)
KRBX	COEFFICIENT BASED ON DESIGN DATA	1.0351E-02	-----
KRH	NEWTON RAPHSON GAS FOR REHEATER	.1	-----
KRT	NEWTON RAPHSON GAS FOR REHEAT TURBINE	.1	-----
KRHFR	FRICTION DROP CONSTANT	2.0075E-05	(PSIA-SEC**2/LBM
KRHGM	GAS TO METAL HEAT TRANSFER COEFFICIENT	416.94	(BTU/LBM-F)
KRHM	REHEATER METAL MASS	456518.4	(LBS)
KRHMS	METAL TO STEAM HEAT TRANSFER	713.78	(BTU/SEC-F)
KRHV	HALF OF REHEATER STEAM VOLUME	39600.	(CU FT)
KRHVT	REHEATER STEAM VOLUME	2753.61	(CU FT)
KRWFR	LINE FRICTION FROM RW TO PRIMARY SUPERHEATER	7.9355E-04	(PSIA-SEC**2/LBM
KSBAR	EMPTY BED CROSS SECTIONAL AREA	1320.	(SQ FT)
KSBF	CARBON CARRYOVER	0.1	-----
KSBGBT	HEAT TRANSFER CONSTANT	164.70	-----
KSBGSV	CONSTANT VOLUME SPECIFIC HEAT	0.2	(BTU/LB DEG F)
KSBGHR	HEAT TRANSFER CONSTANT	3.3843E-09	-----
KSBHV	HEATING VALUE OF COAL	11000	(BTU/LB)
KSBM	ENERGY CONTENT OF METAL IN SUPERHEATER BEDS	44403.	(BTU/DEG F)
KSBQTS	HEAT TRANSFER EQUATION COFFECIENT	9.022	-----
KSBVOL	TOTAL STEAM VOLUME	1972.	(CU FT)
KSBX	VOID FRACTION CORRELATION COEFFICIENT	1.0351E-02	-----
KSHFR	LINE FRICTION DROP FROM PS TO GOVERNOR VALVE	7.2527E-04	-----
KSL	NEWTON RAPHSON GAIN FOR STEAM LINE	.1	-----
KSLM	STEAM LINE METAL MASS	362378.	(LBM)
KSLMQ	STEAM LINE HEAT TRANSFER PARAMETER	451.05	(BTU/SEC-F)
KSLVT	TOTAL STEAM LINE AND FSH VOLUME	4747.72	(CU FT)
KT	SPECIFIC HEAT RATIO	1.2567	-----
KUNASH	AIR SPECIFIC HEAT AT CONSTANT PRESSURE	.28	(BTU/LB-F)

KUNBSH	SPECIFIC HEAT OF BED SPENT MATERIAL	.27	(BTU/LB-F)
KUNFHV	HEATING VALUE OF COAL	11000.	(BTU/LB-F)
KUNFSH	SPECIFIC HEAT OF COAL	.25	(BTU/LB-F)
KUNGP	UNIVERSAL CONSTANT FOR GAS PATH	39.7	-----
KUNGC	UNIVERSAL GAS CONSTANT	1545.0	(FT-LB/MOLE F)
KUNGSH	GAS SPECIFIC HEAT AT CONSTANT PRESSURE	.27	(BTU/LB-F)
KUNGSV	GAS SPECIFIC HEAT AT CONSTANT VOLUME	.2	(BTU/LB-F)
KUNGS1	SPECIFIC HEAT OF GAS IN GAS PASS 1	.3057	(BTU/LBM-F)
KUNLSH	LIMESTONE SPECIFIC HEAT	.25	(BTU/LB F)
KUNLISH	SPECIFIC HEAT OF METAL	.12	(BTU/LB F)
KUNPG	BOILING BED GAS CONSTANT	39.7	(CU FT/IN SQ-R)
KUNSBG	SUPERHEAT BED GAS CONSTANT	39.7	(CU FT/SQ IN)
KUNSSH	SPECIFIC HEAT OF STEAM	.39982	(BTU/DEG-F)
KUNWHH	SPECIFIC HEAT OF WATER	1.386	(BTU/LB-F)
KVECG	GAS PATH 1 VOLUME	216180.	(CU FT)
LEB	LIMESTONE FLOW INTO EVAPORATOR BEDS	10.48	(LBS/SEC)
LEBI	INITIAL LIMESTONE FLOW INTO EVAPORATOR BEDS	10.48	(LBS/SEC)
LRB	LIMESTONE FLOW INTO REHEAT BED	5.24	(LBS/SEC)
LRBI	INITIAL LIMESTONE FLOW INTO REHEAT BED	5.24	(LBS/SEC)
LSB	LIMESTONE FLOW INTO SUPERHEATER BEDS	10.48	(LBS/SEC)
LSBI	INITIAL LIMESTONE FLOW INTO SUPERHEATER BEDS	10.48	(LBS/SEC)
MCB	MASS OF MATERIAL IN CBC	224640.	(LBS)
MCBG	MASS OF GAS IN CBC CELL	214.	(LBS)
MCBM	MASS OF TUBES IN CBC BED, WALLS AND GAS SPACE	438324.	(LBS)
MCBW	MASS OF WATER IN CBC SYSTEM	76994.	(LBS)
MEB	MASS OF MATERIAL IN BED	466752.0	(LBS)
MEC	MASS OF MATERIAL IN ECONOMIZER BED	29582	(LBS)
MEBG	WEIGHT OF GAS IN EVAPORATOR GAS SPACE	938.9	(LBS)
MEBH	METAL MASS IN BOILING BEDS AND WALLS	698950.	(LBS)
MEBW	MASS OF WATER AND STEAM IN BOILING BEDS	55941.	(LBS)

MGN	TOTAL POWER OUTPUT IN PERCENT	570.	(MW)
MGNSS	TOTAL POWER OUTPUT STEADY STATE	570.	(MW)
MGP	GAS MASS IN GAS PASS	3834.9	(LBM)
MGP1	MASS OF GAS IN GAS PASS 1	6202.4	(LBM)
MGPS	STEAM MASS IN GAS PATH ENCLOSURE WALLS	6202.4	(LBM)
MGP2	MASS OF GAS PATH	1380.8	(LBM)
MHP	POWER OUTPUT OF HIGH PRESSURE TURBINE	1.493E+08	(MW)
MPS	PRIMARY SUPERHEATER STEAM MASS	13729.	(LBM)
MRB	MASS OF MATERIAL IN BED	233376.	(LBM)
MRBG	MASS OF GAS	469.4	(LBM)
MRBS	MASS OF STEAM	1618.7	(LBM)
MRH	REHEATER STEAM MASS	2250.	(LBM)
MRHG	MASS OF REHEATER GAS	32352.	(LBM)
MRT	POWER OUTPUT LOW PRESSURE TURBINE	4.1649E+08	(MW)
MSB	MASS OF MATERIAL IN SUPERHEAT BED	466752.	(LBM)
MSBG	MASS OF GAS IN BOTH FSH GAS SPACES	938.9	(LBM)
MSBO	MASS OF STEAM	8468.2	(LBM)
MSL	STEAM LINE AND FSH STEAM MASS	15765.	(LBM)
PATM	ATMOSPHERIC PRESSURE	14.7	(LBS/SQ IN)
PGPI	GAS PATH INITIALIZATION PRESSURE	2717.	(PSIA)
PGVN	GOVERNOR VALVE NOMINAL VALUE	2534.7	(PSIA)
PGVSS	GOVERNOR VALVE SS PRESSURE	2534.7	(PSIA)
PHP	TURBINE EXHAUST PRESSURE	590.7	(PSIA)
PHPSS	TURBINE EXHAUST PRESSURE STEADY STATE	590.7	(PSIA)
PHP1	FIRST STAGE PRESSURE	598.13	(PSIA)
PHP1SS	FIRST STAGE PRESSURE STEADY STATE	598.13	(PSIA)
PPS	FSH INLET PRESSURE	2740.7	(PSIA)
PPSI	INITIAL FINAL SUPERHEATER INLET PRESSURE	2740.7	(PSIA)
PRB	REHEAT BED PRESSURE	550.7	(PSIA)
PRH	OUTLET REHEAT PRESSURE	564.7	(PSIA)

PRT	REHEAT TURBINE THROTTLE PRESSURE	550.7	(PSIA)
PRTI	INITIAL REHEAT TURBINE THROTTLE PRESSURE	550.7	(PSIA)
PRTN	NORMALIZER REHEAT TURBINE THROTTLE PRESSURE	550.7	(PSIA)
PRTSS	STEADY STATE REHEAT TURBINE THROTTLE PRESSURE	550.7	(PSIA)
PRW	REAR WALL OUTLET STEAM PRESSURE	2900.	(PSIA)
PSL	PRESSURE AT GOVERNOR VALVE	2534.7	(PSIA)
PSLI	INITIAL PRESSURE AT GOVERNOR VALVE	2534.7	(PSIA)
QAHA	CONVECTION HEAT TRANSFER FROM TUBE TO AIR	2.09E+05	(BTU/SEC)
QAHG	CONVECTION HEAT TRANSFER FROM GAS TO TUBES	2.09E+05	(BTU/SEC)
QCB	HEAT RELEASE IN CARBON BURNUP CELL	129780.	(BTU/SEC)
QCBEC2	HEAT TRANSFER TO ECONONMIZER 2 TUBES	50738.	(BTU/SEC)
QCBGWE	HEAT TRANSFER TO WATER IN CBC	69489.	(BTU/SEC)
QCBGWR	RADIATION FROM GAS SPACE TO WALLS	18751.	(BTU/SEC)
QCBT	HEAT TRANSFER TO CBC BED TUBES (ECONOMIZER-3)	57098.	(BTU/SEC)
QEB	COAL ENERGY RELEASE	537760.0	(BTU/SEC)
QEBGWR	TOTAL HEAT FLOW FROM BOILING BEDS TO STEAM	90446.	(BTU/SEC)
QEBT	TOTAL HEAT FLOW FROM BOILING BEDS TO STEAM	262514.	(BTU/SEC)
QEBTB	TOTAL HEAT FROM BOILING BEDS, FW,SW AND RW	488629.0	(BTU/SEC)
QECC	CONVECTION HEAT FLOW FROM FLUE GAS TO ECON.	84125.	(BTU/SEC)
QECH	HEAT FLOW FROM TUBE WALLS TO WATER IN ECON.	84076.	(BTU/SEC)
QEN	RADIATIVE HEAT TRANSFER PARAMETER GAS TO METAL	104780.	(BTU/SEC)
QGPMS	HEAT TRANSFER ENERGY METAL TO STEAM	104560.	(BTU/SEC)
QPSA	HEAT TRANSFER ENERGY (GAS TO METAL)	74196.	(BTU/SEC)
QPSMA	HEAT TRANSFER METAL TO STEAM	75004.	(BTU/SEC)
QRB	ENERGY RELEASE OF COAL IN REHEATER CELL	268880.	(BTU/SEC)
QRBGWR	TOTAL HEAT FLOW FROM REHEAT BEDS TO STEAM	45223.	(BTU/SEC)
QRB T	HEAT TRANSFER FROM BED TO IMMERSED TUBES	106730.	(BTU/SEC)
QRBTS	METAL TO STEAM HEAT FLOW	126681.	(BTU/SEC)
QSB	ENERGY RELEASE OF COAL IN SUPERHEATER BED	537760.	(BTU/SEC)
QSBGWR	RADIANT HEAT TRANSFER TO FW,SW,AND RW OF FSH	90058.	(BTU/SEC)

QSBT	HEAT TRANSFER IN SUPERHEAT BED	218780.	(BTU/SEC)
QSBTS	HEAT TRANSFER FROM SUPERHEAT BEDS TO STEAM	126681.	(BTU/SEC)
QSLA	STEAM LINE GAS TO METAL HEAT TRANSFER	0.0	(BTU/SEC)
QSLMA	STEAM LINE METAL TO STEAM HEAT TRANSFER	17.494	(BTU/SEC)
RCBG	CBC BED GAS DENSITY	.016822	(LBS/CU FT)
RCBH	BED DENSITY	160.	(LBS/CU FT)
REBG	BOILING BED GAS DENSITY	.01976	(LBS/CU FT)
REBNEB	DENSITY OF LIMESTONE AND COAL	158.4	(LBS/CU FT)
RECH	DENSITY OF FEEDWATER AT ECONOMIZER OUTLET	50.	(LBS/CU FT)
RGP	GAS PATH GAS DENSITY	.0219	(LBS/CU FT)
RGPS	GAS PATH STEAM DENSITY	6.0774	(LBS/CU FT)
RGP1	DENSITY OF GAS IN NO. 1 MIXING VOLUME	.0288	(LBS/CU FT)
RGP2	DENSITY OF GAS PATH II	.0336	(LBS/CU FT)
RPS	PRIMARY SURPEHEATER STEAM DENSITY	5.2623	(LBS/CU FT)
RRBB	REHEAT BED EXIT STEAM DENSITY	.64907	(LBS/CU FT)
RRBG	GAS DENSITY	.01976	(LBS/CU FT)
RRBH	DENSITY OF REHEAT BED MATERIAL	158.4	(LBS/CU FT)
RREMEB	DENSITY OF LIMESTONE AND COAL	158.4	(LBS/CU FT)
RRBS	DENSITY OF STEAM IN REHEATER BED TUBES	.64906	(LBS/CU FT)
RRH	OUTLET REHEAT STEAM DENSITY	.81528	(LBS/CU FT)
RRT	REHEAT TURBINE THROTTLE DENSITY	.65040	(LBS/CU FT)
RRW	REAR WALL STEAM DENSITY	8.7410	(LBS/CU FT)
RSB	STEAM DENSITY	4.1671	(LBS/CU FT)
RSBG	SUPERHEAT BED GAS DENSITY	.01976	(LBS/CU FT)
RSBO	SUPERHEAT BED EXIT STEAM DENSITY	3.5289	(LBS/CU FT)
RSBMEB	DENSITY OF LIMESTONE AND COAL	158.4	(LBS/CU FT)
RSL	STEAM LINE AND FINISHING SUPERHEATER DENSITY	3.3261	(LBS/CU FT)
SEB	STEAM FLOW OUT OF EVAPORATOR	1103.	(LBS/SEC)
SGV	GOVERNOR VALVE STEAM FLOW	1103.	(LBS/SEC)
SHP	HIGH PRESSURE TURBINE DISCHARGE FLOW	989.7	(LBS/SEC)

SPS	PRIMARY SUPERHEATER STEAM FLOW	1103.	(LBS/SEC)
SSPSS	STEAM MASS FLOW AT 100 % LOAD	1103.	(LBS/SEC)
SRB	STEAM FLOW THRU IMMERSSED BED TUBES	989.7	(LBS/SEC)
SRH	REHEATER STEAM FLOW	989.73	(LBS/SEC)
SRHSS	INITIAL REHEATER STEAM FLOW	1103.	(LBS/SEC)
SRT	REHEAT TURBINE FLOW	989.7	(LBS/SEC)
SRW	STEAM FLOW OUT OF REAR WALL ENCLOSURE	1103.	(LBS/SEC)
SRWSS	STEADY STATE STEAM FLOW OUT OF RW ENCLOSURE	1103.	(LBS/SEC)
SSB	FINISHING SUPERHEATER STEAM FLOW	1103.	(LBS/SEC)
SSDSS	STEADY STATE FINISHING SUPERHEATER STEAM FLOW	1103.	(LBS/SEC)
SSL	STEAM LINE MASS FLOW (SSBSS)	1103.	(LBS/SEC)
TAH	AIR HEATER INLET AIR TEMPERATURE	96.00	(DEG F)
TAHA	AIR HEATER AVERAGE AIR TEMPERATURE	367.42	(DEG F)
TAHG	AIR HEATER AVERAGE GAS TEMPERATURE	501.89	(DEG F)
TAHAO	AIR HEATER OUTLET AIR TEMPERATURE	638.84	(DEG F)
TAHGO	AIR HEATER OUTLET GAS TEMPERATURE	283.64	(DEG F)
TAHM	AIR HEATER TUBE METAL TEMPERATURE	438.1	(DEG F)
TAHO	AIR INLET TEMPERATURE	639.0	(DEG F)
TCB	CBC BED TEMPERATURE	1900.	(DEG F)
TCBF	AVERAGE COAL PARTICLE BURNUP TIME	59.52	(SECS)
TCBG	OUTLET TEMPERATURE OF CARBON BURNUP CELL	720.	(DEG F)
TCBGA	AVERAGE GAS TEMPERATURE IN ECONOMIZER 2	1310.	(DEG F)
TCBSBI	TEMPERATURE OF ENTERING SPENT BED MATERIAL	250.	(DEG F)
TCBGPI	CARBON BED EXIT GAS TEMPERATURE	720.	(DEG F)
TCBSPY	PERCENT CHANGE EXIT GAS TEMPERATURE	0.0	(PERCENT)
TCBI	CARBON BURNUP BED GAS TEMPERATURE	1900.	(DEG F)
TCBW	WATER TEMPERATURE LEAVING CBCSW	623.3	(DEG F)
TCBWI	WATER TEMPERATURE LEAVING CBCSW	623.3	(DEG F)
TCBWHY	PERCENT CHANGE CBC EXIT WATER TEMPERATURE	0.0	(PERCENT)
TCBY	PERCENT CHANGE IN CBC TEMPERATURE		(PERCENT)

TEB	AVERAGE BED MATERIAL TEMPERATURE	1550.	(DEG F)
TEBB	SPENT BED MATERIAL TEMPERATURE	250.	(DEG F)
TEBG	GAS TEMPERATURE LEAVING EVAPORATOR GAS SPACE	1640.	(DEG F)
TEBGP	PEAK GAS TEMPERATURE ABOVE BED	1850.	(DEG F)
TEBGPI	BOILING BED GAS TEMPERATURE	1850.	(DEG F)
TEBGPY	PERCENT CHANGE GAS TEMPERATURE	0.0	(PERCENT)
TEBI	BOILING BED INITIAL TEMPERATURE	1500.	(DEG F)
TEBY	PERCENT CHANGE BOILING BED TEMPERATURE	0.0	(PERCENT)
TEBSAT	SATURATED WATER TEMPERATURE IN WATER WALLS	690.	(DEG F)
TEBT	AVERAGE COAL PARTICLE BURNUP TIME	144.0	(SECS)
TEC	ECONOMIZER OUTLET WATER TEMPERATURE	540.	(DEG F)
TECG	TEMPERATURE OF ECONOMIZER GAS OUTLET	720.	(DEG F)
TECH	ECONOMIZER METAL TEMPERATURE	555.47	(DEG F)
TFF	AMBIENT FUEL AND LIMESTONE TEMPERATURE	96.0	(DEG F)
TFW	FEEDWATER TEMPERATURE	484.0	(DEG F)
TGP	TEMPERATURE OF GAS AT HOT SIDE OF PS TUBES	1353.1	(DEG F)
TGPMR	ABSOLUTE GAS PATH METAL TEMPERATURE	1207.	(DEG F)
TGPM	GAS PATH METAL SURFACE TEMPERATURE	749.0	(DEG F)
TGPR	GAS PATH GAS ABSOLUTE TEMPERATURE	1813.1	(DEG F)
TGPS	GAS PATH ENCLOSURE TUBE STEAM TEMPERATURE	735.0	(DEG F)
TGP1	INLET GAS TEMPERATURE TO ECONOMIZER	920.	(DEG F)
TGP2	AIR HEATER INLET GAS TEMPERATURE	720.	(DEG F)
TGV	TEMPERATURE OF STEAM AT GOVERNOR VALVE	998.13	(DEG F)
TGVN	GOVERNOR VALVE NORMALIZED STEAM TEMPERATURE	990.	(DEG F)
TGVS	SATURATED STEAM TEMPERATURE	670.6	(DEG F)
TGVSH	TEMPERATURE OF STEAM ABOVE SATURATED	328.071	(LBS/CU FT)
TGVT	GOVERNOR VALVE STEAM TEMPERATURE	.51088	(DEG F)
TGVV	GOVERNOR VALVE INITIAL TGV VALUE	998.13	(DEG F)
TGVVS	GOVERNOR VALVE INITIAL TGVS VALUE	670.06	(DEG F)
THP	TURBINE EXHAUST TEMPERATURE	628.	(DEG F)

TPS	PRIMARY SUPERHEATER STEAM OUTLET TEMPERATURE	792.	(DEG F)
TPSG	GAS PATH GAS TEMPERATURE	1044.6	(DEG F)
TPSM	PRIMARY SUPERHEATER AVERAGE TUBE TEMPERATURE	921.54	(DEG F)
TPSA	PRIMARY SUPERHEATER AVERAGE STEAM TEMPERATURE	756.77	(DEG F)
TPSMA	PRIMARY SUPERHEATER METAL TEMPERATURE	1023.4	(DEG F)
TPSGA	PRIMARY SUPERHEATER AVERAGE GAS TEMPERATURE	1200.3	(DEG F)
TRB	TEMPERATURE OF REHEAT BED	1550.	(DEG F)
TRBB	SPENT BED MATERIAL TEMPERATURE	1001.5	(DEG F)
TRBBS	SATURATION TEMPERATURE REHEAT TURBINE STEAM	385.	(DEG F)
TRBF	AVERAGE COAL PARTICLE BURNING TIME	144.	(SECS)
TRBG	GAS TEMPERATURE AT CELL DISCHARGE INTO GP	1637.3	(DEG F)
TRBGP	PEAK GAS TEMPERATURE ABOVE REHEAT BED	1850.	(DEG F)
TREGPI	REHEAT BED GAS TEMPERATURE	1850.	(DEG F)
TREGPY	PERCENT CHANGE GAS TEMPERATURE	0.0	(PERCENT)
TRBI	REHEAT BED TEMPERATURE	1500.	(DEG F)
TRBMT	TUBE METAL TEMPERATURE	1063.	(DEG F)
TRBS	OUTLET STEAM TEMPERATURE	1005.	(DEG F)
TRSSI	REHEAT BED STEAM TEMPERATURE	1005.	(DEG F)
TRBSY	PERCENT CHANGE STEAM TEMPERATURE RB	0.0	(PERCENT)
TRBY	PERCENT CHANGE IN REHEATER BED TEMPERATURE	0.0	(PERCENT)
TRHG	GAS TEMPERATURE DOWN STREAM OF REHEATER	667.1	(DEG F)
TRHM	REHEATER TUBE METAL TEMPERATURE	813.08	(DEG F)
TRT	REHEAT TURBINE THROTTLE TEMPERATURE	989.13	(DEG F)
TRTO	REHEAT TURBINE OUTLET TEMPERATURE	989.13	(DEG F)
TRTS	REHEAT TURBINE THROTTLE STEAM SAT. TEMP.	385.	(DEG F)
TRTSH	DEGREES SUPERHEAT	616.35	(DEG F)
TRTSS	REHEAT TURBINE SS STEAM TEMPERATURE	1005.	(DEG F)
TRWS	REAR WALL EXIT STEAM TEMPERATURE	698.24	(DEG F)
TRWSI	REAR WALL EXIT STEAM TEMPERATURE	698.24	(DEG F)
TRWSY	PERCENT CHANGE RW EXIT STEAM TEMPERATURE	0.0	(PERCENT)

TSB	AVERAGE BED MATERIAL TEMPERATURE	1550.	(DEG F)
TSBB	SPENT BED MATERIAL TEMPERATURE	250.	(DEG F)
TSBF	AVERAGE COAL PARTICLE BURNUP TIME	144.	(SECS)
TSBG	FSH BED CELL EXIT GAS TEMPERATURE	1640.	(DEG F)
TSBGP	PEAK GAS TEMPERATURE ABOVE FSH BEDS	1850.	(DEG F)
TSBGPI	SUPERHEAT BED GAS TEMPERATURE	1850.	(DEG F)
TSBGPY	PERCENT CHANGE IN SUPERHEAT BED GAS TEMP.	0.0	(PERCENT)
TSSMT	METAL TEMPERATURE IN SUPERHEATER BEDS	1094.1	(DEG F)
TSBS	TEMPERATURE FOR BED STEAM	1005.	(DEG F)
TSBSI	INITIAL TEMPERATURE FROM BED TO STEAM	1005.	(DEG F)
TSBSY	PERCENT CHANGE FROM BED TO STEAM	0.0	(PERCENT)
TSBY	PERCENT CHANGE IN SUPERHEAT BED TEMPERATRE	0.0	(PERCENT)
TSLM	STEAM LINE METAL TEMPERATURE	998.13	(DEG F)
TUNTA	AIR STEP TIME	5.	(SECS)
TUNTB	BED MATERIAL STEP TIME	5.	(SECS)
TUNTE	ELUTRIATED SOLIDS STEP TIME	5.	(SECS)
TUNTF	FUEL STEP TIME	5.	(SECS)
TUNTV	GOVERNOR VALVE STEP TIME	5.	(SECS)
TUNTL	LIMESTONE STEP TIME	5.	(SECS)
TUNTW	FEEDWATER STEP TIME	5.	(SECS)
VRBS	TOTAL REHEAT BED STEAM VOLUME	2494.	(CU FT)
WGB	WATER FLOW TO DOILING BEDS	1103.	(LBS/SEC)
WEB	WATER FLOW INTO EVAPORATOR	1103.	(LBS/SEC)
WEBA	WATER FLOW IN BOILING BED	1103.	(LBS/SEC)
NEBW	WATER FLOW IN BOILING BED	1103.	(LBS/SEC)
WEBWS	TWO PHASE FLOW IN EVAPORATOR BED	1103.	(LBS/SEC)
WEC	MASS FLOW RATE AT ECONOMIZER OUTLET	1103.	(LBS/SEC)
NECI	WATER FLOW IN BOILING BED	1103.	(LBS/SEC)
WECSS	WATER FLOW	1103.	(LBS/SEC)
WFH	FEEDWATER MASS FLOW RATE (WFHSS)	1103.	(LBS/SEC)

HFWS	WATER FLOW	1103.	(LBS/SEC)
WRHSP	REHEAT SPRAY WATER FLOW RATE	0.	(LBS/SEC)
XCB	CBC CELL VOID FRACTION	.6743	-----
XCBH	BED HEIGHT	4.	(FT)
XEB	FLUIDIZED BED VOID FRACTION	.6262	-----
XEBH	HEIGHT OF FLUIDIZED BED	4.	(FT)
XEBSF	BOILING BED INLET TO RH OUTLET SUPERHEATED STEAM FRACTION	.122	-----
XEBWF	BOILING BED INLET TO REAR WALL OUTLET WATER FRACTION	0.303	-----
XEVWFI	INITIAL BOILING BED INLET TO REAR WALL OUTLET WATER FRACTION	0.573	-----
XEBWSF	BOILING BED TO RH TWO PHASE FLOW FRACTION	.56194	-----
XEBWSI	RATE OF CHANGE OF TWO PHASE FLOW FRACTION	0.	-----
XR	BED VOID FRACTION	.6262	-----
XR	HEIGHT OF FLUIDIZED REHEATER BED	.4	(FT)
XSB	SUPERHEAT BED FLUIDIZED VOID FRACTION	.6262	-----
XSBH	HEIGHT OF FLUIDIZED BED	4.	(FT)
XUNGV	GOVERNOR VALVE STROKE FRACTION	1.	-----
XUNA	AIR HEATER STROKE FRACTION	1.	-----
XUNB	BED SPENT MATERIAL FRACTION	1.	-----
XUNE	ELUTRIATED SOLIDS STROKE FRACTION	1.	-----
XUNF	FUEL STROKE FRACTION	1.	-----
XUNL	LIMESTONE STROKE FRACTION	1.	-----
XUNW	FEEDWATER STROKE FRACTION	1.	-----

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APPENDIX V-B3

COMPUTER PROGRAM LISTING

This section presents the AFB computer program listing. The language employed is IBM's Continuous System Modeling Program (CSMP).

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*****
*STORAGE H(20),V(20),RV(20),HHRH(20),VRH(20),RVRH(20),...
*   TEMPP(20),PRES(20),TEMRH(20),PRERH(20)
*TABLE H(1)=1000.,H(2)=1095.,H(3)=1282.,H(4)=1372.,H(5)=1456.,...
*   H(6)=1600.,V(1)=.3,V(2)=.2,V(3)=.14,V(4)=.1,...
*   HHRH(1)=1300.,HHRH(2)=1350.,HHRH(3)=1391.,HHRH(4)=1450.,...
*   HHRH(5)=1519.,HHRH(6)=1550.,HHRH(7)=1600.,HHRH(8)=1650.,...
*   VRH(1)=4.,VRH(2)=2.,VRH(3)=.1,VRH(4)=.8,VRH(5)=.6
*
FIXED IBUG1,IBUG2,IBUG3,IBUG4,I,J,K,L
**
*****
** SATURATION TEMPERATURES AS A FUNCTION OF PRESSURE *
** FUNCTION TEMPS=(SAT. PRESSURE, SAT. TEMPERATURES) *
*****
**
FUNCTION TEMPS=(1.,101.74),(2.,126.07),(3.,141.47),...
              (10.,193.21),(1000.,544.58),(1500.,596.20),(2000.,635.80),...
              (2200.,649.45),(2400.,662.11),(2600.,673.91),(2800.,684.96),...
              (2900.,690.0),(3000.,695.33),(3200.,705.08)
**
*****
** SATURATION ENTHALPY'S AS A FUNCTION OF SAT. PRESSURES *
** FUNCTION HSATL=(SAT. PRESSURE, SAT. ENTHALPY) *
*****
**
FUNCTION HSATL=(1000.,542.6),(1500.,611.7),(2000.,672.1),...
              (2200.,695.5),(2400.,719.0),(2600.,744.5),(2800.,770.7),...
              (3000.,801.8),(3200.,875.5)
**
*****
** EVAPORATION ENTHALPY'S AS A FUNCTION OF SAT. PRESSURE *
** FUNCTION HSATDF=(SAT.PRESSURE, EVAP. ENTHALPY) *
*****
**
FUNCTION HSATDF=(1000.,650.4),(1500.,558.4),(2000.,466.2),...
              (2200.,426.7),(2400.,384.8),(2600.,337.5),(2800.,285.1),...
              (3000.,218.4),(3200.,56.10)
**
*****
** SUPERHEAT REGION TEMPERATURES AS A FUNCTION OF ENTHALPY AND DENSITY *
** FUNCTION TEMP, ENTHALPY=(DENSITY,TEMPERATURE) *
*****
**
FUNCTION TEMP, 1000=(1.,430.844),(2.5,520.871),(3.33,551.555),...
              (5.,596.133),(7.143,635.961),(10.,673.141)

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```

FUNCTION TEMP, 1095=(1.,444.702),(2.5,539.672),(3.33,572.000),...
(5.,619.117),(7.143,661.094),(10.,728.889)
FUNCTION TEMP, 1282=(1.,581.957),(2.5,682.034),(3.33,725.135),...
(5.,795.082),(7.143,865.870),(10.,911.779)
FUNCTION TEMP, 1372=(1.,742.299),(2.5,823.385),(3.33,860.629),...
(5.,923.501),(7.143,981.735),(10.,1013.377)
FUNCTION TEMP, 1456=(1.,899.225),(2.5,966.172),(3.33,998.495),...
(5.,1054.845),(7.143,1098.326),(10.,1122.553)
FUNCTION TEMP, 1600=(1.,1166.925),(2.5,1218.765),(3.33,1244.958),...
(5.,1288.463),(7.143,1314.316),(10.,1330.160)
**
*****
** SUPERHEAT REGION PRESSURES AS A FUNCTION OF ENTHALPY AND DENSITY *
** FUNCTION PRESS, ENTHALPY=(DENSITY,TEMPERATURE) *
*****
**
FUNCTION PRESS, 1000=(1.,346.812),(2.5,818.654),(3.33,1058.859),...
(5.,1499.784),(7.143,2002.973),(10.,2586.738)
FUNCTION PRESS, 1095=(1.,400.466),(2.5,959.796),(3.33,1246.134),...
(5.,1775.806),(7.143,2385.155),(10.,3315.097)
FUNCTION PRESS, 1282=(1.,558.030),(2.5,1380.425),(3.33,1833.668),...
(5.,2733.001),(7.143,3950.000),(10.,5600.000)
FUNCTION PRESS, 1372=(1.,668.509),(2.5,1655.341),(3.33,2199.180),...
(5.,3279.593),(7.143,5250.000),(10.,6700.000)
FUNCTION PRESS, 1456=(1.,771.661),(2.5,1912.240),(3.33,2541.857),...
(5.,3795.191),(7.143,5450.000),(10.,7750.000)
FUNCTION PRESS, 1600=(1.,941.899),(2.5,2344.465),(3.33,3121.385),...
(5.,4680.000),(7.143,6790.000),(10.,9600.000)
**
*****
** SUPERHEAT REGION TEMPERATURES AS A FUNCTION OF ENTHALPY AND DENSITY *
** FOR THE REHEATERS *
** FUNCTION TEMPRH, ENTHALPY=(DENSITY, TEMPERATURE) *
*****
**
FUNCTION TEMPRH, 1300=(.25,549.200),(.5,572.110),(1.,612.959),...
(1.25,631.718),(1.667,659.854),(2.,680.684)
FUNCTION TEMPRH, 1350=(.25,649.437),(.5,668.086),(1.,702.102),...
(1.25,718.425),(1.667,743.231),(2.,761.787)
FUNCTION TEMPRH, 1391=(.25,731.503),(.5,747.685),(1.,777.324),...
(1.25,792.160),(1.667,814.538),(2.,831.436)
FUNCTION TEMPRH, 1450=(.25,848.589),(.5,862.192),(1.,900.003),...
(1.25,900.236),(1.667,919.774),(2.,934.678)
FUNCTION TEMPRH, 1519=(.25,983.411),(.5,994.898),(1.,1016.927),...
(1.25,1027.472),(1.667,1044.472),(2.,1057.551)
FUNCTION TEMPRH, 1550=(.25,1043.142),(.5,1053.899),(1.,1074.571),...
(1.25,1084.505),(1.667,1100.572),(2.,1112.971)
FUNCTION TEMPRH, 1600=(.25,1138.342),(.5,1148.086),(1.,1166.925),...
(1.25,1176.013),(1.667,1190.778),(2.,1202.220)
FUNCTION TEMPRH, 1650=(.25,1232.127),(.5,1241.045),(1.,1258.351),...
(1.25,1266.729),(1.667,1280.390),(2.,1291.016)
**
*****
** SUPERHEAT REGION PRESSURES AS A FUNCTION OF ENTHALPY AND DENSITY *
** FOR THE REHEATERS *
** FUNCTION PRESRH, ENTHALPY=(DENSITY, PRESSURE) *
*****
**
FUNCTION PRESRH, 1300=(.25,146.233),(.5,291.583),(1.,580.122),...
(1.25,724.713),(1.667,962.368),(2.,1152.734)

```

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FUNCTION PRESRH, 1350=(.25,161.774),(.5,322.453),(1.,641.555),...
      (1.25,800.919),(1.667,1064.644),(2.,1275.152)
FUNCTION PRESRH, 1391=(.25,174.353),(.5,347.921),(1.,691.708),...
      (1.25,863.816),(1.667,1148.505),(2.,1375.662)
FUNCTION PRESRH, 1450=(.25,192.159),(.5,383.747),(1.,764.417),...
      (1.25,953.573),(1.667,1268.438),(2.,1519.641)
FUNCTION PRESRH, 1519=(.25,212.775),(.5,424.837),(1.,847.019),...
      (1.25,1056.950),(1.667,1406.856),(2.,1686.120)
FUNCTION PRESRH, 1550=(.25,221.825),(.5,443.006),(1.,883.602),...
      (1.25,1102.761),(1.667,1468.267),(2.,1760.068)
FUNCTION PRESRH, 1600=(.25,236.226),(.5,471.931),(1.,941.899),...
      (1.25,1175.786),(1.667,1566.219),(2.,1878.114)
FUNCTION PRESRH, 1650=(.25,250.392),(.5,500.394),(1.,999.324),...
      (1.25,1247.740),(1.667,1662.792),(2.,1994.592)

```

**

**

** MACRO FOR INITIAL STEAM DENSITY CALCULATIONS

*

MACRO R=DENS(IR,H,K,P,PRESS)

R=IMPL(IR,.01,RZ)

PI=TWOVAR (PRESS,R,H)

RZ=R+K*(P-PI)

*

* *****

* R DENSITY OF STEAM DESIRED *

* IR INITIAL VALUE OF R *

* PI PRESSURE RELATED TO R AND H *

* H KNOWN VALUE OF ENTHALPY *

* P KNOWN VALUE OF PRESSURE *

* K SLOPE OF DENSITY VS PRESSURE CURVE *

* PRESS STEAM FUNCTION FOR MACRO TO CALL TO *

* *****

*

ENDMACRO

*

INITIAL

NOSORT

PASS=0.

IRSLI=3.3

HSLI=1456.

KSL=.1

PSLI=2534.7

IRPSI=5.

HPSI=1258.

PPSI=2740.7

KPS=.1

IRRHI=.8

HRHI=1391.

KRH=.1

PRHI=564.7

IRRTI=.6

HRTI=1519.

KRT=.1

PRTI=550.7

IRGPSI=5.

HGPI=1190.

KGP=.1

PGPI=2717.7

IPRRBB=550.7

*

```

IRSL=DENS(IRSLI,HSLI,KSL,PSLI,PRESS)
IRPS=DENS(IRPSI,HPSI,KPS,PPSI,PRESS)
IRRT=DENS(IRRTI,HRTI,KRT,PRTI,PRESRH)
IRRH=1.2561*IRRT
IRGPS=DENS(IRGPSI,HGPI,KGP,PGPI,PRESS)
TGVVS=AFGEN(TEMPS,PSLI)
TGVV=TWOVAR(TEMP,IRSL,HSLI)
AGV=(1103.*60.*(1+.00065*(TGVV-TGVVS)))/(PSLI**.97)
KGV1=(1209.7*(IRSL+IRRH)/(2.*1103.**2.))
RRBB=DENS(.8,1519.,.1,IPRRBB,PRESRH)
TRBBS=AFGEN(TEMPS,PRTI)
TREB=TWOVAR(TEMPRH,IRRT,1519.)
ART=(989.7*60.*(1+.00065*(TRBB-TRBBS)))/(PRTI**.97)
IRSB=(IRPS+IRSL)/2.
KSHFR=((2740.7-2534.7)*IRSB)/1103.**2.
KRWFR=((2900.0-2740.7)*IRGPS)/1103.**2.
KHPFR=(26.*IRRH)/1103.**2
ISDORR=3.52307/IRSL
*
** INITIAL ENTHALPY,DENSITY AND PRESSURE LEAVING REAR WALL
IRRW=DENS(8.2636,IHEBS,.1,IP,PRESS)
INCON IHEBS=1095.
INCON IP=2900.
*
** INITIAL ENTHALPY,DENSITY AND PRESSURE FOR REHEAT BED STEAM
IRRBS=DENS(.65,IHRB,.1,IPRB,PRESRH)
INCON IHRB=1519.
INCON IPRB=550.7
*
** IMPLICIT LOOP TO GENERATE DENSITY FOR REHEAT BED
*   RI=4.
*   HI=1100.
*   PII=2900.
*   KI=0.1
*   R=IMPL (RI,.01,RZ)
*   P=TWOVAR (PRESS,R,HI)
*   RZ=R*KI*(P-PII)
*
** THE FOLLOWING IS FOR STONE & WEBSTER STEAM TABLE FITS
*
* NOW DO THE STEAM FITS FOR THE SUPERHEAT REGION
*
*   DO 100 I=1,4
*   DO 200 J=1,4
*   TEMPP(J)=THV(H(I),V(J))
*   PRES(J)=PHV(H(I),V(J))
*   RV(J)=1./V(J)
*   WRITE (6,110) H(I),RV(J),TEMPP(J)
*   WRITE (6,120) H(I),RV(J),PRES(J)
*200 CONTINUE
*100 CONTINUE
*110 FORMAT (1X,'FUNCTION TEMP ',F8.3,'=(',F8.3,',',F8.3,')',/)
*120 FORMAT (1X,'FUNCTION PRES ',F8.3,'=(',F8.3,',',F8.3,')',/)
*
** NOW DO THE STEAM FITS FOR THE REHEAT BED IN SUPERHEAT REGION
*   DO 300 K=1,8
*   UU 400 L=1,5
*   TEMRH(L)=THV(HHRH(K),VRH(L))
*   PRERH(L)=PHV(HHRH(K),VRH(L))
*   RVRH(L)=1./VRH(L)

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*      WRITE(6,410) HRRH(K),RVRH(L),TEMRH(L)
*      WRITE(6,420) HRRH(K),RVRH(L),PRERH(L)
*400  CONTINUE
*300  CONTINUE
*410  FORMAT (1X,'FUNCTION TEMRH ',F8.3,'=(',F8.3,',',F8.3,')',/)
*420  FORMAT (1X,'FUNCTION PRERH ',F8.3,'=(',F8.3,',',F8.3,')',/)
*
**
**
**
**
*****
*****
*****          SECTION I          *****
*****  COMBINED BED ENERGY BALANCE  *****
*****
*****
*
DYNAMIC
*
*****          UNIT LOAD MANAGEMENT          *****
** FUEL SPECIAL STEP INPUT
   XUNF=1.+0.05*STEP (TUNTF)
   PARAM TUNTF=3000.
*
** AIR SPECIAL STEP INPUT
   XUNA=1.+0.05*STEP (TUNTA)
   PARAM TUNTA=3000.
*
** LIMESTONE SPECIAL STEP INPUT
   XUNL=1.+0.05*STEP (TUNTL)
   PARAM TUNTL=3000.
*
** SPENT BED MATERIAL SPECIAL STEP INPUT
   XUNB=1.+0.05*STEP (TUNTB)
   PARAM TUNTB=3000.
*
** FEEDWATER SPECIAL STEP INPUT
   XUNW=1.+0.05*STEP (TUNTW)
   PARAM TUNTW=0.
*
** ELUTRIATED SOLIDS SPECIAL STEP INPUT
   XUNE=1.+0.05*STEP (TUNTE)
   PARAM TUNTE=3000.
*
** HIGH PRESSURE TURBINE SPECIAL STEP INPUT
   XUNGV=1.+0.05*STEP(TUNTV)
   PARAM TUNTV=3000.
*
* *****
* XUNF  FUEL STROKE FRACTION              1.      *
* TUNTF FUEL STEP TIME                     1.      (SECS) *
* XUNA  AIR STROKE FRACTION                1.      *
* TUNTA AIR STEP TIME                     1.      (SECS) *
* XUNL  LIMESTONE STROKE FRACTION          1.      *
* TUNTL LIMESTONE STEP TIME                1.      (SECS) *
* XUNB  SPENT BED MATERIAL STROKE FRACTION 1.      *
* TUNTB SPENT BED MATERIAL STEP TIME        1.      (SECS) *
* XUNW  FEEDWATER STROKE FRACTION          1.      *
* TUNTW FEEDWATER STEP TIME                1.      (SECS) *

```

```

* XUNE ELUTRIATED SOLIDS STROKE FRACTION 1. *
* TUNTE ELUTREATED SOLIDS STEP TIME (SECS) *
* *****
** THERMAL ENERGY BALANCE
   DQEB=((1-KEBF)*FEB*KEBHV-QEB)/TEBT
   QEB=INTGRL(IQEB,DQEB)
   PARAM KEBF=.1 ,KESHV=11000. ,FEBI=54.32 ,TEBT=144.0
   INCON IQEB=537760.8
*
* *****
* KEBHV HEATING VALUE OF COAL 11000 (BTU/LB) *
* KEBF CARBON CARRY OVER .10 *
* QEB THERMAL ENERGY BALANCE 537760.8 (BTU)/SEC *
* TEBT AVERAGE COAL PARTICLE BURNUP TIME 144.0 (SECS) *
* *****
** MASS OF MATERIAL IN THE BOILING BED
* DMEB=FEB+LEB+AEB-GEB-BEB
* MEB=INTGRL(IMEB,DMEB)
   GEB=FEB+LEB+AEB-BEB
   FEB=FEBI*XUNF
   LEB=LEBI*XUNL
   AEB=AEBI*XUNA
   BEB=BEBI*XUNB
   PARAM LEBI=10.48,BEBI=7.518
   PARAM AEBI=483.76
   PARAM MEB=466752.0
* INCON IMEB=466752.0
*
* *****
* ***** BASED ON TWO BOILING BEDS *****
* FEB COAL FLOW INTO EVAPCRATOR BEDS 54.32 (LB/SEC) *
* LEB LIMESTONE FLOW INTO EVAPORATOR BEDS 10.48 (LB/SEC) *
* AEB AIR FLOW INTO THE EVAPORATOR BEDS 483.76 (LB/SEC) *
* GEB GAS FLOW OUT OF EVAPCRATOR BEDS 541.05 (LB/SEC) *
* FEBI INITIAL COAL FLOW IN EVAPORATOR BEDS 54.32 (LBS/SEC) *
* AEBI INITIAL AIR FLOW INTO EVAPORATOR BEDS 483.76 (LBS/SEC)*
* LEBI INITIAL LIMESTONE FLOW INTO THE BEDS 10.48 (LBS/SEC)*
* BEBI INITIAL SPENT BED MATERIAL REMOVED 7.518 (LBS/SEC)*
* BEB SPENT BED MATERIAL REMOVED 7.518 (LB/SEC) *
* MEB MASS OF MATERIAL IN BED 466752.0 (LBS) *
* *****
** ENERGY BALANCE FOR EVAPORATOR BED
   DEEBT=(LEB*KUNLSH+FEB*KUNFSH)*TFF+(AEB*KUNASH*TAHO)-...
   (BEB*KUNBSH*TEBB)-(GEB*KUNGS*TEB)+0.746314*QEB-QEBT
   EEBT=INTGRL(IEEBT,DEEBT)
   TEB=EEBT/(MEB*KUNBSH)
   PARAM KUNFSH=.25 ,TFF=96. ,KUNASH=.28
   PARAM KUNGS=.27,KUNBSH=.27,KUNLSH=.25,TEBB=250.
   INCON IEEBT=1.953357E+08
*
* *****
* KUNSH SPECIFIC HEAT OF MATERIAL IN BED .27 (BTU/DEG F) *
* TEB AVERAGE BED MATERIAL TEMPERATURE 1550 (DEG F) *
* TEBB SPENT BED MATERIAL TEMPERATURE 250 (DEG F) *
* KUNLSH LIMESTONE SPECIFIC HEAT .25 (BTU/LB DEG F) *
* TFF AMBIENT FUEL AND LIMESTONE TEMPERATURE 96.0 (DEG F) *
* KUNASH SPECIFIC HEAT OF AIR .28 (BTU/DEG F) *

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* KUNFSH SPECIFIC HEAT OF COAL .25 (BTU/LB DEG F) *
* EEBT ENERGY CONTENT OF EVAPORATOR BEDS 1.95E8 (BTU) *
* KUNGSH GAS SPECIFIC HEAT .27 (BTU/LB DEG F) *
* TAHO AIR INLET TEMPERATURE 639. (BTU/SEC) *
* .7517*QEB HEAT RELEASE IN BB1 AND BB2 404234.8 (BTU/SEC) *
* *****
*
** HEAT TRANSFER TO VARIOUS HEAT TRAPS
** HEAT TRANSFER FROM BED TO TUBES. MODIFIED VREEDENBERG CORRELATION
   QEBT=KEBGBT*(1-XEB)*(ABS(GEB)**.326)*(TEB-TEBSAT)
   PARA11 KEBGBT=104.95
*
* *****
* QEBT HEAT TRANSFER FROM BED TO TUBES 262514.0 (BTU/SEC) *
* KEBGBT BED HEAT TRANSFER COEFFICIENT 104.95 (BTU/SEC) *
* XEB FLUIDIZED BED VOID FRACTION .6262 *
* TEBSAT BED SATURATION WATER TEMPERATURE 690 (DEG F) *
* TEB AVERAGE BED MATERIAL TEMPERATURE 1550 (DEG F) *
* GEB GAS FLOW OUT OF EVAPORATOR BEDS 541.05 (LB/SEC) *
* *****
*
** ENERGY BALANCE BOTH BOILING BEDS GAS SPACE
** ***** GAS SIDE *****
   DEEBG=(GEB*KUNGSH*(TEB-TEBG)+.1926385*QEB-QEBGWR)
   TEBG=EEBG/(MEBG*KUNGSV)
   EEBG=INTGRL(IEEBG,DEEBG)
   PARA11 MEBG=938.9 ,KUNGSV=.2
   INCON IEEBG=307959.
*
* *****
* EEBG ENERGY IN GAS SPACE GAS 307959 (BTU) *
* TEBG GAS TEMPERATURE LEAVING EVAPORATOR GAS SPACE 1640 (DEG F) *
* MEBG WEIGHT OF GAS IN EVAPORATOR GAS SPACE 938.9 (LB) *
* TEB AVERAGE BED MATERIAL TEMPERATURE 1550 (DEG F) *
* QEB*.0815 COAL BURNING IN FREESPACE ABOVE BED 43827.5 (BTU/SEC) *
* QEBGWR HEAT TRANSFER TO WALLS ABOVE BED 90446 (BTU/SEC) *
* KUNGSV CONSTANT VOLUME GAS SPECIFIC HEAT .2 (BTU/LB F) *
* *****
*
** PEAK GAS TEMPERATURE ABOVE BED
   TEBGP=TEB+.0815*QEB/(GEB*KUNGSH)
*
* *****
* TEBGP PEAK GAS TEMPERATURE ABOVE BED 1850. (DEG F) *
* TEBGP IS THE PEAK GAS TEMPERATURE ABOVE BED DUE TO COMBUSTION OF *
* FINES *
* KUNGSH CONSTANT PRESSURE GAS SPECIFIC HEAT .27 (BTU/LB F) *
* GEB GAS FLOW RATE 541.05 (LB/SEC) *
* QEB COAL ENERGY RELEASE 537760.8 (BTU/SEC) *
* *****
*
** RADIANT HEAT TRANSFER
   QEBGWR=((TEBG+460)**4)-((TEBSAT+460)**4))*KEBGWR
   PARA11 KEBGWR=5.110205E-09
*
* *****
* QEBGWR RADIANT HEAT TRANSFER TO WALLS IN BOILING BED 90446 *
* (BTU/SEC) *
* KEBGWR RADIANT HEAT TRANSFER COEFFICIENT ABOVE WALL 5.110205E-9 *
* *****

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*
** ENERGY BALANCE TO BOILING BED WALLS
  QEBTB=QEBT+QEBGHR+QRBGHR+QSBGHR
  DEEBH=(WEB*HEBI-SEB*HEBS+QEBTB)
  EEBM=INTGRL(IEEBM,DEEBH)
  INCON IEEBM=119.119E06
*
** BOILING BED AND REAR WALL FLOWS ARE THE SAME
  SEB=WEB
*
** BOILING BED WATER FLOW EQUALS THAT OF CBC
  WEB=KCB
*
* *****
* EEBM ENERGY IN BOILING BEDS, FRONT, SIDE & REAR WALLS OF BEDS *
* 119.128E06 (BTU/LB) *
* QEBT TOTAL HEAT FLOW FROM BOILING BEDS TO STEAM 262514 (BTU/SEC) *
* QRBGHR TOTAL HEAT FLOW FROM REHEAT BEDS TO STEAM 45223 (BTU/SEC) *
* QSBGHR TOTAL HEAT FLOW FROM FINAL SUPERHEAT BEDS TO STEAM *
* 90446 (BTU/SEC) *
* QEBGHR TOTAL HEAT FLOW FROM BOILING BEDS TO STEAM 90446 (BTU/SEC) *
* HEBI EVAPORATOR BED INLET ENTHALPY 652 (BTU/LB) *
* WEB WATER FLOW INTO EVAPORATOR 1103 (LB/SEC) *
* SEB STEAM FLOW OUT OF EVAPORATOR 1103 (LB/SEC) *
* QEBTB TOTAL HEAT FROM BOILING BEDS, FW, SW AND RW 488,629.0 *
* HEC MASS FLOW RATE AT ECONOMIZER OUTLET 1103. (LBS/SEC) *
* HEBS ENTHALPY OF STEAM LEAVING REAR WALL 1095. (BTU/LB) *
* *****
*
* *****
* WATER STEAM SIDE HORIZONTAL TUBES FW, SW & RW ENERGY BALANCE *
* BED ENCLOSURES *
* FW FRONT WALL *
* SW SIDE WALLS *
* RW REAR WALLS *
* *****
*
** EVAPORATOR BED ENTHALPY BALANCE
  HEBS=IMPL (HEBSI,KEBHER,HEBST)
  PRW=THOVAR (PRESS,RRW,HEBS)
  TEBSAT=AFGEN(TEMP,PRW)
  HEBST = (EEBM-HEBH*TEBSAT*KEBSM)/WEBW
  HRW=HEBS
  TRHS=THOVAR(TEMP,RRW,HRW)
  PARAM MEBM=698953,KEBSM=.12,WEBW=55941.
  PARAM HEBSI=1095.,KEBHER=.01
*
* *****
* PRW PRESSURE AT REAR WALL DISCHARGE 2900 (PSIA) *
* MEBM METAL MASS ASSOCIATED WITH BOILING BEDS AND WALLS *
* 698953 (LBS) *
* HEBS ENTHALPY OF STEAM LEAVING REAR WALL 1095 (BTU/LB) *
* HRW ENTHALPY OF STEAM LEAVING REAR WALL 1093. (BTU/LB) *
* KEBSM SPECIFIC HEAT OF WALLS .12 (BTU/LB-F) *
* HEBST ENTHALPY OF STEAM LEAVING REAR WALL 1093.3 (BTU/LB) *
* HEBSI INITIAL ENTHALPY OF STEAM LEAVING RW 1095. (BTU/LB) *
* KEBHER EVAPORATOR BED IMPLICIT LOOP ERROR .01 *
* CRITERIA *
* TEBSAT SATURATED WATER TEMP. IN WATER WALLS 690. (DEG F) *

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* HEBW  MASS OF WATER AND STEAM ASSOCIATED WITH BOILING BEDS  *
*                                     55933. (LBS)                *
*      12716 LBS OF WATER. AT 30.65 (LB/CU FT)                 *
*      35904 LBS OF TWO PHASE. AT 20.17 (LB/CU FT)             *
*      7321 LBS OF STEAM. AT 9.16 (LB/CU FT)                   *
* *****                                                        *
** MASS BALANCE FOR BOILING BEDS AT REAR WALL EXIT
    SRW=SPS
    DRRW=(WCB-SRW)/KEBRHV
    RRW=INTGRL(IRRW,DRRW)
    PARAM KEBRNV=2994.
*
* *****
* KEBRNV BOILING BEDS AND FH,SW,AND RH FLUID VOLUME 2994 (CU FT) *
* WCB    WATER FLOW TO BOILING BEDS                1103 (LB/SEC) *
* SRW    STEAM FLOW OUT OF REAR WALL ENCLOSURE      1103 (LB/SEC) *
* RRW    DENSITY OF STEAM AT OUTLET OF REAR WALL ENCLOSURE      *
*                                     8.7410 (LBS/SQ FT) *
* *****
** BOILING BED INLET TO REAR WALL OUTLET ENTHALPY DIFFERENCE
    HEBDIF=HEBS-HEBI
*
** BOILING BED INLET REAR WALL OUTLET WATER FRACTION
    XEBWF=(HEBWS-HEBI)/HEBDIF
*
** RATE OF CHANGE OF FRACTION OF WATER
    DXEBWF=DERIV(XEBWFI,XEBWF)
    INCON XEBWFI=0.0
*
** WEBW NET WATER INVENTORY RATE OF CHANGE
    WEBW=12716*DXEBWF
*
** XEBWF BOILING BED TO REAR WALL TWO PHASE FLOW FRACTION
    XEBWSF=HEBWS/HEBDIF
*
** DXEBWS RATE OF CHANGE OF TWO PHASE FRACTION
    DXEBWS=DERIV(XEBWSI,XEBWSF)
    INCON XEBWSI=0.0
*
** WEBWS NET TWO PHASE INVENTORY RATE OF CHANGE
    WEBWS=35904.*DXEBWS
*
** NET FLOW GOING TO MAKE PRESSURE PRW
    WEBA=WEB-WEBW-WEBWS
*
** SATURATED LIQUID ENTHALPY
    HEBWS=AFGEN(HSATL,PRW)
*
** SPECIFIC HEAT OF VAPORIZATION
    HEBWSD=AFGEN(HSATDF,PRW)
*
** BOILING BED INLET TO REAR WALL OUTLET SUPERHEATED STEAM FRACTION
    XEBSF=1.-XEBWF-XEBWSF
*
** ECONOMIZER WATER FLOWS THROUGH CBC
    WCB=WEC
*****
* HEBDIF BOILING BED INLET TO REAR WALL OUTLET ENTHALPY DIFFERENCE *

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*                                     442.27 (BTU/LB) *
* XEBWF BOILING BED INLET TO REAR WALL OUTLET WATER FRACTION *
*                                     .303 *
* XEBWSF BOILING BED TO REAR WALL TWO PHASE FLOW FRACTION .122 *
* HEBMS SATURATED LIQUID ENTHALPY 786.25 (BTU/LB) *
* HEBMSD SPECIFIC HEAT OF VAPORIZATION 251.75 (BTU/LB) *
* HEBWS SATURATED LIQUID ENTHALPY 786.25 (BTU/LB) *
* HEBI EVAPORATOR BED INLET ENTHALPY 652. (BTU/LBM) *
* XEBWFI INITIAL BOILING BED INLET WATER FRACTION .573 *
* WEBW WATER FLOW IN BOILING BED 1103. (LBS/SEC) *
* XEBWS RATE OF CHANGE OF TWO PHASE FLOW FRACTION 0. *
* XEBWSI INITIAL RATE OF CHANGE OF TWO PHASE FLOW 0. *
* HEBWS TWO PHASE FLOW IN EVAPORATOR BED 1103. (LBS/SEC) *
* WEBA WATER FLOW IN BOILING BED 1103. (LBS/SEC) *
* WEB WATER FLOW INTO EVAPORATOR BED 1103. (LBS/SEC) *
* WEC MASS FLOW RATE AT ECONOMIZER OUTLET 1103. (LBS/SEC) *
*****
*
**
*****
** ***** BOILING BED FLUIDIZATION HEIGHT PER BED BASIS *****
*****
**
** XEBH IS THE HEIGHT OF FLUIDIZED BED
    XEBH=(500.+WEB/(2.*REBMEB))/((1-XEB)*KEBAR)
    PARAM REBMEB=158.4,KEBAR=1320.
* *****
* XEBH HEIGHT OF FLUIDIZED BED 4 (FT) *
* REBMEB DENSITY OF LIMESTONE AND COAL 158.4 LB/FT**3 *
* KEBAR EMPTY BED CROSS SECTIONAL FLOW AREA 1320 FT**2 *
* *****
*
** BOILING BED FLUIDIZED BED VOID FRACTION
**
* *****
* FLUIDIZED BED VOID FRACTION FROM PERRY'S CHEMICAL ENGINEERS *
* HANDEBOOK PG 5-12 EQUATION 5-168 PER BED BASIS *
* *****
**
    XEB=(KEBX*(GEB/2))*2*((500+WEB/(2*REBMEB))/(REB*KEBAR*...
    (WEB/2.)))*.333333
    PARAM KEBX=1.0351E-02,KEBAR=1320.
*
* *****
* KEBX VOID FRACTION CORRELATION CONSTANT 1.0351E-02 *
* WEB MASS OF MATERIAL IN BED 466752. (LBS) *
* GEB MASS FLOW OUT OF EVAPORATOR BED 541.04 (LBS/SEC) *
* REBG BOILING BED GAS DENSITY .01976 (LB/FT**3) *
* XEB FLUIDIZED BED VOID FRACTION .6262 *
* *****
*
** BOILING BED GAS DENSITY
    REBG=KUNPG/(TEB+460.)
    PARAM KUNPG=39.7
*
* *****
* KUNPG BOILING BED GAS CONSTANT 39.7 (FT**3/IN**2 DEG R)*
* *****
**
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*****
***** SECTION II *****
***** ENERGY BALANCE FOR FINISHING SUPERHEATER BEDS *****
*****
**
**
**
** SUPERHEATER BED MODEL BASED ON TWO BEDS
    DQSB=((1-KSBF)*FSB*KSBHV-QSB)/TSBF
    QSB=INTGRL(IQSB,DQSB)
    PARAM FSB=54.32 ,TSBF=144.
    INCON IQSB=537760.
    KSBHV=KEBHV
    KSBF=KEBF
*
* *****
* QSB ENERGY RELEASE OF COAL IN SUPERHEATER BED 537760. (BTU/SEC)*
* KSBHV HEATING VALUE OF COAL 11000 (BTU/LB) *
* KEBF CARBON CARRY OVER .10 *
* KEBHV HEATING VALUE OF COAL 11000 (BTU/LB) *
* KSBF CARBON CARRYOVER 0.1 *
* TSBF AVERAGE COAL PARTICLE BURNUP TIME 144. (SECS) *
* FSB COAL FLOW TO SUPERHEATER BED 54.32 (LB/SEC) *
* *****
*
** MASS OF MATERIAL IN BOTH FINISHING SUPERHEATER BEDS
* OMSB=FSB+LSB+ASB+GSB+BSB
* MSB=INTGRL(IMS,OMS)
    GSB=FSB+LSB+ASB+BSB
    FSB=FSBI*XUNF
    LSB=LSBI*XUNL
    ASB=ASBI*XUNA
    BSB=BSBI*XUNB
    PARAM MSB=466752.0
    PARAM LSBI=10.48,ASBI=483.76
    PARAM BSBI=7.518
* INCON IMS=466752.
*
* *****
* BASED ON TWO FINISHING SUPERHEATER BEDS *
* FSB COAL FLOW INTO SUPERHEATER BEDS 54.32 (LB/SEC) *
* LSB LIMESTONE FLOW INTO SUPERHEATER BEDS 10.48 (LB/SEC) *
* ASB AIR FLOW INTO THE SUPERHEATER BEDS 483.76 (LB/SEC)*
* FSBI INITIAL COAL FLOW INTO SUPERHEATER BEDS 54.32 (LB/SEC)*
* LSBI INITIAL LIMESTONE FLOW INTO SUPERHEATER BEDS *
* 10.48 (LBS/SEC)*
* ASBI INITIAL AIR FLOW INTO SUPERHEATER BEDS 483.76 (LB/SEC)*
* BSBI INITIAL SPENT BED MATERIAL INTO SUPERHEATER BEDS *
* GSB GAS FLOW OUT OF SUPERHEATER BEDS 541.05 (LB/SEC) *
* BSB SPENT MATERIAL REMOVED 7.518 (LB/SEC) *
* IMS MASS OF MATERIAL IN BED 466752.0 (LBS) *
* *****
*
*
** ENERGY BALANCE FOR FINISHING SUPERHEATER BEDS

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DESBT=(LSB*KUNLSH+FSB*KUNFSH)*TFF+(ASB*KUNASH*TAHO)-...
(BSD*KSBGSV*TSBB)-(GSB*KUNGSH*TSB)+.664275*QSB-QSBT
ESBT=INTGRL (IESBT,DESBT)
TSB=ESBT/(MSB*KUNBSH)
PARAM KSBGSV=.27,TSBB=250.
INCON IESBT=1.953357E08
*
* *****
* FINISHING SUPERHEATER BEDS
* KUNBSH SPECIFIC HEAT OF MATERIAL IN BED .27 (BTU/LB-F)
* TSB AVERAGE BED MATERIAL TEMPERATURE 1550 (DEG-F)
* TSBB SPENT BED MATERIAL TEMPERATURE 250. (DEG F)
* KUNLSH LIMESTONE SPECIFIC HEAT .25 (BTU/LB-F)
* KUNASH SPECIFIC HEAT OF AIR .28 (BTU/LB-F)
* KUNFSH SPECIFIC HEAT OF COAL .25 (BTU/LB-F)
* ESBT ENERGY CONTENT OF BED 1.95E08 (BTU)
* KUNGSH GAS SPECIFIC HEAT .27 (BTU/LB-F)
* KUNGSV GAS CONSTANT VOLUME SPECIFIC HEAT .28 (BTU/LB-F)
* QSBT ENERGY TO BED TUBES 218780.(BTU/SEC)
* TFF
* TAHO
* GSB
* *****
*
** ENERGY BALANCE FOR BOTH FINISHING SUPERHEATER GAS SPACES
DTSBG=(GSB*KUNGSH*(TSB-TSBG)+.192639*QSB-QSDGHR)/(MSBG*KUNGSV)
TSBG=INTGRL(ITSBG,DTSBG)
PARAM ITSBG=938.9
INCON ITSBG=1640.
*
* *****
* FINISHING SUPERHEATER FSH1 AND FSH2 GAS COMBINE GAS SPACE
* ENERGY BALANCE
* MSBG MASS OF GAS IN BOTH FINISHING SUPERHEATERS GAS SPACES
* ABOVE BED 938.9 (LBS)
* TSBG FSH BED CELL EXIT GAS TEMPERATURE 1640 (DEG F)
* QSDGHR RADIANT HEAT TRANSFER TO FH,SH,AND RH OF FSH BEDS
* 90446 (BTU/SEC)
* *****
*
** PEAK GAS TEMPERATURE ABOVE FINISHING SUPERHEATER BEDS
TSBGP=TSB+.00149*QSB/(GSD*KUNGSH)
*
* *****
* TSBGP PEAK GAS TEMPERATURE ABOVE FSH BEDS 1850 (DEG F)
* TSB AVERAGE BED MATERIAL TEMPERATURE 1550. (DEG F)
* *****
*
** RADIANT HEAT TRANSFER TO WALLS IN FSH BEDS
QSBGHR=((TSBG+460.)*.4-(TEBSAT+460.)*.4)*KSBGHR
PARAM KSBGHR=5.110205E-09
*
* *****
* FSH GAS SPACE HEAT TRANSFER
* KSBGHR HEAT TRANSFER CONSTANT 5.110205E-09
* TEBSAT SATURATED WATER TEMPERATURE IN WATER WALLS 690 (DEG F)
* *****
*
** HEAT TRANSFER FROM FINAL SUPERHEATER BED TO TUBES
** MODIFIED VREEDENBERG CORRELATION

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QSBT=KSBGBT*(1-XSB)*(ABS(GSB)**.326)*(TSB-TSBMT)
PARAM KSBGBT=164.699

*
* *****
* FINISHING SUPERHEATER
* QSBT HEAT TRANSFER FROM BED TO TUBE METAL 218394 (BTU/SEC) *
* GSB GAS MASS FLOW THRU BED 541.07 (LB/SEC) *
* XSB FLUIDIZED BED VOID FRACTION 0.6262 *
* TSB AVERAGE BED TEMPERATURE 1550 (DEG F) *
* TSBMT AVERAGE TUBE METAL TEMPERATURE 1094.1 (DEG F) *
* KSBGBT HEAT TRANSFER CONSTANT 197.97 *
* *****
*
** HEAT STORAGE IN SUPERHEATER BED TUBE METAL
   DTSBMT=(QSBT-QSBTS)/KSBMT
   TSBMT=INTGRL (ITSBMT,DTSBMT)
   INCON ITSBMT=1094.1
   PARAM KSBMT=44403.

*
** HEAT TRANSFER FROM STEAM TO SUPERHEAT BED
   QSBTS=KSBQTS*ABS(SSB)**.8*(TSBMT-TSBS)
   PARAM KSBQTS=9.021995
   TSBS=THOVAR (TEMP,RSBO,HSB)
   RSBO=KSBRR*RSL

*
* *****
* KSBMT ENERGY CONTENT OF METAL IN SUPERHEATER BEDS 44403 (BTU/DEG F)*
* QSBTS HEAT TRANSFER FROM SUPERHEAT BEDS TO STEAM 218394.(BTU/SEC)*
* KSBQTS HEAT TRANSFER EQUATION COEFFICIENT 9.022 *
* SSB FINISHING SUPERHEATER STEAM FLOW 1103. (LBS/SEC) *
* TRANSFER PIPE WEIGHT 13413 (LBS) *
* RSBO BED OUTLET DENSITY 3.5269 (LB/CU FT) *
* KSBRR RATIO OF BED OUTLET TO STEAM LINE DENSITY *
* HEADERS WEIGHT 35600 (LBS) *
* SPECIFIC HEAT OF METAL .12 (BTU/LB) *
* TOTAL WEIGHT 370030 (LBS) *
* TSBMT METAL TEMPERATURE IN SUPERHEATER BEDS 1094.1 (DEG F) *
* TSBS TEMPERATURE FOR BED STEAM 1005. (DEG F) *
* *****
*
** HEAT STORAGE IN STEAM IN FINISHING SUPERHEATER BEDS PIPING
   DHSB=(SPS*HPS-SSB*HSB+QSBTS)/HSBO
   HSB=INTGRL (IHSB,DHSB)
   INCON IHSB=1456.
   PARAM HPS=1282.

*
* *****
* SPS PRIMARY SUPERHEATER STEAM FLOW 1103 (LB/SEC) *
* SSB FINISHING SUPERHEATER STEAM FLOW 1103 (LB/SEC) *
* HPS PRIMARY SUPERHEATERS DISCHARGE ENTHALPY 1282 (BTU/LB) *
* HSB FINISHING SUPERHEATER DISCHARGE ENTHALPY 1456 (BTU/LB) *
* QSBTS HEAT FLOW TO STEAM 218394 (BTU/SEC) *
* ENERGY CONTENT OF STEAM 7451 (BTU/DEG F) *
* VOLUME OF STEAM IN TUBES 886 (CU FT) *
* VOLUME OF TRANSFER PIPES 708 (CU FT) *
* VOLUME OF HEADERS 378 (CU FT) *
* KSBVOL TOTAL STEAM VOLUME 1972 (CU FT) *
* AVERAGE DENSITY 4.1671 (LB/(FT**3)) *
* SPECIFIC HEAT OF STEAM 0.8196 (BTU/DEG F) *
* FSH INLET PRESSURE 2740.7 (PSIA) *

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* MSBO MASS OF STEAM 4.1671*1972 *
* *****
*
**
** FINISHING SUPERHEATER FLUIDIZATION HEIGHT PER BED BASIS **
**
XSBH=(500.+MSB/(2.*RSBHEB))/((1-XSB)*KSBAR)
PARAM RSBHEB=158.4,KSBAR=1320.
*
*****
* XSBH HEIGHT OF FLUIDIZED BED 4 (FT) *
* RSBHEB DENSITY OF LIMESTONE AND COAL 158.4 (LB/FT) *
* KSBAR EMPTY BED CROSS SECTIONAL FLOW AREA 1320 (SQ FT) *
* XSB SUPERHEAT BED FLUIDIZED VOID FRACTION .6262 *
* MSB MASS OF MATERIAL IN SUPERHEAT BED 466752 (LBS) *
*****
*
** SUPERHEAT BED FLUIDIZED VOID FRACTION
XSB=(KSBX*(ABS(GSB)/2)**2*(500+MSB/(2.*RSBHEB)))/(RSBG*KSBAR*...
(MSB/2))**0.3333
PARAM KSBX=1.0351E-02,KSBAR=1320.,RSBHEB=158.4
*
**
RSBG=KUNSBG/(TSB+460.)
PARAM KUNSBG=39.7
*
** FINISHING SUPERHEATER BEDS CONTINUITY EQUATION
PARAM KSBVOL=1972.
MSBO=RSB*KSBVOL
*
* *****
* FINISHING SUPERHEATER BEDS *
*
* KSBVOL STEAM VOLUME 1972 (CU FT) *
* RSB STEAM DENSITY 4.1671 (LB/CU-FT) *
* XSB SUPERHEAT FLUIDIZED BED VOID FRACTION .6262 *
* KUNSBG SUPERHEAT BED GAS CONSTANT 39.7 (CU FT/SQ IN) *
* RSBG SUPERHEAT BED GAS DENSITY .01976 (LB/CU FT) *
* KSBX VOID FRACTION CORRELATION CONSTANT 1.0351E-02 *
* GSB GAS FLOW OUT OF SUPERHEAT BEDS 541.05 (LB/SEC) *
* RSBHEB DENSITY OF LIMESTONE AND COAL 158.4 (LB/CU FT) *
* MSB MASS OF MATERIAL IN BED 466752 (LBS) *
* KSBAR EMPTY BED CROSS SECTIONAL AREA 1320 (SQ FT) *
* SSB FSH STEAM FLOW 1103. (LB/SEC) *
* FPS FSH INLET PRESSURE 2740.7 (PSIA) *
* PSB FSH DISCHARGE PRESSURE 2634.7 (PSIA) *
* *****
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*****
***** SECTION III *****
***** ENERGY BALANCE FOR REHEATER BED *****
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** REHEATER BED CALCULATIONS
** MASS OF MATERIAL IN REHEATER BED
* DMRB=FRB+LRB+ARB+GRB+BRB
* MRB=INTGRL(IMRB,DMRB)
  GRB=FRB+LRB+ARB-BRB
  FRB=FRBI*XUNF
  LRB=LRBI*XUNL
  ARB=ARBI*XUNA
  BRB=BRBI*XUNB
  PARAM MRB=233376.
  PARAM FRBI=27.16, LRBI=5.24, ARBI=241.88
  PARAM BRBI=3.759, ERBI=5.491
* INCON IMRB=233376.
*
* *****
* REHEATER BED (RB) PARAMETERS
* FRB COAL FLOW INTO RB 27.16 LB/SEC *
* LRB LIMESTONE FLOW INTO RB 5.24 (LB/SEC) *
* ARB AIR FLOW 241.88 (LB/SEC) *
* GRB GAS FLOW OUT 270.52 (LB/SEC) *
* BRB SPENT MATERIAL REMOVAL 3.759 (LB/SEC) *
* MRB MASS OF MATERIAL IN BED 233376 (LBS) *
* LRBI INITIAL LIMESTONE FLOW INTO RB 5.24 (LBS/SEC) *
* FRBI INITIAL COAL FLOW INTO RB 27.16 (LBS/SEC) *
* ARBI INITIAL AIR FLOW INTO RB 241.88 (LBS/SEC) *
* BRBI INITIAL SPENT MATERIAL REMOVAL 3.759 (LBS/SEC) *
* *****
*
** REHEATER BED COAL ENERGY RELEASE
  DQRB=((1.-KRB)*FRB*KUNFHV-QRB)/TRBF
  QRB=INTGRL(IQRB,DQRB)
  PARAM KUNFHV=11000. , TRBF=144. , KRB=0.1
  INCON IQRB=268884.
*
* *****
* REHEATER BED
* QRB ENERGY RELEASE OF COAL IN REHEATER CELL 268884. (BTU/SEC) *
* KRB CARBON CARRYOVER .1 *
* TRBF AVERAGE COAL PARTICLE BURNING TIME 144 (SEC) *
* KUNFHV HEATING VALUE OF COAL 11000 (BTU/LB) *
* FRB COAL FLOW 27.16 (LB/SEC) *
* *****
*
** REHEATER BED ENERGY BALANCE
  DERBT=(LRB*KUNLSH+FRB*KUNFSH)*TFF+(ARB*KUNASH*TAHO)-...
  (BRB*KUNSSH*TRBB)-(GRB*KUNSSH*TRB)+.729285*QRB-QRBT
*
* *****
* NOTE ENERGY RELEASE IN BED IS .91*QRB WITH .09 RELEASE ABOVE RFD *
* *****
*
  ERBT=INTGRL(IERBT,DERBT)
  TRB=ERBT/(MRB*KUNSSH)
  PARAM TRBB=250.
  INCON IERBT=9.7667E07
*
* *****
* REHEATER BED ENERGY BALANCE
* KUNLSH LIMESTONE SPECIFIC HEAT .25 (BTU/LB F) *
* KUNFSH COAL SPECIFIC HEAT .25 (BTU/LB F) *

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* KUNASH AIR SPECIFIC HEAT .28 (BTU/LB F) *
* KUNBSH BED MATERIAL SPECIFIC HEAT .27 (BTU/LB F) *
* KUNGSH GAS SPECIFIC HEAT .27 (BTU/LB F) *
* QRB REHEAT CELL ENERGY RELEASE 265896 (BTU/SEC) *
* HRB MASS OF MATERIAL IN BED 233376 (LBS) *
* TRB TEMPERATURE OF REHEAT BED 1550 (DEG F) *
* TRBB SPENT BED MATERIAL TEMPERATURE 250 (DEG F) *
* ERBT ENERGY IN REHEATER BED MATERIAL 9.7667E7 (BTU) *
* TAHO AIR HEATER OUTLET AIR TEMPERATURE 638.84 (DEG F) *
* GRB ENERGY RELEASE OF COAL IN REHEAT CELL 268880. (BTU/SEC) *
* QRB*T HEAT TRANSFER FROM BED TO IMMERSED TUBES 106730.(BTU/SEC)*
* *****
*
** ENERGY BALANCE FOR REHEATER BED GAS SPACE
DERBG=GRB*(KUNGSH*(TRB-TRBG)+.192635*QRB-QRBGHR
ERBG=INTGRL(IERBG,DERBG)
TRBG=ERBG/(KUNGSV*HRBG)
PARAM HRBG=469.4
INCON IERBG=153963.0
*
* *****
* REHEAT BED GAS SPACE *
* TRBG GAS TEMPERATURE AT CELL DISCHARGE INTO GAS PATH 1640 DEG F *
* .1926*QRB ENERGY RELEASE FROM COAL BURNED ABOVE BED 52168 (BTU/SEC)*
* QRBGHR HEAT TRANSFERED TO FRONT WALL,SIDE WALL AND REAR BED WALL *
* 45223 (BTU/SEC) *
* ERBG ENERGY CONTENT OF GAS IN GAS SPACE 153963 (BTU) *
* KUNGSV CONSTANT VOLUME GAS SPECIFIC HEAT .2 (BTU/LB) *
* NREG MASS OF GAS 469.4 (LB) *
* *****
*
** PEAK TEMPERATURE IN GAS SPACE ABOVE BED
TRBGP=TRB+.08241*QRB/(GRB*KUNGSH)
*
** RADIANT HEAT TRANSFER TO WALLS IN REHEAT BEDS
QRBGHR=((TRBG+460.)*.4.-(TEBSAT+460.)*.4.)*KRBGHR
PARAM KRBGHR=2.555102E-09
*
** HEAT TRANSFER FROM REHEAT BED TO IMMERSED TUBES
QRB*T=KRBQST*(1-XRB)*(GRB*.326)*(TRB-TRBHT)
PARAM KRBQST=112.110
*
* *****
* REHEAT BED *
* QRB*T HEAT TRANSFER FROM BED TO IMMERSED TUBE SURFACE 126681. *
* (BTU/LB) *
* GRB GAS FLOW RATE 270.52 (LB/SEC) *
* TRBHT TUBE METAL TEMPERATURE 1063 (DEG F) *
* TRBGP PEAK GAS TEMPERATURE ABOVE REHEAT BED 1850 (DEG F) *
* XRB BED VOID FRACTION .6262 *
* KRBGHR RADIANT HEAT TRANSFER GAS CONSTANT 2.555102E-09 *
* KRBQST HEAT TRANSFER CONSTANT 112.86 *
* TRB TEMPERATURE OF REHEAT BED 1550 (DEG F) *
* *****
*
** HEAT STORAGE IN REHEATER BED TUBE METAL
DTRBHT=(QRB*T-QRB*TS)/KRBH
TRBHT=INTGRL(ITRBHT,DTRBHT)
PARAM KRBH=33460.
INCON ITRBHT=1063.

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* *****
* REHEAT BED METAL ENERGY
* KRBM ENERGY CONTENT OF IMMERSED TUBES 33460. (BTU/LB) *
* TRBMT TUBE METAL TEMPERATURE 1063. (DEG F) *
* METAL MASS OF TUBES IN REHEAT BE 110545 (LBS) *
* TRANSFER PIPE WEIGHT 136437 (LBS) *
* HEADER WEIGHT 31853 (LBS) *
* TOTAL WEIGHT OF METAL 278835 (LBS) *
* SPECIFIC HEAT OF METAL .12 (BTU/LB F) *
* THERMAL CONDUCTIVITY 150 (BTU IN/ HR SQ FT F) *
* EQUIVALENT TUBE THICKNESS (IN) *
* *****
*
** HEAT TRANSFER TO STEAM IN REHEATER BED
  QRBTS=KRBQTS*ABS(SRB)**.8*(TRBMT-TRBS)
  PARAM KRBQTS=8.2552
  TRBS=TRT
*
* *****
* REHEAT BED METAL TO STEAM HEAT TRANSFER
* QRBTS METAL TO STEAM HEAT FLOW 126681. (BTU/SEC) *
* TRDS OUTLET STEAM TEMPERATURE 1005. (DEG F) *
* SRB STEAM FLOW THRU IMMERSED BED TUBES 989.7 (LB/SEC) *
* TRBMT TUBE METAL TEMPERATURE 1063. (DEG F) *
* KRBQTS
* *****
*
** HEAT STORAGE IN STEAM IN REHEAT BED IMMERSED TUBES
  DHRB=(SRB*HRH-SRB*HRB+QRBTS)/HRBS
  HRB=INTGRL(IHRB,DHRB)
  INCON IHRB=1519.
*
* *****
* ENERGY - REHEAT BED STEAM
* REHEAT BED IMMERSED TUBE STEAM VOLUME 582 (CU FT) *
* TRANSFER PIPE STEAM VOLUME 1805 (CU FT) *
* HEADERS STEAM VOLUME 107 (CU FT) *
* HRH REHEATER BED INLET ENTHALPY 1391.0 (BTU/LB) *
* HRB REHEATER BED DISCHARGE ENTHALPY 1519.0 (BTU/LB) *
* *****
*
** HIGH PRESSURE TURBINE DISCHARGE FLOW 989.7 (LB/SEC)
  PARAM KHPS=.89728
*
** REHEAT BED STEAM FLOW BALANCE
  HRBS=RRBS*VRBS
  PARAM VRBS=2494.
  RRBS=RRT
*
* *****
* REHEAT BED STEAM FLOW BALANCE
* KHPS RATIO OF REHEAT STEAM TO MAIN STEAM .897 *
* RRBS DENSITY OF STEAM IN REHEATER BED TUBES .64906(LB/CU FT) *
* HRBS MASS OF STEAM 1618.7 (LBS) *
* VRBS VOLUME OF REHEAT BEDS 2494 (CU FT) *
* *****
*
** REHEATER BED FLUIDIZATION HEIGHT
  XRBH=(500.+(HRB/RRDHCB))/((1-XRB)*HRBAR)

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PARAM RRBNEB=158.4, KRBAR=1320.
*
* *****
* XRBH  HEIGHT OF FLUIDIZED REHEATER BED      4 (FT) *
* RRBNEB DENSITY OF LIMESTONE AND COAL    158.4 (LB/CU FT) *
* KRBAR  EMPTY BED CROSS SECTIONAL FLOW AREA 1320 (SQ FT) *
* HRB                                         *
* XRB                                         *
* *****
*
** FLUIDIZED REHEATER BED VOID FRACTION
  XRB=(KRBX*ABS(GRB)**2*(500.+(HRB/RRBM)))/(RRBG*HRB*KRBAR)**.3333
  PARAM KRBX=1.0351E-02,RRBM=158.4,KRBAR=1320.
*
* *****
* GRB    GAS FLOW RATE FROM THE REHEAT BED  270.52 (LB/SEC)*
* KRBX    COEFFICIENT BASED ON DESIGN DATA 1.0351E-02 *
* RRBG    GAS DENSITY                        .01976 (LB/CU FT) *
* KRBAR   EMPTY BED CROSS SECTIONAL FLOW AREA 1320 (SQ FT) *
* RRBH    DENSITY OF REHEAT BED MATERIAL    158.4 (LB/CU FT) *
* TRB     TEMPERATURE OF REHEAT BED         1500 (DEG F) *
* *****
*
** REHEATER BED GAS DENSITY
  RRBG=KUNPG/(TRB+460.)
*
* *****
* KUNPG   GAS LAW CONSTANT ASSUMING ATMOSPHERIC PRESSURE *
*                                     39.7 (LB-R/CU FT) *
* TRB     TEMPERATURE OF REHEAT BED         1550 (DEG F) *
* *****
*
**
**
**
*****
*****
SECTION IV
*****
MASS BALANCE FOR CARBON BURNUP CELL
*****
**
**
**
** MASS BALANCE FOR CARBON BURNUP CELL
* DMCB=FCB+BCB+ACB-GCB
* MCB=INTGR(IHCB,DMCB)
  ACB=ACBI*XUMA
  GCB=FCB+BCB+ACB
  PARAM ACBI=145.06
  INCON IHCB=224640.
*
* *****
* CARBON BURNUP CELL *
* BCB SPENT BED AND ELUTRIATED SOLIDS RETURNED TO CBC 3.1632(LB/SEC) *
* CBC SOLIDS ELUTRIATED FROM CBC 17.66 (LB/SEC) *
* ACB REHEAT AND AIR BLOWER AIR TO CBC 145.06 (LB/SEC) *
* GCB GAS AND SOLIDS FLOW OUT OF CBC 172.44 (LB/SEC) *
* IHCB MASS OF BED 224640 (LBS) *

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* ACBI INITIAL AIR FLOW TO CBC                      145.06 (LBS/SEC)*
* *****
*
***** ENERGY RELEASE OF COAL IN THE CARBON BURNUP CELL *****
***** ELUTRIATED COAL COLLECTED FOR CARBON BURNUP CELL *****
FCBI=(FRB+FSB+FEB)*.1782
*
** ELUTRIATED SOLID TO CBC DELAYED BY MBC BURNUP TIME
DFCB=(FCBI-FCB)/TEBT
FCB=INTGRL(IFCB,DFCB)
INCON IFCB=24.4
BCB=.1683*(BRB+BEB+BSB)
PARAM KEBF=.1
*
* *****
* FCB ELUTRIATED COAL AND SOLIDS COLLECTED FOR CBC      24.2 (LB/SEC) *
* NOTE .92 IS CYCLONE RECOVERY FACTOR OF MBC ELUTRIATED SOLIDS *
* NOTE .1683 IS FRACTION OF SPENT BED MATERIAL SENT TO CARBON BURNUP CELL*
* *****
*
** CARBON BURNUP CELL COAL ENERGY RELEASE
DQCB=((1-KCBF)*( .5353*FCB+.0125*ECB)*KUNFHV-QCB)/TCBF
*
* *****
* NOTE .06 IS FRACTION OR RECYCLED SPENT FEED MATERIAL THAT IS CARBON *
* *****
*
QCB=INTGRL(IQCB,DQCB)
PARAM KCBF=0.1, TCBF=59.52
INCON IQCB=129777.
*
* *****
* CARBON BURNUP CELL 'CBC' *
* QCB HEAT RELEASE IN CARBON BURNUP CELL 129777. (BTU/SEC) *
* KCBF ELUTRIATED CARBON FROM CBC 0.1 *
* FCB ELUTRIATED COAL COLLECTED FOR CBC 24.4 (LB/SEC) *
* TCBF AVERAGE COAL PARTICLE BURNUP TIME 59.52 (SECS) *
* KUNFHV FUEL HEATING VALUE 11000 (BTU/LB) *
* BCB SPENT MAIN BED MATERIAL RECYCLED TO CBC 3.796 *
* *****
*
** ENERGY BALANCE FOR CARBON BURNUP BED
DECB=BCB*KUNBSH*TCBSSI+FCB*KUNFSH*TECG+ACB*KUNASH*TAHO-...
GCB=KUNSSH*TCB+.899836*QCB-QCBT
ECB=INTGRL(IECB,DECB)
TCB=ECB/(HCB*KUNGSV)
PARAM TCBSSI=250.,HCB=224640.
INCON IECB=85.3632E06
*
* *****
* CARBON BURNUP CELL ENERGY BALANCE *
* KUNBSH SPECIFIC HEAT OF BED SPENT MATERIAL .27 (BTU/LB-F) *
* TCBSSI TEMPERATURE OF ENTERING SPENT BED MATERIAL 250 (DEG F) *
* KUNFSH SPECIFIC HEAT OF COAL .25 (BTU/LB-F) *
* TECG TEMPERATURE OF SOLID MATERIAL FROM CYCLONE SEPERATOR *
* 750 (DEG F) *
* ACB AIR FLOW TO CBC 145.06 (LB/SEC) *
* KUNASH AIR SPECIFIC HEAT AT CONSTANT PRESSURE .28 (BTU/LB-F) *
* GCB GAS FLOW OUT OF CBC 172.44 (LB/SEC) *
* BCB SPENT SOLIDS REMOVED FROM CBC 0 (LB/SEC) *

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* QCB*.887886 ENERGY RELEASE OF COAL IN CBC 115214 (BTU/SEC) *
* TCB BED TEMPERATURE 1900 (DEG F) *
* KUNGSV GAS SPECIFIC HEAT AT CONSTANT VOLUME .2 (BTU/LB-F) *
* MCB MASS OF MATERIAL IN CBC 224640 (LBS) *
* ECB ENERGY CONTENT OF CBC MATERIAL 85.3632E06 (BTU) *
* QCBT HEAT TRANSFER TO CBC BED TUBES (ECONOMIZER-3) *
* 57356 (BTU/SEC) *
* TAHO AIR INLET TEMPERATURE 639 (DEG F) *
* KUNGSH GAS SPECIFIC HEAT AT CONSTANT PRESSURE .27 (BTU/LB-F) *
* *****
** HEAT BALANCE IN CONVECTIVE AND GAS ZONE OF CBC
DECBG=GCB*KUNGSH*(TCB-TCBG)+.11167*QCB-QCBGNE
ECBG=INTGRL(IECBG,DECBG)
TCBG=ECBG/(MCBG*KUNGSV)
PARAM MCBG=214.
INCON IECBG=30836.
*
* *****
* TCBG GAS EXIT TEMPERATURE 720 (DEG F) *
* QCB*.11211 CARBON BURNUP IN GAS SPACE 14549. (BTU/SEC) *
* QCBGNE HEAT TRANSFER TO WATER IN CBC 69489. (BTU/SEC) *
* TCB CBC BED TEMPERATURE 1900 (DEG F) *
* ECBG ENERGY IN CBC CELL GAS 30836 (BTU) *
* MCBG MASS OF GAS IN CBC CELL 214 (LB) *
* GCB GAS FLOW RATE 172.44 (LB/SEC) *
* *****
** HEAT TRANSFER FROM CARBON BURNUP CELL TO IMMERSED TUBES
QCBT=KCBGCB*(1-XCB)*(ABS(GCB)**.326)*(TCB-TCBW)
PARAM KCBGCB=25.77
*
* *****
* CARBON BURNUP BED *
* GCB GAS FLOW RATE FROM CBC 172.44 (LBS/SEC) *
* TCBW WATER TEMPERATURE LEAVING CBCSW 623.3 (DEG F) *
* XCB FLUIDIZED BED VOID FRACTION .6743 *
* TCB AVERAGE FLUIDIZED BED TEMPERATURE 1900 (DEG F) *
* KCBGCB HEAT TRANSFER CONSTANT 8.727 *
* *****
** HEAT TRANSFER FROM CBC GAS SPACE TO WALLS AND ECONOMIZER 2
QCBGNE=QCBGHR+QCBEC2
*
** RADIATION FROM GAS SPACE TO WALLS
QCBGHR=KCBGHR*(TCBGA+460.)**4.-((TCBW+460.)**4.
PARAM KCBGHR=2.2224E-09
*
** CONVECTION TO ECONOMIZER 2 TUBE BANKS
QCBEC2=KCBEC2*(ABS(GCB)**.61)*(TCBGA-TCBW)
PARAM KCBEC2=3.1932
*
** AVERAGE GAS TEMPERATURE IN ECONOMIZER 2
TCBGA=(TCBG+TCB)/2.
*
* *****
* RADIANT AND CONVECTIVE CARBON BURNUP CELL HEAT TRANSFER *
* QCBGNE TOTAL OF GAS SPACE RADIANT AND CONVECTIVE HEAT TRANSFER 69489 (BTU/SEC) *
* QCBGHR RADIATION FROM GAS SPACE TO WALLS 18751 (BTU/SEC) *

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* QCBEC2 CONVECTION HEAT TRANSFER FROM GAS TO ECONOMIZER 2 TUBES *
* 50738 (BTU/SEC) *
* KCBGWR RADIATION HEAT TRANSFER CONSTANT 2.2224E-09 *
* KCBEC2 CONVECTION HEAT TRANSFER CONSTANT 3.1932 *
* GCB GAS AND SOLIDS FLOW RATE 172.43 (LB/SEC) *
* TCBGA AVERAGE GAS TEMPERATURE IN ECONOMIZER 2 1310. (DEG F) *
* *****
*
** WATER AND METAL ENERGY BALANCE FOR CBC
  DECBW=HEC*KUNNSH*(TEC-TCBW)+QCBGWE+QCBT
  ECBW=INTGRL(IECBW,DECBW)
  TCBW=ECBW/(HCBW*KUNNSH+MCBW*KUNNSH)
  PARAM KUNNSH=1.38055,KUNMSH=.12,HECI=1103.,HCBW=438324.
  PARAM HCBW=76994.
  INCON IECBW=.990379E08
*
** FEEDWATER STEP INPUT
  WEC=XUNW*WECI
*
*
* *****
* CARBON BURNUP CELL WATER - METAL ENERGY BALANCE *
* TCBW TEMPERATURE OF WATER LEAVING CBC FOR BOILING BEDS 623.3(DEG F) *
* QCBT HEAT TRANSFER TO CBC BED TUBES (ECON -3) 57098. (BTU/SEC) *
* XUNW FEEDWATER STROKE FRACTION 1. *
* WECI WATER FLOW 1103. (LB/SEC) *
* QCBGWE HEAT TRANSFER TO WATER IN CBC 69489 (BTU/SEC) *
* WEC WATER FLOW THRU CBC 1103. (LB/SEC) *
* KUNNSH SPECIFIC HEAT OF WATER 1.38055 (BTU/LB-F) *
* TEC TEMPERATURE OF WATER ENTERING CBC FROM ECONOMIZER 1 540 (DEG F) *
* HCBW MASS OF METAL TUBES IN CBC BED, WALLS AND GAS SPACE 438324 (LBS) *
* 414623 (LBS) HEATED SURFACE *
* 20180 (LBS) TRANSFER PIPES *
* 3521 (LBS) HEADERS *
*
* 438324 (LBS) TOTAL METAL WEIGHT *
* HCBW MASS OF WATER IN CBC SYSTEM 76994 (LBS) *
* KUNNSH METAL SPECIFIC HEAT .12 (BTU/LB-F) *
* ECBW ENERGY CONTENT OF METAL AND WATER 1.01770E08 (BTU) *
* *****
*
** CBC ENTHALPY PICKUP OF WATER
  HEBI=HEC+KUNNSH*(TCBW-TEC)
  PARAM HEC=537.
*
* *****
* HEC GAS PATH ECONOMIZER DISCHARGE ENTHALPY 537 (BTU/LB) *
* HEBI BOILING BED INLET ENTHALPY 652 (BTU/LB) *
* *****
*
** FLUIDIZED BED HEIGHT CARBON BURNUP CELL
  XCBH=(159.+(HCB/RCBW))/((1.-XCB)*KCBAR)
  PARAM RCBW=160., KCBAR=1200.
*
* *****
* CBC BED HEIGHT *
* XCBH BED HEIGHT 4 (FT) *
* RCBW BED DENSITY 160 (LB/CU FT) *
* KCBAR EMPTY BED FLOW AREA 1200 (SQ FT) *

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* MCB WEIGHT OF BED MATERIAL      224640 (LBS)      *
* XCB VOID FRACTION                .6743            *
* *****
*
** FLUIDIZED CARBON BURNUP CELL VOID FRACTION
   XCB=(KCBX*ABS(GCB)**2*(159.+(MCB/RCBG))/(RCBG*MCB*KCBAR))**.3333
   PARAM KCBX=2.9917E-02
*
* *****
* KCBX COEFFICIENT BASED ON DESIGN DATA  2.056E-06  *
* GCB GAS AND SOLID FLOW RATE            172.43 (LB/SEC) *
* XCB CBC CELL VOID FRACTION              .6743      *
* *****
*
** CBC GAS DENSITY IN BED
   RCBG=KUNPG/(TCB+460.)
*
* *****
* RCDO CBC BED GAS DENSITY                .016822      *
* KUNPG GAS LAW CONSTANT ASSUMES ATMOSPHERIC PRESSURE  *
*                                     39.7 (LB-R/CU FT)  *
* TCB CBC BED TEMPERATURE                1900 (DEG F)  *
* *****
*
**
**
**
**
*****
*****
***** SECTION V *****
***** STEAM LINE, GOVERNOR VALVE, AND HIGH PRESSURE TURBINE MODELS *****
*****
**
**
**
** STEAM LINE, GOVERNOR VALVE AND HIGH PRESSURE TURBINE MODELS:
** STEAM CONTINUITY EQUATIONS
   DRSL=(SSL-SGV)/KSLVT
   RSL=INTGRL(IRSL,DRSL)
   HSL=RSL*KSLVT
   PARAM KSLVT=4747.72
* *****
* SSL (LB/SEC) *
* SGV STEAM FLOW INPUT TO GOVERNOR VALVE 1103. (LB/SEC) *
* RSL STEAM LINE AND FINISHING SUPERHEATER DENSITY 3.3206 *
*                                     (LB/CU FT) *
* KSLVT TOTAL STEAM LINE AND FINISHING SUPERHEATER VOLUME 4747.72 *
*                                     (CU FT) *
* *****
*
** STEAM LINE AND GOVERNOR VALVE FLOW CALCULATIONS
   DHSL=(SSL*(HSL-HSL)+QSLMA)/HSL
   HSL=INTGRL(IHSL,DHSL)
   PSL=THOVAR(PRESS,RSL,HSL)
   DTSLM=(QSLA-QSLIA)/(KSLM*KUNMSH)
   TSLM=INTGRL(ITSML,DTSLM)
   QSLA=0.

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      QSLMA=KSLMQ*ABS(SSB/SSBSS)**.8*(TSLM-TGV)
      PARAM SSBSS=1103. ,KSLM=362378. ,KSLMQ=451.05
      INCON IHSL=1456.
      INCON ITSLM=998.13
** INSULATED STEAM LINE AND GOVERNOR VALVE ENTHALPY
** AND PRESSURE CALCULATIONS
*
* *****
* SSL STEAM LINE MASS FLOW (SSBSS) 1103. (LBM/SEC) *
* HSL STEAM LINE OUTLET ENTHALPY 1456. (BTU/LBM) *
* HSB FINISHING SUPERHEATER OUTLET ENTHALPY 1456. (BTU/LBM) *
* KSLM STEAM LINE METAL MASS 362378. (LBM) *
* TSLM STEAM LINE METAL TEMPERATURE 1005. (DEG F) *
* QSLMA STEAM LINE METAL TO STEAM HEAT TRANSFER 17.484 (BTU/SEC) *
* QSLA STEAM LINE GAS TO METAL HEAT TRANSFER 0. (BTU/SEC) *
* KUNSSH SPECIFIC HEAT OF METAL .12 (BTU/LBM-F) *
* KSLMQ STEAM LINE HEAT TRANSFER PARAMETER 451.05 (BTU/SEC-F) *
* SSBSS STEADY STATE FINISHING SUPERHEAT STEAM FLOW 1103. (LBS/SEC) *
* SSB FINISHING SUPERHEAT STEAM FLOW 1103. (LBS/SEC) *
* *****
*
* ** HIGH PRESSURE TURBINE GOVERNOR VALVE TEMPERATURE AND STEAM FLOW
      TGV=TGOVAR (TEMP,RSL,HSL)
      TGV5=AFGEN (TEMPS,PSL)
      TGVSH=(TGV-TGV5)
      SGV=AGVF*PSL**.97/(60.*(1+.00065*TGVSH))
      AGVF=AGV*XUNGV
*
* *****
* TGV TEMPERATURE OF STEAM AT GOVERNOR VALVE 998.13 (DEG F) *
* TGV5 SATURATED STEAM TEMPERATURE 670.6 (DEG F) *
* TGVSH TEMPERATURE OF STEAM ABOVE SATURATED 328.071 (LB/CU FT) *
* AGV TURBINE EFFECTIVE AREA 40.047 (SQ IN)*
* SGV STEAM FLOW INPUT TO GOVERNOR VALVE 1103. (LBS/SEC) *
* PSL PRESSURE AT GOVERNOR VALVE 2534.7 (PSIA) *
* AGVF TURBINE EFFECTIVE AREA (STATIC) 40.047 (SQ IN) *
* XUNGV GOVERNOR VALVE STROKE FRACTION 1. *
* *****
*
* ** REHEATER STEAM OUTLET DENSITY AND PRESSURE
      PRH=PRT+KRHFR*ABS(SRH)*SRH
      RRH=1.2561*RRT
      PARAM KRHFR=2.0075E-05
*
* *****
* KRHFR FRICTION DROP CONSTANT 2.0075E-05 (PSIA-SEC**2/LBM CU-FT)*
* RRH OUTLET REHEAT STEAM DENSITY .81528 (LB/CU FT) *
* PRT REHEAT TURBINE THROTTLE PRESSURE 550.7 (PSIA) *
* SRH REHEAT STEAM FLOW 989.73 (LBS/SEC) *
* RRT REHEAT TURBINE THROTTLE DENSITY .65040 (LB/CU FT) *
* PRH OUTLET REHEAT PRESSURE 564.7 (PSIA) *
* *****
*
* ** HIGH PRESSURE TURBINE EXHAUST STATES
      PHP=KHPFR*ABS(SHP)*SHP/RRH*PRH
      THP=(TGV+460.)*(PHP/PSL)**((KT-1.)/KT)-460.
      HHP=HSL-KUNSSH*(TGV-THP)
      PHP1=PHP+KGV1*ABS(SGV)*SGV/(RRH+RSL)/2
      PARAM KT=1.2567 ,KUNSSH=.39982

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* *****
* SHP   HIGH PRESSURE TURBINE DISCHARGE FLOW   989.7 (LBS/SEC) *
* HSL   STEAM LINE OUTLET ENTHALPY           1456. (BTU/LBM) *
* THP   TURBINE EXHAUST TEMPERATURE           628. (DEG F) *
* KGV1  FRICTION DROP CONSTANT   849870. (PSIA SEC**2/LBM**2) *
* RSL   STEAM LINE AND FINISHING SUPERHEAT DENSITY 3.3261(LB/CU FT)*
* THP   TURBINE EXHAUST TEMPERATURE           628. (DEG F) *
* HHP   TURBINE EXHAUST ENTHALPY             1308. (BTU/LBM) *
* PHP   TURBINE EXHAUST PRESSURE             590.7 (PSIA) *
* KT    SPECIFIC HEAT RATIO                 1.2567 *
* PHP1  FIRST STAGE PRESSURE                 598.13 (PSIA) *
* KHPFR  HIGH PRESSURE TURBINE EXHAUST FRICTION LOSS 1.7423E-05 *
*      (SEC SQ/LBM-IN SQ) *
* KUNSSH SPECIFIC HEAT OF STEAM              .39982 (BTU/DEG-F) *
* *****
*
** REHEAT BED OUTLET DENSITY AND STEAM MASS AND PRESSURE
   DRRT=(SRB-SRT)/(KRBV+KRHV)
   RRT=INTGRL(IRRT,DRRT)
   HRT=HRB
   PRT=THOVAR (PRESRH,RRT,HRT)
   SRH=SHP
   SRB=SRH
   PARAM KRBV=5333. ,KRHV=5333.
*
* *****
* SRB   REHEATER 1 FLOW                     989.7 (LBM/SEC) *
* SRH   REHEATER 2 FLOW                     989.7 (LBM/SEC) *
* SRT   REHEAT TURBINE FLOW                 989.7 (LBM/SEC) *
* RRT   REHEAT TURBINE THROTTLE DENSITY     .64906 (LBM/CU FT) *
* HRB   REHEAT BED OUTLET ENTHALPY          1519. (BTU/LBM) *
* PRT   REHEAT TURBINE THROTTLE PRESSURE    550.7 (PSIA) *
* KRHV  HALF OF REHEATER STEAM VOLUME       5333. (CU FT) *
* KRBV  HALF OF REHEATER STEAM LINE VOLUME  5333. (CU FT) *
* *****
*
** TURBINE GOVERNOR VALVE FLOW ENTHALPY
   SRT=ART*ABS(PRT)**.97/(60.*(1+.00065*TRTSH))*INSH(PRT,-1.,1.)
   TRTSH=TRT-TRTS
   TRT=THOVAR (TEMPRH,RRT,HRT)
   TRTS=ARGEN (TEMPS,PRT)
*
* *****
* SRT   LOW PRESSURE TURBINE STEAM FLOW     989.7 (LBM/SEC) *
* PRB   REHEAT BED PRESSURE                 550.7 (PSIA) *
* TRT   REHEAT TURBINE THROTTLE TEMPERATURE 1001.5 (DEG F) *
* TRTSH DEGREES SUPERHEAT                   616.35 (DEG F) *
* TRTS  REHEAT TURBINE THROTTLE STEAM SATURATION TEMPERATURE
*      385.4 (DEG F) *
* ART   LOW PRESSURE TURBINE GOVERNOR VALVE AREA 182.71 (SQ-IN) *
* *****
*
** HIGH PRESSURE AND LOW PRESSURE TURBINE THERMAL POWER OUTPUT
   MHP=KEF*SGV*(HSL-HHP)*.2931*3600.
   MRT=NEF*SRT*(HRT-HCD)*.2931*3600.
   PARAM HCD=1050. ,KEF=.85676
*
* *****
* SGV   GOVERNOR VALVE STEAM FLOW           1103. (LBS/SEC) *

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* KPSGH DITTUS BOELTER COEFFICIENT FOR CONVECTION HEAT TRANSFER *
* FROM GAS TO SUPERHEATER TUBE 270.47 (BTU/LB-F)*
* KPSV GAS PATH GAS VOLUME 39600 (CU FT) *
* KPSMG GAS PATH GAS MASS 867.09 (LBM) *
* GPS GAS PATH FLOW RATE (GPSS) 901.73 (LBM) *
* TGP TEMPERATURE OF GAS AT HOT SIDE OF PS TUBES 1353.1 (DEG F) *
* TPSGA PRIMARY SUPERHEATER AVERAGE GAS TEMPERATURE 1023. (DEG F) *
* GPSSS STEADY STATE MASS FLOW RATE IN GAS MIXTURE 1 901.73(LB/SEC)*
* TPSM PRIMARY SUPERHEATER AVERAGE TUBE TEMPERATURE 921.54 (DEG F)*
* RGP GAS PATH GAS DENSITY .0219 (LB/CU FT) *
* *****
*
** STEAM PROPERTY FITS FOR TPS AND HPS CALCULATIONS
DHPS=((SPS*(HGPS-HPS))+QPSMA)/HPS
HPS=RPS*KPSVT
QPSMA=KPSMS*ABS(SPS/SPSSS)**.8*(TPSM-TPSA)
HPS=INTGRL(IHPS,DHPS)
TPS=TWOVAR (TEMP,RPS,HPS)
TPSA=(TPS+TGPS)/2.
PARAM KPSMS=438.54 ,SPSSS=1103. ,KPSVI=2608.94
INCON IHPS=1258.

*
* *****
* HPS PRIMARY SUPERHEATER OUTLET STEAM ENTHALPY 1258. (BTU/LBM) *
* TPSG GAS PATH GAS TEMPERATURE 1353.1 (DEG F) *
* TPS PRIMARY SUPERHEATER STEAM OUTLET TEMPERATURE 792. (DEG F) *
* TPSMA PRIMARY SUPERHEATER METAL TEMPERATURE 1023.4 (DEG F) *
* KPSHS METAL TO STEAM HEAT TRANSFER COEFFICIENT 438.54 (BTU/SEC-F)*
* SPSSS STEAM MASS FLOW AT 100 % LOAD 1103. (LBM/SEC) *
* HGPS ENTHALPY OF GAS PATH STEAM 1190. (BTU/LBM) *
* RPS PRIMARY SUPERHEATER STEAM DENSITY 5.2623 (LB/CU FT) *
* TGPS GAS PATH ENCLOSURE TUBE STEAM TEMPERATURE 735. (DEG F) *
* TPSA PRIMARY SUPERHEATER AVERAGE TUBE TEMP. 756.77 (DEG F) *
* IPS PRIMARY SUPERHEATER STEAM MASS 136. (CU FT) *
* KPSVT PRIMARY SUPERHEATER STEAM VOLUME 2608.94 (CU FT) *
* QPSMA HEAT TRANSFER METAL TO STEAM 75004. (BTU/SEC) *
* *****
*
** PRIMARY SUPERHEATER TUBE METAL TEMPERATURE
DTPSM=(QPSA-QPSMA)/(KPSM*KUNNSH)
TPSM=INTGRL(ITPSM,DTPSM)
PARAM KPSM=798510.4
INCON ITPSM=921.54

*
* *****
* KPSM PRIMARY SUPERHEATER TUBE METAL MASS 798510.4 (LBM) *
* TPSM PRIMARY SUPERHEATER AVERAGE TUBE TEMPERATURE 921.54 (DEG F) *
* *****
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* *****
* *****
* SECTION VII *****
* REHEATER MODEL *****
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**
** REHEAT FLOW RATE BALANCES
    KRHSP=0.
    SHP= KHPSFR*SGV+KRHSP
    PARAM KHPSFR=.8973
*
* *****
* KRHSP REHEAT SPRAY WATER FLOW RATE          0. (LBS/SEC) *
* SHP HIGH PRESSURE TURBINE OUTLET STEAM FLOW 1103. (LBS/SEC) *
* KHPSFR HIGH PRESSURE TURBINE EXHAUST FLOW FRACTION .8973 *
* SGV GOVERNOR VALVE STEAM FLOW              1103. (LBS/SEC) *
* *****
*
** GAS ENERGY TO REHEAT TUBES
    TRHGA=(TRHG+TGP)/2.
    DTRHG=(GRH*KUNGSV*(TGP-TRHG)-KRHGM*(ABS(GRH)/GRHSS))*6...
    (TRHGA-TRHM)/(KUNGSV*MRHG)
    TPRNG=INTGRL(ITRHG,DTRHG)
    MRHG=KRHV*RRH
    PARAM KRHV=39600. ,GRHSS=450.43
    INCON ITRHG=667.1
*
* *****
* TRHGA GAS TEMPERATURE DOWN STEAM OF REHEATER 667.1 (DEG F) *
* GRHSS STEADY STATE GAS MASS FLOW THROUGH REHEATER 450.43 (LB/SEC) *
* KUNGSV GAS SPECIFIC HEAT AT CONSTANT VOLUME .2 *
* MRHG MASS OF REHEATER GAS 32352. (LBM) *
* RRH OUTLET REHEAT STEAM DENSITY .81528 (LB/CU FT) *
* GRH REHEAT GAS FLOW (GRHSS) 450.43 (LB/SEC) *
* TGP GAS TEMPERATURE AT HOT SIDE OF REHEAT TUBES 1353.1 (DEG F) *
* TRHG GAS TEMPERATURE DOWN STREAM OF REHEATER 667.1 (DEG F) *
* KRHGM GAS TO METAL HEAT TRANSFER COEFFICIENT 416.9 (BTU/LBM-F) *
* KRHV GAS VOLUME AROUND REHEATER 39600. (CU FT) *
* *****
*
** REHEATER TUBE METAL TEMPERATURE
    TRHSA=(TRHS+THP)/2.
    DTRHM=(KRHGM*(ABS(GRH)/GRHSS))*6*(TRHGA-TRHM)-KRHMS*...
    (ABS(SRH)/SRHSS))*8*(TRHM-TRHSA))/(KUNHSH*KRHM)
    TRHM=INTGRL(ITRHM,DTRHM)
    PARAM KRHMS=713.78 ,KRHM=456518.4 ,KRHGM=416.938
    PARAM SRHSS=1103.
    INCON ITRHM=813.08
*
* *****
* KRHM REHEATER METAL MASS 456518.4 (LBS) *
* TRHSA AVERAGE REHEATER TUBE METAL TEMPERATURE 813.08 (DEG F) *
* THP TURBINE EXHAUST TEMPERATURE 628. (DEG F) *
* SRH REHEATER STEAM FLOW 989.73 (LBS/SEC) *
* SRHSS INITIAL REHEATER STEAM FLOW 1103. (LBS/SEC) *
* KRHMS METAL TO STEAM HEAT TRANSFER COEFFICIENT 713.78 (BTU/SEC-F) *
* TRHM REHEATER TUBE METAL TEMPERATURE 803.0 (DEG F) *
* KRHGM GAS TO METAL HEAT TRANSFER COEFFICIENT 313.8 (BTU/SEC-F) *
* *****
*
** REHEATER STEAM ENTHALPY
    DHRHS=(KRHSP*HRHSPW+SRH*HHP-SRH*HRHS+KRHMS*...
    *ABS(SRH/SRHSS))*8*(TRHM-TRHSA))/MRH
    HRH=KRHV*RRH

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      TRHS=TWOVAR( TEMPRH,RRH,HRHS)
      HRHS=INTGRL( IHRHS,DHRHS)
      HRH=HRHS
      PARAM HRHSPW=350. ,KRHVT=2753.61
      INCON IHRHS=1391.
*
* *****
* HRHS REHEATER STEAM OUTLET ENTHALPY 1391. (BTU/LBM) *
* HRHSP REHEATER MASS FLOW RATE (WFWSS) 1103. (LBS/SEC) *
* HRH REHEATER STEAM MASS 2250. (LBM) *
* HRH REHEATER BED INLET ENTHALPY 1391. (BTU/LBM) *
* HHP HIGH PRESSURE TURBINE STEAM ENTHALPY 1456. (BTU/LBM) *
* TRHM REHEATER TUBE METAL TEMPERATURE 892.9 (DEG F) *
* KRHS METAL TO STEAM HEAT TRANSFER 681.29 (BTU/SEC-F) *
* SRH REHEATER STEAM FLOW 989.73 (LBM/SEC) *
* KRHVT REHEATER STEAM VOLUME 2753.61 (CU FT) *
* HRHSPW REHEATER SPRAY WATER ENTHALPY 350. (BTU/LBM) *
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* *****
* *****
* SECTION VIII *****
* ECONOMIZER MODEL *****
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*
* METAL ENERGY
* DTECH=(QECC-QECH)/(KECM*KUNISH)
* TECH=INTGRL(ITECH,DTECH)
* QECC=KECG*ABS(GGP1/GGP1SS)**.6*(TECG-TECH)
* QECM=KECM*ABS(WFH/WFWSS)**.8*(TECH-TEC)
* PARAM KECM=290149.81 ,KECH=6141.42 ,KECG=502.79
* PARAM WFWSS=1103. ,GGP1SS=1352.64
* INCON ITECH=555.47
*
* *****
* GGP1 GAS FLOW RATE AROUND ECONOMIZER 1352.64 (LBM/SEC) *
* TEC ECONOMIZER OUTLET WATER TEMPERATURE 540. (DEG F) *
* TECH ECONOMIZER METAL TEMPERATURE 555.47 (DEG F) *
* GGP1SS STEADY STATE AIR HEATER INLET GAS FLOW RATE 1352.(LB/SEC)*
* TECG TEMPERATURE OF ECONOMIZER GAS OUTLET 720. (DEG F) *
* WFWSS WATER FLOW 1103. (LBS/SEC) *
* KECM ECONOMIZER TUBE METAL MASS 290149.81 (LBS) *
* QECC CONVECTION HEAT FLOW FROM FLUE GAS TO ECONOMIZER *
* TUBE WALLS 82724. (BTU/SEC-F) *
* KECG GAS TO METAL HEAT TRANSFER PARAMETER 502.79 (BTU/SEC-F) *
* TGP1 INLET GAS TEMPERATURE TO ECONOMIZER 920 (DEG F) *
* QECM HEAT FLOW FROM TUBE WALLS TO WATER IN ECONOMIZER TUBES *
* 82725. (BTU/SEC) *
* KECM METAL TO WATER HEAT TRANSFER PARAMETER 5347.44 *
* (BTU/SEC-F) *
* WFH FEEDWATER MASS FLOW RATE (WFWSS) 1103. (LBM/SEC) *
* *****
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MEC=KECVH*RECH
WFW=WFHSS*XUNH
WECSS=WFHSS
PARAM KECVN=591.65 ,RECH=50.

*
* *****
* RECH  DENSITY OF FEEDWATER AT ECONOMIZER OUTLET  50.  (LBH/CU FT) *
* WFW   MASS FLOW RATE OF FEEDWATER                1103. (LBS)      *
* WEC   MASS FLOW RATE AT ECONOMIZER OUTLET         1103. (LBS)      *
* KECVN  VOLUME OF WATER IN ECONOMIZER              526.8 (CU FT)    *
* WEC    MASS OF MATERIAL IN BED                    466752. (LBS)    *
* WFHSS  WATER FLOW                                 1103. (LBS/SEC)   *
* XUNH   FEEDWATER STROKE FRACTION                  1.              *
* WECSS  WATER FLOW                                 1103. (LBS/SEC)   *
* *****
*
** TEMPERATURE AND PRESSURE OF ECONOMIZER OUTLET WATER
   DTEC=((WEC*KUNHSH)*(TFH-TEC)+KECH*ABS(WEC/WECSS)**.8...
   *(TECH-TEC))/(HSP1*KUNHSH)
   TEC=INTGRL(ITEC,DTEC)
   PARAM TFH=484.
   INCON ITEC=540.

*
* *****
* TEC   TEMPERATURE OF ECONOMIZER OUTLET WATER 540 (DEG F)*
* KECH  METAL TO WATER HEAT TRANSFER PARAMETER 6141.42 *
* TFH   FEEDWATER FLOW 484. (DEG F) *
* *****
*
** TEMPERATURE OF ECONOMIZER GAS FLOW
   DTECG=((GGP1*KUNGS1)*(TGP1-TECG)-KECG*ABS(GGP1/GGP1SS)**.6*...
   (TECG-TECH))/(HSP1*KUNGSV)
   HSP1=RGPI*KVECG
   TECG=INTGRL(ITECG,DTECG)
   PARAM KVECG=216180. ,GGP1SS=1352.64 ,KUNGS1=.3057
   INCON ITECG=720.

*
* *****
* KECG  GAS PATH 1 VOLUME 216180. (CU FT) *
* GGP1  GAS FLOW RATE APPROX ECONOMIZER 1352.64 (LBS/SEC) *
* KUNGS1 SPECIFIC HEAT OF GAS PATH MIX. 1 .3057 (BTU/LB-F)*
* GGP1SS STEADY STATE AIR HEATER INLET GAS 1352.6 (LBS/SEC) *
*        FLOW RATE *
* TECH  ECONOMIZER METAL TEMPERATURE 555.47 (DEG F) *
* TECG  TEMPERATURE OF ECONOMIZER GAS OUTLET 720. (DEG F) *
* TGP1  TEMPERATURE OF GAS IN GAS MIXTURE 1 920. (DEG F) *
* MGP1  MASS FLOW RATE OF GAS IN GAS MIXTURE 1 (GGP1SS) *
*        1352.64 (LB/SEC) *
* RGPI  DENSITY OF ECONOMIZER GAS 1352.64 (LB/SEC) *
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***** SECTION IX *****
***** AIR HEATER *****
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**
** AIR HEATER FLOWS
    AAHO=(AEB+ASB+ARB+ACB)*.9548
    GEC=GGP1
    GCBC=.747*GCB
    GGP2=GCBC+GEC
    AAL=KAH*AAHO
    GAHO=GGP2+AAL
    AAHI=AAHO+AAL
    AAH=.5*(AAHI+AAHO)
    GAH=.5*(GGP2+GAHO)
    TAHG=.5*(TGP2+TAHGO)
    TAHA=.5*(TAH+TAHAO)
    PARAM KAH=.1331

*
** AIR HEATER OUTLET AIR TEMPERATURE
    KAHTA=AAHO+.5*AAL+.5*KAHAHT*AAHI*.8/KUNASH
    TAHAO=(AAHI*TAH-.5*AAL*TAH+AAH*.8*KAHAHT*(TAHM-.5*TAH))/KUNASH/KAHTA
    TAHO=TAHAO
    PARAM KAHAHT=9.13011,TAH=96.

*
** AIR HEATER OUTLET GAS TEMPERATURE
    KAHTG=KAHGS*GAHO+.5*KAHGHT*GAH*.8
    TAHO=(KAHGS*GGP2+TGP2+KUNASH*AAL*TAHA-.5*KAHGHT*GAH*.8...
    TGP2+KAHGHT*GAH*.8*TAHM)/KAHTG
    PARAM KAHGHT=9.1354, KAHGS=.3209

*
** AIR HEATER METAL TEMPERATURE
    DTAHM=(QAHG-QAHA)/(KAHM*KUNASH)
    QAHG=KAHGHT*GAH*.8*(TAHG-TAHM)
    QAHA=KAHAHT*AAH*.8*(TAHM-TAHA)
    TAHM=INTGRL(ITAHM,DTAHM)
    PARAM KAHM=362571.5
    INCON ITAHM=438.1

*
* *****
* GEC    ECONOMIZER GAS FLOW RATE          1352.6    (LBS/SEC) *
* GGP2   AIR HEATER INLET GAS FLOW RATE     1481.4    (LBS/SEC) *
* GCBC   GAS FLOW RATE FROM CBC TO ECONOMIZER 128.      (LBS/SEC) *
* GAH    AIR HEATER AVERAGE FLOW RATE      1547.      (LBS/SEC) *
* AEB    AIR FLOW INTO THE EVAPORATOR BEDS  483.76    (LBS/SEC) *
* ASB    AIR FLOW INTO THE SUPERHEATER BEDS 483.76    (LBS/SEC) *
* ARB    AIR FLOW INTO THE REHEATER BED     241.85    (LBS/SEC) *
* ACB    AIR FLOW INTO THE CBC              145.06    (LBS/SEC) *
* GGP1   GAS FLOW RATE AROUND ECONOMIZER    1352.4    (LBS/SEC) *
* AAL    AIR LEAKAGE IN AIR HEATER          172.13    (LBS/SEC) *
* KAH    AIR HEATER LEAKAGE FRACTION        .13310
* TAHG   AIR HEATER AVERAGE GAS TEMPERATURE 501.89    (DEG F) *
* KAHTA  AIR HEATER INTERMEDIATE AIR VARIABLE 1676.1
* KAHAHT AIR HEATER GAS HEAT TRANSFER PARAM. 9.1301 (BTU/DEG F-SEC)*
* KAHTG  AIR HEATER INTERMEDIATE GAS VARIABLE 2174.4
* KAHGS  AIR HEATER GAS SPECIFIC HEAT       .32090(BTU/DEG F-SEC)*
* KAHGHT AIR HEATER GAS HEAT TRANSFER PARAM. 9.1314(BTU/DEG F-SEC)*
* GAHO   AIR HEATER OUTLET GAS FLOW RATE     1653.6    (LBS/SEC) *
* AAHO   AIR HEATER OUTLET AIR FLOW RATE     1293.3    (LBS/SEC) *
* AAH    AIR HEATER AVERAGE AIR FLOW RATE   1379.4    (LBS/SEC) *

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* AAHI AIR HEATER INLET AIR FLOW RATE 1465.4 (LBS/SEC) *
* TAHI AIR HEATER TUBE METAL TEMPERATURE 438.1 (DEG F) *
* QAHG CONVECTION HEAT TRANSFER RATE FROM GAS TO TUBES 2.09E+05 (BTU/SEC) *
* QAHA CONVECTION HEAT TRANSFER RATE FROM TUBE TO AIR 2.09E+05 (BTU/SEC) *
* KAHM AIR HEATER TUBE TO AIR HEAT TRANSFER PARAMETER 3.62E+05 (BTU/SEC F) *
* TAH AIR HEATER INLET AIR TEMPERATURE 96.00 (DEG F) *
* TAHA AIR HEATER AVERAGE AIR TEMPERATURE 367.42 (DEG F) *
* TAHAO AIR HEATER OUTLET AIR TEMPERATURE 638.84 (DEG F) *
* TGP2 AIR HEATER INLET GAS TEMPERATURE 720. (DEG F) *
* TAHO AIR HEATER OUTLET GAS TEMPERATURE 283.64 (DEG F) *
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***** SECTION X *****
***** GAS PATH *****
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*****
***** GAS PATH MODEL (GP) MIXING *****
*****
**
** GAS MASS IN GAS PATH
RGP=KUNGP/(TGP2)
HGP=RGP*KGPGVT
GGP=GSB+GRB+GEB
PARAM KUNGP=39.7 ,KGPGVT=175140.,GSB=541.05,GRB=270.53,GEB=541.05
*
** GAS MASS FLOW RATE TO REHEATER AND TO PRIMARY SUPERHEATER
GRH=KDAHP*GGP
GPS=(1.-KDAHP)*GGP
PARAM KDAHP=.333333
*
** GAS PASS AVERAGE TEMPERATURE
DTGP=(KUNGS*(GSB*TSBG+GRB*TRBG+GEB*TEBG-GGP*TGP)-QEN)...
/(KUNGSV*HGP)
TGP=INTGRL(ITGP,DTGP)
QEN=KGPRAD*(TGPR**4.-TGPHR**4.)
TGPR=TGP+460.
PARAM KGPRAD=1.208587E-08
TGPHR=TGP+460.
*
** GAS PATH ENCLOSURE TUBE METAL TEMPERATURE
DTGPH=(QEN-QGPIS)/(KUNISH*KGPM)
QGPIS=KGPMIS*(ABS(SRW)/SRWSS)**.8*(TGPH-TGPS)
TGPH=INTGRL(ITGPH,DTGPH)
PARAM SRWSS=1103.
*
** GAS PATH ENCLOSURE STEAM TEMPERATURE
DHGPS=(SRW*(HRW-HGPS)+QGPIS)/NGPS
HGPS=RGPS*KGPMVT

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HGPS=INTGRL(IHGPS,DHGPS)
 TGPS=TNOVAR (TEMP,RGPS,HGPS)
 RGPS=.2343*RRH+.7657*RPS
 PARAM KGPMS=8402.29 ,KGPM=845720.1
 PARAM KGPVT=2809. ,TSBG=1640. ,TRBG=1640. ,TEBG=1640.
 INCON ITGP=1353.1 ,ITGPM=749. ,IHGPS=1190.

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*
* *****
* TGP  GAS PATH AVERAGE GAS TEMPERATURE      1353.1  (DEG F)  *
* RGP  GAS PATH GAS DENSITY                    .0219    (LBH/CU FT) *
* MGP  GAS MASS                                3834.9    (LBH)    *
* GGP  GAS PATH MASS FLOW RATE                 1352.64  (LB/SEC)  *
* KDAIP HEAT RECOVERY AREA GAS FLOW DAMPER     .333333
* GRH  GAS PATH TO REHEATER                    450.43  (LBH/SEC) *
* KUNGP UNIVERSAL CONSTANT FOR GAS PATH        39.7
* KGPRAO GAS PATH RADIATION COEFFICIENT 1.2085E-08 (BTU/SEC DEG R**4)*
* TGPMR ABSOLUTE GAS PATH METAL TEMPERATURE   1207.    (DEG F)  *
* TGMH  GAS PATH METAL SURFACE TEMPERATURE     749.0    (DEG F)  *
* QCPHS HEAT TRANSFER ENERGY METAL TO STEAM  104560.  (BTU/SEC)  *
* SRW  STEAM FLOW OUT OF REAR WALL ENCLOSURE   1103.    (LBS/SEC) *
* SRHSS STEADY STATE STEAM FLOW OUT OF RW ENCLOSURE 1103.(LBS/SEC) *
* HGPS  ENTHALPY OF GAS PATH STEAM             1190.    (BTU/LBH)  *
* HRW  ENTHALPY OF STEAM LEAVING REAR WALL     1093.    (BTU/LBH)  *
* RGPS  GAS PATH STEAM DENSITY                  6.0774  (LBS/CU FT) *
* KUNGSV SPECIFIC HEAT (CONSTANT VOLUME)       1.4
* GPS  GAS PATH TO PRIMARY SUPERHEATER         903.21  (LBH/SEC) *
* GSB  GAS FLOW RATE FROM TWO SUPERHEATER BEDS  544.06  (LB/SEC)  *
* TSS  GAS TEMPERATURE AT SUPERHEATER BEDS     155.0    (DEG F)  *
* GRB  GAS FLOW RATE FROM THE REHEAT BED       270.52  (LBS/SEC) *
* GEB  GAS FLOW RATE FROM TWO EVAPORATING BEDS  541.05  (LBS/SEC) *
* QEN  RADIATIVE HEAT TRANSFER PARAMETER GAS TO METAL 104785.
*
*
* TGPM  GAS PATH METAL SURFACE TEMPERATURE     749.0    (DEG F)  *
* TGPR  GAS PATH GAS ABSOLUTE TEMPERATURE      1813.1  (DEG F)  *
* KGPM  GAS PATH, ROOF AND 1/2 HRA METAL MASS   845720.  (CU FT)  *
* KGPMS METAL TO STEAM HEAT TRANSFER PARAMETER 5373.6  (BTU/SEC-F)*
* TGPS  GAS PATH ENCLOSURE TUBE STEAM TEMPERATURE 735.0  (DEG F)  *
* HGPS  STEAM MASS IN GAS PATH ENCLOSURE WALLS
* KGPVT STEAM VOLUME IN GAS PATH ENCLOSURE WALLS 2809. (CU FT)  *
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* *****

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*****
*****      GAS PATH NUMBER 1 MODEL      *****
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** GAS MASS IN NUMBER 1 MIXING VOLUME
   RGPI=KUNGP/(TGPI+460.)
   GGPI=GRH+GPS

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*
* *****
* RGPI  DENSITY OF GAS IN NO. 1 MIXING VOLUME   .0288  (LBH/CU FT)  *
* KUNGP  BOILING BED GAS CONSTANT               39.7  (LB-R/CU FT)  *
* TGPI  GAS PATH MIXING NO. 1 TEMPERATURE      920.    (DEG F)  *
* GGPI  GAS MASS FLOW RATE                     1353.64  (LB/SEC)  *
* GRH  GAS MASS FLOW RATE THROUGH REHEATER     450.43  (LB/SEC)  *
* GPS  GAS MASS FLOW RATE THROUGH PRIMARY SUPERHEATER 903.21 (LB/SEC)*
* *****

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** GAS PATH NUMBER 1 AVERAGE TEMPERATURE
   DTGPI=(GRH*TRHG+GPS*TPSG-(GGPI*TGPI))/HGPI

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TGP1=INTGRL(ITGP1,DTGP1)
INCON ITGP1=920.
*
*****
*****      GAS PATH NUMBER II MODEL      *****
*****
*
** GAS MASS IN NUMBER II MIXING VOLUME
   RGP2=KUNGP/(TGP2+460.)
   MGP2=RGP2*KGP2GV
*
** GAS PATH AVERAGE TEMPERATURE
   DTGP2=(GCBC*TCBG+GEC*TECG-GGP2*TGP2)/MGP2
   TGP2=INTGRL(ITGP2,DTGP2)
   PARAM KGP2GV=41040.
   INCON ITGP2=720.
*
* *****
* RGP2  DENSITY OF GAS PATH II                .0336 (LBM/CU FT) *
* GCBC  FLOW RATE OF CARBON BURNUP CELL        128.0 (LBM/SEC)  *
* TCBG  OUTLET TEMPERATURE OF CARBON BURNUP CELL 720. (DEG F)   *
* TGP2  TEMPERATURE OF GAS PATH 2 MIX         720. (DEG F)     *
* MGP2  MASS OF GAS PATH                      1380.8 (LBM)      *
* KGP2GV GAS VOLUME OF GAS PATH 2             41040. (CU FT)    *
* GEC   GAS FLOW THROUGH ECONOMIZER           1352.6 (LBM/SEC)  *
* TECG  TEMPERATURE AT OUTLET OF ECONOMIZER    720. (DEG F)     *
* KUNGP BOILING BED GAS CONSTANT              39.7 (LB-R/CU.FT) *
* GGP2  FLOW RATE OF GAS TO ECONOMIZER        1481.4 (LBM/SEC)  *
* *****
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*****
*****      SECTION XI      *****
*****      CAL-COMP PLOTTED DATA      *****
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**
NOSORT
* INITIAL VALUES OF BED TEMPERATURES
   TRBI=1550.
   TEBI=1550.
   TSBI=1550.
   TCBi=1900.
*
* INITIAL VALUES FOR PEAK GAS BED TEMPERATURES
   TEBGPI=1850.
   TSSGPI=1850.
   TRBGPI=1850.
   TCBGPI=720.
*
* INITIAL VALUES FOR BED STEAM TEMPERATURES
   TCBNI=623.3
   TRBSI=1005.
   TRHSI=700.

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        TSBSI=1005.
*
*
* DETERMINE THE PERCENT CHANGE IN BED TEMPERATURES
    TRBY=(TRB/TRBI)*100.-100.
    TEBY=(TEB/TEBI)*100.-100.
    TSBY=(TSB/TSBI)*100.-100.
    TCBY=(TCB/TCBI)*100.-100.
*
* NOW DETERMINE THE PERCENT CHANGE IN PEAK GAS BED TEMPERATURES
    TEBGPY=(TEBGP/TEBGPI)*100.-100.
    TSBGPY=(TSBGP/TSBGPI)*100.-100.
    TRBGPY=(TRBGP/TRBGPI)*100.-100.
    TCBGPY=(TCBGP/TCBGPI)*100.-100.
*
* NOW DETERMINE THE PERCENT CHANGE IN BED STEAM TEMPERATURES
    TCBHY=(TCBH/TCBHI)*100.-100.
    TRBSY=(TRBS/TRBSI)*100.-100.
    TRNSY=(TRNS/TRNSI)*100.-100.
    TSBSY=(TSBS/TSBSI)*100.-100.
*
* NOW CONVERT TIME FROM SECONDS TO MINUTES AND WRITE DATA ON TO A
* DISK FILE DATA SET NAME 'RLD.DATA1'
*
*     IF(KEEP.NE.1) GO TO 999
*     IF(TIME.LE.0) TPRIN=0.
*     IF(TIME.LT.TPRIN) GO TO 999
*     TIMEH=TIME/60.
*     WRITE(25,606) TIMEH,TEBY,TSBY,TRBY,TCBY
*606  FORMAT(3X,F8.3,4F8.3)
*     TPRIN=TPRIN+12.
*999  CONTINUE
**
**
** INITIAL VALUES FOR CAL-COMP PLOTTED DATA
    PGVSS=2534.7
    TGVN=990.0
    PRTSS=550.7
    PHP1SS=1800.0
    MGNSS=570.E+06
    TRTSS=1005.
    PHP1SS=-100.*(1.-PHP1/PHP1SS)
    PGVN= 100.*(1.-PSL/PGVSS)
    TGVN=-100.*(1.-TGV/PGVN)
    PRTN=-100.*(1.-PRT/PRTSS)
    TRTO=-100.*(1.-TRT/TRTSS)
    MGN=-100.*(1.-MRT/MHP)/MGNSS)
* NOW INCREMENT TIME FROM SECONDS TO MINUTES AND WRITE DATA ONTO DISK
    IF(KEEP.NE.1) GO TO 999
    IF(TIME.LE.0)TPRIN=0.
    IF(TIME.LT.TPRIN) GO TO 999
    TIMEH=TIME/60.
    WRITE(25,606)TIMEH,PGVN,PRTN,TGVN,TRTO,MGN
*606  FORMAT(3X,F8.3,5F8.3)
    TPRIN=TPRIN+12.5
*999  CONTINUE
*
** NUMBER OF DEBUGS
    PARAM IBUG1=4.,IBUG2=3.,IBUG3=3.,IBUG4=3.
*

```

```

** DEBUG TIME
    PARAM BUG1=0.,BUG2=550.,BUG3=1500.,BUG4=2200.
    CALL DEBUG(BUG1,BUG1)
    CALL DEBUG(BUG2,BUG2)
    CALL DEBUG(BUG3,BUG3)
    CALL DEBUG(BUG4,BUG4)
    PASS=PASS+1.

*
* TERMINAL
**
**
**
** END OF CSMP PROGRAM
**
**
** INTEGRATION ROUTINES SECTION
** TO SELECT A DESIRED INTERATION ROUTINE REMOVE THE '***' IN COLUMNS 1&2
**
** METHOD RKSFX
** METHOD STIFF
** METHOD RECT
**
**
** INTEGRATION TIMES SECTION
** DELT.----- INTEGRATION TIME STEP (SECS)
** OUTDEL.--- PRINT PLOT TIME INCREMENT (SECS)
** PRDEL.---- PRINTED DATA TIME INCREMENT (SECS)
** FINTIM.--- RUN REAL TIME DURATION (SECS)
**
**
**
TIMER DELT=.1,OUTDEL=44.,PRDEL=44.,FINTIM=2200.
**
** OUTPUT RANGE AND PRDEL SECTION
**
RANGE DELT,EEBT,EEBG,EEBH,ESBT,ERBT,ERBG,ERBS,ECB,ECBG,ECBW,...
    QEB,QSB,QRB,QCB,TSBG,TSBHT,TRBHT,HSB,FCB,RRBS,RSS,RRW,TCB,TCBG,...
    TCBI,TCBW,TEB,TEBG,TEBGP,TEBI,TEBSAT,TRB,TRBG,TRBGP,TRBI,...
    TRBS,TSB,TSBGP,RCBG,REBG,RRBG,RSBG,PSL,PHP,THP,SHP,SGV,SRT,RRT
*
*
PRINT TGVV,RRBB,TRBBS,TRBB,IRSL,IRPS,IRRH,IRRT,IRGPS,...
    PSL,TGV,TGVS,PRH,PHP,PRT,TRT,TRTS,PPS,TPS,TRHS
**
**
** TITLE, OUTDEL AND LABEL SECTION
**
**
** TITLE IS PRINTED ON EACH PRDEL PAGE
** LABEL IS PRINTED ON EACH OUTDEL PAGE
** OUTPUT IS PRINTED ON ONE PAGE (5 PER PAGE MAXIMUM)
**
**
TITLE ERDA ONCE THROUGH FLUIDIZED BED STUDY 3/20/78
LABEL 5 PERCENT STEP CHANGE IN FEEDWATER FLOW DEMAND
*
OUTPUT PGVN(-10.,10.),TGV(-10.,10.),PRTN(-10.,10.),...
    TRTO(-10.,10.),MGM(-10.,10.)
LABEL CALCOMP PLOT VARIABLES
OUTPUT HSL,PSL,TGV,SGV
LABEL STEAM LINE TO HP TURBINE VARIABLES
OUTPUT HHP,PHP,FHP1,SHP,TRTSH

```

```

LABEL HIGH PRESSURE TURBINE VARIABLES
OUTPUT HRT,PRT,SRB,SRT,TRT
LABEL REHEATER LINE STATES
OUTPUT FPS,SSL,SPS,QPSA,QSPHS
LABEL PRIMARY SUPERHEATER LOOP STATES
OUTPUT HPS,TPS,TPSG,TPSH,QEN
LABEL PRIMARY SUPERHEAT STATES
OUTPUT HRHS,TRHS,TRHG,TRHM
LABEL REHEATER STATES
OUTPUT TEC,TECG,TECH,HFW
LABEL ECONOMIZER STATES
OUTPUT QAHG,TAHO,TAHN,AAH,GAH
LABEL AIR HEATER STATES
OUTPUT TGP,TGPN,TGPS,TGP1,TGP2
LABEL GAS PATH STATES
OUTPUT GGP,GGP1,GGP2,GCBC
LABEL GAS FLOW
OUTPUT DELT,PASS
LABEL INTEGRATION TIME PATTERN
OUTPUT EEBH,HEBS,QEB,TEB,RRT
OUTPUT QSB,TSB,HSB,ESBT
OUTPUT HRB,QRB,TRB,QRBT,QRBGWR
OUTPUT ECB,ECBH,ECBG,TCBG,TCBH
OUTPUT XEBH,XSBH,XRBH,XCBH,PASS
LABEL FLUIDIZED CELL BED HEIGHTS (FT)
OUTPUT XSB,XEB,XRB,XCB,DELT
LABEL FLUIDIZED BED VOID FRACTION
OUTPUT TEBGPY(-2.5,7.5),TSBGPY(-2.5,7.5),TRBGPY(-2.5,7.5),TCBGPY(-2.5,7.5)
LABEL CELL EXIT GAS TEMPERATURES PERCENT CHANGE
OUTPUT TCBHY(-2.5,7.5),TRBSY(-2.5,7.5),TRHSY(-2.5,7.5),TSBSY(-2.5,7.5)
LABEL PERCENT CHANGE IN BED STEAM FLOW
OUTPUT TEBY(-2.5,7.5),TSBY(-2.5,7.5),TRBY(-2.5,7.5),TCBY(-2.5,7.5)
LABEL PERCENT CHANGE IN BED TEMPERATURES
OUTPUT XEBHF,XEBHSF,XEBSF
LABEL FRACTION OF WATER,TWO PHASE,STEAM BOILING BED INLET TO RW OUTLET
OUTPUT DXEBHF,DXEBHS,WEBH,WEBHS,WEBA
LABEL NET WATER AND TWO PHASE FLOW INVENTORIES
OUTPUT PRH,PPS,PRH
LABEL PRESSURES IN BOILING,SUPERHEAT AND REHEAT BEDS
OUTPUT QSPHS,QPSA,QPSMA,QSBTS
LABEL HEAT FLUX
OUTPUT QRBTS,QSBGWR,QSBT,QSBTS,QCBEC2
END
STOP
/*

```

APPENDIX V-B4

STEADY STATE INITIAL CONDITIONS

This section presents all of the steady state computer program parameter values. The variables include input parameters, integrator variables and output variables.

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TIMER VARIABLES RKS INTEGRATION START TIME = .0
 DELT DELMIN FINTIM PRDEL OUTDEL DELMAX
 2.7500 2.20000-04 2200.0 44.000 44.000 44.000

DEBUG 327 OUTPUT 1 KEEP 0 DELT 2.7500 TIME 0.0

PARAMETERS

ACBI	145.06	AEBI	483.76	ARBI	241.88	ASBI	483.76	BEBI	7.5180
BRBI	3.7590	BSBI	7.5180	BUG1	.0	BUG2	550.00	BUG3	1500.0
BUG4	2200.0	DET	.10000	ERBI	5.4910	FEBI	54.320	FRBI	27.160
FSBI	54.320	GEB	541.04	GGP1SS	1352.6	GPSSS	901.73	GRB	270.52
GRHSS	450.43	GSB	541.04	HCD	1050.0	HEBSI	1095.0	HEC	537.00
HRHSPW	350.00	IBUG1	4.0000	IBUG2	3.0000	IBUG3	3.0000	IBUG4	3.0000
IECB	8.5363E+07	IECBG	30836.	IECBH	9.9038E+07	IEEBG	3.0796E+05	IEEBH	1.1912E+08
IEEBT	1.9534E+08	IERBG	1.5396E+05	IERBT	9.7667E+07	IESBT	1.9534E+08	IFCB	24.400
IHEBS	1095.0	IHGPS	1190.0	IHPS	1258.0	IHRB	1519.0	IHRHS	1391.0
IHSB	1456.0	IHSL	1456.0	IMCB	2.2464E+05	IP	2900.0	IPRB	550.70
IQCB	1.2978E+05	IQEB	5.3776E+05	IQRB	2.6888E+05	IQSB	5.3776E+05	ITAHM	438.10
ITEC	540.00	ITECG	720.00	ITECH	555.47	ITGP	1353.1	ITGPM	749.00
ITGP1	920.00	ITGP2	720.00	ITPSG	1044.6	ITPSH	921.54	ITRBMT	1063.0
ITRHG	667.10	ITRHM	813.08	ITSBG	1640.0	ITSBMT	1094.1	ITSLM	998.13
KAH	.13310	KAHAHT	9.1301	KAHGHT	9.1354	KAHGS	.32090	KAHM	3.6257E+05
KCBAR	1200.0	KCBEC2	3.1932	KCBF	.10000	KCBGCB	25.770	KCBGHR	2.2222E-09
KCBX	2.9917E-02	KDAMP	.33333	KEBAR	1320.0	KEBF	.10000	KEBGBT	104.95
KEDGHR	5.1102E-09	KEBHER	1.0000E-02	KEBHV	11000.	KEBRHV	2994.0	KEBSM	.12000
KEBX	1.0351E-02	KECG	502.79	KECH	2.9015E+05	KECVH	591.65	KECH	6141.4
KEF	.85676	KGPGVT	1.7514E+05	KGPH	8.4572E+05	KGPMS	8402.3	KGPRAD	1.2086E-08
KGPVT	2809.0	KGP2GV	41040.	KHPS	.89728	KHPSFR	.89730	KPSCV	5443.0
KPSGM	270.47	KPSM	7.9851E+05	KPSHS	438.54	KPSV	39600.	KPSVT	2608.9
KRBAR	1320.0	KRBF	.10000	KRBGHR	2.5551E-09	KRBH	33460.	KRBQBT	112.11
KRBQTS	8.2552	KRBV	5333.0	KRD	1.0351E-02	KRHFR	2.0075E-05	KRHGM	416.94
KRHH	4.5652E+05	KRHMS	713.78	KRHV	39600.	KRHVT	2753.6	KSBAR	1320.0
KSBGBT	164.70	KSBGSV	.27000	KSBGHR	5.1102E-09	KSBH	44403.	KSBQTS	9.0220
KSBVOL	1972.0	KSBX	1.0351E-02	KSLM	3.6238E+05	KSLMQ	451.05	KSLVT	4747.7
KT	1.2567	KUNASH	.28000	KUNBSH	.27000	KUNFHV	11000.	KUNFSH	.25000
KUNGP	39.700	KUNGSH	.27000	KUNGSV	.20000	KUNGS1	.30570	KUNLSH	.25000
KUNHSH	.12000	KUNPG	39.700	KUNSBG	39.700	KUNSSH	.39982	KUNHSH	1.3806
KVECG	2.1618E+05	LEBI	10.480	LRBI	5.2400	LSBI	10.480	MCB	2.2464E+05
MCBG	214.00	MCBM	4.3832E+05	MCBH	76994.	MEB	4.6675E+05	MEBG	938.90
MEBM	6.9895E+05	MEBW	55941.	MRB	2.3338E+05	MRBG	469.40	MSB	4.6675E+05
MSBG	938.90	RCBM	160.00	REBMEB	158.40	RECH	50.000	RRBM	158.40
RRBMEB	158.40	RSBMEB	158.40	SPSSS	1103.0	SRHSS	1103.0	SRHSS	1103.0
SSBSS	1103.0	TAH	96.000	TCBF	59.520	TCBSBI	250.00	TEBB	250.00
TEBG	1640.0	TEBT	103.00	TFF	96.000	TFW	484.00	TRBB	1001.5
TRBF	103.00	TRBG	1637.3	TSBB	250.00	TSBF	103.00	TUNTA	3000.0

TUNTB	3000.0	TUNTE	3000.0	TUNTF	3000.0	TUNTV	3000.0	TUNTL	3000.0
TUNTH	3000.0	VRBS	2494.0	WECI	1103.0	WFHSS	1103.0	XEBNFI	.0
XEBHSI	.0								

INTEGRATOR VARIABLES

LOCATION	OUTPUTS	DERIVATIVES	INITIAL	CONDITIONS	ERROR	RATIO	ABSERR	RELERR
1	QEB	5.3776E+05	QDEB	7.7670E-02	ZZ1022	5.3776E+05	.0	1.0000E-04
2	EEBT	1.9533E+08	DEEBT	-6.2500	ZZ1024	1.9533E+08	.0	1.0000E-04
3	EEBG	3.0795E+05	DEEBG	1.7500	ZZ1026	3.0795E+05	.0	1.0000E-04
4	EEBM	1.1901E+08	DEEBM	612.06	ZZ1028	1.1901E+08	.0	1.0000E-04
5	RRW	8.7410	DRRW	-1.7271E-04	ZZ1031	8.7410	.0	1.0000E-04
6	QSB	5.3776E+05	DQSB	7.7670E-02	ZZ1033	5.3776E+05	.0	1.0000E-04
7	ESBT	1.9504E+08	DESBT	-59.688	ZZ1035	1.9504E+08	.0	1.0000E-04
8	TSDG	1640.3	DTSDG	-2.4031	ZZ1037	1640.3	.0	1.0000E-04
9	TSEMT	1091.1	DTSEMT	7.8683E-04	ZZ1039	1091.1	.0	1.0000E-04
10	HGB	1453.9	DHGB	.28818	ZZ1041	1453.9	.0	1.0000E-04
11	QRB	2.6888E+05	DQRB	3.0035E-02	ZZ1043	2.6888E+05	.0	1.0000E-04
12	ERBT	9.7154E+07	DERBT	-40.250	ZZ1045	9.7154E+07	.0	1.0000E-04
13	ERBG	1.5371E+05	DERBG	-148.82	ZZ1047	1.5371E+05	.0	1.0000E-04
14	TRBMT	1056.3	DTRBMT	5.0078E-03	ZZ1049	1056.3	.0	1.0000E-04
15	HRB	1515.5	DHRB	-.12981	ZZ1051	1515.5	.0	1.0000E-04
16	FCB	24.200	DFCB	-4.2962E-06	ZZ1053	24.200	.0	1.0000E-04
17	QCB	1.2864E+05	DQCB	-2.4152E-02	ZZ1055	1.2864E+05	.0	1.0000E-04
18	ECB	8.4730E+07	DECB	-34.715	ZZ1057	8.4730E+07	.0	1.0000E-04
19	ECBG	30822.	DECBG	-118.94	ZZ1059	30822.	.0	1.0000E-04
20	ECBW	9.8803E+07	DECBW	118.38	ZZ1061	9.8803E+07	.0	1.0000E-04
21	RSL	3.3261	DRSL	-2.4889E-04	ZZ1063	3.3261	.0	1.0000E-04
22	HSL	1454.0	DHSL	-8.0920E-03	ZZ1065	1454.0	.0	1.0000E-04
23	TSLM	995.02	DTSLM	4.0230E-04	ZZ1067	995.02	.0	1.0000E-04
24	RRT	.65040	DRRT	4.1837E-07	ZZ1069	.65040	.0	1.0000E-04
25	RPS	5.2623	DRPS	2.0518E-04	ZZ1071	5.2623	.0	1.0000E-04
26	TPSG	1047.9	DTPSG	7.9631E-02	ZZ1073	1047.9	.0	1.0000E-04
27	HPS	1255.5	DHPS	5.4265E-03	ZZ1075	1255.5	.0	1.0000E-04
28	TPSM	925.98	DTPSM	-3.7113E-04	ZZ1077	925.98	.0	1.0000E-04
29	TRHG	675.28	DTRHG	-1.1205E-03	ZZ1079	675.28	.0	1.0000E-04
30	TRHM	816.30	DTRHM	5.2937E-04	ZZ1081	816.30	.0	1.0000E-04
31	HRHS	1387.6	DHRHS	-1.2252E-02	ZZ1083	1387.6	.0	1.0000E-04
32	TECM	552.94	DTECM	1.4271E-03	ZZ1085	552.94	.0	1.0000E-04
33	TEC	539.25	DTEC	-1.3727E-03	ZZ1087	539.25	.0	1.0000E-04
34	TECG	720.26	DTECG	-4.5345E-04	ZZ1089	720.26	.0	1.0000E-04
35	TAHM	438.12	DTAHM	-1.0343E-04	ZZ1091	438.12	.0	1.0000E-04
36	TGP	1352.7	DTGP	-2.4686E-02	ZZ1093	1352.7	.0	1.0000E-04
37	TGPM	747.68	DTGPM	2.1733E-03	ZZ1095	747.68	.0	1.0000E-04
38	HGPS	1188.3	DHGPS	-1.8236E-02	ZZ1097	1188.3	.0	1.0000E-04
39	TGP1	923.71	DTGP1	-3.5470E-03	ZZ1099	923.71	.0	1.0000E-04
40	TGP2	720.25	DTGP2	-7.2440E-04	ZZ1101	720.25	.0	1.0000E-04

OUTPUT VARIABLES

AAH	1379.3	AAHI	1465.4	AAHO	1293.2	AAL	172.13	ACB	145.06
AEB	483.76	AGV	40.074	AGVF	40.074	ARAMP	3.3333E-04	ARB	241.88
ART	182.51	ASB	483.76	BCB	3.1632	BEB	7.5180	BRB	3.7590
BSB	7.5180	DXEBHF	.0	DXEBHS	.0	FCBI	24.200	FEB	94.320
FRB	27.160	FSB	54.320	GAH	1567.5	GAHO	1653.5	GCB	172.42
GCBC	128.80	GEC	1352.6	GGP	1352.6	GGP1	1352.6	GCP2	1481.4
GPS	901.74	GRH	450.87	HEBDIF	442.27	HEBI	650.99	HEBS	1093.3
HEBST	1093.3	HEDHS	785.44	HEBNSD	253.49	HGPT	1190.0	HHP	1304.3
HPSI	1258.0	HRH	1387.6	HRHI	1391.0	HRT	1515.5	HRIL	1519.0
HRW	1093.3	HSLI	1456.0	IPRRBB	550.70	IRGPS	6.0605	IRGPSI	5.0000
IRPS	5.2455	IRPSI	5.0000	IRRS	.64906	IRRH	.81529	IRRI	.80000
IRRT	.64906	IRRTI	.60000	IRRW	8.7247	IRSB	4.2830	IRSL	3.3206

IRSLI	3.3000	KAHTA	6676.1	KAHTG	2174.4	KGP	.10000	KGVI	2.0555E-03
KHPFR	1.7423E-05	KPS	.10000	KPSMG	867.28	KRH	.10000	KRT	.10000
KRWFR	7.9355E-04	KSBF	.10000	KSBHV	11000.	KSBRR	1.0610	KSHFR	7.2522E-04
KSL	.10000	LEB	10.480	LRB	5.2400	LSB	10.480	MEC	29582.
MGN	-3.6359E-04	MGNSS	5.6579E+08	MGP	3835.7	MGPS	17071.	MGP1	6202.4
MGP2	1380.5	MHP	1.4930E+08	MPS	13729.	MRBS	1622.1	MRH	2249.6
MRHG	32352.	MRT	4.1649E+08	MSBO	8468.2	MSL	15791.	PASS	.0
PGPI	2717.7	PGVN	1.8120E-03	PGVSS	2530.7	PHP	589.67	PHPISS	-50.474
PHP1	891.47	PHP1SS	1800.0	PPS	2735.8	PPSI	2740.7	PRH	568.78
PRHI	564.70	PRT	549.11	PRTI	550.70	PRTN	1.9073E-04	PRTSS	549.11
PRW	2894.8	PSL	2530.7	PSLI	2534.7	QAHA	2.0966E+05	QAHG	2.0966E+05
QCBEC2	50330.	QCBGWE	68756.	QCBGWR	18426.	QCBT	57098.	QCBGWR	90445.
QEBT	2.6251E+05	QEBTB	4.8844E+05	QECC	84125.	QECM	84076.	QEN	1.0478E+05
QGPMS	1.0456E+05	QPSA	74196.	QPSMA	74231.	QRBGWR	44972.	QRB	1.2654E+05
QRBTS	1.2638E+05	QSBGWR	90511.	QSBT	2.1878E+05	QSBTS	2.1875E+05	QSLA	.0
QSLMA	-17.494	RCBG	1.6923E-02	REBG	1.9752E-02	RGP	2.1901E-02	RGPS	6.0774
RGP1	2.8691E-02	RGP2	3.3637E-02	RRBB	.64907	RRBG	1.9832E-02	RRBS	.65040
RRH	.81697	RSB	4.2942	RSBG	1.9774E-02	RSBO	3.5289	SEB	1103.0
SGV	1103.0	SHP	989.73	SPS	1103.5	SRB	989.73	SRH	989.73
SRT	989.71	SRW	1103.5	SSB	1101.8	SSL	1101.8	TAHA	367.44
TAHAO	638.87	TAHG	501.89	TAHGO	283.53	TAHO	638.87	TCB	1885.9
TCBG	720.14	TCBGA	1303.0	TCBGPI	720.00	TCBGPY	1.9455E-02	TCBI	1900.0
TCBN	621.82	TCBNI	623.30	TCBNY	-.23726	TCBY	-.74178	TEB	1550.0
TEBGP	1850.0	TEBGPI	1850.0	TEBGPY	-1.3123E-03	TEBI	1550.0	TEBSAT	669.74
TEBY	-2.9144E-03	TGPMR	1207.7	TGPR	1812.7	TGPR	735.04	TGV	995.06
TGVN	995.06	TGV3	669.82	TGVSH	325.23	TGVT	-1.2517E-04	TGVV	998.13
TGVVS	670.06	THP	620.57	TIMEM	.0	TPRIN	.0	TPS	778.31
TPSA	756.77	TPSGA	1200.3	TRB	1541.8	TRBBS	385.11	TRBGP	1845.2
TRBGPI	1850.0	TRBGPY	-.25861	TRBI	1550.0	TRBS	994.85	TRBSI	1005.0
TRBSY	-1.0100	TRBY	-.52612	TRHGA	1014.0	TRHS	760.10	TRHSA	690.34
TRT	994.85	TRTO	-2.9802E-05	TRTS	304.55	TRTSH	610.30	TRTSS	994.85
TRWS	698.24	TRNSI	700.00	TRWSY	-.25127	TSB	1547.7	TSBGP	1847.6
TSBGPI	1850.0	TSBGPY	-.12770	TSBI	1550.0	TSBS	1001.0	TSBSI	1005.0
TSBSY	-.32045	TSBY	-.15138	WCB	1103.0	WEB	1103.0	WEBA	1103.0
WEBN	.0	WEBWS	.0	WEC	1103.0	WECSS	1103.0	WFW	1103.0
WRHSP	.0	XCB	.67296	XCBH	3.9827	XEB	.62630	XEBH	4.0004
XEBSF	.12286	XEBWF	.30399	XEBWSF	.57316	XR	.62549	XR	3.9917
XSB	.62607	XSBH	3.9979	XUNA	1.0000	XUNB	1.0000	XUNE	1.0000
XUNF	1.0000	XUNGV	1.0000	XUNL	1.0000	XUNW	1.0000	ZZ1000	2534.7
ZZ1001	3.3208	ZZ1002	.0	ZZ1003	2740.6	ZZ1004	5.2515	ZZ1005	.0
ZZ1006	550.70	ZZ1007	.64921	ZZ1008	.0	ZZ1009	2716.4	ZZ1010	6.1912
ZZ1011	.0	ZZ1012	550.70	ZZ1013	.64880	ZZ1014	.0	ZZ1015	2900.0
ZZ1016	8.7247	ZZ1017	.0	ZZ1018	550.70	ZZ1019	.64906	ZZ1020	.0
ZZ1029	.0	ZZ1102	.0						

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APPENDIX V-B5

STEP IN COMBUSTION RATE

This section presents the detailed results in CSMP plot format for a 5% step increase in combustion rate.

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5 PERCENT STEP CHANGE IN COMBUSTION RATE
CALCOMP PLOT VARIABLES

		-10.00		'S'=-MGN	10.00				
		-10.00		'O'=-TRTO	10.00				
		-10.00		'X'=-PHPISS	10.00				
		-10.00		'M'=-TGVN	10.00				
		-10.00		'A'=-PGVN	10.00				
TIME	PGVN					TGVN	PHPISS	TRTO	MGN
0	1.8120E-03	I	I	I	I	-1.2517E-04	-1.14905	-2.9802E-05	-1.4961E-03
44.000	-.33884	I	I	I	I	-.37951	-.45303	-.31542	-.47708
88.000	-.37163	I	I	I	I	-.40540	-.49039	-.35613	-.54744
132.00	-.25882	I	I	I	I	-.37706	-.37582	-.28502	-.41093
176.00	-9.1815E-02	I	I	I	I	-.36756	-.20247	-.18450	-.18850
220.00	6.5800E-02	I	I	I	I	-.35523	-2.8718E-02	-7.4977E-02	5.4073E-02
264.00	.20075	I	I	I	I	-.30991	.11835	3.2806E-02	.27628
308.00	.36303	I	I	I	I	-.17951	.27676	.15793	.51174
352.00	.52099	I	I	I	I	-.2.5469E-02	.42734	.29783	.71510
396.00	.64240	I	I	I	I	.15556	.54102	.45137	.96607
440.00	.74167	I	I	I	I	.36631	.62885	.62408	1.1628
484.00	.83218	I	I	I	I	.61340	.69332	.81329	1.3504
528.00	.92268	I	I	I	I	.88272	.75245	1.0170	1.5363
572.00	1.01464	I	I	I	I	1.1623	.81415	1.2352	1.7342
616.00	1.1142	I	I	I	I	1.4456	.87776	1.4547	1.9304
660.00	1.2159	I	I	I	I	1.7262	.94662	1.6812	2.1357
704.00	1.3201	I	I	I	I	2.0003	1.0188	1.9070	2.3433
748.00	1.4251	I	I	I	I	2.2653	1.0932	2.1306	2.5525
792.00	1.5296	I	I	I	I	2.5193	1.1693	2.3498	2.7604
836.00	1.6321	I	I	I	I	2.7620	1.2449	2.5630	2.9650
880.00	1.7343	I	I	I	I	2.9892	1.3222	2.7692	3.1655
924.00	1.8358	I	I	I	I	3.1983	1.4019	2.9644	3.3628
968.00	1.9296	I	I	I	I	3.3985	1.4750	3.1508	3.5502
1012.00	2.0170	I	I	I	I	3.5898	1.5429	3.3303	3.7284
1056.00	2.0995	I	I	I	I	3.7730	1.6067	3.5025	3.8979
1100.00	2.1775	I	I	I	I	3.9480	1.6665	3.6671	4.0586
1144.00	2.2519	I	I	I	I	4.1154	1.7234	3.8259	4.2132
1188.00	2.3230	I	I	I	I	4.2749	1.7789	3.9810	4.3640
1232.00	2.3906	I	I	I	I	4.4268	1.8301	4.1235	4.5022
1276.00	2.4551	I	I	I	I	4.5712	1.8798	4.2623	4.6369
1320.00	2.5167	I	I	I	I	4.7086	1.9270	4.3952	4.7657
1364.00	2.5755	I	I	I	I	4.8391	1.9729	4.5236	4.8904
1408.00	2.6316	I	I	I	I	4.9630	2.0158	4.6429	5.0066
1452.00	2.6849	I	I	I	I	5.0805	2.0573	4.7584	5.1188
1496.00	2.7356	I	I	I	I	5.1920	2.0966	4.8682	5.2257
1540.00	2.7840	I	I	I	I	5.2976	2.1338	4.9728	5.3276
1584.00	2.8300	I	I	I	I	5.3979	2.1694	5.0724	5.4245
1628.00	2.8736	I	I	I	I	5.4930	2.2031	5.1679	5.5174
1672.00	2.9150	I	I	I	I	5.5832	2.2346	5.2570	5.6041
1716.00	2.9545	I	I	I	I	5.6687	2.2649	5.3407	5.6855
1760.00	2.9921	I	I	I	I	5.7498	2.2948	5.4197	5.7627
1804.00	3.0277	I	I	I	I	5.8269	2.3221	5.5012	5.8361
1848.00	3.0616	I	I	I	I	5.8997	2.3479	5.5738	5.9130
1892.00	3.0936	I	I	I	I	5.9680	2.3728	5.6440	5.9823
1936.00	3.1240	I	I	I	I	6.0342	2.3966	5.7111	6.0468
1980.00	3.1527	I	I	I	I	6.0963	2.4188	5.7736	6.1076
2024.00	3.1800	I	I	I	I	6.1552	2.4402	5.8343	6.1666
2068.00	3.2058	I	I	I	I	6.2110	2.4599	5.8905	6.2213
2112.00	3.2307	I	I	I	I	6.2640	2.4792	5.9429	6.2727
2156.00	3.2539	I	I	I	I	6.3140	2.4973	5.9941	6.3227
2200.00	3.2762	I	I	I	I	6.3613	2.5147	6.0432	6.3706

5 PERCENT STEP CHANGE IN COMBUSTION RATE
STEAM LINE TO HP TURBINE VARIABLES

		1100.		'O'=-SGV	1110.				
		980.0		'X'=-TGV	1060.				
		2520.		'M'=-PSL	2640.				
		1400.		'A'=-HSL	1500.				
TIME	HSL					PSL	TGV	SGV	
0	1459.0	I	I	I	I	2530.7	995.06	1103.0	
44.000	1451.7	I	I	I	I	2522.1	991.28	1101.3	
88.000	1451.5	I	I	I	I	2521.3	991.03	1101.1	
132.00	1451.6	I	I	I	I	2520.3	991.31	1101.3	
176.00	1451.5	I	I	I	I	2520.4	991.40	1104.1	
220.00	1451.5	I	I	I	I	2532.4	991.53	1105.8	
264.00	1451.7	I	I	I	I	2535.8	991.98	1107.1	
308.00	1452.5	I	I	I	I	2539.9	993.27	1108.3	
352.00	1453.4	I	I	I	I	2543.9	994.81	1109.2	
396.00	1454.5	I	I	I	I	2547.0	996.61	1109.5	
440.00	1455.9	I	I	I	I	2549.5	998.71	1109.4	
484.00	1457.5	I	I	I	I	2551.8	1001.2	1109.0	
528.00	1459.1	I	I	I	I	2554.1	1003.8	1108.4	
572.00	1460.9	I	I	I	I	2556.4	1006.6	1107.9	
616.00	1462.7	I	I	I	I	2558.9	1009.4	1107.3	
660.00	1464.5	I	I	I	I	2561.5	1012.2	1106.9	
704.00	1466.2	I	I	I	I	2564.1	1015.0	1106.5	
748.00	1467.8	I	I	I	I	2566.8	1017.6	1106.1	
792.00	1469.4	I	I	I	I	2569.4	1020.1	1105.8	
836.00	1470.9	I	I	I	I	2572.0	1022.5	1105.6	
880.00	1472.3	I	I	I	I	2574.6	1024.8	1105.4	
924.00	1473.6	I	I	I	I	2577.2	1026.9	1105.4	
968.00	1474.8	I	I	I	I	2579.5	1028.9	1105.3	
1012.00	1476.0	I	I	I	I	2581.7	1030.8	1105.2	
1056.00	1477.1	I	I	I	I	2583.8	1032.6	1105.0	
1100.00	1478.2	I	I	I	I	2585.8	1034.3	1104.9	
1144.00	1479.3	I	I	I	I	2587.7	1036.0	1104.8	
1188.00	1480.2	I	I	I	I	2589.5	1037.6	1104.7	
1232.00	1481.2	I	I	I	I	2591.2	1039.1	1104.6	
1276.00	1482.1	I	I	I	I	2592.8	1040.5	1104.5	
1320.00	1482.9	I	I	I	I	2594.4	1041.9	1104.4	
1364.00	1483.7	I	I	I	I	2595.9	1043.2	1104.3	
1408.00	1484.5	I	I	I	I	2597.3	1044.4	1104.2	
1452.00	1485.2	I	I	I	I	2598.6	1045.6	1104.1	
1496.00	1485.9	I	I	I	I	2599.9	1046.7	1104.1	
1540.00	1486.5	I	I	I	I	2601.2	1047.8	1104.0	
1584.00	1487.2	I	I	I	I	2602.3	1048.8	1103.9	
1628.00	1487.7	I	I	I	I	2603.4	1049.7	1103.9	
1672.00	1488.3	I	I	I	I	2604.5	1050.6	1103.8	
1716.00	1488.8	I	I	I	I	2605.5	1051.5	1103.8	
1760.00	1489.3	I	I	I	I	2606.4	1052.3	1103.7	
1804.00	1489.8	I	I	I	I	2607.3	1053.0	1103.7	
1848.00	1490.2	I	I	I	I	2608.2	1053.8	1103.6	
1892.00	1490.7	I	I	I	I	2609.0	1054.6	1103.6	
1936.00	1491.1	I	I	I	I	2609.8	1055.1	1103.6	
1980.00	1491.4	I	I	I	I	2610.5	1055.7	1103.5	
2024.00	1491.8	I	I	I	I	2611.2	1056.3	1103.5	
2068.00	1492.1	I	I	I	I	2611.8	1056.9	1103.5	
2112.00	1492.5	I	I	I	I	2612.5	1057.4	1103.5	
2156.00	1492.8	I	I	I	I	2613.0	1057.9	1103.4	
2200.00	1493.1	I	I	I	I	2613.6	1058.4	1103.4	

5 PERCENT STEP CHANGE IN COMBUSTION RATE
HIGH PRESSURE TURBINE VARIABLES

		600.0	'S'=TRTSH	600.0				
		987.5	'O'=SHP	997.5				
		1780.	'X'=PHP1	1860.				
		585.0	'M'=PHP	605.0				
		1300.	'A'=KHP	1340.				
TIME	HHP				PHP	PHP1	SHP	TRTSH
0	1300.3	I-----S-----O-I-----I-----I-----I-----I			589.71	1797.4	989.73	610.30
44.000	1302.4	I + O S X I I I I I I I I I I I			588.17	1791.8	988.19	607.67
88.000	1302.3	I O S X I I I I I I I I I I I			587.84	1791.2	987.98	607.37
132.000	1302.3	I + S O X I I I I I I I I I I I			588.39	1793.2	989.05	607.92
176.000	1302.2	I + S X M I O I I I I I I I I I I I			589.44	1796.4	990.70	608.58
220.000	1302.2	I + S X I O O I I I I I I I I I I I			590.63	1799.5	992.27	609.28
264.000	1302.4	I + S I X I I O I I I I I I I I I I I			591.69	1802.1	993.44	610.01
308.000	1303.1	I + S I X I I O I I I I I I I I I I I			592.64	1805.0	994.45	610.94
352.000	1303.8	I + S I X I I O I I I I I I I I I I I			593.56	1807.7	995.26	612.02
396.000	1304.8	I + S I X I I O I I I I I I I I I I I			594.28	1809.7	995.56	613.30
440.000	1305.9	I-----S-----I-----X-----I-----I-----I-----I-----I			594.80	1811.3	995.47	614.84
484.000	1307.2	I + S I X I I O I I I I I I I I I I I			595.16	1812.5	995.10	616.59
528.000	1308.6	I + S I X I I O I I I I I I I I I I I			595.44	1813.5	994.61	618.51
572.000	1310.0	I + S I X I I O I I I I I I I I I I I			595.71	1814.7	994.10	620.58
616.000	1311.4	I + S I X I I O I I I I I I I I I I I			595.97	1815.8	993.62	622.66
660.000	1312.9	I + S I X I I O I I I I I I I I I I I			596.26	1817.0	993.19	624.81
704.000	1314.3	I + S I X I I O I I I I I I I I I I I			596.58	1818.3	992.83	626.94
748.000	1315.6	I + S I X I I O I I I I I I I I I I I			596.93	1819.7	992.51	629.04
792.000	1316.9	I + S I X I I O I I I I I I I I I I I			597.30	1821.0	992.26	631.09
836.000	1318.1	I + S I X I I O I I I I I I I I I I I			597.60	1822.4	992.04	633.07
880.000	1319.3	I-----S-----I-----X-----I-----I-----I-----I-----I			598.06	1823.8	991.90	634.99
924.000	1320.3	I + S I O S + X I I I I I I I I I I I			598.49	1825.2	991.85	636.79
968.000	1321.3	I + S I O S I + X I I I I I I I I I I I			598.89	1826.5	991.76	638.50
1012.000	1322.3	I + S I O S + X I I I I I I I I I I I			599.27	1827.8	991.66	640.15
1056.000	1323.2	I + S I O S I + X I I I I I I I I I I I			599.62	1828.9	991.55	641.74
1100.000	1324.1	I + S I O S I + X I I I I I I I I I I I			599.95	1830.0	991.44	643.26
1144.000	1324.9	I + S I O S I + X I I I I I I I I I I I			600.27	1831.0	991.33	644.73
1188.000	1325.7	I + S I O S I + X I I I I I I I I I I I			600.59	1832.0	991.22	646.16
1232.000	1326.5	I + S I O S I + X I I I I I I I I I I I			600.87	1832.9	991.12	647.48
1276.000	1327.2	I + S I O S I + X I I I I I I I I I I I			601.15	1833.8	991.03	648.74
1320.000	1327.9	I-----S-----I-----O-----I-----I-----I-----I-----I			601.41	1834.7	990.94	649.99
1364.000	1328.6	I + S I O S I + X I I I I I I I I I I I			601.68	1835.5	990.87	651.18
1408.000	1329.2	I + S I O S I + X I I I I I I I I I I I			601.97	1836.3	990.80	652.28
1452.000	1329.6	I + S I O S I + X I I I I I I I I I I I			602.16	1837.0	990.73	653.35
1496.000	1330.3	I + S I O S I + X I I I I I I I I I I I			602.38	1837.7	990.67	654.34
1540.000	1330.9	I + S I O S I + X I I I I I I I I I I I			602.60	1838.4	990.61	655.32
1584.000	1331.4	I + S I O S I + X I I I I I I I I I I I			602.81	1839.0	990.56	656.24
1628.000	1331.8	I + S I O S I + X I I I I I I I I I I I			603.01	1839.7	990.51	657.12
1672.000	1332.3	I + S I O S I + X I I I I I I I I I I I			603.19	1840.2	990.46	657.95
1716.000	1332.7	I + S I O S I + X I I I I I I I I I I I			603.36	1840.8	990.42	658.72
1760.000	1333.1	I-----S-----I-----O-----I-----I-----I-----I-----I			603.70	1841.3	990.38	659.49
1804.000	1333.5	I + S I O S I + X I I I I I I I I I I I			603.85	1841.8	990.34	660.20
1848.000	1333.9	I + S I O S I + X I I I I I I I I I I I			604.05	1842.3	990.30	660.86
1892.000	1334.2	I + S I O S I + X I I I I I I I I I I I			604.01	1842.7	990.27	661.52
1936.000	1334.6	I + S I O S I + X I I I I I I I I I I I			604.15	1843.1	990.24	662.13
1980.000	1334.9	I + S I O S I + X I I I I I I I I I I I			604.28	1843.5	990.21	662.70
2024.000	1335.2	I + S I O S I + X I I I I I I I I I I I			604.41	1843.9	990.18	663.26
2068.000	1335.4	I + S I O S I + X I I I I I I I I I I I			604.53	1844.3	990.15	663.78
2112.000	1335.7	I + S I O S I + X I I I I I I I I I I I			604.64	1844.6	990.13	664.26
2156.000	1336.0	I + S I O S I + X I I I I I I I I I I I			604.75	1845.0	990.11	664.73
2200.000	1336.2	I-----S-----I-----O-----I-----I-----I-----I-----I			604.85	1845.3	990.09	665.19

5 PERCENT STEP CHANGE IN COMBUSTION RATE
REHEATER LINE STATES

		980.0	'S'=TRT	1040.				
		988.0	'O'=SRT	996.0				
		987.5	'X'=SRB	997.5				
		545.0	'M'=PRT	565.0				
		1510.	'A'=HRT	1550.				
TIME	HRT				PRT	SRB	SRT	TRT
0	1515.5	I-----S-----I-----I-----I-----I-----I-----I-----I			599.11	989.73	987.71	989.85
44.000	1517.9	I + O S X I I I I I I I I I I I			597.69	988.19	986.49	991.71
88.000	1513.7	I O S X I I I I I I I I I I I			597.37	987.98	986.02	991.71
132.000	1514.0	I + S O X I I I I I I I I I I I			597.84	989.05	988.50	992.01
176.000	1514.5	I + S X U I X I I I I I I I I I I I			598.77	990.70	989.91	993.01
220.000	1515.1	I + S X I O O I I I I I I I I I I I			599.87	992.27	991.50	994.10
264.000	1515.6	I + S X I O O I I I I I I I I I I I			599.85	993.44	992.89	995.18
308.000	1516.3	I + S X I O O I I I I I I I I I I I			599.73	994.45	993.99	996.42
352.000	1517.0	I + S X I O O I I I I I I I I I I I			599.60	995.26	995.01	997.61
396.000	1517.8	I + S X I O O I I I I I I I I I I I			599.30	995.56	995.63	999.34
440.000	1518.7	I-----S-----I-----X-----I-----I-----I-----I-----I			599.82	995.47	995.83	1001.1
484.000	1519.7	I + S X I O O I I I I I I I I I I I			599.19	995.10	995.68	1002.9
528.000	1520.8	I + S X I O O I I I I I I I I I I I			599.49	994.61	995.31	1005.0
572.000	1522.0	I + S X I O O I I I I I I I I I I I			599.78	994.10	994.84	1007.1
616.000	1523.1	I + S X I O O I I I I I I I I I I I			599.62	993.62	994.37	1009.3
660.000	1524.3	I + S X I O O I I I I I I I I I I I			599.34	993.19	993.92	1011.6
704.000	1525.5	I + S X I O O I I I I I I I I I I I			599.69	992.83	993.51	1013.8
748.000	1526.7	I + S X I O O I I I I I I I I I I I			599.04	992.51	993.16	1016.0
792.000	1527.9	I + S X I O O I I I I I I I I I I I			599.41	992.26	992.86	1018.2
836.000	1529.0	I + S X I O O I I I I I I I I I I I			599.78	992.04	992.60	1020.3
880.000	1530.1	I-----S-----I-----X-----I-----I-----I-----I-----I			599.17	991.90	992.39	1022.4
924.000	1531.2	I + S X I O O I I I I I I I I I I I			599.58	991.85	992.28	1024.3
968.000	1532.2	I + S X I O O I I I I I I I I I I I			599.97	991.76	992.18	1026.2
1012.000	1533.1	I + S X I O O I I I I I I I I I I I			599.35	991.64	992.07	1028.0
1056.000	1534.0	I + S X I O O I I I I I I I I I I I			599.70	991.55	991.95	1029.7
1100.000	1534.9	I + S X I O O I I I I I I I I I I I			599.03	991.44	991.82	1031.3
1144.000	1535.7	I + S X I O O I I I I I I I I I I I			599.74	991.33	991.70	1032.9
1188.000	1536.6	I + S X I O O I I I I I I I I I I I			599.59	991.22	991.59	1034.5
1232.000	1537.3	I + S X I O O I I I I I I I I I I I			599.93	991.12	991.46	1035.9
1276.000	1538.1	I + S X I O O I I I I I I I I I I I			599.21	991.03	991.35	1037.3
1320.000	1538.8	I-----S-----I-----X-----I-----I-----I-----I-----I			599.47	990.94	991.25	1038.6
1364.000	1539.5	I + S X I O O I I I I I I I I I I I			599.73	990.87	991.16	1039.9
1408.000	1540.1	I + S X I O O I I I I I I I I I I I			599.97	990.80	991.07	1041.0
1452.000	1540.7	I + S X I O O I I I I I I I I I I I			599.20	990.73	990.99	1042.2
1496.000	1541.3	I + S X I O O I I I I I I I I I I I			599.43	990.67	990.91	1043.3
1540.000	1541.8	I + S X I O O I I I I I I I I I I I			599.64	990.61	990.84	1044.3
1584.000	1542.4	I + S X I O O I I I I I I I I I I I			599.84	990.56	990.78	1045.3
1628.000	1542.9	I + S X I O O I I I I I I I I I I I			599.04	990.51	990.72	1046.3
1672.000	1543.4	I + S X I O O I I I I I I I I I I I			599.22	990.46	990.66	1047.2
1716.000	1543.8	I + S X I O O I I I I I I I I I I I			599.42	990.42	990.60	1048.0
1760.000	1544.2	I + S X I O O I I I I I I I I I I I			599.57	990.38	990.56	1048.8
1804.000	1544.6	I + S X I O O I I I I I I I I I I I			599.73	990.34	990.50	1049.6
1848.000	1545.0	I + S X I O O I I I I I I I I I I I			599.88	990.30	990.46	1050.3
1892.000	1545.4	I + S X I O O I I I I I I I I I I I			599.03	990.27	990.42	1051.0
1936.000	1545.8	I + S X I O O I I I I I I I I I I I			599.17	990.24	990.38	1051.7
1980.000	1546.1	I + S X I O O I I I I I I I I I I I			599.29	990.21	990.34	1052.3
2024.000	1546.4	I + S X I O O I I I I I I I I I I I			599.42	990.18	990.31	1052.9
2068.000	1546.7	I + S X I O O I I I I I I I I I I I			599.50	990.15	990.28	1053.5
2112.000	1547.0	I + S X I O O I I I I I I I I I I I			599.65	990.13	990.24	1054.0
2156.000	1547.3	I + S X I O O I I I I I I I I I I I			599.75	990.11	990.22	1054.5
2200.000	1547.5	I-----S-----I-----X-----I-----I-----I-----I-----I			599.84	990.09	990.19	1055.0

5 PERCENT STEP CHANGE IN COMBUSTION RATE
PRIMARY SUPERHEATER LOOP STATES

		1.020E+05	'S'=QGPHS	1.140E+05				
		7.600E+04	'O'=QPSA	7.920E+04				
		1098.	'X'=SPS	1108.				
		1100.	'M'=SSL	1110.				
		2720.	'A'=PPS	2880.				
TIME	PPS				SSL	SPS	QPSA	QGPHS
.0	2735.8	I--O--X--I--	I--X--I--	I--	1101.8	1103.6	74000.	1.0457E+05
48.000	2727.4	I--X--I--	I--O--I--	I--	1101.2	1099.7	78341.	1.0904E+05
88.000	2726.5	I--X--I--	I--O--I--	I--	1101.2	1102.4	78572.	1.0990E+05
132.000	2729.8	I--X--I--	I--O--I--	I--	1102.8	1104.0	78772.	1.0914E+05
176.000	2734.5	I--X--I--	I--O--I--	I--	1104.7	1104.8	78939.	1.0804E+05
220.000	2739.0	I--X--I--	I--O--I--	I--	1106.4	1105.2	79066.	1.0718E+05
264.000	2742.9	I--X--I--	I--O--I--	I--	1107.4	1105.2	79146.	1.0670E+05
308.000	2747.7	I--X--I--	I--O--I--	I--	1108.4	1106.5	79189.	1.0675E+05
352.000	2752.2	I--X--I--	I--O--I--	I--	1109.1	1106.5	79186.	1.0690E+05
396.000	2755.7	I--X--I--	I--O--I--	I--	1109.2	1106.2	79155.	1.0717E+05
440.000	2758.6	I--X--I--	I--O--I--	I--	1108.9	1105.9	79100.	1.0752E+05
484.000	2761.2	I--X--I--	I--O--I--	I--	1108.4	1105.6	79029.	1.0790E+05
528.000	2763.8	I--X--I--	I--O--I--	I--	1107.8	1105.3	78948.	1.0828E+05
572.000	2766.4	I--X--I--	I--O--I--	I--	1107.2	1105.0	78862.	1.0865E+05
616.000	2769.1	I--X--I--	I--O--I--	I--	1106.7	1104.7	78779.	1.0899E+05
660.000	2771.9	I--X--I--	I--O--I--	I--	1106.3	1104.5	78689.	1.0931E+05
704.000	2774.7	I--X--I--	I--O--I--	I--	1105.9	1104.4	78607.	1.0959E+05
748.000	2777.4	I--X--I--	I--O--I--	I--	1105.6	1104.3	78527.	1.0986E+05
792.000	2780.4	I--X--I--	I--O--I--	I--	1105.3	1104.2	78453.	1.1010E+05
836.000	2783.2	I--X--I--	I--O--I--	I--	1105.1	1104.1	78382.	1.1032E+05
880.000	2786.0	I--X--I--	I--O--I--	I--	1105.1	1103.9	78315.	1.1054E+05
924.000	2788.8	I--X--I--	I--O--I--	I--	1105.0	1103.9	78246.	1.1076E+05
968.000	2791.4	I--X--I--	I--O--I--	I--	1104.9	1103.8	78176.	1.1097E+05
1012.000	2793.8	I--X--I--	I--O--I--	I--	1104.8	1103.8	78107.	1.1116E+05
1056.000	2796.0	I--X--I--	I--O--I--	I--	1104.7	1103.7	78039.	1.1133E+05
1100.000	2798.2	I--X--I--	I--O--I--	I--	1104.6	1103.7	77972.	1.1149E+05
1144.000	2800.2	I--X--I--	I--O--I--	I--	1104.5	1103.7	77907.	1.1165E+05
1188.000	2802.1	I--X--I--	I--O--I--	I--	1104.4	1103.6	77845.	1.1179E+05
1232.000	2804.0	I--X--I--	I--O--I--	I--	1104.3	1103.6	77785.	1.1193E+05
1276.000	2805.7	I--X--I--	I--O--I--	I--	1104.2	1103.5	77728.	1.1208E+05
1320.000	2807.4	I--X--I--	I--O--I--	I--	1104.1	1103.5	77674.	1.1219E+05
1364.000	2809.0	I--X--I--	I--O--I--	I--	1104.1	1103.5	77623.	1.1230E+05
1408.000	2810.5	I--X--I--	I--O--I--	I--	1104.0	1103.4	77574.	1.1241E+05
1452.000	2812.0	I--X--I--	I--O--I--	I--	1103.9	1103.4	77527.	1.1251E+05
1496.000	2813.4	I--X--I--	I--O--I--	I--	1103.9	1103.4	77483.	1.1260E+05
1540.000	2814.7	I--X--I--	I--O--I--	I--	1103.8	1103.4	77441.	1.1270E+05
1584.000	2815.9	I--X--I--	I--O--I--	I--	1103.8	1103.3	77401.	1.1279E+05
1628.000	2817.1	I--X--I--	I--O--I--	I--	1103.7	1103.3	77363.	1.1287E+05
1672.000	2818.2	I--X--I--	I--O--I--	I--	1103.7	1103.3	77328.	1.1295E+05
1716.000	2819.3	I--X--I--	I--O--I--	I--	1103.6	1103.3	77294.	1.1303E+05
1760.000	2820.3	I--X--I--	I--O--I--	I--	1103.6	1103.3	77262.	1.1310E+05
1804.000	2821.3	I--X--I--	I--O--I--	I--	1103.6	1103.2	77231.	1.1316E+05
1848.000	2822.2	I--X--I--	I--O--I--	I--	1103.5	1103.2	77202.	1.1325E+05
1892.000	2823.1	I--X--I--	I--O--I--	I--	1103.5	1103.2	77175.	1.1329E+05
1936.000	2823.9	I--X--I--	I--O--I--	I--	1103.5	1103.2	77149.	1.1335E+05
1980.000	2824.6	I--X--I--	I--O--I--	I--	1103.4	1103.2	77124.	1.1340E+05
2024.000	2825.4	I--X--I--	I--O--I--	I--	1103.4	1103.2	77101.	1.1346E+05
2068.000	2826.1	I--X--I--	I--O--I--	I--	1103.4	1103.2	77079.	1.1351E+05
2112.000	2826.8	I--X--I--	I--O--I--	I--	1103.4	1103.2	77058.	1.1355E+05
2156.000	2827.4	I--X--I--	I--O--I--	I--	1103.4	1103.2	77038.	1.1359E+05
2200.000	2828.0	I--X--I--	I--O--I--	I--	1103.3	1103.2	77019.	1.1364E+05

5 PERCENT STEP CHANGE IN COMBUSTION RATE
PRIMARY SUPERHEAT STATES

		1.040E+05	'S'=GEN	1.200E+05				
		915.0	'O'=TPSH	975.0				
		1035.	'X'=TPSG	1095.				
		765.0	'M'=TPS	825.0				
		1245.	'A'=HPS	1305.				
TIME	HPS				TPS	TPSG	TPSH	GEN
.0	1255.5	I--O--X--I--	I--X--I--	I--	778.31	1047.9	925.98	1.0478E+05
48.000	1255.9	I--O--X--I--	I--X--I--	I--	778.04	1055.7	927.69	1.0755E+05
88.000	1255.7	I--O--X--I--	I--X--I--	I--	777.86	1057.5	929.08	1.0839E+05
132.000	1255.6	I--O--X--I--	I--X--I--	I--	778.02	1058.9	930.16	1.0907E+05
176.000	1256.1	I--O--X--I--	I--X--I--	I--	778.42	1060.2	931.14	1.0961E+05
220.000	1257.2	I--O--X--I--	I--X--I--	I--	779.40	1061.4	932.17	1.1003E+05
264.000	1258.8	I--O--X--I--	I--X--I--	I--	780.85	1062.6	933.25	1.1037E+05
308.000	1260.7	I--O--X--I--	I--X--I--	I--	782.32	1063.9	934.42	1.1064E+05
352.000	1262.7	I--O--X--I--	I--X--I--	I--	783.88	1065.1	935.64	1.1086E+05
396.000	1264.9	I--O--X--I--	I--X--I--	I--	785.44	1066.3	936.96	1.1105E+05
440.000	1267.0	I--O--X--I--	I--X--I--	I--	786.96	1067.6	938.31	1.1122E+05
484.000	1269.0	I--O--X--I--	I--X--I--	I--	788.41	1068.8	939.66	1.1138E+05
528.000	1271.0	I--O--X--I--	I--X--I--	I--	789.80	1070.1	941.01	1.1152E+05
572.000	1273.0	I--O--X--I--	I--X--I--	I--	791.10	1071.2	942.33	1.1165E+05
616.000	1274.4	I--O--X--I--	I--X--I--	I--	792.47	1072.4	943.61	1.1178E+05
660.000	1276.0	I--O--X--I--	I--X--I--	I--	793.80	1073.5	944.84	1.1191E+05
704.000	1277.4	I--O--X--I--	I--X--I--	I--	794.57	1074.5	946.01	1.1203E+05
748.000	1278.8	I--O--X--I--	I--X--I--	I--	795.40	1075.5	947.13	1.1214E+05
792.000	1280.0	I--O--X--I--	I--X--I--	I--	796.56	1076.4	948.19	1.1225E+05
836.000	1281.2	I--O--X--I--	I--X--I--	I--	797.48	1077.3	949.20	1.1236E+05
880.000	1282.3	I--O--X--I--	I--X--I--	I--	798.46	1078.2	950.16	1.1246E+05
924.000	1283.3	I--O--X--I--	I--X--I--	I--	799.66	1079.0	951.09	1.1256E+05
968.000	1284.2	I--O--X--I--	I--X--I--	I--	800.80	1079.8	952.00	1.1265E+05
1012.000	1285.1	I--O--X--I--	I--X--I--	I--	801.88	1080.6	952.89	1.1274E+05
1056.000	1286.0	I--O--X--I--	I--X--I--	I--	802.92	1081.3	953.74	1.1282E+05
1100.000	1286.8	I--O--X--I--	I--X--I--	I--	803.90	1082.0	954.55	1.1290E+05
1144.000	1287.5	I--O--X--I--	I--X--I--	I--	804.83	1082.7	955.33	1.1298E+05
1188.000	1288.2	I--O--X--I--	I--X--I--	I--	805.71	1083.3	956.08	1.1305E+05
1232.000	1288.9	I--O--X--I--	I--X--I--	I--	806.54	1083.9	956.79	1.1312E+05
1276.000	1289.6	I--O--X--I--	I--X--I--	I--	807.40	1084.5	957.47	1.1318E+05
1320.000	1290.2	I--O--X--I--	I--X--I--	I--	808.09	1085.1	958.11	1.1324E+05
1364.000	1290.8	I--O--X--I--	I--X--I--	I--	808.80	1085.6	958.73	1.1331E+05
1408.000	1291.3	I--O--X--I--	I--X--I--	I--	809.48	1086.1	959.31	1.1336E+05
1452.000	1291.6	I--O--X--I--	I--X--I--	I--	810.12	1086.6	959.86	1.1342E+05
1496.000	1292.3	I--O--X--I--	I--X--I--	I--	810.73	1087.0	960.48	1.1347E+05
1540.000	1292.8	I--O--X--I--	I--X--I--	I--	811.30	1087.5	961.08	1.1352E+05
1584.000	1293.2	I--O--X--I--	I--X--I--	I--	811.85	1087.9	961.55	1.1356E+05
1628.000	1293.6	I--O--X--I--	I--X--I--	I--	812.37	1088.3	961.80	1.1361E+05
1672.000	1294.0	I--O--X--I--	I--X--I--	I--	812.84	1088.6	962.23	1.1365E+05
1716.000	1294.4	I--O--X--I--	I--X--I--	I--	813.33	1088.9	962.63	1.1369E+05
1760.000	1294.7	I--O--X--I--	I--X--I--	I--	813.77	1089.3	963.01	1.1372E+05
1804.000	1295.0	I--O--X--I--	I--X--I--	I--	814.19	1089.6	963.38	1.1376E+05
1848.000	1295.4	I--O--X--I--	I--X--I--	I--	814.58	1089.9	963.72	1.1380E+05
1892.000	1295.7	I--O--X--I--	I--X--I--	I--	814.94	1090.2	964.04	1.1383E+05
1936.000	1296.0	I--O--X--I--	I--X--I--	I--	815.32	1090.5	964.35	1.1386E+05
1980.000	1296.2	I--O--X--I--	I--X--I--	I--	815.66	1090.7	964.65	1.1389E+05
2024.000	1296.5	I--O--X--I--	I--X--I--	I--	815.98	1091.0	964.93	1.1391E+05
2068.000	1296.7	I--O--X--I--	I--X--I--	I--	816.28	1091.2	965.19	1.1394E+05
2112.000	1297.0	I--O--X--I--	I--X--I--	I--	816.57	1091.4	965.44	1.1396E+05
2156.000	1297.2	I--O--X--I--	I--X--I--	I--	816.84	1091.6	965.67	1.1399E+05
2200.000	1297.4	I--O--X--I--	I--X--I--	I--	817.10	1091.8	965.90	1.1401E+05

5 PERCENT STEP CHANGE IN COMBUSTION RATE
REHEATER STATES

TIME	HRMS	800.0 660.0 760.0 1380.	'O' = TRHM 'X' = TRHG 'M' = TRMS '+' = HRMS	680.0 740.0 840.0 1440.	TRHS	TRHG	TRHM
0	1387.6	I	---	I	760.10	675.28	816.30
44.000	1387.9	I	+	I	760.72	679.65	818.67
88.000	1388.6	I	+	I	761.90	681.48	820.32
132.00	1389.1	I	+	I	762.89	682.72	821.64
176.00	1389.4	I	+	I	763.57	683.64	822.65
220.00	1389.7	I	+	I	764.08	684.20	823.43
264.00	1390.0	I	+	I	764.66	684.77	824.11
308.00	1390.4	I	+	I	765.56	685.27	824.82
352.00	1391.0	I	+	I	766.66	685.95	825.68
396.00	1391.7	I	+	I	768.03	686.82	826.69
440.00	1392.6	I	+	I	769.66	687.94	827.87
484.00	1393.6	I	+	I	771.49	689.30	829.23
528.00	1394.6	I	+	I	773.51	690.89	830.77
572.00	1395.8	I	+	I	775.70	692.69	832.43
616.00	1397.0	I	+	I	777.94	694.65	834.20
660.00	1398.3	I	+	I	780.26	696.72	836.03
704.00	1399.5	I	+	I	782.55	698.84	837.88
748.00	1400.7	I	+	I	784.79	700.98	839.72
792.00	1401.9	I	+	I	786.98	703.09	841.52
836.00	1403.0	I	+	I	789.09	705.17	843.29
880.00	1404.1	I	+	I	791.10	707.18	844.99
924.00	1405.1	I	+	I	792.98	709.11	846.60
968.00	1406.1	I	+	I	794.77	710.93	848.13
1012.00	1407.0	I	+	I	796.48	712.67	849.58
1056.00	1407.9	I	+	I	798.11	714.32	850.97
1100.00	1408.7	I	+	I	799.67	715.90	852.30
1144.00	1409.5	I	+	I	801.16	717.41	853.56
1188.00	1410.3	I	+	I	802.58	718.85	854.77
1232.00	1411.0	I	+	I	803.93	720.23	855.92
1276.00	1411.7	I	+	I	805.22	721.54	857.02
1320.00	1412.3	I	+	I	806.45	722.79	858.07
1364.00	1412.9	I	+	I	807.62	723.99	859.04
1408.00	1413.5	I	+	I	808.72	725.12	860.01
1452.00	1414.1	I	+	I	809.77	726.19	860.91
1496.00	1414.6	I	+	I	810.77	727.21	861.74
1540.00	1415.1	I	+	I	811.72	728.19	862.57
1584.00	1415.6	I	+	I	812.61	729.11	863.34
1628.00	1416.1	I	+	I	813.47	729.98	864.07
1672.00	1416.5	I	+	I	814.27	730.81	864.76
1716.00	1417.3	I	+	I	815.04	731.60	865.42
1760.00	1417.7	I	+	I	815.77	732.34	866.04
1804.00	1418.0	I	+	I	816.46	733.05	866.64
1848.00	1418.0	I	+	I	817.11	733.72	867.20
1892.00	1418.4	I	+	I	817.73	734.36	867.73
1936.00	1418.7	I	+	I	818.31	734.96	868.23
1980.00	1419.0	I	+	I	818.87	735.53	868.71
2024.00	1419.3	I	+	I	819.40	736.08	869.16
2068.00	1419.5	I	+	I	819.90	736.59	869.59
2112.00	1419.8	I	+	I	820.37	737.08	870.00
2156.00	1420.0	I	+	I	820.82	737.54	870.38
2200.00	1420.2	I	+	I	821.24	737.98	870.75

5 PERCENT STEP CHANGE IN COMBUSTION RATE
ECONOMIZER STATES

TIME	TEC	400.0 552.0 720.0 537.0	'O' = MFW 'X' = TECH 'M' = TEGC '+' = TEC	2000. 564.0 752.0 549.0	TECG	TECH	MFW
0	539.25	I	---	I	720.26	552.94	1103.0
44.000	540.74	I	+	I	726.05	554.99	1103.0
88.000	541.50	I	+	I	737.44	555.45	1103.0
132.00	542.07	I	+	I	739.17	556.47	1103.0
176.00	542.70	I	+	I	739.08	556.79	1103.0
220.00	542.44	I	+	I	739.60	557.02	1103.0
264.00	542.64	I	+	I	739.22	557.00	1103.0
308.00	542.78	I	+	I	739.76	557.37	1103.0
352.00	542.91	I	+	I	739.33	557.54	1103.0
396.00	543.05	I	+	I	739.94	557.71	1103.0
440.00	543.20	I	+	I	739.58	557.90	1103.0
484.00	543.35	I	+	I	739.27	558.09	1103.0
528.00	543.51	I	+	I	739.99	558.30	1103.0
572.00	543.69	I	+	I	739.74	558.51	1103.0
616.00	543.86	I	+	I	739.69	558.74	1103.0
660.00	544.05	I	+	I	739.27	558.96	1103.0
704.00	544.23	I	+	I	739.03	559.19	1103.0
748.00	544.41	I	+	I	739.78	559.42	1103.0
792.00	544.59	I	+	I	738.51	559.64	1103.0
836.00	544.76	I	+	I	739.22	559.85	1103.0
880.00	544.93	I	+	I	739.90	560.06	1103.0
924.00	545.09	I	+	I	740.66	560.26	1103.0
968.00	545.25	I	+	I	741.19	560.46	1103.0
1012.00	545.39	I	+	I	741.79	560.64	1103.0
1056.00	545.54	I	+	I	742.36	560.82	1103.0
1100.00	545.68	I	+	I	742.91	560.99	1103.0
1144.00	545.81	I	+	I	743.44	561.15	1103.0
1188.00	545.93	I	+	I	743.94	561.31	1103.0
1232.00	546.05	I	+	I	744.42	561.44	1103.0
1276.00	546.17	I	+	I	744.88	561.60	1103.0
1320.00	546.27	I	+	I	745.31	561.73	1103.0
1364.00	546.38	I	+	I	745.73	561.86	1103.0
1408.00	546.48	I	+	I	746.12	561.98	1103.0
1452.00	546.57	I	+	I	746.49	562.10	1103.0
1496.00	546.66	I	+	I	746.85	562.21	1103.0
1540.00	546.74	I	+	I	747.18	562.31	1103.0
1584.00	546.82	I	+	I	747.50	562.41	1103.0
1628.00	546.90	I	+	I	747.81	562.51	1103.0
1672.00	546.97	I	+	I	748.10	562.60	1103.0
1716.00	547.04	I	+	I	748.37	562.68	1103.0
1760.00	547.10	I	+	I	748.63	562.76	1103.0
1804.00	547.17	I	+	I	748.87	562.84	1103.0
1848.00	547.22	I	+	I	749.11	562.91	1103.0
1892.00	547.28	I	+	I	749.33	562.98	1103.0
1936.00	547.33	I	+	I	749.54	563.04	1103.0
1980.00	547.38	I	+	I	749.74	563.11	1103.0
2024.00	547.43	I	+	I	749.93	563.17	1103.0
2068.00	547.48	I	+	I	750.10	563.22	1103.0
2112.00	547.52	I	+	I	750.27	563.28	1103.0
2156.00	547.56	I	+	I	750.43	563.32	1103.0
2200.00	547.60	I	+	I	750.58	563.37	1103.0

5 PERCENT STEP CHANGE IN COMBUSTION RATE
AIR HEATER STATES

	1645. 500.0 435.0 632.0 2.190E+05	'S'=GAH 'O'=AAH 'X'=TAHM 'M'=TAHD '*'=QAHG	1646. 2500. 455.0 664.0 2.310E+05			
TIME	QAHG		TAHD	TAHM	AAH	GAH
0	2.1947E+05	I S---Xm-I	I	637.78	438.12	1448.3
44.000	2.2270E+05	I X#0	I	641.00	440.15	1448.3
88.000	2.2282E+05	I X#0	I	643.06	441.46	1448.3
132.00	2.2299E+05	I X#0	I	644.31	442.25	1448.3
176.00	2.2316E+05	I X#0	I	645.17	442.79	1448.3
220.00	2.2332E+05	I X#0	I	645.81	443.19	1448.3
264.00	2.2348E+05	I X#0	I	646.34	443.53	1448.3
308.00	2.2365E+05	I X#0	I	646.81	443.82	1448.3
352.00	2.2384E+05	I X#0	I	647.26	444.11	1448.3
396.00	2.2404E+05	I X#0	I	647.73	444.41	1448.3
440.00	2.2425E+05	I X#0	I	648.22	444.71	1448.3
484.00	2.2448E+05	I X#0	I	648.73	445.04	1448.3
528.00	2.2471E+05	I X#0	I	649.27	445.38	1448.3
572.00	2.2496E+05	I X#0	I	649.84	445.74	1448.3
616.00	2.2520E+05	I X#0	I	650.42	446.11	1448.3
660.00	2.2545E+05	I X#0	I	651.02	446.48	1448.3
704.00	2.2569E+05	I X#0	I	651.62	446.86	1448.3
748.00	2.2593E+05	I X#0	I	652.21	447.23	1448.3
792.00	2.2615E+05	I X#0	I	652.79	447.60	1448.3
836.00	2.2637E+05	I X#0	I	653.36	447.96	1448.3
880.00	2.2658E+05	I X#0	I	653.91	448.31	1448.3
924.00	2.2678E+05	I X#0	I	654.43	448.64	1448.3
968.00	2.2698E+05	I X#0	I	654.94	448.96	1448.3
1012.00	2.2716E+05	I X#0	I	655.43	449.27	1448.3
1056.00	2.2734E+05	I X#0	I	655.89	449.56	1448.3
1100.00	2.2751E+05	I X#0	I	656.34	449.84	1448.3
1144.00	2.2767E+05	I X#0	I	656.77	450.11	1448.3
1188.00	2.2782E+05	I X#0	I	657.17	450.37	1448.3
1232.00	2.2797E+05	I X#0	I	657.56	450.62	1448.3
1276.00	2.2811E+05	I X#0	I	657.94	450.85	1448.3
1320.00	2.2824E+05	I X#0	I	658.29	451.07	1448.3
1364.00	2.2837E+05	I X#0	I	658.63	451.29	1448.3
1408.00	2.2849E+05	I X#0	I	658.95	451.49	1448.3
1452.00	2.2860E+05	I X#0	I	659.25	451.68	1448.3
1496.00	2.2871E+05	I X#0	I	659.54	451.86	1448.3
1540.00	2.2881E+05	I X#0	I	659.81	452.04	1448.3
1584.00	2.2891E+05	I X#0	I	660.08	452.20	1448.3
1628.00	2.2900E+05	I X#0	I	660.32	452.36	1448.3
1672.00	2.2909E+05	I X#0	I	660.56	452.51	1448.3
1716.00	2.2917E+05	I X#0	I	660.78	452.65	1448.3
1760.00	2.2925E+05	I X#0	I	660.99	452.78	1448.3
1804.00	2.2933E+05	I X#0	I	661.19	452.91	1448.3
1848.00	2.2940E+05	I X#0	I	661.39	453.03	1448.3
1892.00	2.2946E+05	I X#0	I	661.57	453.14	1448.3
1936.00	2.2951E+05	I X#0	I	661.74	453.25	1448.3
1980.00	2.2955E+05	I X#0	I	661.89	453.35	1448.3
2024.00	2.2958E+05	I X#0	I	662.05	453.45	1448.3
2068.00	2.2970E+05	I X#0	I	662.20	453.54	1448.3
2112.00	2.2975E+05	I X#0	I	662.34	453.63	1448.3
2156.00	2.2980E+05	I X#0	I	662.47	453.71	1448.3
2200.00	2.2984E+05	I X#0	I	662.59	453.79	1448.3

5 PERCENT STEP CHANGE IN COMBUSTION RATE
GAS PATH STATES

	720.0 915.0 730.0 740.0 1350.	'S'=TGP2 'O'=TGP1 'X'=TGPS 'M'=TGPM '*'=TGP	752.0 975.0 770.0 780.0 1410.			
TIME	TGP		TGPM	TGPS	TGP1	TGP2
0	1352.7	I S---XO-I	I	747.68	735.24	923.71
44.000	1362.2	I X#0	I	747.65	734.64	930.16
88.000	1364.9	I X#0	I	746.90	733.82	932.00
132.00	1367.1	I X#0	I	746.53	733.55	933.40
176.00	1369.0	I X#0	I	746.86	734.01	934.57
220.00	1370.7	I X#0	I	747.83	735.09	935.60
264.00	1372.2	I X#0	I	749.25	736.57	936.58
308.00	1373.6	I X#0	I	750.90	738.23	937.56
352.00	1374.9	I X#0	I	752.40	739.91	938.60
396.00	1376.0	I X#0	I	754.30	741.57	939.73
440.00	1377.0	I X#0	I	755.94	743.17	940.93
484.00	1378.0	I X#0	I	757.49	744.68	942.20
528.00	1378.9	I X#0	I	758.94	746.08	943.54
572.00	1379.7	I X#0	I	760.29	747.38	944.92
616.00	1380.5	I X#0	I	761.54	748.59	946.33
660.00	1381.3	I X#0	I	762.70	749.71	947.74
704.00	1382.0	I X#0	I	763.79	750.76	949.15
748.00	1382.7	I X#0	I	764.81	751.74	950.52
792.00	1383.3	I X#0	I	765.76	752.67	951.86
836.00	1383.9	I X#0	I	766.66	753.54	953.15
880.00	1384.5	I X#0	I	767.52	754.37	954.39
924.00	1385.1	I X#0	I	768.31	755.14	955.59
968.00	1385.6	I X#0	I	769.06	755.86	956.73
1012.00	1386.1	I X#0	I	769.76	756.54	957.83
1056.00	1386.6	I X#0	I	770.42	757.18	958.88
1100.00	1387.0	I X#0	I	771.05	757.78	959.88
1144.00	1387.4	I X#0	I	771.63	758.35	960.84
1188.00	1387.8	I X#0	I	772.19	758.89	961.75
1232.00	1388.2	I X#0	I	772.71	759.39	962.62
1276.00	1388.6	I X#0	I	773.20	759.87	963.46
1320.00	1388.9	I X#0	I	773.67	760.32	964.25
1364.00	1389.3	I X#0	I	774.11	760.75	965.00
1408.00	1389.6	I X#0	I	774.53	761.16	965.72
1452.00	1389.9	I X#0	I	774.93	761.54	966.39
1496.00	1390.1	I X#0	I	775.31	761.91	967.04
1540.00	1390.4	I X#0	I	775.66	762.25	967.65
1584.00	1390.7	I X#0	I	776.00	762.58	968.24
1628.00	1390.9	I X#0	I	776.32	762.89	968.79
1672.00	1391.1	I X#0	I	776.63	763.19	969.31
1716.00	1391.3	I X#0	I	776.91	763.46	969.81
1760.00	1391.5	I X#0	I	777.19	763.73	970.28
1804.00	1391.7	I X#0	I	777.45	763.98	970.73
1848.00	1391.9	I X#0	I	777.69	764.22	971.15
1892.00	1392.1	I X#0	I	777.92	764.44	971.55
1936.00	1392.3	I X#0	I	778.14	764.66	971.93
1980.00	1392.4	I X#0	I	778.35	764.86	972.29
2024.00	1392.6	I X#0	I	778.55	765.05	972.64
2068.00	1392.7	I X#0	I	778.74	765.23	972.96
2112.00	1392.9	I X#0	I	778.91	765.40	973.27
2156.00	1393.0	I X#0	I	779.08	765.56	973.56
2200.00	1393.1	I X#0	I	779.24	765.72	973.83

5 PERCENT STEP CHANGE IN COMBUSTION RATE
GAS FLOW

		134.2 1554. 500.0 500.0	'O' = GCBC 'X' = GGP2 'H' = GGP1 'A' = GGP	135.2 1555. 2500. 2500.			
TIME	GGP				GGP1	GGP2	GCBC
.0	1420.2	I---XO-----I-----H-I-----I-----I			1420.2	1554.4	134.34
40.000	1420.2	I-----I-----XO-----H-I-----I-----I			1420.2	1554.9	134.65
80.000	1420.2	I-----I-----I-----H-XO-----I-----I			1420.2	1555.1	134.85
132.000	1420.2	I-----I-----I-----H-I-----XO-----I			1420.2	1555.2	134.99
176.000	1420.2	I-----I-----I-----H-I-----I-----XO			1420.2	1555.3	135.08
220.000	1420.2	I-----I-----I-----H-I-----I-----XO			1420.2	1555.4	135.13
264.000	1420.2	I-----I-----I-----H-I-----I-----XO			1420.2	1555.4	135.17
308.000	1420.2	I-----I-----I-----H-I-----I-----XO			1420.2	1555.4	135.19
352.000	1420.2	I-----I-----I-----H-I-----I-----XO			1420.2	1555.4	135.21
396.000	1420.2	I-----I-----I-----H-I-----I-----XOI			1420.2	1555.5	135.22
440.000	1420.2	I-----I-----I-----H-I-----I-----XOI			1420.2	1555.5	135.23
484.000	1420.2	I-----I-----I-----H-I-----I-----XOI			1420.2	1555.5	135.23
528.000	1420.2	I-----I-----I-----H-I-----I-----XOI			1420.2	1555.5	135.23
572.000	1420.2	I-----I-----I-----H-I-----I-----XO			1420.2	1555.5	135.24
616.000	1420.2	I-----I-----I-----H-I-----I-----XO			1420.2	1555.5	135.24
660.000	1420.2	I-----I-----I-----H-I-----I-----XO			1420.2	1555.5	135.24
704.000	1420.2	I-----I-----I-----H-I-----I-----XO			1420.2	1555.5	135.24
748.000	1420.2	I-----I-----I-----H-I-----I-----XO			1420.2	1555.5	135.24
792.000	1420.2	I-----I-----I-----H-I-----I-----XO			1420.2	1555.5	135.24
836.000	1420.2	I-----I-----I-----H-I-----I-----XO			1420.2	1555.5	135.24
880.000	1420.2	I-----I-----I-----H-I-----I-----XO			1420.2	1555.5	135.24
924.000	1420.2	I-----I-----I-----H-I-----I-----XO			1420.2	1555.5	135.24
968.000	1420.2	I-----I-----I-----H-I-----I-----XO			1420.2	1555.5	135.24
1012.000	1420.2	I-----I-----I-----H-I-----I-----XO			1420.2	1555.5	135.24
1056.000	1420.2	I-----I-----I-----H-I-----I-----XO			1420.2	1555.5	135.24
1100.000	1420.2	I-----I-----I-----H-I-----I-----XO			1420.2	1555.5	135.24
1144.000	1420.2	I-----I-----I-----H-I-----I-----XO			1420.2	1555.5	135.24
1188.000	1420.2	I-----I-----I-----H-I-----I-----XO			1420.2	1555.5	135.24
1232.000	1420.2	I-----I-----I-----H-I-----I-----XO			1420.2	1555.5	135.24
1276.000	1420.2	I-----I-----I-----H-I-----I-----XO			1420.2	1555.5	135.24
1320.000	1420.2	I-----I-----I-----H-I-----I-----XO			1420.2	1555.5	135.24
1364.000	1420.2	I-----I-----I-----H-I-----I-----XO			1420.2	1555.5	135.24
1408.000	1420.2	I-----I-----I-----H-I-----I-----XO			1420.2	1555.5	135.24
1452.000	1420.2	I-----I-----I-----H-I-----I-----XO			1420.2	1555.5	135.24
1496.000	1420.2	I-----I-----I-----H-I-----I-----XO			1420.2	1555.5	135.24
1540.000	1420.2	I-----I-----I-----H-I-----I-----XO			1420.2	1555.5	135.24
1584.000	1420.2	I-----I-----I-----H-I-----I-----XO			1420.2	1555.5	135.24
1628.000	1420.2	I-----I-----I-----H-I-----I-----XO			1420.2	1555.5	135.24
1672.000	1420.2	I-----I-----I-----H-I-----I-----XO			1420.2	1555.5	135.24
1716.000	1420.2	I-----I-----I-----H-I-----I-----XO			1420.2	1555.5	135.24
1760.000	1420.2	I-----I-----I-----H-I-----I-----XO			1420.2	1555.5	135.24
1804.000	1420.2	I-----I-----I-----H-I-----I-----XO			1420.2	1555.5	135.24
1848.000	1420.2	I-----I-----I-----H-I-----I-----XO			1420.2	1555.5	135.24
1892.000	1420.2	I-----I-----I-----H-I-----I-----XO			1420.2	1555.5	135.24
1936.000	1420.2	I-----I-----I-----H-I-----I-----XO			1420.2	1555.5	135.24
1980.000	1420.2	I-----I-----I-----H-I-----I-----XO			1420.2	1555.5	135.24
2024.000	1420.2	I-----I-----I-----H-I-----I-----XO			1420.2	1555.5	135.24
2068.000	1420.2	I-----I-----I-----H-I-----I-----XO			1420.2	1555.5	135.24
2112.000	1420.2	I-----I-----I-----H-I-----I-----XO			1420.2	1555.5	135.24
2156.000	1420.2	I-----I-----I-----H-I-----I-----XO			1420.2	1555.5	135.24
2200.000	1420.2	I-----I-----I-----H-I-----I-----XO			1420.2	1555.5	135.24

5 PERCENT STEP CHANGE IN COMBUSTION RATE
INTEGRATION TIME PATTERN

TIME	DELT	.0 .5000	'H' = PASS 'A' = DELT	2.000E+04 3.000	PASS
0	2.1500	I	I	I	2.0000
40.000	1.90234	I	I	I	311.00
80.000	1.6973	I	I	I	645.00
120.000	2.0571	I	I	I	1059.0
160.000	1.2286	I	I	I	1332.0
200.000	2.5473	I	I	I	1637.0
240.000	2.8618	I	I	I	1943.0
280.000	2.4591	I	I	I	2241.0
320.000	1.6444	I	I	I	2571.0
360.000	2.2432	I	I	I	2916.0
400.000	1.1860	I	I	I	3205.0
440.000	1.2152	I	I	I	3485.0
480.000	1.2782	I	I	I	3789.0
520.000	2.8204	I	I	I	4087.0
560.000	2.5396	I	I	I	4418.0
600.000	2.0441	I	I	I	4715.0
640.000	1.6131	I	I	I	5005.0
680.000	1.8745	I	I	I	5383.0
720.000	1.67928	I	I	I	5706.0
760.000	1.4900	I	I	I	6044.0
800.000	2.5393	I	I	I	6359.0
840.000	1.4505	I	I	I	6665.0
880.000	1.7533	I	I	I	6954.0
920.000	1.1378	I	I	I	7308.0
960.000	1.874	I	I	I	7614.0
1000.000	1.3472	I	I	I	7904.0
1040.000	1.89430	I	I	I	8243.0
1080.000	2.2814	I	I	I	8588.0
1120.000	1.3040	I	I	I	8893.0
1160.000	2.6430	I	I	I	9182.0
1200.000	1.0770	I	I	I	9503.0
1240.000	1.4419	I	I	I	9786.0
1280.000	1.8152	I	I	I	10108.0
1320.000	1.5785	I	I	I	10455.0
1360.000	1.93684	I	I	I	10834.0
1400.000	1.1632	I	I	I	11149.0
1440.000	1.4034	I	I	I	11480.0
1480.000	2.8976	I	I	I	11795.0
1520.000	1.0728	I	I	I	12094.0
1560.000	2.6484	I	I	I	12367.0
1600.000	2.4839	I	I	I	12713.0
1640.000	1.8942	I	I	I	13011.0
1680.000	2.5442	I	I	I	13252.0
1720.000	2.7685	I	I	I	13574.0
1760.000	1.9287	I	I	I	13880.0
1800.000	1.3566	I	I	I	14138.0
1840.000	1.8427	I	I	I	14427.0
1880.000	1.3258	I	I	I	14660.0
1920.000	2.1209	I	I	I	14966.0
1960.000	2.3140	I	I	I	15244.0
2000.000	1.1657	I	I	I	15537.0

.6350	'R'=RRY	.6550
1530.	'O'=TEB	1650.
5.360E+05	'X'=QEB	5.680E+05
1080.	'H'=HEBS	1140.
1.184E+08	'A'=EEBH	1.216E+08

TIME	EEBH	HEBS	QEB	TEB	RRT
0	1.1901E+08 I-X-----I-----I-----I	1093.3	5.3776E+05	1550.0	.650400
94.000	1.1869E+08 I + * O I X I I	1088.2	5.4711E+05	1552.4	.65023
98.000	2.1840E+08 I + * O I X I X	1086.7	5.5321E+05	1556.5	.65004
132.0	1.1866E+08 I + * O I X I X	1087.5	5.5719E+05	1561.4	.65026
176.0	1.1879E+08 I + * O I X I X	1089.4	5.5978E+05	1566.5	.65090
220.0	1.1894E+08 I + * O I X I X	1091.7	5.6148E+05	1571.6	.65169
264.0	1.1909E+08 I + * O I X I X	1094.1	5.6258E+05	1576.5	.65235
308.0	1.1924E+08 I + * O I X I X	1096.4	5.6330E+05	1581.1	.65281
352.0	1.1938E+08 I + * O I X I X	1098.5	5.6377E+05	1585.3	.65317
396.0	1.1951E+08 I + * O I X I X	1100.9	5.6400E+05	1589.1	.65326
440.0	1.1965E+08 I + * O I X I X	1102.2	5.6428E+05	1592.4	.65304
484.0	1.1973E+08 I + * O I X I X	1103.9	5.6441E+05	1595.8	.65254
528.0	1.1983E+08 I + * O I X I X	1105.4	5.6449E+05	1598.6	.65193
572.0	1.1992E+08 I + * O I X I X	1106.7	5.6455E+05	1601.2	.65122
616.0	1.2000E+08 I + * O I X I X	1107.9	5.6458E+05	1603.5	.65048
660.0	1.2008E+08 I + * O I X I X	1109.1	5.6461E+05	1605.6	.64975
704.0	1.2015E+08 I + * O I X I X	1110.1	5.6462E+05	1607.5	.64906
748.0	1.2022E+08 I + * O I X I X	1111.1	5.6463E+05	1609.2	.64841
792.0	1.2028E+08 I + * O I X I X	1112.0	5.6464E+05	1610.7	.64780
836.0	1.2035E+08 I + * O I X I X	1112.9	5.6464E+05	1612.1	.64723
880.0	1.2041E+08 I + * O I X I X	1113.7	5.6465E+05	1613.4	.64670
924.0	1.2046E+08 I + * O I X I X	1114.5	5.6465E+05	1614.6	.64626
968.0	1.2051E+08 I + * O I X I X	1115.3	5.6465E+05	1615.7	.64584
1012.0	1.2056E+08 I + * O I X I X	1115.9	5.6465E+05	1616.7	.64548
1056.0	1.2061E+08 I + * O I X I X	1116.5	5.6465E+05	1617.6	.64504
1100.0	1.2066E+08 I + * O I X I X	1117.2	5.6465E+05	1618.4	.64465
1144.0	1.2070E+08 I + * O I X I X	1117.7	5.6465E+05	1619.2	.64427
1188.0	1.2074E+08 I + * O I X I X	1118.3	5.6465E+05	1619.9	.64391
1232.0	1.2078E+08 I + * O I X I X	1118.8	5.6465E+05	1620.5	.64357
1276.0	1.2081E+08 I + * O I X I X	1119.3	5.6465E+05	1621.1	.64324
1320.0	1.2085E+08 I + * O I X I X	1119.7	5.6465E+05	1621.7	.64293
1364.0	1.2088E+08 I + * O I X I X	1120.2	5.6465E+05	1622.2	.64264
1408.0	1.2091E+08 I + * O I X I X	1120.6	5.6465E+05	1622.7	.64236
1452.0	1.2094E+08 I + * O I X I X	1121.0	5.6465E+05	1623.1	.64210
1496.0	1.2097E+08 I + * O I X I X	1121.3	5.6465E+05	1623.5	.64184
1540.0	1.2099E+08 I + * O I X I X	1121.7	5.6465E+05	1623.9	.64161
1584.0	1.2101E+08 I + * O I X I X	1122.0	5.6465E+05	1624.3	.64139
1628.0	1.2104E+08 I + * O I X I X	1122.3	5.6465E+05	1624.6	.64118
1672.0	1.2106E+08 I + * O I X I X	1122.6	5.6465E+05	1624.9	.64098
1716.0	1.2108E+08 I + * O I X I X	1122.9	5.6465E+05	1625.2	.64079
1760.0	1.2110E+08 I + * O I X I X	1123.1	5.6465E+05	1625.5	.64061
1804.0	1.2112E+08 I + * O I X I X	1123.4	5.6465E+05	1625.7	.64044
1848.0	1.2113E+08 I + * O I X I X	1123.6	5.6465E+05	1626.0	.64029
1892.0	1.2115E+08 I + * O I X I X	1123.8	5.6465E+05	1626.2	.64012
1936.0	1.2117E+08 I + * O I X I X	1124.1	5.6465E+05	1626.4	.63998
1980.0	1.2119E+08 I + * O I X I X	1124.3	5.6465E+05	1626.6	.63984
2024.0	1.2121E+08 I + * O I X I X	1124.4	5.6465E+05	1626.8	.63971
2068.0	1.2121E+08 I + * O I X I X	1124.6	5.6465E+05	1627.0	.63959
2112.0	1.2122E+08 I + * O I X I X	1124.8	5.6465E+05	1627.1	.63947
2156.0	1.2123E+08 I + * O I X I X	1125.0	5.6465E+05	1627.3	.63936
2200.0	1.2124E+08 I + * O I X I X	1125.1	5.6465E+05	1627.4	.63926

1.950E+08	'Q'=ESBY	2.070E+08
1440.	'X'=MSB	1500.
1530.	'W'=TSB	1650.
5.360E+05	'A'=QSB	5.680E+05

TIME	QSB	TSB	MSB	ESBT
0	5.3776E+05	0	1547.7	1.9504E+08
44.000	5.4711E+05	0	1548.7	1.9517E+08
88.000	5.5321E+05	0	1550.8	1.9544E+08
132.00	5.5719E+05	0	1553.8	1.9582E+08
176.00	5.5978E+05	0	1557.2	1.9624E+08
220.00	5.6148E+05	0	1560.5	1.9666E+08
264.00	5.6258E+05	0	1563.7	1.9704E+08
308.00	5.6370E+05	0	1566.7	1.9744E+08
352.00	5.6377E+05	0	1569.7	1.9782E+08
396.00	5.6445E+05	0	1572.4	1.9816E+08
440.00	5.6428E+05	0	1575.4	1.9854E+08
484.00	5.6441E+05	0	1578.2	1.9889E+08
528.00	5.6449E+05	0	1581.0	1.9924E+08
572.00	5.6455E+05	0	1587.8	1.9959E+08
616.00	5.6458E+05	0	1586.5	1.9994E+08
660.00	5.6461E+05	0	1589.3	2.0029E+08
704.00	5.6462E+05	0	1592.0	2.0063E+08
748.00	5.6463E+05	0	1594.7	2.0097E+08
792.00	5.6464E+05	0	1597.3	2.0129E+08
836.00	5.6464E+05	0	1599.8	2.0161E+08
880.00	5.6465E+05	0	1602.2	2.0192E+08
924.00	5.6465E+05	0	1604.6	2.0221E+08
968.00	5.6465E+05	0	1606.8	2.0249E+08
1012.00	5.6465E+05	0	1608.9	2.0276E+08
1056.00	5.6465E+05	0	1610.9	2.0302E+08
1100.00	5.6465E+05	0	1612.9	2.0326E+08
1144.00	5.6465E+05	0	1614.7	2.0349E+08
1188.00	5.6465E+05	0	1616.5	2.0372E+08
1232.00	5.6465E+05	0	1618.2	2.0394E+08
1276.00	5.6465E+05	0	1619.8	2.0413E+08
1320.00	5.6465E+05	0	1621.3	2.0433E+08
1364.00	5.6465E+05	0	1622.8	2.0451E+08
1408.00	5.6465E+05	0	1624.2	2.0469E+08
1452.00	5.6465E+05	0	1625.6	2.0486E+08
1496.00	5.6465E+05	0	1626.8	2.0502E+08
1540.00	5.6465E+05	0	1628.0	2.0517E+08
1584.00	5.6465E+05	0	1629.2	2.0531E+08
1628.00	5.6465E+05	0	1630.3	2.0545E+08
1672.00	5.6465E+05	0	1631.3	2.0558E+08
1716.00	5.6465E+05	0	1632.3	2.0571E+08
1760.00	5.6465E+05	0	1633.2	2.0583E+08
1804.00	5.6465E+05	0	1634.1	2.0594E+08
1848.00	5.6465E+05	0	1635.0	2.0604E+08
1892.00	5.6465E+05	0	1635.8	2.0615E+08
1936.00	5.6465E+05	0	1636.5	2.0624E+08
1980.00	5.6465E+05	0	1637.3	2.0632E+08
2024.00	5.6465E+05	0	1638.0	2.0642E+08
2068.00	5.6465E+05	0	1638.6	2.0650E+08
2112.00	5.6465E+05	0	1639.2	2.0658E+08
2156.00	5.6465E+05	0	1639.8	2.0665E+08
2200.00	5.6465E+05	0	1640.4	2.0672E+08

5 PERCENT STEP CHANGE IN COMBUSTION RATE

		4.400E+04	'M'=QRBGMR	5.200E+04				
		1.200E+05	'O'=QRBT	1.280E+05				
		1530.	'X'=TRB	1450.				
		2.680E+05	'M'=QRD	2.040E+05				
		1510.	'M'=HRB	1550.				
TIME	HRB				QRB	TRB	QRBT	QRBGMR
.0	1515.5	I--X0--0--I			2.6888E+05	1541.8	1.2147E+05	44972.
40.000	1513.9	I +X I	0	I	2.7355E+05	1543.6	1.2286E+05	45268.
80.000	1513.7	I +X I		I	2.7460E+05	1546.6	1.2370E+05	45722.
120.000	1510.0	I +X I		I	2.7059E+05	1550.3	1.2431E+05	46089.
176.000	1514.5	I +X I		I	2.7969E+05	1554.2	1.2487E+05	46396.
220.000	1515.1	I +X I		I	2.8074E+05	1558.2	1.2539E+05	46652.
264.000	1515.6	I +X I		I	2.8129E+05	1561.9	1.2586E+05	46871.
308.000	1516.3	I +X I		I	2.8145E+05	1565.4	1.2626E+05	47058.
352.000	1517.0	I +X I		I	2.8188E+05	1568.6	1.2658E+05	47221.
396.000	1517.8	I +X I		I	2.8204E+05	1571.6	1.2682E+05	47364.
440.000	1518.7	I +X I		I	2.8214E+05	1574.4	1.2697E+05	47494.
484.000	1519.7	I +X I		I	2.8220E+05	1577.1	1.2706E+05	47613.
528.000	1520.8	I +X I		I	2.8224E+05	1579.6	1.2709E+05	47725.
572.000	1522.0	I +X I		I	2.8227E+05	1582.0	1.2706E+05	47831.
616.000	1523.1	I +X I		I	2.8229E+05	1584.3	1.2701E+05	47934.
660.000	1524.3	I +X I		I	2.8230E+05	1586.7	1.2694E+05	48034.
704.000	1525.5	I +X I		I	2.8231E+05	1588.9	1.2687E+05	48132.
748.000	1526.7	I +X I		I	2.8231E+05	1591.2	1.2679E+05	48228.
792.000	1527.9	I +X I		I	2.8232E+05	1593.4	1.2671E+05	48323.
836.000	1529.0	I +X I		I	2.8232E+05	1595.6	1.2664E+05	48417.
880.000	1530.1	I +X I		I	2.8232E+05	1597.7	1.2658E+05	48508.
924.000	1531.2	I +X I		I	2.8232E+05	1599.8	1.2653E+05	48597.
968.000	1532.2	I +X I		I	2.8232E+05	1601.8	1.2649E+05	48684.
1012.000	1533.1	I +X I		I	2.8232E+05	1603.8	1.2646E+05	48769.
1056.000	1534.0	I +X I		I	2.8232E+05	1605.7	1.2643E+05	48851.
1100.000	1534.9	I +X I		I	2.8232E+05	1607.6	1.2641E+05	48931.
1144.000	1535.7	I +X I		I	2.8232E+05	1609.4	1.2639E+05	49008.
1188.000	1536.6	I +X I		I	2.8232E+05	1611.1	1.2637E+05	49082.
1232.000	1537.3	I +X I		I	2.8232E+05	1612.8	1.2635E+05	49154.
1276.000	1538.1	I +X I		I	2.8232E+05	1614.4	1.2634E+05	49220.
1320.000	1538.8	I +X I		I	2.8232E+05	1615.9	1.2634E+05	49291.
1364.000	1539.5	I +X I		I	2.8232E+05	1617.4	1.2633E+05	49355.
1408.000	1540.1	I +X I		I	2.8232E+05	1618.9	1.2633E+05	49417.
1452.000	1540.7	I +X I		I	2.8232E+05	1620.2	1.2632E+05	49477.
1496.000	1541.3	I +X I		I	2.8232E+05	1621.4	1.2632E+05	49534.
1540.000	1541.8	I +X I		I	2.8232E+05	1622.6	1.2632E+05	49588.
1584.000	1542.4	I +X I		I	2.8232E+05	1624.0	1.2633E+05	49641.
1628.000	1542.9	I +X I		I	2.8232E+05	1625.2	1.2633E+05	49691.
1672.000	1543.4	I +X I		I	2.8232E+05	1626.3	1.2633E+05	49739.
1716.000	1543.8	I +X I		I	2.8232E+05	1627.4	1.2634E+05	49785.
1760.000	1544.2	I +X I		I	2.8232E+05	1628.4	1.2634E+05	49828.
1804.000	1544.6	I +X I		I	2.8232E+05	1629.3	1.2635E+05	49870.
1848.000	1545.0	I +X I		I	2.8232E+05	1630.3	1.2635E+05	49909.
1892.000	1545.4	I +X I		I	2.8232E+05	1631.1	1.2635E+05	49948.
1936.000	1545.8	I +X I		I	2.8232E+05	1632.0	1.2637E+05	49984.
1980.000	1546.1	I +X I		I	2.8232E+05	1632.8	1.2637E+05	50018.
2024.000	1546.4	I +X I		I	2.8232E+05	1633.5	1.2638E+05	50051.
2068.000	1546.7	I +X I		I	2.8232E+05	1634.2	1.2639E+05	50082.
2112.000	1547.0	I +X I		I	2.8232E+05	1634.9	1.2639E+05	50112.
2156.000	1547.3	I +X I		I	2.8232E+05	1635.6	1.2640E+05	50140.
2200.000	1547.5	I +X I		I	2.8232E+05	1636.2	1.2641E+05	50167.

5 PERCENT STEP CHANGE IN COMBUSTION RATE

		620.0	'M'=TCBM	676.0				
		720.0	'O'=TCBG	736.0				
		3.080E+04	'M'=ECBG	3.160E+04				
		9.840E+07	'M'=ECBM	1.008E+08				
		8.400E+07	'M'=ECB	9.000E+07				
TIME	ECB				ECBM	ECBG	TCBG	TCBM
0	0.4730E+07	OK--0--0--I			9.8400E+07	J0922.	720.14	621.82
40.000	0.4774E+07	I +X I		I	9.8635E+07	31425.	724.38	621.95
80.000	0.4800E+07	I +X I		I	9.8900E+07	31503.	724.38	622.45
120.000	0.4917E+07	I +X I		I	9.8995E+07	31370.	732.95	623.03
176.000	0.5063E+07	I +X I		I	9.9047E+07	31419.	734.09	623.64
220.000	0.5233E+07	I +X I		I	9.9162E+07	31450.	734.81	624.08
264.000	0.5416E+07	I +X I		I	9.9235E+07	31469.	735.26	624.34
308.000	0.5605E+07	I +X I		I	9.9301E+07	31476.	735.43	624.96
352.000	0.5793E+07	I +X I		I	9.9364E+07	31478.	735.46	625.35
396.000	0.5977E+07	I +X I		I	9.9424E+07	31476.	735.41	625.73
440.000	0.6155E+07	I +X I		I	9.9481E+07	31471.	735.30	626.09
484.000	0.6325E+07	I +X I		I	9.9537E+07	31465.	735.16	626.44
528.000	0.6480E+07	I +X I		I	9.9593E+07	31458.	735.01	626.79
572.000	0.6644E+07	I +X I		I	9.9648E+07	31452.	734.87	627.14
616.000	0.6790E+07	I +X I		I	9.9702E+07	31446.	734.73	627.48
660.000	0.6929E+07	I +X I		I	9.9755E+07	31440.	734.59	627.81
704.000	0.7061E+07	I +X I		I	9.9808E+07	31435.	734.44	628.15
748.000	0.7184E+07	I +X I		I	9.9860E+07	31430.	734.35	628.47
792.000	0.7304E+07	I +X I		I	9.9910E+07	31426.	734.26	628.79
836.000	0.7410E+07	I +X I		I	9.9959E+07	31422.	734.16	629.10
880.000	0.7522E+07	I +X I		I	1.0001E+08	31418.	734.07	629.40
924.000	0.7622E+07	I +X I		I	1.0005E+08	31416.	734.01	629.69
968.000	0.7718E+07	I +X I		I	1.0010E+08	31413.	733.94	629.96
1012.000	0.7808E+07	I +X I		I	1.0014E+08	31410.	733.87	630.22
1056.000	0.7893E+07	I +X I		I	1.0018E+08	31407.	733.81	630.49
1100.000	0.7974E+07	I +X I		I	1.0022E+08	31405.	733.76	630.73
1144.000	0.8051E+07	I +X I		I	1.0026E+08	31401.	733.71	630.94
1188.000	0.8124E+07	I +X I		I	1.0029E+08	31401.	733.67	631.19
1232.000	0.8193E+07	I +X I		I	1.0033E+08	31399.	733.61	631.40
1276.000	0.8259E+07	I +X I		I	1.0036E+08	31397.	733.58	631.60
1320.000	0.8321E+07	I +X I		I	1.0039E+08	31395.	733.53	631.80
1364.000	0.8380E+07	I +X I		I	1.0042E+08	31394.	733.50	631.98
1408.000	0.8434E+07	I +X I		I	1.0044E+08	31392.	733.46	632.15
1452.000	0.8490E+07	I +X I		I	1.0047E+08	31391.	733.42	632.32
1496.000	0.8540E+07	I +X I		I	1.0050E+08	31389.	733.39	632.48
1540.000	0.8588E+07	I +X I		I	1.0052E+08	31388.	733.36	632.63
1584.000	0.8633E+07	I +X I		I	1.0054E+08	31387.	733.33	632.77
1628.000	0.8676E+07	I +X I		I	1.0056E+08	31385.	733.30	632.91
1672.000	0.8717E+07	I +X I		I	1.0058E+08	31384.	733.28	633.03
1716.000	0.8756E+07	I +X I		I	1.0060E+08	31383.	733.25	633.16
1760.000	0.8793E+07	I +X I		I	1.0062E+08	31382.	733.23	633.27
1804.000	0.8828E+07	I +X I		I	1.0064E+08	31381.	733.21	633.38
1848.000	0.8861E+07	I +X I		I	1.0066E+08	31380.	733.18	633.49
1892.000	0.8893E+07	I +X I		I	1.0067E+08	31379.	733.15	633.59
1936.000	0.8923E+07	I +X I		I	1.0069E+08	31379.	733.14	633.68
1980.000	0.8951E+07	I +X I		I	1.0070E+08	31378.	733.12	633.77
2024.000	0.8978E+07	I +X I		I	1.0072E+08	31377.	733.10	633.85
2068.000	0.9004E+07	I +X I		I	1.0073E+08	31376.	733.09	633.94
2112.000	0.9028E+07	I +X I		I	1.0074E+08	31376.	733.07	634.01
2156.000	0.9051E+07	I +X I		I	1.0075E+08	31375.	733.05	634.08
2200.000	0.9073E+07	I +X I		I	1.0076E+08	31374.	733.04	634.15

5 PERCENT STEP CHANGE IN COMBUSTION RATE
FLUIDIZED CELL BED HEIGHTS (FT)

		.0	'0' = PASS	1.600E+04				
		Q.200	'0' = XCBH	4.440				
		Q.200	'X' = XRBH	4.360				
		Q.200	'0' = XCBH	4.360				
		Q.230	'0' = XCBH	4.350				
TIME	XEBH				XSBH	XRBH	XCBH	PASS
.0	Q.2351	0+-----OX--W--I-----I-----I-----I			Q.2322	Q.2250	Q.2304	2.0000
44.000	Q.2382	0+-----XOW--I-----I-----I-----I			Q.2335	Q.2273	Q.2457	311.00
68.000	Q.2435	0+-----XOI-----I-----I-----I-----I			Q.2382	Q.2311	Q.2574	665.00
132.000	Q.2498	0+-----XWO-----I-----I-----I-----I			Q.2401	Q.2359	Q.2671	1059.00
176.000	Q.2545	0+-----XOI-----I-----I-----I-----I			Q.2444	Q.2409	Q.2758	1332.00
220.000	Q.2631	0+-----IXW-----I-----I-----I-----I			Q.2487	Q.2460	Q.2837	1637.00
264.000	Q.2694	0+-----XWO-----I-----I-----I-----I			Q.2528	Q.2508	Q.2912	1943.00
308.000	Q.2753	0+-----XWO-----I-----I-----I-----I			Q.2567	Q.2553	Q.2982	2241.00
352.000	Q.2808	0+-----XWO-----I-----I-----I-----I			Q.2606	Q.2595	Q.3048	2571.00
396.000	Q.2858	0+-----XOI-----I-----I-----I-----I			Q.2643	Q.2634	Q.3110	2916.00
440.000	Q.2903	0+-----XWO-----I-----I-----I-----I			Q.2680	Q.2670	Q.3169	3205.00
484.000	Q.2944	0+-----XOI-----I-----I-----I-----I			Q.2716	Q.2704	Q.3225	3485.00
528.000	Q.2982	0+-----XWO-----I-----I-----I-----I			Q.2752	Q.2737	Q.3277	3789.00
572.000	Q.3015	0+-----XWO-----I-----I-----I-----I			Q.2788	Q.2768	Q.3326	4087.00
616.000	Q.3048	0+-----XWO-----I-----I-----I-----I			Q.2824	Q.2799	Q.3373	4418.00
660.000	Q.3072	0+-----IXW-----I-----I-----I-----I			Q.2860	Q.2829	Q.3417	4715.00
704.000	Q.3097	0+-----IXW-----I-----I-----I-----I			Q.2896	Q.2859	Q.3458	5005.00
748.000	Q.3119	0+-----IXW-----I-----I-----I-----I			Q.2931	Q.2888	Q.3498	5381.00
792.000	Q.3140	0+-----IXW-----I-----I-----I-----I			Q.2964	Q.2917	Q.3535	5706.00
836.000	Q.3158	0+-----IXW-----I-----I-----I-----I			Q.2997	Q.2945	Q.3570	6044.00
880.000	Q.3175	0+-----XWO-----I-----I-----I-----I			Q.3029	Q.2973	Q.3604	6359.00
924.000	Q.3191	0+-----XWO-----I-----I-----I-----I			Q.3060	Q.3000	Q.3636	6665.00
968.000	Q.3205	0+-----XWO-----I-----I-----I-----I			Q.3089	Q.3027	Q.3666	6954.00
1012.000	Q.3218	0+-----XWO-----I-----I-----I-----I			Q.3116	Q.3053	Q.3694	7308.00
1056.000	Q.3229	0+-----XWO-----I-----I-----I-----I			Q.3143	Q.3078	Q.3721	7614.00
1100.000	Q.3239	0+-----XWO-----I-----I-----I-----I			Q.3168	Q.3107	Q.3747	7907.00
1144.000	Q.3250	0+-----XWO-----I-----I-----I-----I			Q.3193	Q.3125	Q.3771	8243.00
1188.000	Q.3260	0+-----XWO-----I-----I-----I-----I			Q.3216	Q.3148	Q.3795	8588.00
1232.000	Q.326A	0+-----XWO-----I-----I-----I-----I			Q.3238	Q.3170	Q.3816	8893.00
1276.000	Q.3276	0+-----XWO-----I-----I-----I-----I			Q.3259	Q.3191	Q.3837	9182.00
1320.000	Q.3283	0+-----XWO-----I-----I-----I-----I			Q.3279	Q.3211	Q.3857	9505.00
1364.000	Q.3290	0+-----XWO-----I-----I-----I-----I			Q.3299	Q.3231	Q.3876	9786.00
1408.000	Q.3296	0+-----XWO-----I-----I-----I-----I			Q.3317	Q.3250	Q.3894	10108.00
1452.000	Q.3302	0+-----XWO-----I-----I-----I-----I			Q.3335	Q.3268	Q.3910	10455.00
1496.000	Q.3308	0+-----XWO-----I-----I-----I-----I			Q.3351	Q.3285	Q.3927	10834.00
1540.000	Q.3313	0+-----XWO-----I-----I-----I-----I			Q.3367	Q.3302	Q.3942	11249.00
1584.000	Q.3317	0+-----XWO-----I-----I-----I-----I			Q.3382	Q.3318	Q.3958	11698.00
1628.000	Q.3322	0+-----XWO-----I-----I-----I-----I			Q.3397	Q.3333	Q.3970	11795.00
1672.000	Q.3326	0+-----XWO-----I-----I-----I-----I			Q.3411	Q.3348	Q.3983	12094.00
1716.000	Q.3330	0+-----XWO-----I-----I-----I-----I			Q.3424	Q.3362	Q.3995	12367.00
1760.000	Q.3333	0+-----XWO-----I-----I-----I-----I			Q.3436	Q.3375	Q.4007	12713.00
1804.000	Q.3337	0+-----XWO-----I-----I-----I-----I			Q.3448	Q.3388	Q.4018	13011.00
1848.000	Q.3340	0+-----XWO-----I-----I-----I-----I			Q.3459	Q.3400	Q.4029	13252.00
1892.000	Q.3343	0+-----XWO-----I-----I-----I-----I			Q.3469	Q.3411	Q.4039	13574.00
1936.000	Q.3346	0+-----XWO-----I-----I-----I-----I			Q.3479	Q.3422	Q.4048	13880.00
1980.000	Q.3351	0+-----XWO-----I-----I-----I-----I			Q.3489	Q.3432	Q.4057	14174.00
2024.000	Q.3351	0+-----XWO-----I-----I-----I-----I			Q.3498	Q.3443	Q.4066	14460.00
2068.000	Q.3353	0+-----XWO-----I-----I-----I-----I			Q.3507	Q.3452	Q.4074	14660.00
2112.000	Q.3355	0+-----XWO-----I-----I-----I-----I			Q.3515	Q.3461	Q.4082	14944.00
2156.000	Q.3357	0+-----XWO-----I-----I-----I-----I			Q.3523	Q.3470	Q.4089	15244.00
2200.000	Q.3359	0+-----XWO-----I-----I-----I-----I			Q.3530	Q.3478	Q.4096	15537.00

5 PERCENT STEP CHANGE IN COMBUSTION RATE FLUIDIZED BED VOID FRACTION

TIME	XSB					XEB	XRB	XCB	DEL
.0	.64676	O	-	X	-	I			
88.000	.64687	I	O	X	*	I			
88.000	.64710	I	O	+	*	I			
132.00	.64793	I				I			
176.00	.64778	I	O	*	*	I			
220.00	.64814	I	X	O	*	I			
264.00	.64898	I	I	O	+	I			
308.00	.64880	I	I	I	O	I			
352.00	.64912	I	I	I	O	I			
396.00	.64943	I	I	I	O	I			
440.00	.64973	I	I	I	O	I			
484.00	.65002	I	I	I	O	I			
528.00	.65032	I	I	I	O	I			
572.00	.65062	I	I	I	O	I			
616.00	.65091	I	I	I	O	I			
660.00	.65120	I	I	I	O	I			
704.00	.65149	I	I	I	O	I			
748.00	.65177	I	I	I	O	I			
792.00	.65205	I	I	I	O	I			
836.00	.65232	I	I	I	O	I			
880.00	.65257	I	I	I	O	I			
924.00	.65282	I	I	I	O	I			
968.00	.65305	I	I	I	O	I			
1012.00	.65328	I	I	I	O	I			
1056.00	.65349	I	I	I	O	I			
1100.00	.65369	I	I	I	O	I			
1144.00	.65389	I	I	I	O	I			
1188.00	.65407	I	I	I	O	I			
1232.00	.65425	I	I	I	O	I			
1276.00	.65442	I	I	I	O	I			
1320.00	.65458	I	I	I	O	I			
1364.00	.65474	I	I	I	O	I			
1408.00	.65488	I	I	I	O	I			
1452.00	.65502	I	I	I	O	I			
1496.00	.65514	I	I	I	O	I			
1540.00	.65528	I	I	I	O	I			
1584.00	.65540	I	I	I	O	I			
1628.00	.65552	I	I	I	O	I			
1672.00	.65562	I	I	I	O	I			
1716.00	.65573	I	I	I	O	I			
1760.00	.65583	I	I	I	O	I			
1804.00	.65592	I	I	I	O	I			
1848.00	.65601	I	I	I	O	I			
1892.00	.65609	I	I	I	O	I			
1936.00	.65617	I	I	I	O	I			
1980.00	.65625	I	I	I	O	I			
2024.00	.65632	I	I	I	O	I			
2068.00	.65639	I	I	I	O	I			
2112.00	.65645	I	I	I	O	I			
2156.00	.65651	I	I	I	O	I			
2200.00	.65657	I	I	I	O	I			

[illegible]

		975.0 496.0 980.0 620.0	O'=TSBS X'=TRMS M'=TRMS +'=TCBM	1075. 720.0 1606. 636.0				
TIME	TCBM				TRBS	TRMS	TSBS	
.0	621.82	I	X	I	I	994.85	998.24	1001.8
44.000	621.95	I	X	I	I	991.71	997.52	995.85
80.000	622.45	I	X	I	I	991.31	997.49	996.48
130.00	623.03	I	X	I	I	992.01	997.74	997.52
176.00	623.58	I	X	I	I	993.01	998.11	997.65
220.00	624.08	I	X	I	I	994.10	998.50	998.31
264.00	624.54	I	X	I	I	995.18	998.83	999.28
308.00	624.96	I	X	I	I	996.42	999.08	1001.5
352.00	625.35	I	X	I	I	997.81	1000.54	1003.6
396.00	625.73	I	X	I	I	999.34	1001.43	1006.0
440.00	626.09	I	X	I	I	1001.1	1002.44	1008.6
484.00	626.44	I	X	I	I	1002.9	1002.98	1011.8
528.00	626.79	I	X	I	I	1005.0	1003.69	1014.9
572.00	627.14	I	X	I	I	1007.1	1004.36	1018.1
616.00	627.48	I	X	I	I	1009.3	1005.09	1021.1
660.00	627.81	I	X	I	I	1011.6	1005.62	1024.0
704.00	628.15	I	X	I	I	1013.8	1006.22	1026.8
748.00	628.47	I	X	I	I	1016.0	1006.80	1029.4
792.00	628.79	I	X	I	I	1018.2	1007.36	1031.8
836.00	629.10	I	X	I	I	1020.3	1007.89	1034.0
880.00	629.40	I	X	I	I	1022.4	1008.41	1036.0
924.00	629.69	I	X	I	I	1024.7	1009.11	1038.1
968.00	629.98	I	X	I	I	1026.2	1009.38	1039.7
1012.00	630.23	I	X	I	I	1028.0	1009.03	1041.4
1056.00	630.49	I	X	I	I	1029.7	1010.26	1043.0
1100.00	630.73	I	X	I	I	1031.3	1010.66	1044.6
1144.00	630.96	I	X	I	I	1032.9	1011.04	1046.1
1188.00	631.19	I	X	I	I	1034.5	1011.40	1047.6
1232.00	631.40	I	X	I	I	1035.9	1011.75	1048.4
1276.00	631.61	I	X	I	I	1037.3	1012.07	1050.2
1320.00	631.80	I	X	I	I	1038.6	1012.38	1051.4
1364.00	631.98	I	X	I	I	1039.9	1012.68	1052.6
1408.00	632.15	I	X	I	I	1041.0	1012.96	1053.7
1452.00	632.32	I	X	I	I	1042.2	1013.23	1054.8
1496.00	632.48	I	X	I	I	1043.3	1013.48	1055.7
1540.00	632.63	I	X	I	I	1044.3	1013.72	1056.7
1584.00	632.77	I	X	I	I	1045.3	1013.95	1057.6
1628.00	632.91	I	X	I	I	1046.3	1014.16	1058.4
1672.00	633.03	I	X	I	I	1047.2	1014.37	1059.2
1716.00	633.16	I	X	I	I	1048.0	1014.56	1060.0
1760.00	633.27	I	X	I	I	1048.8	1014.75	1060.7
1804.00	633.38	I	X	I	I	1049.6	1014.92	1061.4
1848.00	633.49	I	X	I	I	1050.3	1015.09	1062.0
1892.00	633.59	I	X	I	I	1051.0	1015.25	1062.6
1936.00	633.68	I	X	I	I	1051.7	1015.40	1063.2
1980.00	633.77	I	X	I	I	1052.3	1015.67	1063.8
2024.00	633.85	I	X	I	I	1052.9	1015.69	1064.3
2068.00	633.94	I	X	I	I	1053.5	1015.80	1064.8
2112.00	634.01	I	X	I	I	1054.0	1015.92	1065.2
2156.00	634.08	I	X	I	I	1054.5	1016.03	1065.7
2200.00	634.15	I	X	I	I	1055.0	1016.18	1066.1

5 PERCENT STEP CHANGE IN COMBUSTION RATE
BED TEMPERATURES

TIME	TEB	1880. 1530. 1530. 1530.	'O'=-TCB 'X'=-TRB '*'=TSB '+'=TEB	2040. 1650. 1650. 1650.	TSB	TRB	TCB
0	1550.0	I	I	I	1547.7	1541.8	1545.9
44.000	1552.4	I	I	I	1548.7	1543.6	1548.3
88.000	1556.5	I	I	I	1550.8	1546.4	1549.7
132.00	1561.4	I	I	I	1553.8	1550.3	1550.1
176.00	1566.5	I	I	I	1557.2	1554.2	1553.3
220.00	1571.4	I	I	I	1560.5	1558.2	1557.1
264.00	1576.5	I	I	I	1563.7	1561.9	1561.2
308.00	1581.1	I	I	I	1566.7	1565.4	1565.4
352.00	1585.3	I	I	I	1569.7	1568.6	1569.6
396.00	1589.1	I	I	I	1572.6	1571.6	1573.7
440.00	1592.6	I	I	I	1575.4	1574.4	1577.6
484.00	1595.8	I	I	I	1578.2	1577.1	1581.4
528.00	1598.6	I	I	I	1581.0	1579.6	1585.0
572.00	1601.2	I	I	I	1583.8	1582.0	1588.5
616.00	1603.5	I	I	I	1586.5	1584.3	1591.8
660.00	1605.6	I	I	I	1589.3	1586.7	1594.8
704.00	1607.5	I	I	I	1592.0	1589.9	1597.8
748.00	1609.2	I	I	I	1594.7	1591.2	1599.6
792.00	1610.7	I	I	I	1597.3	1593.4	1601.2
836.00	1612.1	I	I	I	1599.8	1595.6	1603.7
880.00	1613.4	I	I	I	1602.2	1597.7	1606.0
924.00	1614.6	I	I	I	1604.6	1599.8	1608.3
968.00	1615.7	I	I	I	1606.8	1601.8	1610.5
1012.00	1616.7	I	I	I	1608.9	1603.8	1612.7
1056.00	1617.6	I	I	I	1610.9	1605.7	1614.9
1100.00	1618.4	I	I	I	1612.9	1607.6	1617.1
1144.00	1619.2	I	I	I	1614.7	1609.4	1619.3
1188.00	1619.9	I	I	I	1616.5	1611.1	1621.5
1232.00	1620.5	I	I	I	1618.2	1612.8	1623.7
1276.00	1621.1	I	I	I	1619.8	1614.4	1625.9
1320.00	1621.7	I	I	I	1621.3	1615.9	1628.1
1364.00	1622.2	I	I	I	1622.8	1617.4	1630.3
1408.00	1622.7	I	I	I	1624.2	1618.9	1632.5
1452.00	1623.1	I	I	I	1625.6	1620.2	1634.7
1496.00	1623.5	I	I	I	1626.8	1621.6	1636.9
1540.00	1623.9	I	I	I	1628.0	1622.8	1639.1
1584.00	1624.3	I	I	I	1629.2	1624.0	1641.3
1628.00	1624.6	I	I	I	1630.3	1625.2	1643.5
1672.00	1624.9	I	I	I	1631.3	1626.3	1645.7
1716.00	1625.2	I	I	I	1632.3	1627.4	1647.9
1760.00	1625.5	I	I	I	1633.2	1628.4	1650.1
1804.00	1625.7	I	I	I	1634.1	1629.3	1652.3
1848.00	1626.0	I	I	I	1635.0	1630.3	1654.5
1892.00	1626.2	I	I	I	1635.8	1631.1	1656.7
1936.00	1626.4	I	I	I	1636.5	1632.0	1658.9
1980.00	1626.6	I	I	I	1637.3	1632.8	1661.1
2024.00	1626.8	I	I	I	1638.0	1633.5	1663.3
2068.00	1627.0	I	I	I	1638.6	1634.2	1665.5
2112.00	1627.1	I	I	I	1639.2	1634.9	1667.7
2156.00	1627.3	I	I	I	1639.8	1635.6	1669.9
2200.00	1627.4	I	I	I	1640.4	1636.2	1672.1

5 PERCENT STEP CHANGE IN COMBUSTION RATE
FRACTION OF WATER, TWO PHASE, STEAM BOILING BED INLET TO RM OUTLET

TIME	XEBMF	0.000E-02 .4400 .3020	'X'=-XEBSF '*'=XEBMSF '+'=XEBMF	.2400 .6000 .3100	XEBMSF	XEBSF
0	.30399	I	I	I	.57313	.12268
44.000	.30712	I	I	I	.58456	.10832
88.000	.30879	I	I	I	.58606	.10515
132.00	.30925	I	I	I	.58751	.10294
176.00	.30964	I	I	I	.57679	.11415
220.00	.30897	I	I	I	.57042	.12092
264.00	.30765	I	I	I	.56480	.12755
308.00	.30746	I	I	I	.55832	.13421
352.00	.30723	I	I	I	.55236	.14042
396.00	.30678	I	I	I	.54731	.14591
440.00	.30627	I	I	I	.54295	.15078
484.00	.30580	I	I	I	.53904	.15516
528.00	.30544	I	I	I	.53538	.15918
572.00	.30520	I	I	I	.53187	.16292
616.00	.30508	I	I	I	.52846	.16645
660.00	.30506	I	I	I	.52513	.16981
704.00	.30510	I	I	I	.52188	.17301
748.00	.30520	I	I	I	.51873	.17608
792.00	.30533	I	I	I	.51567	.17900
836.00	.30548	I	I	I	.51274	.18178
880.00	.30567	I	I	I	.50987	.18445
924.00	.30592	I	I	I	.50705	.18704
968.00	.30611	I	I	I	.50442	.18947
1012.00	.30628	I	I	I	.50197	.19175
1056.00	.30644	I	I	I	.49968	.19388
1100.00	.30659	I	I	I	.49752	.19590
1144.00	.30672	I	I	I	.49547	.19780
1188.00	.30686	I	I	I	.49354	.19960
1232.00	.30699	I	I	I	.49170	.20130
1276.00	.30712	I	I	I	.48997	.20294
1320.00	.30725	I	I	I	.48832	.20443
1364.00	.30737	I	I	I	.48675	.20588
1408.00	.30748	I	I	I	.48527	.20724
1452.00	.30760	I	I	I	.48377	.20854
1496.00	.30770	I	I	I	.48233	.20977
1540.00	.30780	I	I	I	.48127	.21093
1584.00	.30790	I	I	I	.48007	.21203
1628.00	.30800	I	I	I	.47893	.21307
1672.00	.30809	I	I	I	.47786	.21405
1716.00	.30818	I	I	I	.47684	.21498
1760.00	.30826	I	I	I	.47587	.21587
1804.00	.30834	I	I	I	.47496	.21671
1848.00	.30841	I	I	I	.47409	.21750
1892.00	.30848	I	I	I	.47326	.21825
1936.00	.30855	I	I	I	.47249	.21896
1980.00	.30861	I	I	I	.47175	.21964
2024.00	.30867	I	I	I	.47106	.22027
2068.00	.30873	I	I	I	.47040	.22087
2112.00	.30878	I	I	I	.46977	.22145
2156.00	.30883	I	I	I	.46918	.22199
2200.00	.30888	I	I	I	.46862	.22251

5 PERCENT STEP CHANGE IN COMBUSTION RATE
NET WATER AND TWO PHASE FLOW INVENTORIES

TIME	DXEBMF	1096.				1112.			
		-6.000	'S'=-MEBA	0.000	'O'=-HEDMS	6.000	MEBM	MEBMS	MEBA
0	0	-1.3000	'X'=-MEBM	0.000	'O'=-HEDMS	6.000	MEBM	MEBMS	MEBA
40.000	5.9783E-05	-1.600E-04	'S'=-MEBA	0.000	'O'=-HEDMS	6.000	MEBM	MEBMS	MEBA
80.000	2.0504E-05	-2.000E-05	'S'=-MEBA	0.000	'O'=-HEDMS	6.000	MEBM	MEBMS	MEBA
132.000	2.3842E-06		'S'=-MEBA	0.000	'O'=-HEDMS	6.000	MEBM	MEBMS	MEBA
176.000	-1.1384E-05		'S'=-MEBA	0.000	'O'=-HEDMS	6.000	MEBM	MEBMS	MEBA
220.000	-1.6928E-05		'S'=-MEBA	0.000	'O'=-HEDMS	6.000	MEBM	MEBMS	MEBA
264.000	-1.6477E-05		'S'=-MEBA	0.000	'O'=-HEDMS	6.000	MEBM	MEBMS	MEBA
308.000	5.9605E-08		'S'=-MEBA	0.000	'O'=-HEDMS	6.000	MEBM	MEBMS	MEBA
352.000	-8.0466E-06		'S'=-MEBA	0.000	'O'=-HEDMS	6.000	MEBM	MEBMS	MEBA
396.000	-1.1683E-05		'S'=-MEBA	0.000	'O'=-HEDMS	6.000	MEBM	MEBMS	MEBA
440.000	-1.1563E-05		'S'=-MEBA	0.000	'O'=-HEDMS	6.000	MEBM	MEBMS	MEBA
484.000	-8.8811E-06		'S'=-MEBA	0.000	'O'=-HEDMS	6.000	MEBM	MEBMS	MEBA
528.000	-7.3314E-06		'S'=-MEBA	0.000	'O'=-HEDMS	6.000	MEBM	MEBMS	MEBA
572.000	-3.2187E-06		'S'=-MEBA	0.000	'O'=-HEDMS	6.000	MEBM	MEBMS	MEBA
616.000	-7.1526E-07		'S'=-MEBA	0.000	'O'=-HEDMS	6.000	MEBM	MEBMS	MEBA
660.000	2.3842E-07		'S'=-MEBA	0.000	'O'=-HEDMS	6.000	MEBM	MEBMS	MEBA
704.000	2.5630E-06		'S'=-MEBA	0.000	'O'=-HEDMS	6.000	MEBM	MEBMS	MEBA
748.000	3.0994E-06		'S'=-MEBA	0.000	'O'=-HEDMS	6.000	MEBM	MEBMS	MEBA
792.000	0		'S'=-MEBA	0.000	'O'=-HEDMS	6.000	MEBM	MEBMS	MEBA
836.000	3.3975E-06		'S'=-MEBA	0.000	'O'=-HEDMS	6.000	MEBM	MEBMS	MEBA
880.000	6.1989E-06		'S'=-MEBA	0.000	'O'=-HEDMS	6.000	MEBM	MEBMS	MEBA
924.000	4.0531E-06		'S'=-MEBA	0.000	'O'=-HEDMS	6.000	MEBM	MEBMS	MEBA
968.000	2.9206E-06		'S'=-MEBA	0.000	'O'=-HEDMS	6.000	MEBM	MEBMS	MEBA
1012.000	4.8876E-06		'S'=-MEBA	0.000	'O'=-HEDMS	6.000	MEBM	MEBMS	MEBA
1056.000	4.6492E-06		'S'=-MEBA	0.000	'O'=-HEDMS	6.000	MEBM	MEBMS	MEBA
1100.000	3.0398E-06		'S'=-MEBA	0.000	'O'=-HEDMS	6.000	MEBM	MEBMS	MEBA
1144.000	2.9802E-06		'S'=-MEBA	0.000	'O'=-HEDMS	6.000	MEBM	MEBMS	MEBA
1188.000	3.1570E-06		'S'=-MEBA	0.000	'O'=-HEDMS	6.000	MEBM	MEBMS	MEBA
1232.000	2.2650E-06		'S'=-MEBA	0.000	'O'=-HEDMS	6.000	MEBM	MEBMS	MEBA
1276.000	5.1260E-06		'S'=-MEBA	0.000	'O'=-HEDMS	6.000	MEBM	MEBMS	MEBA
1320.000	6.3015E-06		'S'=-MEBA	0.000	'O'=-HEDMS	6.000	MEBM	MEBMS	MEBA
1364.000	2.9206E-06		'S'=-MEBA	0.000	'O'=-HEDMS	6.000	MEBM	MEBMS	MEBA
1408.000	2.9802E-06		'S'=-MEBA	0.000	'O'=-HEDMS	6.000	MEBM	MEBMS	MEBA
1452.000	2.2054E-06		'S'=-MEBA	0.000	'O'=-HEDMS	6.000	MEBM	MEBMS	MEBA
1496.000	5.9605E-07		'S'=-MEBA	0.000	'O'=-HEDMS	6.000	MEBM	MEBMS	MEBA
1540.000	2.2054E-06		'S'=-MEBA	0.000	'O'=-HEDMS	6.000	MEBM	MEBMS	MEBA
1584.000	8.3447E-07		'S'=-MEBA	0.000	'O'=-HEDMS	6.000	MEBM	MEBMS	MEBA
1628.000	1.9670E-06		'S'=-MEBA	0.000	'O'=-HEDMS	6.000	MEBM	MEBMS	MEBA
1672.000	1.0133E-06		'S'=-MEBA	0.000	'O'=-HEDMS	6.000	MEBM	MEBMS	MEBA
1716.000	1.9670E-06		'S'=-MEBA	0.000	'O'=-HEDMS	6.000	MEBM	MEBMS	MEBA
1760.000	2.2054E-06		'S'=-MEBA	0.000	'O'=-HEDMS	6.000	MEBM	MEBMS	MEBA
1804.000	1.2517E-06		'S'=-MEBA	0.000	'O'=-HEDMS	6.000	MEBM	MEBMS	MEBA
1848.000	2.6266E-06		'S'=-MEBA	0.000	'O'=-HEDMS	6.000	MEBM	MEBMS	MEBA
1892.000	1.1325E-06		'S'=-MEBA	0.000	'O'=-HEDMS	6.000	MEBM	MEBMS	MEBA
1936.000	2.0266E-06		'S'=-MEBA	0.000	'O'=-HEDMS	6.000	MEBM	MEBMS	MEBA
1980.000	1.1325E-06		'S'=-MEBA	0.000	'O'=-HEDMS	6.000	MEBM	MEBMS	MEBA
2024.000	1.9073E-06		'S'=-MEBA	0.000	'O'=-HEDMS	6.000	MEBM	MEBMS	MEBA
2068.000	2.9802E-07		'S'=-MEBA	0.000	'O'=-HEDMS	6.000	MEBM	MEBMS	MEBA
2112.000	1.2517E-06		'S'=-MEBA	0.000	'O'=-HEDMS	6.000	MEBM	MEBMS	MEBA
2156.000	3.5763E-07		'S'=-MEBA	0.000	'O'=-HEDMS	6.000	MEBM	MEBMS	MEBA
2200.000	4.7694E-07		'S'=-MEBA	0.000	'O'=-HEDMS	6.000	MEBM	MEBMS	MEBA

5 PERCENT STEP CHANGE IN COMBUSTION RATE
PRESSURES IN BOILING, SUPERHEAT AND REHEAT BEDS

TIME	PPH	565.0				585.0			
		2720.	'X'=-PRH	2880.	'X'=-PPS	2880.	PPH	PPS	PPH
0	2894.8		'X'=-PRH	2880.	'X'=-PPS	2880.	PPH	PPS	PPH
40.000	2894.8		'X'=-PRH	2880.	'X'=-PPS	2880.	PPH	PPS	PPH
80.000	2894.8		'X'=-PRH	2880.	'X'=-PPS	2880.	PPH	PPS	PPH
132.000	2894.8		'X'=-PRH	2880.	'X'=-PPS	2880.	PPH	PPS	PPH
176.000	2894.8		'X'=-PRH	2880.	'X'=-PPS	2880.	PPH	PPS	PPH
220.000	2894.8		'X'=-PRH	2880.	'X'=-PPS	2880.	PPH	PPS	PPH
264.000	2894.8		'X'=-PRH	2880.	'X'=-PPS	2880.	PPH	PPS	PPH
308.000	2894.8		'X'=-PRH	2880.	'X'=-PPS	2880.	PPH	PPS	PPH
352.000	2894.8		'X'=-PRH	2880.	'X'=-PPS	2880.	PPH	PPS	PPH
396.000	2894.8		'X'=-PRH	2880.	'X'=-PPS	2880.	PPH	PPS	PPH
440.000	2894.8		'X'=-PRH	2880.	'X'=-PPS	2880.	PPH	PPS	PPH
484.000	2894.8		'X'=-PRH	2880.	'X'=-PPS	2880.	PPH	PPS	PPH
528.000	2894.8		'X'=-PRH	2880.	'X'=-PPS	2880.	PPH	PPS	PPH
572.000	2894.8		'X'=-PRH	2880.	'X'=-PPS	2880.	PPH	PPS	PPH
616.000	2894.8		'X'=-PRH	2880.	'X'=-PPS	2880.	PPH	PPS	PPH
660.000	2894.8		'X'=-PRH	2880.	'X'=-PPS	2880.	PPH	PPS	PPH
704.000	2894.8		'X'=-PRH	2880.	'X'=-PPS	2880.	PPH	PPS	PPH
748.000	2894.8		'X'=-PRH	2880.	'X'=-PPS	2880.	PPH	PPS	PPH
792.000	2894.8		'X'=-PRH	2880.	'X'=-PPS	2880.	PPH	PPS	PPH
836.000	2894.8		'X'=-PRH	2880.	'X'=-PPS	2880.	PPH	PPS	PPH
880.000	2894.8		'X'=-PRH	2880.	'X'=-PPS	2880.	PPH	PPS	PPH
924.000	2894.8		'X'=-PRH	2880.	'X'=-PPS	2880.	PPH	PPS	PPH
968.000	2894.8		'X'=-PRH	2880.	'X'=-PPS	2880.	PPH	PPS	PPH
1012.000	2894.8		'X'=-PRH	2880.	'X'=-PPS	2880.	PPH	PPS	PPH
1056.000	2894.8		'X'=-PRH	2880.	'X'=-PPS	2880.	PPH	PPS	PPH
1100.000	2894.8		'X'=-PRH	2880.	'X'=-PPS	2880.	PPH	PPS	PPH
1144.000	2894.8		'X'=-PRH	2880.	'X'=-PPS	2880.	PPH	PPS	PPH
1188.000	2894.8		'X'=-PRH	2880.	'X'=-PPS	2880.	PPH	PPS	PPH
1232.000	2894.8		'X'=-PRH	2880.	'X'=-PPS	2880.	PPH	PPS	PPH
1276.000	2894.8		'X'=-PRH	2880.	'X'=-PPS	2880.	PPH	PPS	PPH
1320.000	2894.8		'X'=-PRH	2880.	'X'=-PPS	2880.	PPH	PPS	PPH
1364.000	2894.8		'X'=-PRH	2880.	'X'=-PPS	2880.	PPH	PPS	PPH
1408.000	2894.8		'X'=-PRH	2880.	'X'=-PPS	2880.	PPH	PPS	PPH
1452.000	2894.8		'X'=-PRH	2880.	'X'=-PPS	2880.	PPH	PPS	PPH
1496.000	2894.8		'X'=-PRH	2880.	'X'=-PPS	2880.	PPH	PPS	PPH
1540.000	2894.8		'X'=-PRH	2880.	'X'=-PPS	2880.	PPH	PPS	PPH
1584.000	2894.8		'X'=-PRH	2880.	'X'=-PPS	2880.	PPH	PPS	PPH
1628.000	2894.8		'X'=-PRH	2880.	'X'=-PPS	2880.	PPH	PPS	PPH
1672.000	2894.8		'X'=-PRH	2880.	'X'=-PPS	2880.	PPH	PPS	PPH
1716.000	2894.8		'X'=-PRH	2880.	'X'=-PPS	2880.	PPH	PPS	PPH
1760.000	2894.8		'X'=-PRH	2880.	'X'=-PPS	2880.	PPH	PPS	PPH
1804.000	2894.8		'X'=-PRH	2880.	'X'=-PPS	2880.	PPH	PPS	PPH
1848.000	2894.8		'X'=-PRH	2880.	'X'=-PPS	2880.	PPH	PPS	PPH
1892.000	2894.8		'X'=-PRH	2880.	'X'=-PPS	2880.	PPH	PPS	PPH
1936.000	2894.8		'X'=-PRH	2880.	'X'=-PPS	2880.	PPH	PPS	PPH
1980.000	2894.8		'X'=-PRH	2880.	'X'=-PPS	2880.	PPH	PPS	PPH
2024.000	2894.8		'X'=-PRH	2880.	'X'=-PPS	2880.	PPH	PPS	PPH
2068.000	2894.8		'X'=-PRH	2880.	'X'=-PPS	2880.	PPH	PPS	PPH
2112.000	2894.8		'X'=-PRH	2880.	'X'=-PPS	2880.	PPH	PPS	PPH
2156.000	2894.8		'X'=-PRH	2880.	'X'=-PPS	2880.	PPH	PPS	PPH
2200.000	2894.8		'X'=-PRH	2880.	'X'=-PPS	2880.	PPH	PPS	PPH

5 PERCENT STEP CHANGE IN COMBUSTION RATE
HEAT FLUX

	2.130E+05	'O'=QSBTS	2.190E+05			
	7.360E+04	'X'=QPSHA	7.480E+04			
	7.600E+04	'*'=QPSA	7.920E+04			
	1.020E+05	'+'=QGPMS	1.140E+05			
TIME	QGPMS		QPSA	QPSHA	QSBTS	
.0	1.0457E+05	I-----X-I	76400.	74237.	2.1875E+05	
44.000	1.0904E+05	I X OI + *I	78341.	74965.	2.1588E+05	
88.000	1.0990E+05	I O I + *I	78572.	75927.	2.1355E+05	
132.00	1.0914E+05	I O I + *I	78772.	76524.	2.1431E+05	
176.00	1.0804E+05	I O I + *I	78939.	76776.	2.1557E+05	
220.00	1.0718E+05	I O I + *I	79066.	76787.	2.1642E+05	
264.00	1.0670E+05	I O I + *I	79146.	76664.	2.1671E+05	
308.00	1.0675E+05	I O I + *I	79184.	76562.	2.1607E+05	
352.00	1.0690E+05	I O I + *I	79186.	76399.	2.1628E+05	
396.00	1.0717E+05	I O I + *I	79155.	76246.	2.1607E+05	
440.00	1.0752E+05	I O I + *I	79100.	76136.	2.1564E+05	
484.00	1.0790E+05	I O I + *I	79029.	76063.	2.1523E+05	
528.00	1.0826E+05	I O I + *I	78948.	76025.	2.1489E+05	
572.00	1.0865E+05	I O I + *I	78862.	76017.	2.1456E+05	
616.00	1.0899E+05	I O I + *I	78774.	76030.	2.1436E+05	
660.00	1.0931E+05	I O I + *I	78689.	76058.	2.1425E+05	
704.00	1.0959E+05	I O I + *I	78607.	76096.	2.1421E+05	
748.00	1.0986E+05	I O I + *I	78527.	76139.	2.1422E+05	
792.00	1.1010E+05	I O I + *I	78453.	76184.	2.1426E+05	
836.00	1.1032E+05	I O I + *I	78382.	76228.	2.1434E+05	
880.00	1.1054E+05	I O I + *I	78315.	76244.	2.1466E+05	
924.00	1.1076E+05	I O I + *I	78246.	76221.	2.1473E+05	
968.00	1.1097E+05	I O I + *I	78176.	76210.	2.1483E+05	
1012.00	1.1116E+05	I O I + *I	78107.	76208.	2.1493E+05	
1056.00	1.1133E+05	I O I + *I	78039.	76210.	2.1502E+05	
1100.00	1.1145E+05	I O I + *I	77972.	76218.	2.1510E+05	
1144.00	1.1155E+05	I O I + *I	77907.	76230.	2.1519E+05	
1188.00	1.1179E+05	I O I + *I	77845.	76243.	2.1528E+05	
1232.00	1.1193E+05	I O I + *I	77785.	76259.	2.1537E+05	
1276.00	1.1206E+05	I O I + *I	77728.	76275.	2.1546E+05	
1320.00	1.1219E+05	I O I + *I	77674.	76292.	2.1554E+05	
1364.00	1.1230E+05	I O I + *I	77623.	76308.	2.1564E+05	
1408.00	1.1241E+05	I O I + *I	77574.	76324.	2.1572E+05	
1452.00	1.1251E+05	I O I + *I	77527.	76340.	2.1580E+05	
1496.00	1.1260E+05	I O I + *I	77483.	76356.	2.1589E+05	
1540.00	1.1270E+05	I O I + *I	77441.	76371.	2.1594E+05	
1584.00	1.1279E+05	I O I + *I	77401.	76385.	2.1604E+05	
1628.00	1.1287E+05	I O I + *I	77363.	76399.	2.1611E+05	
1672.00	1.1295E+05	I O I + *I	77328.	76412.	2.1618E+05	
1716.00	1.1303E+05	I O I + *I	77294.	76425.	2.1625E+05	
1760.00	1.1310E+05	I O I + *I	77262.	76437.	2.1632E+05	
1804.00	1.1314E+05	I O I + *I	77231.	76447.	2.1638E+05	
1848.00	1.1323E+05	I O I + *I	77202.	76459.	2.1643E+05	
1892.00	1.1329E+05	I O I + *I	77175.	76469.	2.1649E+05	
1936.00	1.1335E+05	I O I + *I	77149.	76479.	2.1654E+05	
1980.00	1.1340E+05	I O I + *I	77128.	76489.	2.1659E+05	
2024.00	1.1346E+05	I O I + *I	77101.	76497.	2.1664E+05	
2068.00	1.1351E+05	I O I + *I	77079.	76507.	2.1669E+05	
2112.00	1.1355E+05	I O I + *I	77058.	76515.	2.1673E+05	
2156.00	1.1359E+05	I O I + *I	77038.	76522.	2.1678E+05	
2200.00	1.1364E+05	I O I + *I	77019.	76530.	2.1681E+05	

5 PERCENT STEP CHANGE IN COMBUSTION RATE

	5.100E+04	'8'=QCBEC2	5.700E+04			
	2.130E+05	'O'=QSBTS	2.190E+05			
	2.070E+05	'X'=QSBT	2.190E+05			
	9.000E+04	'*'=QSBGR	1.020E+05			
	1.232E+05	'+'=QSBTS	1.264E+05			
TIME	QSBTS		QSBGR	QSBT	QCBEC2	
.0	1.2638E+05	I-----X-I	90511.	2.0999E+05	2.1875E+05	51639.
44.000	1.2491E+05	I O I + *I	90966.	2.1364E+05	2.1588E+05	52074.
88.000	1.2358E+05	I O I + *I	91802.	2.1454E+05	2.1355E+05	52205.
132.00	1.2355E+05	I O I + *I	92402.	2.1524E+05	2.1431E+05	52345.
176.00	1.2359E+05	I O I + *I	93042.	2.1621E+05	2.1557E+05	52491.
220.00	1.2438E+05	I O I + *I	93507.	2.1721E+05	2.1642E+05	52637.
264.00	1.2489E+05	I O I + *I	93896.	2.1800E+05	2.1671E+05	52783.
308.00	1.2521E+05	I O I + *I	94231.	2.1831E+05	2.1607E+05	52923.
352.00	1.2543E+05	I O I + *I	94534.	2.1890E+05	2.1628E+05	53068.
396.00	1.2556E+05	I O I + *I	94812.	2.1954E+05	2.1607E+05	53185.
440.00	1.2559E+05	I O I + *I	95073.	2.1847E+05	2.1564E+05	53304.
484.00	1.2554E+05	I O I + *I	95325.	2.1824E+05	2.1523E+05	53419.
528.00	1.2549E+05	I O I + *I	95572.	2.1794E+05	2.1489E+05	53525.
572.00	1.2534E+05	I O I + *I	95816.	2.1763E+05	2.1456E+05	53625.
616.00	1.2531E+05	I O I + *I	96058.	2.1735E+05	2.1436E+05	53719.
660.00	1.2522E+05	I O I + *I	96294.	2.1710E+05	2.1425E+05	53806.
704.00	1.2517E+05	I O I + *I	96531.	2.1691E+05	2.1421E+05	53888.
748.00	1.2511E+05	I O I + *I	96761.	2.1677E+05	2.1422E+05	53965.
792.00	1.2507E+05	I O I + *I	96984.	2.1667E+05	2.1426E+05	54037.
836.00	1.2505E+05	I O I + *I	97201.	2.1660E+05	2.1434E+05	54105.
880.00	1.2504E+05	I O I + *I	97411.	2.1658E+05	2.1466E+05	54168.
924.00	1.2507E+05	I O I + *I	97610.	2.1662E+05	2.1473E+05	54229.
968.00	1.2510E+05	I O I + *I	97801.	2.1665E+05	2.1483E+05	54286.
1012.00	1.2511E+05	I O I + *I	97984.	2.1667E+05	2.1493E+05	54340.
1056.00	1.2517E+05	I O I + *I	98158.	2.1669E+05	2.1502E+05	54390.
1100.00	1.2517E+05	I O I + *I	98325.	2.1671E+05	2.1510E+05	54438.
1144.00	1.2519E+05	I O I + *I	98484.	2.1672E+05	2.1519E+05	54484.
1188.00	1.2515E+05	I O I + *I	98637.	2.1674E+05	2.1528E+05	54527.
1232.00	1.2525E+05	I O I + *I	98783.	2.1676E+05	2.1537E+05	54567.
1276.00	1.2529E+05	I O I + *I	98922.	2.1678E+05	2.1546E+05	54606.
1320.00	1.2533E+05	I O I + *I	99055.	2.1680E+05	2.1554E+05	54643.
1364.00	1.2534E+05	I O I + *I	99182.	2.1682E+05	2.1564E+05	54677.
1408.00	1.2541E+05	I O I + *I	99303.	2.1685E+05	2.1572E+05	54710.
1452.00	1.2545E+05	I O I + *I	99419.	2.1687E+05	2.1580E+05	54741.
1496.00	1.2549E+05	I O I + *I	99528.	2.1690E+05	2.1589E+05	54770.
1540.00	1.2553E+05	I O I + *I	99633.	2.1693E+05	2.1594E+05	54794.
1584.00	1.2557E+05	I O I + *I	99732.	2.1695E+05	2.1604E+05	54825.
1628.00	1.2559E+05	I O I + *I	99827.	2.1698E+05	2.1611E+05	54850.
1672.00	1.2565E+05	I O I + *I	99917.	2.1700E+05	2.1618E+05	54874.
1716.00	1.2573E+05	I O I + *I	1.0000E+05	2.1703E+05	2.1625E+05	54894.
1760.00	1.2571E+05	I O I + *I	1.0008E+05	2.1705E+05	2.1632E+05	54918.
1804.00	1.2574E+05	I O I + *I	1.0016E+05	2.1707E+05	2.1638E+05	54939.
1848.00	1.2581E+05	I O I + *I	1.0023E+05	2.1710E+05	2.1643E+05	54958.
1892.00	1.2582E+05	I O I + *I	1.0030E+05	2.1712E+05	2.1649E+05	54976.
1936.00	1.2585E+05	I O I + *I	1.0037E+05	2.1714E+05	2.1654E+05	54994.
1980.00	1.2589E+05	I O I + *I	1.0043E+05	2.1716E+05	2.1659E+05	55010.
2024.00	1.2590E+05	I O I + *I	1.0049E+05	2.1718E+05	2.1664E+05	55026.
2068.00	1.2594E+05	I O I + *I	1.0055E+05	2.1720E+05	2.1669E+05	55041.
2112.00	1.2600E+05	I O I + *I	1.0060E+05	2.1722E+05	2.1673E+05	55055.
2156.00	1.2602E+05	I O I + *I	1.0065E+05	2.1724E+05	2.1678E+05	55068.
2200.00	1.2603E+05	I O I + *I	1.0070E+05	2.1725E+05	2.1681E+05	55081.

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APPENDIX V-B6

STEP IN FEEDWATER FLOW

This section presents the detailed results in CSMP plot format for a 5% step increase in feedwater flow rate.

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-10.00	'Q' = MGN	10.00
-10.00	'O' = TRTO	10.00
-10.00	'X' = PHPISS	10.00
-10.00	'H' = TGVT	10.00
-10.00	'A' = PGVN	10.00

5 PERCENT STEP CHANGE IN FEEDWATER FLOW DEMAND STEAM LINE TO HP TURBINE VARIABLES

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5 PERCENT STEP CHANGE IN FEEDWATER FLOW DEMAND
HIGH PRESSURE TURBINE VARIABLES

		525.0	'B'=TRTSH	625.0				
		980.0	'O'=SHP	1040.				
		1780.	'X'=PHP1	1860.				
		588.0	'W'=PHP	612.0				
		1260.	'A'=HNP	1320.				
TIME	HNP				PHP	PHP1	SHP	TRTSH
.0	1304.3	I--O--X-I			589.71	1797.4	989.73	610.30
44.000	1308.4	I * O I	X I	I + O	592.18	1814.0	996.93	610.23
68.000	1308.1	I I	O X	I + O	596.72	1810.6	1006.6	608.60
132.000	1305.3	I I	I O	I + O	601.48	1843.9	1015.9	605.24
176.000	1301.4	I I	I O	I + O	605.37	1852.5	1023.5	600.73
220.000	1297.4	I I	I O	I + O	608.08	1857.3	1029.2	595.67
264.000	1293.8	I I	I O	I + O	609.70	1859.1	1033.1	590.56
308.000	1290.6	I I	I O	I + O	610.46	1858.9	1035.8	585.72
352.000	1287.9	I I	I O	I + O	610.61	1857.6	1037.4	581.28
396.000	1285.7	I I	I O	I + O	610.39	1855.5	1038.3	577.31
440.000	1283.9	I I	I O	I + O	609.83	1853.1	1038.7	573.77
484.000	1282.3	I I	I O	I + O	609.20	1850.7	1038.8	570.66
528.000	1281.0	I I	I O	I + O	608.62	1848.3	1038.8	567.92
572.000	1279.9	I I	I O	I + O	607.85	1846.0	1038.8	565.48
616.000	1278.9	I I	I O	I + O	607.21	1844.0	1038.7	563.31
660.000	1278.0	I I	I O	I + O	606.62	1842.1	1038.6	561.34
704.000	1277.1	I I	I O	I + O	606.10	1840.4	1038.5	559.57
748.000	1276.4	I I	I O	I + O	605.60	1838.9	1038.4	557.91
792.000	1275.7	I I	I O	I + O	605.16	1837.6	1038.4	556.39
836.000	1275.0	I I	I O	I + O	604.77	1836.3	1038.4	554.98
880.000	1274.4	I I	I O	I + O	604.41	1835.2	1038.4	553.66
924.000	1273.8	I I	I O	I + O	604.08	1834.1	1038.4	552.43
968.000	1273.3	I I	I O	I + O	603.80	1833.2	1038.5	551.31
1012.000	1272.8	I I	I O	I + O	603.50	1832.2	1038.5	550.20
1056.000	1272.3	I I	I O	I + O	603.29	1831.4	1038.5	549.19
1100.000	1271.8	I I	I O	I + O	603.01	1830.6	1038.6	548.24
1144.000	1271.4	I I	I O	I + O	602.78	1829.9	1038.6	547.35
1188.000	1271.0	I I	I O	I + O	602.57	1829.2	1038.6	546.52
1232.000	1270.6	I I	I O	I + O	602.38	1828.5	1038.7	545.74
1276.000	1270.3	I I	I O	I + O	602.19	1827.9	1038.7	545.00
1320.000	1269.9	I I	I O	I + O	602.02	1827.4	1038.7	544.31
1364.000	1269.6	I I	I O	I + O	601.86	1826.8	1038.8	543.67
1408.000	1269.3	I I	I O	I + O	601.71	1826.3	1038.8	543.06
1452.000	1269.1	I I	I O	I + O	601.57	1825.9	1038.8	542.50
1496.000	1268.8	I I	I O	I + O	601.43	1825.4	1038.8	541.97
1540.000	1268.6	I I	I O	I + O	601.31	1825.0	1038.8	541.47
1584.000	1268.4	I I	I O	I + O	601.20	1824.6	1038.9	541.00
1628.000	1268.1	I I	I O	I + O	601.08	1824.3	1038.9	540.56
1672.000	1267.9	I I	I O	I + O	600.98	1823.9	1038.9	540.15
1716.000	1267.8	I I	I O	I + O	600.89	1823.6	1038.9	539.76
1760.000	1267.6	I I	I O	I + O	600.80	1823.3	1038.9	539.40
1804.000	1267.4	I I	I O	I + O	600.71	1823.0	1038.9	539.05
1848.000	1267.3	I I	I O	I + O	600.63	1822.7	1039.0	538.74
1892.000	1267.1	I I	I O	I + O	600.55	1822.5	1039.0	538.43
1936.000	1267.0	I I	I O	I + O	600.49	1822.3	1039.0	538.15
1980.000	1266.8	I I	I O	I + O	600.41	1822.0	1039.0	537.87
2024.000	1266.7	I I	I O	I + O	600.36	1821.8	1039.0	537.64
2068.000	1266.6	I I	I O	I + O	600.30	1821.6	1039.0	537.40
2112.000	1266.5	I I	I O	I + O	600.24	1821.4	1039.0	537.17
2156.000	1266.4	I I	I O	I + O	600.20	1821.3	1039.0	536.99
2200.000	1266.3	I I	I O	I + O	600.15	1821.1	1039.0	536.78

5 PERCENT STEP CHANGE IN FEEDWATER FLOW DEMAND
REHEATER LINE STATES

		920.0	'B'=TRT	1000.				
		980.0	'O'=SRB	1040.				
		1780.	'X'=SRB	1040.				
		546.0	'W'=PRT	570.0				
		1470.	'A'=MRT	1510.				
TIME	MRT				PRT	SRB	SRT	TOT
.0	1515.8	I-----I						

1.020E+05	'8'
7.360E+04	'0'
1100.	'X'
1100.	'#'
2730.	'4'

		1.020E+05	'0'='QGPHS	5.140E+05				
		7.360E+04	'0'='QPISA	7.680E+04				
		1100.	'X'='SPS	1180.				
		1100.	'*='SSL	1180.				
		2730.	'+'='PPS	2850.				
TIME	PPS			SSL		SPS	QPSA	QGPHS
.0	2735.8	I=X-----0S-I-----I-----I-----I		1101.8		1103.6	74196.	1.0457E+05
44.000	2767.9	I #0 I + XI I I		1113.6		1138.9	74248.	1.1301E+05
88.000	2793.7	I 10 I + X I I		1126.0		1167.3	74460.	1.1318E+05
132.00	2811.4	I I O I + X + I I		1134.6		1152.2	74721.	1.1515E+05
176.00	2821.7	I I I O I + X I I		1149.7		1155.1	74982.	1.0981E+05
220.00	2826.4	I I I O I + X I +		1150.3		1156.8	75216.	1.0850E+05
264.00	2827.5	I I I I O I + X I +		1154.0		1157.7	75412.	1.0757E+05
308.00	2826.2	I I I I I O + X I +		1156.3		1158.2	75568.	1.0696E+05
352.00	2823.5	I I I I I O X I +		1157.6		1158.5	75690.	1.0656E+05
396.00	2820.1	I I I I I O X +		1158.2		1158.5	75782.	1.0630E+05
440.00	2816.5	I I-----I-----I-----OXI-----I		1158.4		1158.5	75853.	1.0612E+05
484.00	2812.9	I I I I I + OI		1158.4		1158.4	75908.	1.0598E+05
528.00	2809.5	I I I I I OI		1158.2		1158.3	75951.	1.0587E+05
572.00	2804.3	I I I I I XO		1158.1		1158.2	75987.	1.0575E+05
616.00	2803.5	I I I I I XO		1157.9		1158.2	76018.	1.0565E+05
660.00	2800.9	I I I I I XIO		1157.8		1158.1	76046.	1.0553E+05
704.00	2798.6	I I I I I XIO		1157.7		1158.1	76072.	1.0541E+05
748.00	2796.5	I I I I I + XIO		1157.6		1158.1	76096.	1.0529E+05
792.00	2794.6	I I I I I XIO		1157.6		1158.0	76120.	1.0517E+05
836.00	2792.9	I I I I I + XIO		1157.5		1158.0	76142.	1.0505E+05
880.00	2791.4	I-----0I-----I-----XI-----0		1157.5		1158.0	76164.	1.0494E+05
924.00	2789.9	I I I I I + XI		1157.6		1158.0	76185.	1.0483E+05
968.00	2788.6	I I I I I + XI		1157.6		1158.0	76205.	1.0472E+05
1012.00	2787.3	I I I I I + XI		1157.6		1158.0	76223.	1.0463E+05
1056.00	2784.2	I I I I I + XI		1157.6		1158.0	76241.	1.0454E+05
1100.00	2785.1	I I I I I + XI		1157.6		1158.0	76258.	1.0446E+05
1144.00	2784.1	I I I I I + XI		1157.7		1158.0	76274.	1.0437E+05
1188.00	2783.1	I I I I I + XI		1157.7		1158.1	76289.	1.0430E+05
1232.00	2782.2	I I I I I + XI		1157.7		1158.1	76303.	1.0423E+05
1276.00	2781.4	I I I I I + XI		1157.8		1158.1	76317.	1.0416E+05
1320.00	2780.6	I-----I-----I-----XI-----0		1157.8		1158.1	76329.	1.0410E+05
1364.00	2779.9	I I I I I + XI		1157.8		1158.1	76341.	1.0404E+05
1408.00	2779.2	I I I I I + XI		1157.8		1158.1	76352.	1.0399E+05
1452.00	2778.6	I I I I I + XI		1157.8		1158.1	76363.	1.0394E+05
1496.00	2778.0	I I I I I + XI		1157.8		1158.1	76372.	1.0389E+05
1540.00	2777.4	I I I I I + XI		1157.9		1158.1	76382.	1.0385E+05
1584.00	2776.9	I I I I I + XI		1157.9		1158.1	76390.	1.0380E+05
1628.00	2776.4	I I I I I + XI		1157.9		1158.1	76399.	1.0377E+05
1672.00	2775.9	I I I I I + XI		1157.9		1158.1	76407.	1.0374E+05
1716.00	2775.4	I I I I I + XI		1157.9		1158.1	76414.	1.0370E+05
1760.00	2775.0	I-----I-----I-----XI-----0		1157.9		1158.1	76420.	1.0367E+05
1804.00	2774.6	I I I I I + XI		1157.9		1158.1	76427.	1.0364E+05
1848.00	2774.1	I I I I I + XI		1157.9		1158.1	76433.	1.0361E+05
1892.00	2773.9	I I I I I + XI		1157.9		1158.1	76439.	1.0358E+05
1936.00	2773.6	I I I I I + XI		1158.0		1158.1	76445.	1.0356E+05
1980.00	2773.3	I I I I I + XI		1158.0		1158.1	76450.	1.0353E+05
2024.00	2773.0	I I I I I + XI		1158.0		1158.1	76455.	1.0351E+05
2068.00	2772.8	I I I I I + XI		1158.0		1158.1	76459.	1.0349E+05
2112.00	2772.5	I I I I I + XI		1158.0		1158.1	76463.	1.0347E+05
2156.00	2772.3	I I I I I + XI		1158.0		1158.1	76468.	1.0345E+05
2200.00	2772.0	I-----I-----I-----XI-----0		1158.0		1158.1	76471.	1.0343E+05

1.032E+05	'8'
896.0	'0'
1024.	'X'
752.0	'H'
1200.	'A'

[illegible]

5 PERCENT STEP CHANGE IN FEEDWATER FLOW DEMAND
REHEATER STATES

		765.0				'O' = TRHH	825.0								
		600.0				'X' = TRHG	680.0								
		675.0				'+' = TRHS	775.0								
		1350.				'-' = HRHS	1390.								
TIME	HRHS						TRHS	TRHG	TRHH						
.0	1387.6	I	-	-	-	I	-	O	-	X	I	760.10	675.28	816.30	
44.000	1389.1	I				I		O		X	I	763.11	675.86	817.11	
88.000	1389.1	I				I		O		X	I	763.46	677.17	818.03	
132.00	1387.7	I				I			O		X	I	761.24	677.45	817.63
176.00	1385.2	I				I			O		X	I	757.13	676.00	815.78
220.00	1382.4	I				I			O		X	I	752.11	672.98	812.81
264.00	1379.4	I				I			O		X	I	746.90	668.92	809.22
308.00	1376.6	I				I			O		X	I	741.88	664.38	805.42
352.00	1374.0	I				I			O		X	I	737.28	659.78	801.70
396.00	1371.7	I				I		O		X	I	733.19	655.39	798.22	
440.00	1369.7	I	-	-	-	I	-	-	-	-	-	729.61	651.38	795.08	
484.00	1368.0	I				I			O		X	I	726.52	647.80	792.30
528.00	1366.4	I				I			O		X	I	723.83	644.66	789.86
572.00	1365.3	I				I			O		X	I	721.51	641.92	787.73
616.00	1364.2	I				I			O		X	I	719.47	639.54	785.87
660.00	1363.2	I				I			O		X	I	717.66	637.46	784.23
704.00	1362.3	I				I			O		X	I	716.05	635.63	782.77
748.00	1361.5	I				I			O		X	I	714.59	634.00	781.47
792.00	1360.8	I				I			O		X	I	713.25	632.53	780.29
836.00	1360.1	I				I			O		X	I	712.02	631.21	779.21
880.00	1359.5	I	-	-	-	I	-	-	-	-	-	710.88	629.99	778.22	
924.00	1358.9	I				I			O		X	I	709.82	628.87	777.31
968.00	1358.3	I				I			O		X	I	708.83	627.83	776.45
1012.00	1357.8	I				I			O		X	I	707.91	626.87	775.66
1056.00	1357.3	I				I			O		X	I	707.04	625.96	774.91
1100.00	1356.9	I				I			O		X	I	706.22	625.12	774.22
1144.00	1356.5	I				I			O		X	I	705.46	624.33	773.57
1188.00	1356.1	I				I			O		X	I	704.75	623.59	772.95
1232.00	1355.7	I				I			O		X	I	704.08	622.89	772.38
1276.00	1355.4	I				I			O		X	I	703.45	622.24	771.81
1320.00	1355.0	I				I			O		X	I	702.86	621.63	771.34
1364.00	1354.7	I	-	-	-	I	-	-	-	-	-	702.30	621.06	770.87	
1408.00	1354.4	I				I			O		X	I	701.78	620.52	770.42
1452.00	1354.2	I				I			O		X	I	701.30	620.02	770.01
1496.00	1353.9	I				I			O		X	I	700.84	619.55	769.62
1540.00	1353.7	I				I			O		X	I	700.41	619.11	769.25
1584.00	1353.4	I				I			O		X	I	700.01	618.69	768.91
1628.00	1353.2	I				I			O		X	I	699.63	618.30	768.59
1672.00	1353.0	I				I			O		X	I	699.28	617.93	768.29
1716.00	1352.9	I				I			O		X	I	698.94	617.59	768.00
1760.00	1352.7	I	-	-	-	I	-	-	-	-	-	698.63	617.27	767.74	
1804.00	1352.5	I				I			O		X	I	698.34	616.97	767.48
1848.00	1352.4	I				I			O		X	I	698.06	616.68	767.25
1892.00	1352.2	I				I			O		X	I	697.80	616.41	767.03
1936.00	1352.1	I	O	+		I			O		X	I	697.56	616.16	766.82
1980.00	1352.0	I	O	+		I			O		X	I	697.33	615.93	766.63
2024.00	1351.8	I	O	+		I			O		X	I	697.11	615.70	766.44
2068.00	1351.7	I	O	+		I			O		X	I	696.90	615.49	766.27
2112.00	1351.6	I	O	+		I			O		X	I	696.72	615.30	766.11
2156.00	1351.5	I	O	+		I			O		X	I	696.54	615.11	765.95
2200.00	1351.4	I	O	+		I			O		X	I	696.37	614.94	765.81

5 PERCENT STEP CHANGE IN FEEDWATER FLOW DEMAND
ECONOMIZER STATES

	400.0		'O' = MFH		2000.				
	515.0		'X' = TECH		555.0				
	696.0		'+' = TECG		728.0				
	532.0		'-' = TEC		540.0				
TIME	TEC				TECG	TECH	MFH		
.0	533.25	I-----	X-----	U-I-----	I-X-----	I	710.28	552.94	1158.1
44.000	537.82	I	I	O I	X	I	719.00	551.17	1158.1
88.000	537.24	I	I	O I X		I	710.73	550.55	1158.1
132.00	537.03	I	I	O I X		I	718.26	550.28	1158.1
176.00	536.88	I	I	O I X		I	717.88	550.07	1158.1
220.00	536.68	I	I	O I X		I	716.58	549.84	1158.1
264.00	536.48	I	I	X O I		I	715.45	549.55	1158.1
308.00	536.20	I	I	X O I		I	714.24	549.23	1158.1
352.00	535.93	I	I	X O I		I	713.05	548.90	1158.1
396.00	535.67	I	I	X O I		I	711.92	548.57	1158.1
440.00	535.42	I-----	I-----	X-----	O-I-----	I-----	710.88	548.26	1158.1
484.00	535.19	I	I	X	O I	I	709.94	547.97	1158.1
528.00	534.98	I	I	X	O I	I	709.10	547.72	1158.1
572.00	534.79	I	I	X	O I	I	708.36	547.49	1158.1
616.00	534.63	I	I	X	O I	I	707.70	547.28	1158.1
660.00	534.48	I	I	X	O I	I	707.11	547.10	1158.1
704.00	534.35	I	I	X	O I	I	706.58	546.94	1158.1
748.00	534.23	I	I	X	O I	I	706.10	546.79	1158.1
792.00	534.12	I	I	X	O I	I	705.66	546.65	1158.1
836.00	534.02	I	I	X	O I	I	705.26	546.53	1158.1
880.00	533.93	I-----	I-----	X-----	O-I-----	I-----	704.89	546.42	1158.1
924.00	533.85	I	I	X	O I	I	704.55	546.32	1158.1
968.00	533.77	I	I	X	O I	I	704.22	546.22	1158.1
1012.00	533.70	I	I	X	O I	I	703.92	546.13	1158.1
1056.00	533.63	I	I	X	O I	I	703.64	546.05	1158.1
1100.00	533.57	I	I	X	O I	I	703.38	545.97	1158.1
1144.00	533.51	I	I	X	O I	I	703.13	545.90	1158.1
1188.00	533.45	I	I	X	O I	I	702.90	545.83	1158.1
1232.00	533.40	I	I	X	O I	I	702.69	545.76	1158.1
1276.00	533.35	I	I	X	O I	I	702.48	545.70	1158.1
1320.00	533.31	I-----	I-----	X-----	O-I-----	I-----	702.29	545.65	1158.1
1364.00	533.26	I	I	X	O I	I	702.11	545.59	1158.1
1408.00	533.22	I	I	X	O I	I	701.94	545.54	1158.1
1452.00	533.18	I	I	X	O I	I	701.78	545.49	1158.1
1496.00	533.15	I	I	X	O I	I	701.64	545.45	1158.1
1540.00	533.12	I	I	X	O I	I	701.50	545.41	1158.1
1584.00	533.09	I	I	X	O I	I	701.37	545.37	1158.1
1628.00	533.06	I	I	X	O I	I	701.25	545.34	1158.1
1672.00	533.03	I	I	X	O I	I	701.13	545.30	1158.1
1716.00	533.00	I	I	X	O I	I	701.02	545.27	1158.1
1760.00	532.98	I-----	I-----	X-----	O-I-----	I-----	700.92	545.24	1158.1
1804.00	532.96	I	I	X	O I	I	700.83	545.21	1158.1
1848.00	532.93	I	I	X	O I	I	700.74	545.18	1158.1
1892.00	532.91	I	I	X	O I	I	700.65	545.16	1158.1
1936.00	532.89	I	I	X	O I	I	700.57	545.13	1158.1
1980.00	532.88	I	I	X	O I	I	700.50	545.11	1158.1
2024.00	532.86	I	I	X	O I	I	700.43	545.09	1158.1
2068.00	532.84	I	I	X	O I	I	700.36	545.07	1158.1
2112.00	532.83	I	I	X	O I	I	700.30	545.05	1158.1
2156.00	532.82	I	I	X	O I	I	700.24	545.04	1158.1
2200.00	532.80	I-----	I-----	X-----	O-I-----	I-----	700.19	545.02	1158.1

5 PERCENT STEP CHANGE IN FEEDWATER FLOW DEMAND
AIR HEATER STATES

	1567. 500.0 424.0 620.0 2.020E+05	'O'=GAH 'O'=AAH 'X'=TAHM 'M'=TAHO '*'=QAHG	1567. 2500. 440.0 640.0 2.100E+05			
TIME	QAHG		TAHO	TAHM	AAH	GAH
0	2.0964E+05	I-----I-----O-I-----I-----X--M--O	630.87	430.12	1379.3	1567.5
44.000	2.0903E+05	I O O I X--M--I	630.33	437.70	1379.3	1567.5
88.000	2.0892E+05	I O O I X--M--I	637.74	437.41	1379.3	1567.5
132.00	2.0877E+05	I O O I X--M--I	637.29	437.12	1379.3	1567.5
176.00	2.0849E+05	I O O I X--M--I	636.78	436.80	1379.3	1567.5
220.00	2.0813E+05	I O O I X--M--I	636.11	436.38	1379.3	1567.5
264.00	2.0773E+05	I O O I X--M--I	635.28	435.86	1379.3	1567.5
308.00	2.0733E+05	I O O I X--M--I	634.36	435.27	1379.3	1567.5
352.00	2.0695E+05	I O O I X--M--I	633.40	434.67	1379.3	1567.5
396.00	2.0661E+05	I O O I X--M--I	632.46	434.07	1379.3	1567.5
440.00	2.0631E+05	I-----I-----O-I-----I-----X--M--O	631.57	433.52	1379.3	1567.5
484.00	2.0605E+05	I O O I X--M--I	630.75	433.00	1379.3	1567.5
528.00	2.0581E+05	I O O I X--M--I	630.02	432.54	1379.3	1567.5
572.00	2.0561E+05	I O O I X--M--I	629.36	432.13	1379.3	1567.5
616.00	2.0542E+05	I O O I X--M--I	628.70	431.76	1379.3	1567.5
660.00	2.0526E+05	I O O I X--M--I	628.26	431.43	1379.3	1567.5
704.00	2.0511E+05	I O O I X--M--I	627.80	431.14	1379.3	1567.5
748.00	2.0498E+05	I O O I X--M--I	627.38	430.88	1379.3	1567.5
792.00	2.0485E+05	I O O I X--M--I	627.00	430.64	1379.3	1567.5
836.00	2.0474E+05	I O O I X--M--I	626.65	430.42	1379.3	1567.5
880.00	2.0463E+05	I-----I-----O-I-----I-----X--M--O	626.34	430.22	1379.3	1567.5
924.00	2.0453E+05	I O O I X--M--I	626.04	430.03	1379.3	1567.5
968.00	2.0444E+05	I O O I X--M--I	625.77	429.86	1379.3	1567.5
1012.00	2.0435E+05	I O O I X--M--I	625.52	429.70	1379.3	1567.5
1056.00	2.0427E+05	I O O I X--M--I	625.28	429.55	1379.3	1567.5
1100.00	2.0420E+05	I O O I X--M--I	625.06	429.41	1379.3	1567.5
1144.00	2.0413E+05	I O O I X--M--I	624.85	429.28	1379.3	1567.5
1188.00	2.0406E+05	I O O I X--M--I	624.66	429.16	1379.3	1567.5
1232.00	2.0399E+05	I O O I X--M--I	624.47	429.05	1379.3	1567.5
1276.00	2.0394E+05	I O O I X--M--I	624.30	428.94	1379.3	1567.5
1320.00	2.0388E+05	I-----I-----O-I-----I-----X--M--O	624.14	428.84	1379.3	1567.5
1364.00	2.0383E+05	I O O I X--M--I	623.99	428.74	1379.3	1567.5
1408.00	2.0378E+05	I O O I X--M--I	623.85	428.65	1379.3	1567.5
1452.00	2.0373E+05	I O O I X--M--I	623.72	428.57	1379.3	1567.5
1496.00	2.0369E+05	I O O I X--M--I	623.60	428.49	1379.3	1567.5
1540.00	2.0365E+05	I O O I X--M--I	623.48	428.42	1379.3	1567.5
1584.00	2.0361E+05	I O O I X--M--I	623.37	428.35	1379.3	1567.5
1628.00	2.0358E+05	I O O I X--M--I	623.27	428.29	1379.3	1567.5
1672.00	2.0354E+05	I O O I X--M--I	623.17	428.22	1379.3	1567.5
1716.00	2.0351E+05	I O O I X--M--I	623.08	428.17	1379.3	1567.5
1760.00	2.0348E+05	I-----I-----O-I-----I-----X--M--O	623.00	428.11	1379.3	1567.5
1804.00	2.0345E+05	I O O I X--M--I	622.92	428.06	1379.3	1567.5
1848.00	2.0343E+05	I O O I X--M--I	622.84	428.02	1379.3	1567.5
1892.00	2.0340E+05	I O O I X--M--I	622.77	427.97	1379.3	1567.5
1936.00	2.0338E+05	I O O I X--M--I	622.70	427.93	1379.3	1567.5
1980.00	2.0336E+05	I O O I X--M--I	622.64	427.89	1379.3	1567.5
2024.00	2.0334E+05	I O O I X--M--I	622.59	427.86	1379.3	1567.5
2068.00	2.0332E+05	I O O I X--M--I	622.53	427.82	1379.3	1567.5
2112.00	2.0330E+05	I O O I X--M--I	622.48	427.79	1379.3	1567.5
2156.00	2.0329E+05	I O O I X--M--I	622.43	427.76	1379.3	1567.5
2200.00	2.0327E+05	I-----I-----O-I-----I-----X--M--O	622.39	427.73	1379.3	1567.5

5 PERCENT STEP CHANGE IN FEEDWATER FLOW DEMAND
GAS PATH STATES

	696.0 885.0 704.0 720.0 1335.	'O'=TGP2 'O'=TGP1 'X'=TGPH 'M'=TGPH '*'=TGP	720.0 945.0 736.0 752.0 1355.			
TIME	TGP		TGPH	TGPS	TGP1	TGP2
0	1352.7	I-----I-----O-I-----I-----X--M--O	747.68	735.24	923.71	720.25
44.000	1352.2	I O O I X--M--I	745.96	732.33	923.46	719.08
88.000	1352.0	I O O I X--M--I	741.77	728.72	923.21	718.56
132.00	1351.7	I O O I X--M--I	738.64	725.82	922.48	718.07
176.00	1351.4	I O O I X--M--I	736.33	723.73	921.14	717.38
220.00	1351.0	I O O I X--M--I	734.70	722.27	919.27	716.47
264.00	1350.5	I O O I X--M--I	733.55	721.24	917.09	715.41
308.00	1350.0	I O O I X--M--I	732.71	720.47	914.81	714.29
352.00	1349.5	I O O I X--M--I	732.04	719.85	912.57	713.19
396.00	1349.0	I O O I X--M--I	731.47	719.30	910.47	712.14
440.00	1348.4	I-----I-----O-I-----I-----X--M--O	730.94	718.79	908.55	711.17
484.00	1347.8	I O O I X--M--I	730.43	718.30	906.82	710.30
528.00	1347.3	I O O I X--M--I	729.92	717.80	905.29	709.52
572.00	1346.8	I O O I X--M--I	729.42	717.31	903.93	708.83
616.00	1346.3	I O O I X--M--I	728.92	716.83	902.72	708.22
660.00	1345.9	I O O I X--M--I	728.46	716.36	901.64	707.67
704.00	1345.5	I O O I X--M--I	727.97	715.90	900.67	707.18
748.00	1345.1	I O O I X--M--I	727.51	715.46	899.79	706.73
792.00	1344.7	I O O I X--M--I	727.08	715.04	898.98	706.33
836.00	1344.4	I O O I X--M--I	726.67	714.65	898.24	705.96
880.00	1344.1	I-----I-----O-I-----I-----X--M--O	726.29	714.27	897.56	705.61
924.00	1343.8	I O O I X--M--I	725.92	713.92	896.92	705.29
968.00	1343.5	I O O I X--M--I	725.58	713.59	896.33	705.00
1012.00	1343.2	I O O I X--M--I	725.26	713.29	895.77	704.72
1056.00	1343.0	I O O I X--M--I	724.97	713.00	895.25	704.46
1100.00	1342.7	I O O I X--M--I	724.68	712.73	894.77	704.22
1144.00	1342.5	I O O I X--M--I	724.42	712.48	894.31	703.99
1188.00	1342.3	I O O I X--M--I	724.18	712.24	893.88	703.78
1232.00	1342.1	I O O I X--M--I	723.94	712.01	893.48	703.58
1276.00	1341.9	I O O I X--M--I	723.73	711.80	893.10	703.39
1320.00	1341.8	I-----I-----O-I-----I-----X--M--O	723.52	711.61	892.75	703.22
1364.00	1341.4	I O O I X--M--I	723.33	711.42	892.42	703.05
1408.00	1341.5	I O O I X--M--I	723.15	711.25	892.11	702.90
1452.00	1341.3	I O O I X--M--I	722.98	711.08	891.82	702.75
1496.00	1341.2	I O O I X--M--I	722.82	710.93	891.54	702.61
1540.00	1341.1	I O O I X--M--I	722.67	710.78	891.28	702.49
1584.00	1340.9	I O O I X--M--I	722.53	710.65	891.04	702.37
1628.00	1340.8	I O O I X--M--I	722.40	710.52	890.82	702.26
1672.00	1340.7	I O O I X--M--I	722.27	710.40	890.60	702.15
1716.00	1340.6	I O O I X--M--I	722.15	710.28	890.40	702.05
1760.00	1340.5	I-----I-----O-I-----I-----X--M--O	722.04	710.18	890.22	701.96
1804.00	1340.5	I O O I X--M--I	721.94	710.08	890.04	701.87
1848.00	1340.4	I O O I X--M--I	721.84	709.98	889.87	701.79
1892.00	1340.3	I O O I X--M--I	721.74	709.89	889.72	701.71
1936.00	1340.2	I O O I X--M--I	721.66	709.80	889.57	701.64
1980.00	1340.2	I O O I X--M--I	721.57	709.72	889.43	701.57
2024.00	1340.1	I O O I X--M--I	721.50	709.65	889.30	701.51
2068.00	1340.0	I O O I X--M--I	721.43	709.58	889.18	701.45
2112.00	1340.0	I O O I X--M--I	721.36	709.51	889.07	701.39
2156.00	1339.9	I O O I X--M--I	721.29	709.45	888.96	701.34
2200.00	1339.9	I-----I-----O-I-----I-----X--M--O	721.23	709.39	888.86	701.29

[illegible][illegible]

5 PERCENT STEP CHANGE IN FEEDWATER FLOW DEMAND

		.6450		.7050	
		1544.		1552.	
		5.378E+05		5.378E+05	
		1050.		1110.	
		1.170E+08		1.194E+08	
TIME	EEBH			HEBS	
.0	1.1901E+08	I	-X	I	1093.3
94.000	1.1836E+08	I	X	I	1078.7
98.000	1.1814E+08	I	X	I	1072.7
132.000	1.1806E+08	I	X	I	1070.0
176.000	1.1803E+08	I	X	I	1068.7
220.000	1.1800E+08	I	X	I	1068.0
264.000	1.1798E+08	I	X	I	1067.6
308.000	1.1796E+08	I	X	I	1067.3
352.000	1.1794E+08	I	X	I	1067.0
396.000	1.1791E+08	I	X	I	1066.8
440.000	1.1787E+08	I	X	I	1066.4
484.000	1.1784E+08	I	X	I	1066.1
528.000	1.1780E+08	I	X	I	1065.7
572.000	1.1777E+08	I	X	I	1065.4
616.000	1.1773E+08	I	X	I	1065.0
660.000	1.1770E+08	I	X	I	1064.6
704.000	1.1767E+08	I	X	I	1064.2
748.000	1.1764E+08	I	X	I	1063.9
792.000	1.1761E+08	I	X	I	1063.6
836.000	1.1759E+08	I	X	I	1063.2
880.000	1.1756E+08	I	X	I	1062.9
924.000	1.1754E+08	I	X	I	1062.7
968.000	1.1752E+08	I	X	I	1062.4
1012.000	1.1750E+08	I	X	I	1062.1
1056.000	1.1748E+08	I	X	I	1061.9
1100.000	1.1746E+08	I	X	I	1061.7
1144.000	1.1745E+08	I	X	I	1061.5
1188.000	1.1743E+08	I	X	I	1061.3
1232.000	1.1742E+08	I	X	I	1061.1
1276.000	1.1740E+08	I	X	I	1061.0
1320.000	1.1739E+08	I	X	I	1060.8
1364.000	1.1738E+08	I	X	I	1060.6
1408.000	1.1737E+08	I	X	I	1060.5
1452.000	1.1736E+08	I	X	I	1060.4
1496.000	1.1735E+08	I	X	I	1060.2
1540.000	1.1734E+08	I	X	I	1060.1
1584.000	1.1733E+08	I	X	I	1060.0
1628.000	1.1732E+08	I	X	I	1059.9
1672.000	1.1731E+08	I	X	I	1059.8
1716.000	1.1731E+08	I	X	I	1059.7
1760.000	1.1730E+08	I	X	I	1059.6
1804.000	1.1729E+08	I	X	I	1059.5
1848.000	1.1729E+08	I	X	I	1059.4
1892.000	1.1728E+08	I	X	I	1059.4
1936.000	1.1728E+08	I	X	I	1059.3
1980.000	1.1727E+08	I	X	I	1059.2
2024.000	1.1727E+08	I	X	I	1059.2
2068.000	1.1726E+08	I	X	I	1059.1
2112.000	1.1726E+08	I	X	I	1059.1
2156.000	1.1725E+08	I	X	I	1059.0
2200.000	1.1725E+08	I	X	I	1058.9

5 PERCENT STEP CHANGE IN FEEDWATER FLOW DEMAND

		1.880E+08		1.940E+08	
		1400.		1480.	
		5.378E+05		5.378E+05	
		1480.		1560.	
TIME	QSB			TSB	MSB
.0	5.3776E+05	I	-X	I	1547.7
94.000	5.3776E+05	I	X	I	1543.9
98.000	5.3776E+05	I	X	I	1540.6
132.000	5.3776E+05	I	X	I	1550.3
176.000	5.3776E+05	I	X	I	1551.2
220.000	5.3776E+05	I	X	I	1550.6
264.000	5.3776E+05	I	X	I	1546.1
308.000	5.3776E+05	I	X	I	1542.6
352.000	5.3776E+05	I	X	I	1539.4
396.000	5.3776E+05	I	X	I	1535.9
440.000	5.3776E+05	I	X	I	1532.5
484.000	5.3776E+05	I	X	I	1529.4
528.000	5.3776E+05	I	X	I	1526.4
572.000	5.3776E+05	I	X	I	1523.8
616.000	5.3776E+05	I	X	I	1521.3
660.000	5.3776E+05	I	X	I	1519.0
704.000	5.3776E+05	I	X	I	1517.0
748.000	5.3776E+05	I	X	I	1515.1
792.000	5.3776E+05	I	X	I	1513.4
836.000	5.3776E+05	I	X	I	1511.8
880.000	5.3776E+05	I	X	I	1510.3
924.000	5.3776E+05	I	X	I	1508.9
968.000	5.3776E+05	I	X	I	1507.6
1012.000	5.3776E+05	I	X	I	1506.4
1056.000	5.3776E+05	I	X	I	1505.3
1100.000	5.3776E+05	I	X	I	1504.3
1144.000	5.3776E+05	I	X	I	1503.3
1188.000	5.3776E+05	I	X	I	1502.4
1232.000	5.3776E+05	I	X	I	1501.5
1276.000	5.3776E+05	I	X	I	1500.7
1320.000	5.3776E+05	I	X	I	1500.0
1364.000	5.3776E+05	I	X	I	1499.3
1408.000	5.3776E+05	I	X	I	1498.6
1452.000	5.3776E+05	I	X	I	1498.0
1496.000	5.3776E+05	I	X	I	1497.4
1540.000	5.3776E+05	I	X	I	1496.9
1584.000	5.3776E+05	I	X	I	1496.4
1628.000	5.3776E+05	I	X	I	1495.9
1672.000	5.3776E+05	I	X	I	1495.5
1716.000	5.3776E+05	I	X	I	1495.1
1760.000	5.3776E+05	I	X	I	1494.7
1804.000	5.3776E+05	I	X	I	1494.3
1848.000	5.3776E+05	I	X	I	1494.0
1892.000	5.3776E+05	I	X	I	1493.7
1936.000	5.3776E+05	I	X	I	1493.4
1980.000	5.3776E+05	I	X	I	1493.1
2024.000	5.3776E+05	I	X	I	1492.8
2068.000	5.3776E+05	I	X	I	1492.6
2112.000	5.3776E+05	I	X	I	1492.3
2156.000	5.3776E+05	I	X	I	1492.1
2200.000	5.3776E+05	I	X	I	1491.9

[illegible]

TIME	ECB	ECBM	ECBG	TCBG	TCBM
.0	8.4730E+07 I	-I	-I	-I	-I
44.000	8.4724E+07 I	I	I	I	I
88.000	8.4710E+07 I	I	I	I	I
132.00	8.4707E+07 I	I	I	I	I
176.00	8.4699E+07 I	I	I	I	I
220.00	8.4680E+07 I	I	I	I	I
264.00	8.4645E+07 I	I	I	I	I
308.00	8.4644E+07 I	I	I	I	I
352.00	8.4630E+07 I	I	I	I	I
396.00	8.4610E+07 I	I	I	I	I
440.00	8.4590E+07 I	I	I	I	I
484.00	8.4568E+07 I	I	I	I	I
528.00	8.4546E+07 I	I	I	I	I
572.00	8.4529E+07 I	I	I	I	I
616.00	8.4500E+07 I	I	I	I	I
660.00	8.4479E+07 I	I	I	I	I
704.00	8.4457E+07 I	I	I	I	I
748.00	8.4436E+07 I	I	I	I	I
792.00	8.4414E+07 I	I	I	I	I
836.00	8.4393E+07 I	I	I	I	I
880.00	8.4373E+07 I	I	I	I	I
924.00	8.4354E+07 I	I	I	I	I
968.00	8.4335E+07 I	I	I	I	I
1012.00	8.4314E+07 I	I	I	I	I
1056.00	8.4299E+07 I	I	I	I	I
1100.00	8.4281E+07 I	I	I	I	I
1144.00	8.4264E+07 I	I	I	I	I
1188.00	8.4248E+07 I	I	I	I	I
1232.00	8.4237E+07 I	I	I	I	I
1276.00	8.4218E+07 I	I	I	I	I
1320.00	8.4204E+07 I	I	I	I	I
1364.00	8.4190E+07 I	I	I	I	I
1408.00	8.4177E+07 I	I	I	I	I
1452.00	8.4165E+07 I	I	I	I	I
1496.00	8.4152E+07 I	I	I	I	I
1540.00	8.4141E+07 I	I	I	I	I
1584.00	8.4130E+07 I	I	I	I	I
1628.00	8.4119E+07 I	I	I	I	I
1672.00	8.4109E+07 I	I	I	I	I
1716.00	8.4099E+07 I	I	I	I	I
1760.00	8.4090E+07 I	I	I	I	I
1804.00	8.4082E+07 I	I	I	I	I
1848.00	8.4073E+07 I	I	I	I	I
1892.00	8.4065E+07 I	I	I	I	I
1936.00	8.4057E+07 I	I	I	I	I
1980.00	8.4050E+07 I	I	I	I	I
2024.00	8.4043E+07 I	I	I	I	I
2068.00	8.4037E+07 I	I	I	I	I
2112.00	8.4030E+07 I	I	I	I	I
2156.00	8.4025E+07 I	I	I	I	I
2200.00	8.4019E+07 I	I	I	I	I

5 PERCENT STEP CHANGE IN FEEDWATER FLOW DEMAND
FLUIDIZED CELL BED HEIGHTS (FT)

	.0	'Q'=PASS	1.600E+04				
	3.960	'O'=XCBH	3.984				
	3.920	'X'=XRBH	4.000				
	3.925	'M'=XSBH	4.025				
	3.995	'A'=XEBH	4.005				
TIME	XEBH			XSBH	XRBH	XCBH	PASS
.0	4.0008	I-----I-----I-----I-----X-O-I	3.9979	3.9917	3.9827	2.0000	
44.000	4.0005	I-----I-----I-----I-----X O I	3.9989	3.9917	3.9826	333.00	
88.000	4.0008	I-----I-----I-----I-----X O I	4.0009	3.9916	3.9824	696.00	
132.00	4.0011	I-----I-----I-----I-----X O I	4.0018	3.9914	3.9821	1067.00	
176.00	4.0014	I-----I-----I-----I-----X O I	4.0012	3.9908	3.9818	1397.00	
220.00	4.0017	I-----I-----I-----I-----X O I	3.9992	3.9894	3.9814	1663.00	
264.00	4.0019	I-----I-----I-----I-----X O I	3.9961	3.9879	3.9810	1912.00	
308.00	4.0021	I-----I-----I-----I-----X O I	3.9925	3.9856	3.9806	2160.00	
352.00	4.0021	I-----I-----I-----I-----X O I	3.9887	3.9830	3.9801	2456.00	
396.00	4.0021	I-----I-----I-----I-----X O I	3.9848	3.9800	3.9796	2744.00	
440.00	4.0021	I-----I-----I-----I-----X-O-I	3.9811	3.9768	3.9791	3050.00	
484.00	4.0019	I-----I-----I-----I-----X X + IO	3.9774	3.9736	3.9785	3372.00	
528.00	4.0018	I-----I-----I-----I-----X X + IO	3.9744	3.9703	3.9780	3645.00	
572.00	4.0016	I-----I-----I-----I-----X X + IO	3.9714	3.9671	3.9774	3910.00	
616.00	4.0014	I-----I-----I-----I-----X X + IO	3.9687	3.9640	3.9768	4206.00	
660.00	4.0011	I-----I-----I-----I-----X X + IO	3.9662	3.9611	3.9762	4502.00	
704.00	4.0009	I-----I-----I-----I-----X X + IO	3.9639	3.9582	3.9757	4750.00	
748.00	4.0006	I-----I-----I-----I-----X X + IO	3.9619	3.9556	3.9751	5043.00	
792.00	4.0004	I-----I-----I-----I-----X X + IO	3.9599	3.9531	3.9745	5320.00	
836.00	4.0001	I-----I-----I-----I-----X X + IO	3.9582	3.9507	3.9740	5641.00	
880.00	3.9999	I-----I-----I-----I-----X X + IO	3.9545	3.9485	3.9735	5929.00	
924.00	3.9996	I-----I-----I-----I-----X X + IO	3.9550	3.9464	3.9730	6314.00	
968.00	3.9994	I-----I-----I-----I-----X X + IO	3.9536	3.9445	3.9725	6645.00	
1012.00	3.9992	I-----I-----I-----I-----X X + IO	3.9523	3.9426	3.9720	6951.00	
1056.00	3.9990	I-----I-----I-----I-----X X + IO	3.9511	3.9410	3.9715	7240.00	
1100.00	3.9988	I-----I-----I-----I-----X X + IO	3.9499	3.9394	3.9711	7538.00	
1144.00	3.9986	I-----I-----I-----I-----X X + IO	3.9488	3.9379	3.9707	7916.00	
1188.00	3.9984	I-----I-----I-----I-----X X + IO	3.9478	3.9365	3.9702	8221.00	
1232.00	3.9982	I-----I-----I-----I-----X X + IO	3.9469	3.9352	3.9698	8502.00	
1276.00	3.9980	I-----I-----I-----I-----X X + IO	3.9460	3.9339	3.9695	8823.00	
1320.00	3.9979	I-----I-----I-----I-----X X + IO	3.9452	3.9326	3.9691	9079.00	
1364.00	3.9977	I-----I-----I-----I-----X X + IO	3.9444	3.9317	3.9687	9360.00	
1408.00	3.9976	I-----I-----I-----I-----X X + IO	3.9437	3.9307	3.9684	9633.00	
1452.00	3.9974	I-----I-----I-----I-----X X + IO	3.9430	3.9298	3.9681	9946.00	
1496.00	3.9973	I-----I-----I-----I-----X X + IO	3.9424	3.9289	3.9678	10243.00	
1540.00	3.9972	I-----I-----I-----I-----X X + IO	3.9418	3.9280	3.9675	10604.00	
1584.00	3.9970	I-----I-----I-----I-----X X + IO	3.9413	3.9273	3.9672	10868.00	
1628.00	3.9969	I-----I-----I-----I-----X X + IO	3.9407	3.9265	3.9669	11140.00	
1672.00	3.9968	I-----I-----I-----I-----X X + IO	3.9403	3.9259	3.9667	11421.00	
1716.00	3.9967	I-----I-----I-----I-----X X + IO	3.9398	3.9252	3.9664	11767.00	
1760.00	3.9966	I-----I-----I-----I-----X X + IO	3.9394	3.9246	3.9662	12007.00	
1804.00	3.9965	I-----I-----I-----I-----X X + IO	3.9390	3.9240	3.9659	12320.00	
1848.00	3.9964	I-----I-----I-----I-----X X + IO	3.9384	3.9234	3.9657	12617.00	
1892.00	3.9964	I-----I-----I-----I-----X X + IO	3.9382	3.9230	3.9655	12880.00	
1936.00	3.9963	I-----I-----I-----I-----X X + IO	3.9379	3.9226	3.9653	13154.00	
1980.00	3.9962	I-----I-----I-----I-----X X + IO	3.9376	3.9221	3.9651	13424.00	
2024.00	3.9962	I-----I-----I-----I-----X X + IO	3.9373	3.9217	3.9650	13683.00	
2068.00	3.9961	I-----I-----I-----I-----X X + IO	3.9370	3.9213	3.9648	14029.00	
2112.00	3.9960	I-----I-----I-----I-----X X + IO	3.9368	3.9210	3.9646	14285.00	
2156.00	3.9960	I-----I-----I-----I-----X X + IO	3.9365	3.9206	3.9645	14606.00	
2200.00	3.9959	I-----I-----I-----I-----X X + IO	3.9363	3.9203	3.9643	14911.00	

5 PERCENT STEP CHANGE IN FEEDWATER FLOW DEMAND
FLUIDIZED BED VOID FRACTION

		.8000	'Q'=DELT	4.000			
		.6710	'O'=XCB	.6730			
		.6180	'X'=XRB	.6260			
		.6258	'M'=XEB	.6266			
		.6200	'A'=XSB	.6280			
TIME	XSB			XEB	XRB	XCB	DELT
.0	.62607	I-----I-----I-----I-----X-O-I	.62630	.62549	.62796	2.7500	
48.000	.62616	I-----I-----I-----I-----X O I	.62631	.62548	.62795	1.5469	
88.000	.62634	I-----I-----I-----I-----X O I	.62633	.62548	.62793	.8978	
132.000	.62643	I-----I-----I-----I-----X O I	.62634	.62546	.62791	1.4636	
176.000	.62637	I-----I-----I-----I-----X O I	.62639	.62540	.62789	2.0097	
220.000	.62618	I-----I-----I-----I-----X O I	.62642	.62529	.62786	.95171	
264.000	.62590	I-----I-----I-----I-----X O I	.62644	.62513	.62782	1.0070	
308.000	.62556	I-----I-----I-----I-----X O I	.62645	.62491	.62779	1.1817	
352.000	.62520	I-----I-----I-----I-----X O I	.62646	.62466	.62775	1.2506	
396.000	.62484	I-----I-----I-----I-----X O I	.62646	.62438	.62771	2.6162	
440.000	.62449	I-----I-----I-----I-----X-O-I	.62646	.62408	.62766	.86234	
484.000	.62416	I-----I-----I-----I-----X O I	.62644	.62378	.62762	1.0831	
528.000	.62385	I-----I-----I-----I-----X O I	.62643	.62347	.62757	.90137	
572.000	.62357	I-----I-----I-----I-----X X + IO	.62641	.62316	.62752	1.1873	
616.000	.62331	I-----I-----I-----I-----X X + IO	.62639	.62287	.62747	1.2051	
660.000	.62308	I-----I-----I-----I-----X X + IO	.62637	.62259	.62743	2.0756	
704.000	.62286	I-----I-----I-----I-----X X + IO	.62634	.62232	.62738	3.5010	
748.000	.62266	I-----I-----I-----I-----X X + IO	.62632	.62206	.62733	2.3067	
792.000	.62248	I-----I-----I-----I-----X X + IO	.62630	.62182	.62729	.90798	
836.000	.62231	I-----I-----I-----I-----X X + IO	.62627	.62160	.62724	1.2392	
880.000	.62216	I-----I-----I-----I-----X X + IO	.62625	.62139	.62720	1.7456	
924.000	.62201	I-----I-----I-----I-----X X + IO	.62623	.62119	.62716	1.9259	
968.000	.62188	I-----I-----I-----I-----X X + IO	.62621	.62100	.62712	2.2598	
1012.000	.62175	I-----I-----I-----I-----X X + IO	.62619	.62083	.62708	1.3916	
1056.000	.62163	I-----I-----I-----I-----X X + IO	.62617	.62066	.62704	1.1258	
1100.000	.62152	I-----I-----I-----I-----X X + IO	.62615	.62051	.62700	1.7881	
1144.000	.62142	I-----I-----I-----I-----X X + IO	.62613	.62037	.62697	1.1655	
1188.000	.62132	I-----I-----I-----I-----X X + IO	.62611	.62023	.62693	1.0475	
1232.000	.62123	I-----I-----I-----I-----X X + IO	.62609	.62010	.62689	1.5730	
1276.000	.62115	I-----I-----I-----I-----X X + IO	.62608	.61999	.62687	1.1578	
1320.000	.62107	I-----I-----I-----I-----X X + IO	.62606	.61987	.62684	1.1584	
1364.000	.62100	I-----I-----I-----I-----X X + IO	.62605	.61977	.62681	2.5215	
1408.000	.62093	I-----I-----I-----I-----X X + IO	.62603	.61967	.62678	1.5442	
1452.000	.62086	I-----I-----I-----I-----X X + IO	.62602	.61958	.62676	1.1554	
1496.000	.62080	I-----I-----I-----I-----X X + IO	.62601	.61950	.62673	.88991	
1540.000	.62075	I-----I-----I-----I-----X X + IO	.62600	.61942	.62671	1.2110	
1584.000	.62069	I-----I-----I-----I-----X X + IO	.62599	.61934	.62668	1.3120	
1628.000	.62064	I-----I-----I-----I-----X X + IO	.62598	.61927	.62666	2.0431	
1672.000	.62060	I-----I-----I-----I-----X X + IO	.62596	.61920	.62664	1.5690	
1716.000	.62055	I-----I-----I-----I-----X X + IO	.62596	.61914	.62662	.99760	
1760.000	.62051	I-----I-----I-----I-----X X + IO	.62595	.61908	.62660	1.2734	
1804.000	.62047	I-----I-----I-----I-----X X + IO	.62594	.61903	.62658	2.5445	
1848.000	.62044	I-----I-----I-----I-----X X + IO	.62593	.61898	.62656	2.5453	
1892.000	.62040	I-----I-----I-----I-----X X + IO	.62592	.61893	.62654	1.3800	
1936.000	.62037	I-----I-----I-----I-----X X + IO	.62592	.61888	.62653	2.8471	
1980.000	.62034	I-----I-----I-----I-----X X + IO	.62591	.61884	.62651	2.0048	
2024.000	.62031	I-----I-----I-----I-----X X + IO	.62590	.61880	.62650	1.8467	
2068.000	.62029	I-----I-----I-----I-----X X + IO	.62590	.61876	.62648	1.0740	
2112.000	.62026	I-----I-----I-----I-----X X + IO	.62589	.61873	.62647	3.3345	
2156.000	.62024	I-----I-----I-----I-----X X + IO	.62589	.61870	.62646	2.4916	
2200.000	.62021	I-----I-----I-----I-----X X + IO	.62588	.61867	.62644	1.0354	

712.5	'O'=TCBG	722.5
1600.	'X'=TRBG	1640.
1610.	'W'=TSBG	1650.
1630.	'4'=TEBG	1642.

TIME	TEBG	1630.	1640.	1650.	1700.	1710.	1720.	1730.	1740.	1750.	1760.	1770.	1780.	1790.	1800.	1810.	1820.	1830.	1840.	1850.	1900.	1910.	1920.	1930.	1940.	1950.	2000.	2010.	2020.	2030.	2040.	2050.	2100.	2110.	2120.	2130.	2140.	2150.	2200.	2210.	2220.	2230.	2240.	2250.	2300.	2310.	2320.	2330.	2340.	2350.	2400.	2410.	2420.	2430.	2440.	2450.	2500.	2510.	2520.	2530.	2540.	2550.	2600.	2610.	2620.	2630.	2640.	2650.	2700.	2710.	2720.	2730.	2740.	2750.	2800.	2810.	2820.	2830.	2840.	2850.	2900.	2910.	2920.	2930.	2940.	2950.	3000.	3010.	3020.	3030.	3040.	3050.	3100.	3110.	3120.	3130.	3140.	3150.	3200.	3210.	3220.	3230.	3240.	3250.	3300.	3310.	3320.	3330.	3340.	3350.	3400.	3410.	3420.	3430.	3440.	3450.	3500.	3510.	3520.	3530.	3540.	3550.	3600.	3610.	3620.	3630.	3640.	3650.	3700.	3710.	3720.	3730.	3740.	3750.	3800.	3810.	3820.	3830.	3840.	3850.	3900.	3910.	3920.	3930.	3940.	3950.	4000.	4010.	4020.	4030.	4040.	4050.	4100.	4110.	4120.	4130.	4140.	4150.	4200.	4210.	4220.	4230.	4240.	4250.	4300.	4310.	4320.	4330.	4340.	4350.	4400.	4410.	4420.	4430.	4440.	4450.	4500.	4510.	4520.	4530.	4540.	4550.	4600.	4610.	4620.	4630.	4640.	4650.	4700.	4710.	4720.	4730.	4740.	4750.	4800.	4810.	4820.	4830.	4840.	4850.	4900.	4910.	4920.	4930.	4940.	4950.	5000.	5010.	5020.	5030.	5040.	5050.	5100.	5110.	5120.	5130.	5140.	5150.	5200.	5210.	5220.	5230.	5240.	5250.	5300.	5310.	5320.	5330.	5340.	5350.	5400.	5410.	5420.	5430.	5440.	5450.	5500.	5510.	5520.	5530.	5540.	5550.	5600.	5610.	5620.	5630.	5640.	5650.	5700.	5710.	5720.	5730.	5740.	5750.	5800.	5810.	5820.	5830.	5840.	5850.	5900.	5910.	5920.	5930.	5940.	5950.	6000.	6010.	6020.	6030.	6040.	6050.	6100.	6110.	6120.	6130.	6140.	6150.	6200.	6210.	6220.	6230.	6240.	6250.	6300.	6310.	6320.	6330.	6340.	6350.	6400.	6410.	6420.	6430.	6440.	6450.	6500.	6510.	6520.	6530.	6540.	6550.	6600.	6610.	6620.	6630.	6640.	6650.	6700.	6710.	6720.	6730.	6740.	6750.	6800.	6810.	6820.	6830.	6840.	6850.	6900.	6910.	6920.	6930.	6940.	6950.	7000.	7010.	7020.	7030.	7040.	7050.	7100.	7110.	7120.	7130.	7140.	7150.	7200.	7210.	7220.	7230.	7240.	7250.	7300.	7310.	7320.	7330.	7340.	7350.	7400.	7410.	7420.	7430.	7440.	7450.	7500.	7510.	7520.	7530.	7540.	7550.	7600.	7610.	7620.	7630.	7640.	7650.	7700.	7710.	7720.	7730.	7740.	7750.	7800.	7810.	7820.	7830.	7840.	7850.	7900.	7910.	7920.	7930.	7940.	7950.	8000.	8010.	8020.	8030.	8040.	8050.	8100.	8110.	8120.	8130.	8140.	8150.	8200.	8210.	8220.	8230.	8240.	8250.	8300.	8310.	8320.	8330.	8340.	8350.	8400.	8410.	8420.	8430.	8440.	8450.	8500.	8510.	8520.	8530.	8540.	8550.	8600.	8610.	8620.	8630.	8640.	8650.	8700.	8710.	8720.	8730.	8740.	8750.	8800.	8810.	8820.	8830.	8840.	8850.	8900.	8910.	8920.	8930.	8940.	8950.	9000.	9010.	9020.	9030.	9040.	9050.	9100.	9110.	9120.	9130.	9140.	9150.	9200.	9210.	9220.	9230.	9240.	9250.	9300.	9310.	9320.	9330.	9340.	9350.	9400.	9410.	9420.	9430.	9440.	9450.	9500.	9510.	9520.	9530.	9540.	9550.	9600.	9610.	9620.	9630.	9640.	9650.	9700.	9710.	9720.	9730.	9740.	9750.	9800.	9810.	9820.	9830.	9840.	9850.	9900.	9910.	9920.	9930.	9940.	9950.	10000.																																																	
0	1640.0	I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I		I

940.0	'D'=TSBS	1020.
698.0	'X'=TRMS	706.0
920.0	'N'=TRBS	1000.
608.0	'4'=TCBW	624.0

[illegible]

5 PERCENT STEP CHANGE IN FEEDWATER FLOW DEMAND
BED TEMPERATURES

TIME	TEB	1870. 1475. 1480. 1544.	'O' = TCB 'X' = TRB 'e' = TSB '+' = TEB	1890. 1575. 1560. 1552.	TSB	TRB	TCB
.0	1550.0	I	I	I	I	1547.7	1541.8
44.000	1550.1	I	I	I	I	1548.6	1541.8
88.000	1550.3	I	I	I	I	1550.3	1541.8
132.000	1550.5	I	I	I	I	1551.2	1541.6
176.000	1550.8	I	I	I	I	1550.6	1541.0
220.000	1551.1	I	I	I	I	1548.8	1540.0
264.000	1551.3	I	I	I	I	1546.1	1538.4
308.000	1551.4	I	I	I	I	1542.8	1536.4
352.000	1551.5	I	I	I	I	1539.4	1533.9
396.000	1551.5	I	I	I	I	1535.9	1531.3
440.000	1551.4	I	I	I	I	1532.5	1528.4
484.000	1551.3	I	I	I	I	1529.4	1525.5
528.000	1551.2	I	I	I	I	1526.4	1522.5
572.000	1551.0	I	I	I	I	1523.8	1519.4
616.000	1550.8	I	I	I	I	1521.3	1516.8
660.000	1550.4	I	I	I	I	1519.0	1514.1
704.000	1550.4	I	I	I	I	1517.0	1511.6
748.000	1550.1	I	I	I	I	1515.1	1509.2
792.000	1549.9	I	I	I	I	1513.4	1506.9
836.000	1549.7	I	I	I	I	1511.8	1504.7
880.000	1549.5	I	I	I	I	1510.3	1502.7
924.000	1549.3	I	I	I	I	1508.9	1500.8
968.000	1549.1	I	I	I	I	1507.6	1499.1
1012.000	1548.9	I	I	I	I	1506.4	1497.4
1056.000	1548.7	I	I	I	I	1505.3	1495.9
1100.000	1548.5	I	I	I	I	1504.3	1494.4
1144.000	1548.3	I	I	I	I	1503.3	1493.1
1188.000	1548.1	I	I	I	I	1502.4	1491.8
1232.000	1548.0	I	I	I	I	1501.5	1490.6
1276.000	1547.8	I	I	I	I	1500.7	1489.5
1320.000	1547.7	I	I	I	I	1500.0	1488.4
1364.000	1547.5	I	I	I	I	1499.3	1487.5
1408.000	1547.4	I	I	I	I	1498.6	1486.5
1452.000	1547.3	I	I	I	I	1498.0	1485.7
1496.000	1547.1	I	I	I	I	1497.4	1484.9
1540.000	1547.0	I	I	I	I	1496.9	1484.1
1584.000	1546.9	I	I	I	I	1496.4	1483.4
1628.000	1546.8	I	I	I	I	1495.9	1482.7
1672.000	1546.7	I	I	I	I	1495.5	1482.1
1716.000	1546.6	I	I	I	I	1495.1	1481.5
1760.000	1546.5	I	I	I	I	1494.7	1481.0
1804.000	1546.5	I	I	I	I	1494.3	1480.5
1848.000	1546.4	I	I	I	I	1494.0	1480.0
1892.000	1546.3	I	I	I	I	1493.7	1479.5
1936.000	1546.2	I	I	I	I	1493.4	1479.1
1980.000	1546.2	I	I	I	I	1493.1	1478.7
2024.000	1546.1	I	I	I	I	1492.8	1478.3
2068.000	1546.1	I	I	I	I	1492.6	1478.0
2112.000	1546.0	I	I	I	I	1492.3	1477.7
2156.000	1546.0	I	I	I	I	1492.1	1477.3
2200.000	1545.9	I	I	I	I	1491.9	1477.1

5 PERCENT STEP CHANGE IN FEEDWATER FLOW DEMAND
FRACTION OF WATER, TWO PHASE, STEAM BOILING BED INLET TO RM OUTLET

TIME	XEBNF	6.000E-02 .5250 .3000	'X' = XEBSF 'e' = XEBMSF '+' = XEBHF	.1400 .5850 .3800	XEBMSF	XEBSF
.0	.30399	I	I	I	.57313	.12288
44.000	.32851	I	I	I	.56298	.10851
88.000	.34390	I	I	I	.55019	.10591
132.000	.35385	I	I	I	.53939	.10676
176.000	.35959	I	I	I	.53270	.10771
220.000	.36243	I	I	I	.52966	.10792
264.000	.36341	I	I	I	.52927	.10732
308.000	.36330	I	I	I	.53064	.10604
352.000	.36240	I	I	I	.53308	.10434
396.000	.36165	I	I	I	.53404	.10231
440.000	.36064	I	I	I	.53924	.10012
484.000	.35969	I	I	I	.54244	9.7854E-02
528.000	.35883	I	I	I	.54557	9.5401E-02
572.000	.35809	I	I	I	.54849	9.3423E-02
616.000	.35746	I	I	I	.55110	9.1353E-02
660.000	.35694	I	I	I	.55366	8.9404E-02
704.000	.35649	I	I	I	.55593	8.7541E-02
748.000	.35610	I	I	I	.55801	8.5884E-02
792.000	.35577	I	I	I	.55992	8.4311E-02
836.000	.35547	I	I	I	.56169	8.2844E-02
880.000	.35521	I	I	I	.56331	8.1485E-02
924.000	.35494	I	I	I	.56482	8.0218E-02
968.000	.35474	I	I	I	.56622	7.9039E-02
1012.000	.35453	I	I	I	.56758	7.7930E-02
1056.000	.35435	I	I	I	.56876	7.6894E-02
1100.000	.35417	I	I	I	.56990	7.5922E-02
1144.000	.35401	I	I	I	.57099	7.5007E-02
1188.000	.35386	I	I	I	.57200	7.4145E-02
1232.000	.35371	I	I	I	.57295	7.3339E-02
1276.000	.35358	I	I	I	.57384	7.2582E-02
1320.000	.35346	I	I	I	.57467	7.1867E-02
1364.000	.35335	I	I	I	.57546	7.1192E-02
1408.000	.35324	I	I	I	.57620	7.0562E-02
1452.000	.35314	I	I	I	.57689	6.9961E-02
1496.000	.35305	I	I	I	.57754	6.9406E-02
1540.000	.35297	I	I	I	.57814	6.8871E-02
1584.000	.35290	I	I	I	.57873	6.8372E-02
1628.000	.35282	I	I	I	.57928	6.7896E-02
1672.000	.35276	I	I	I	.57978	6.7450E-02
1716.000	.35269	I	I	I	.58026	6.7040E-02
1760.000	.35264	I	I	I	.58071	6.6657E-02
1804.000	.35258	I	I	I	.58113	6.6288E-02
1848.000	.35253	I	I	I	.58154	6.5933E-02
1892.000	.35248	I	I	I	.58190	6.5612E-02
1936.000	.35244	I	I	I	.58226	6.5298E-02
1980.000	.35240	I	I	I	.58258	6.5012E-02
2024.000	.35236	I	I	I	.58290	6.4736E-02
2068.000	.35233	I	I	I	.58319	6.4479E-02
2112.000	.35230	I	I	I	.58346	6.4247E-02
2156.000	.35227	I	I	I	.58372	6.4012E-02
2200.000	.35224	I	I	I	.58397	6.3798E-02

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1155.          '0'='WEBA
-12.00        'O'='WEBWS
-2.000       'X'='WEBN
-3.000E-04   'W'='DXEBWS
-1.500E-04   '+'='DXEBHF

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5 PERCENT STEP CHANGE IN FEEDWATER FLOW DEMAND
PRESSURES IN BOILING, SUPERHEAT AND REHEAT BEDS

98

5 PERCENT STEP CHANGE IN FEEDWATER FLOW DEMAND
HEAT FLUX

TIME	QGPBS	2.000E+05				2.400E+05			
		7.350E+04				7.950E+04			
		1.020E+05				1.140E+05			
		0' = QSBTS				0' = QPSHA			
		1' = QPSA				1' = QGPBS			
		QPSA				QPSHA			
		QSBTS							
0	1.057E+05	I	X	I	I	I	I	I	I
44.000	1.1301E+05	I							
88.000	1.1318E+05	I							
132.000	1.1151E+05	I							
176.000	1.0981E+05	I							
220.000	1.0850E+05	I							
264.000	1.0757E+05	I							
308.000	1.0696E+05	I							
352.000	1.0656E+05	I							
396.000	1.0630E+05	I							
440.000	1.0612E+05	I							
484.000	1.0598E+05	I							
528.000	1.0587E+05	I							
572.000	1.0575E+05	I							
616.000	1.0565E+05	I							
660.000	1.0553E+05	I							
704.000	1.0541E+05	I							
748.000	1.0529E+05	I							
792.000	1.0517E+05	I							
836.000	1.0505E+05	I							
880.000	1.0494E+05	I							
924.000	1.0483E+05	I							
968.000	1.0472E+05	I							
1012.000	1.0463E+05	I							
1056.000	1.0454E+05	I							
1100.000	1.0445E+05	I							
1144.000	1.0437E+05	I							
1188.000	1.0430E+05	I							
1232.000	1.0423E+05	I							
1276.000	1.0416E+05	I							
1320.000	1.0410E+05	I							
1364.000	1.0404E+05	I							
1408.000	1.0399E+05	I							
1452.000	1.0394E+05	I							
1496.000	1.0389E+05	I							
1540.000	1.0385E+05	I							
1584.000	1.0381E+05	I							
1628.000	1.0377E+05	I							
1672.000	1.0374E+05	I							
1716.000	1.0370E+05	I							
1760.000	1.0367E+05	I							
1804.000	1.0364E+05	I							
1848.000	1.0361E+05	I							
1892.000	1.0358E+05	I							
1936.000	1.0355E+05	I							
1980.000	1.0353E+05	I							
2024.000	1.0351E+05	I							
2068.000	1.0350E+05	I							
2112.000	1.0347E+05	I							
2156.000	1.0345E+05	I							
2200.000	1.0343E+05	I							

5 PERCENT STEP CHANGE IN FEEDWATER FLOW DEMAND

TIME	QSBGHR	5.024E+04				5.056E+04			
		2.000E+05				2.400E+05			
		2.100E+05				2.300E+05			
		0.550E+04				9.150E+04			
		1.240E+05				1.340E+05			
		0' = QCBEC2				0' = QSBTS			
		1' = QSBT				1' = QSBGHR			
		QSBT				QSBTS			
		QCBEC2							
0	1.2438E+05	I	X	I	I	I	I	I	I
44.000	1.2427E+05	I							
88.000	1.2723E+05	I							
132.000	1.2866E+05	I							
176.000	1.3019E+05	I							
220.000	1.3150E+05	I							
264.000	1.3247E+05	I							
308.000	1.3314E+05	I							
352.000	1.3354E+05	I							
396.000	1.3374E+05	I							
440.000	1.3383E+05	I							
484.000	1.3378E+05	I							
528.000	1.3368E+05	I							
572.000	1.3357E+05	I							
616.000	1.3346E+05	I							
660.000	1.3331E+05	I							
704.000	1.3325E+05	I							
748.000	1.3282E+05	I							
792.000	1.3266E+05	I							
836.000	1.3253E+05	I							
880.000	1.3239E+05	I							
924.000	1.3224E+05	I							
968.000	1.3204E+05	I							
1012.000	1.3183E+05	I							
1056.000	1.3162E+05	I							
1100.000	1.3142E+05	I							
1144.000	1.3123E+05	I							
1188.000	1.3105E+05	I							
1232.000	1.3156E+05	I							
1276.000	1.3149E+05	I							
1320.000	1.3142E+05	I							
1364.000	1.3135E+05	I							
1408.000	1.3127E+05	I							
1452.000	1.3120E+05	I							
1496.000	1.3118E+05	I							
1540.000	1.3113E+05	I							
1584.000	1.3108E+05	I							
1628.000	1.3104E+05	I							
1672.000	1.3100E+05	I							
1716.000	1.3096E+05	I							
1760.000	1.3093E+05	I							
1804.000	1.3091E+05	I							
1848.000	1.3086E+05	I							
1892.000	1.3085E+05	I							
1936.000	1.3081E+05	I							
1980.000	1.3083E+05	I							
2024.000	1.3078E+05	I							
2068.000	1.3074E+05	I							
2112.000	1.3066E+05	I							
2156.000	1.3064E+05	I							
2200.000	1.3067E+05	I							

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APPENDIX V-B7

STEP IN THROTTLE VALVE POSITION

This section presents the detailed results in CSMP plot format for a 5% step increase in throttle valve position.

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1.045E+05	'Q' = QGPHS	1.065E+05
7.410E+04	'O' = QPSA	7.470E+04
1100.	'X' = SPS	1116.
1100.	'H' = SSL	1140.
2600.	'P' = PPS	2760.

[illegible]

1.045E+05	'#'='QEN	1.048E+05
921.0	'O'='TPSH	927.0
1044.	'X'='TPSG	1048.
772.5	'H'='TPS	778.5
1256.	'+'='HPS	1262.

TIME	HPS						TPS	TPSG	TPSM	QEN
.0	1255.5	I	+	+	+	+	778.31	1047.9	925.98	1.0478E+05
44.000	1257.5	I	I	+	+	+	776.67	1047.4	925.50	1.0462E+05
88.000	1259.4	I	+	+	+	+	776.11	1046.9	925.09	1.0455E+05
132.00	1260.1	I	+	+	+	+	775.51	1046.6	924.71	1.0451E+05
176.00	1260.0	I	+	+	+	+	774.91	1046.2	924.33	1.0451E+05
220.00	1259.6	I	+	+	+	+	774.37	1045.9	923.93	1.0453E+05
264.00	1259.0	I	+	+	+	+	773.92	1045.6	923.53	1.0457E+05
308.00	1258.4	I	+	+	+	+	773.55	1045.3	923.15	1.0464E+05
352.00	1257.9	I	+	+	+	+	773.24	1045.1	922.80	1.0464E+05
396.00	1257.5	I	+	+	+	+	773.05	1044.9	922.50	1.0467E+05
440.00	1257.3	I	+	+	+	+	772.90	1044.7	922.24	1.0469E+05
484.00	1257.1	I	+	+	+	+	772.79	1044.6	922.02	1.0471E+05
528.00	1256.9	I	+	+	+	+	772.72	1044.4	921.85	1.0472E+05
572.00	1256.8	I	+	+	+	+	772.68	1044.3	921.72	1.0473E+05
616.00	1256.8	I	+	+	+	+	772.65	1044.3	921.62	1.0473E+05
660.00	1256.8	I	+	+	+	+	772.63	1044.2	921.54	1.0474E+05
704.00	1256.7	I	+	+	+	+	772.61	1044.2	921.48	1.0474E+05
748.00	1256.7	I	+	+	+	+	772.60	1044.2	921.44	1.0474E+05
792.00	1256.7	I	+	+	+	+	772.60	1044.1	921.40	1.0474E+05
836.00	1256.7	I	+	+	+	+	772.59	1044.1	921.38	1.0475E+05
880.00	1256.7	I	+	+	+	+	772.59	1044.1	921.36	1.0475E+05
924.00	1256.7	I	+	+	+	+	772.58	1044.1	921.35	1.0475E+05
968.00	1256.7	I	+	+	+	+	772.58	1044.1	921.34	1.0475E+05
1012.0	1256.7	I	+	+	+	+	772.58	1044.1	921.33	1.0475E+05
1056.0	1256.7	I	+	+	+	+	772.58	1044.1	921.33	1.0475E+05
1100.0	1256.7	I	+	+	+	+	772.57	1044.1	921.33	1.0475E+05
1144.0	1256.7	I	+	+	+	+	772.57	1044.1	921.33	1.0475E+05
1188.0	1256.7	I	+	+	+	+	772.57	1044.1	921.32	1.0475E+05
1232.0	1256.7	I	+	+	+	+	772.57	1044.1	921.32	1.0475E+05
1276.0	1256.7	I	+	+	+	+	772.57	1044.1	921.32	1.0475E+05
1320.0	1256.7	I	+	+	+	+	772.57	1044.1	921.32	1.0475E+05
1364.0	1256.7	I	+	+	+	+	772.57	1044.1	921.32	1.0475E+05
1408.0	1256.7	I	+	+	+	+	772.57	1044.1	921.32	1.0475E+05
1452.0	1256.7	I	+	+	+	+	772.57	1044.1	921.32	1.0475E+05
1496.0	1256.7	I	+	+	+	+	772.57	1044.1	921.32	1.0475E+05
1540.0	1256.7	I	+	+	+	+	772.56	1044.1	921.32	1.0475E+05
1584.0	1256.7	I	+	+	+	+	772.56	1044.1	921.32	1.0475E+05
1628.0	1256.7	I	+	+	+	+	772.56	1044.1	921.32	1.0475E+05
1672.0	1256.7	I	+	+	+	+	772.56	1044.1	921.32	1.0475E+05
1716.0	1256.7	I	+	+	+	+	772.56	1044.1	921.32	1.0475E+05
1760.0	1256.7	I	+	+	+	+	772.56	1044.1	921.32	1.0475E+05
1804.0	1256.7	I	+	+	+	+	772.56	1044.1	921.32	1.0475E+05
1848.0	1256.7	I	+	+	+	+	772.56	1044.1	921.32	1.0475E+05
1892.0	1256.7	I	+	+	+	+	772.56	1044.1	921.32	1.0475E+05
1936.0	1256.7	I	+	+	+	+	772.56	1044.1	921.32	1.0475E+05
1980.0	1256.7	I	+	+	+	+	772.56	1044.1	921.32	1.0475E+05
2024.0	1256.7	I	+	+	+	+	772.56	1044.1	921.32	1.0475E+05
2068.0	1256.7	I	+	+	+	+	772.56	1044.1	921.32	1.0475E+05
2112.0	1256.7	I	+	+	+	+	772.56	1044.1	921.32	1.0475E+05
2156.0	1256.7	I	+	+	+	+	772.56	1044.1	921.32	1.0475E+05
2200.0	1256.7	I	+	+	+	+	772.56	1044.1	921.32	1.0475E+05

5 PERCENT STEP CHANGE IN GOVERNOR VALVE POSITION
REHEATER STATES

		413.0		'O' = TRHM	825.0			
		672.0		'X' = TRHG	688.0			
		756.0		'M' = TRHS	772.0			
		1385.		'+' = HRHS	1395.			
TIME	HRHS					TRHS	TRHG	TRHM
.0	1387.6	I	-X-O-	I	I	760.10	675.28	816.30
44.000	1385.7	I	+XO	I	I	757.83	674.39	815.02
88.000	1386.1	I	XO	I	I	758.40	673.61	814.63
132.00	1387.3	I	XO +I	I	I	760.35	673.95	815.24
176.00	1388.8	I	XO	I	I	762.66	675.26	816.49
220.00	1390.0	I	XO	I	I	764.76	677.07	817.99
264.00	1391.0	I	XO	I	I	766.49	678.95	819.43
308.00	1391.7	I	XO	I	I	767.75	680.62	820.65
352.00	1392.2	I	XO	I	I	768.62	681.94	821.59
396.00	1392.5	I	XO	I	I	769.16	682.94	822.28
440.00	1392.7	I	XO	I	I	769.52	683.66	822.74
484.00	1392.8	I	XO	I	I	769.71	684.12	823.04
528.00	1392.8	I	XO	I	I	769.79	684.41	823.22
572.00	1392.8	I	XO	I	I	769.81	684.57	823.32
616.00	1392.8	I	XO	I	I	769.80	684.65	823.36
660.00	1392.8	I	XO	I	I	769.78	684.67	823.37
704.00	1392.8	I	XO	I	I	769.75	684.67	823.36
748.00	1392.8	I	XO	I	I	769.72	684.65	823.35
792.00	1392.8	I	XO	I	I	769.69	684.63	823.33
836.00	1392.7	I	XO	I	I	769.66	684.61	823.32
880.00	1392.7	I	XO	I	I	769.65	684.59	823.30
924.00	1392.7	I	XO	I	I	769.63	684.57	823.29
968.00	1392.7	I	XO	I	I	769.62	684.56	823.28
1012.00	1392.7	I	XO	I	I	769.60	684.54	823.27
1056.00	1392.7	I	XO	I	I	769.59	684.53	823.26
1100.00	1392.7	I	XO	I	I	769.59	684.52	823.26
1144.00	1392.7	I	XO	I	I	769.58	684.52	823.26
1188.00	1392.7	I	XO	I	I	769.58	684.52	823.25
1232.00	1392.7	I	XO	I	I	769.58	684.51	823.25
1276.00	1392.7	I	XO	I	I	769.58	684.51	823.25
1320.00	1392.7	I	XO	I	I	769.57	684.51	823.25
1364.00	1392.7	I	XO	I	I	769.57	684.51	823.25
1408.00	1392.7	I	XO	I	I	769.57	684.51	823.25
1452.00	1392.7	I	XO	I	I	769.57	684.51	823.25
1496.00	1392.7	I	XO	I	I	769.57	684.51	823.25
1540.00	1392.7	I	XO	I	I	769.57	684.51	823.25
1584.00	1392.7	I	XO	I	I	769.57	684.51	823.25
1628.00	1392.7	I	XO	I	I	769.57	684.51	823.25
1672.00	1392.7	I	XO	I	I	769.56	684.50	823.24
1716.00	1392.7	I	XO	I	I	769.56	684.50	823.24
1760.00	1392.7	I	XO	I	I	769.56	684.50	823.24
1804.00	1392.7	I	XO	I	I	769.56	684.50	823.24
1848.00	1392.7	I	XO	I	I	769.56	684.50	823.24
1892.00	1392.7	I	XO	I	I	769.56	684.50	823.24
1936.00	1392.7	I	XO	I	I	769.56	684.50	823.24
1980.00	1392.7	I	XO	I	I	769.56	684.50	823.24
2024.00	1392.7	I	XO	I	I	769.56	684.50	823.24
2068.00	1392.7	I	XO	I	I	769.56	684.50	823.24
2112.00	1392.7	I	XO	I	I	769.56	684.50	823.24
2156.00	1392.7	I	XO	I	I	769.56	684.50	823.24
2200.00	1392.7	I	XO	I	I	769.56	684.50	823.24

5 PERCENT STEP CHANGE IN GOVERNOR VALVE POSITION
ECONOMIZER STATES

		400.0		'O' = HFM	2000.			
		552.7		'X' = TECH	553.1			
		719.2		'M' = TECO	720.8			
		539.0		'+' = TEC	539.4			
TIME	TEC					TECO	TECH	HFM
.0	539.25	I	-X-O-	I	I	720.24	552.94	1103.0
44.000	539.25	I	XO	I	I	719.94	552.91	1103.0
88.000	539.16	I	XO	I	I	719.67	552.93	1103.0
132.00	539.11	I	XO	I	I	719.55	552.77	1103.0
176.00	539.09	I	XO	I	I	719.62	552.75	1103.0
220.00	539.14	I	XO	I	I	719.80	552.77	1103.0
264.00	539.14	I	XO	I	I	720.02	552.82	1103.0
308.00	539.19	I	XO	I	I	720.22	552.88	1103.0
352.00	539.23	I	XO	I	I	720.39	552.93	1103.0
396.00	539.27	I	XO	I	I	720.61	552.94	1103.0
440.00	539.29	I	XO	I	I	720.58	553.01	1103.0
484.00	539.31	I	XO	I	I	720.62	553.03	1103.0
528.00	539.32	I	XO	I	I	720.64	553.04	1103.0
572.00	539.33	I	XO	I	I	720.64	553.05	1103.0
616.00	539.33	I	XO	I	I	720.63	553.05	1103.0
660.00	539.33	I	XO	I	I	720.62	553.04	1103.0
704.00	539.33	I	XO	I	I	720.61	553.04	1103.0
748.00	539.32	I	XO	I	I	720.59	553.04	1103.0
792.00	539.32	I	XO	I	I	720.58	553.04	1103.0
836.00	539.32	I	XO	I	I	720.57	553.03	1103.0
880.00	539.32	I	XO	I	I	720.56	553.03	1103.0
924.00	539.32	I	XO	I	I	720.56	553.03	1103.0
968.00	539.31	I	XO	I	I	720.55	553.03	1103.0
1012.00	539.31	I	XO	I	I	720.55	553.03	1103.0
1056.00	539.31	I	XO	I	I	720.55	553.03	1103.0
1100.00	539.31	I	XO	I	I	720.54	553.03	1103.0
1144.00	539.31	I	XO	I	I	720.54	553.03	1103.0
1188.00	539.31	I	XO	I	I	720.54	553.03	1103.0
1232.00	539.31	I	XO	I	I	720.54	553.03	1103.0
1276.00	539.31	I	XO	I	I	720.54	553.03	1103.0
1320.00	539.31	I	XO	I	I	720.54	553.03	1103.0
1364.00	539.31	I	XO	I	I	720.54	553.03	1103.0
1408.00	539.31	I	XO	I	I	720.54	553.03	1103.0
1452.00	539.31	I	XO	I	I	720.54	553.03	1103.0
1496.00	539.31	I	XO	I	I	720.54	553.03	1103.0
1540.00	539.31	I	XO	I	I	720.54	553.03	1103.0
1584.00	539.31	I	XO	I	I	720.54	553.03	1103.0
1628.00	539.31	I	XO	I	I	720.54	553.03	1103.0
1672.00	539.31	I	XO	I	I	720.54	553.03	1103.0
1716.00	539.31	I	XO	I	I	720.54	553.03	1103.0
1760.00	539.31	I	XO	I	I	720.54	553.03	1103.0
1804.00	539.31	I	XO	I	I	720.54	553.03	1103.0
1848.00	539.31	I	XO	I	I	720.54	553.03	1103.0
1892.00	539.31	I	XO	I	I	720.54	553.03	1103.0
1936.00	539.31	I	XO	I	I	720.54	553.03	1103.0
1980.00	539.31	I	XO	I	I	720.54	553.03	1103.0
2024.00	539.31	I	XO	I	I	720.54	553.03	1103.0
2068.00	539.31	I	XO	I	I	720.54	553.03	1103.0
2112.00	539.31	I	XO	I	I	720.54	553.03	1103.0
2156.00	539.31	I	XO	I	I	720.54	553.03	1103.0
2200.00	539.31	I	XO	I	I	720.54	553.03	1103.0

5 PERCENT STEP CHANGE IN GOVERNOR VALVE POSITION
AIR HEATER STATES

	1567. 500.0 437.7 438.2 2.093E+05	'B'=GAH 'O'=AAH 'X'=TAHH '*'=TAHQ '+ '=QAHG	1567. 2500. 438.3 439.2 2.099E+05			
TIME	QAHG		TAHQ	TAHH	AAH	GAH
.0	2.0966E+05	I-----I-----O--X-I-----	638.87	438.12	1379.3	1567.5
44.000	2.0947E+05	I I + O+ X I I	638.72	438.02	1379.3	1567.5
88.000	2.0937E+05	I + *I X I I	638.48	437.87	1379.3	1567.5
132.00	2.0937E+05	I + I I I	638.30	437.76	1379.3	1567.5
176.00	2.0943E+05	I + I I I	638.25	437.73	1379.3	1567.5
220.00	2.0953E+05	I * X I I	638.32	437.77	1379.3	1567.5
264.00	2.0961E+05	I * IX I I	638.46	437.86	1379.3	1567.5
308.00	2.0967E+05	I I I I I	638.63	437.96	1379.3	1567.5
352.00	2.0972E+05	I I I I I	638.78	438.06	1379.3	1567.5
396.00	2.0975E+05	I I I I I	638.90	438.13	1379.3	1567.5
440.00	2.0975E+05	I-----I-----O--X-I-----	638.98	438.19	1379.3	1567.5
484.00	2.0976E+05	I I I I I	639.04	438.22	1379.3	1567.5
528.00	2.0976E+05	I I I I I	639.07	438.24	1379.3	1567.5
572.00	2.0975E+05	I I I I I	639.08	438.25	1379.3	1567.5
616.00	2.0975E+05	I I I I I	639.08	438.25	1379.3	1567.5
660.00	2.0976E+05	I I I I I	639.08	438.25	1379.3	1567.5
704.00	2.0976E+05	I I I I I	639.07	438.24	1379.3	1567.5
748.00	2.0973E+05	I I I I I	639.06	438.24	1379.3	1567.5
792.00	2.0973E+05	I I I I I	639.05	438.23	1379.3	1567.5
836.00	2.0972E+05	I I I I I	639.04	438.23	1379.3	1567.5
880.00	2.0972E+05	I-----I-----O--X-I-----	639.04	438.22	1379.3	1567.5
924.00	2.0972E+05	I I I I I	639.03	438.22	1379.3	1567.5
968.00	2.0972E+05	I I I I I	639.03	438.22	1379.3	1567.5
1012.00	2.0972E+05	I I I I I	639.02	438.21	1379.3	1567.5
1056.00	2.0972E+05	I I I I I	639.02	438.21	1379.3	1567.5
1100.00	2.0972E+05	I I I I I	639.02	438.21	1379.3	1567.5
1144.00	2.0972E+05	I I I I I	639.02	438.21	1379.3	1567.5
1188.00	2.0972E+05	I I I I I	639.02	438.21	1379.3	1567.5
1232.00	2.0972E+05	I I I I I	639.02	438.21	1379.3	1567.5
1276.00	2.0972E+05	I I I I I	639.02	438.21	1379.3	1567.5
1320.00	2.0972E+05	I-----I-----O--X-I-----	639.02	438.21	1379.3	1567.5
1364.00	2.0972E+05	I I I I I	639.02	438.21	1379.3	1567.5
1408.00	2.0972E+05	I I I I I	639.02	438.21	1379.3	1567.5
1452.00	2.0971E+05	I I I I I	639.02	438.21	1379.3	1567.5
1496.00	2.0971E+05	I I I I I	639.02	438.21	1379.3	1567.5
1540.00	2.0971E+05	I I I I I	639.02	438.21	1379.3	1567.5
1584.00	2.0972E+05	I I I I I	639.01	438.21	1379.3	1567.5
1628.00	2.0971E+05	I I I I I	639.01	438.21	1379.3	1567.5
1672.00	2.0971E+05	I I I I I	639.01	438.21	1379.3	1567.5
1716.00	2.0971E+05	I I I I I	639.01	438.21	1379.3	1567.5
1760.00	2.0971E+05	I-----I-----O--X-I-----	639.01	438.21	1379.3	1567.5
1804.00	2.0971E+05	I I I I I	639.01	438.21	1379.3	1567.5
1848.00	2.0971E+05	I I I I I	639.01	438.21	1379.3	1567.5
1892.00	2.0971E+05	I I I I I	639.01	438.21	1379.3	1567.5
1936.00	2.0971E+05	I I I I I	639.01	438.21	1379.3	1567.5
1980.00	2.0971E+05	I I I I I	639.01	438.21	1379.3	1567.5
2024.00	2.0971E+05	I I I I I	639.01	438.21	1379.3	1567.5
2068.00	2.0971E+05	I I I I I	639.01	438.21	1379.3	1567.5
2112.00	2.0971E+05	I I I I I	639.01	438.21	1379.3	1567.5
2156.00	2.0971E+05	I I I I I	639.01	438.21	1379.3	1567.5
2200.00	2.0971E+05	I-----I-----O--X-I-----	639.01	438.21	1379.3	1567.5

5 PERCENT STEP CHANGE IN GOVERNOR VALVE POSITION
GAS PATH STATES

	719.4 922.2 728.0 740.0 1351.	'B'=TGP2 'O'=TGP1 'X'=TGPS '*'=TGPH '+ '=TGP	720.6 924.6 736.0 748.0 1353.			
TIME	TGP		TGPH	TGPS	TGP1	TGP2
.0	1352.7	I-----I-----O--X-I-----	747.68	735.24	923.71	720.25
44.000	1351.9	I I I I I	746.79	734.21	923.11	719.91
88.000	1351.4	I O+ I + X I I	746.01	733.39	922.53	719.62
132.00	1351.0	I O+ I I X I I	745.21	732.56	922.35	719.51
176.00	1350.8	I I I I I	744.42	731.78	922.53	719.56
220.00	1350.7	I+ I I I I I	743.72	731.10	922.91	719.72
264.00	1350.6	I I X I I I	743.13	730.54	923.33	719.92
308.00	1350.6	I I X I I I	742.67	730.11	923.72	720.11
352.00	1350.6	I I X I I I	742.34	729.81	924.01	720.27
396.00	1350.7	I+ I I I I I	742.12	729.62	924.22	720.38
440.00	1350.7	I-----I-----O--X-I-----	741.98	729.49	924.43	720.45
484.00	1350.7	I+ I I I I I	741.90	729.43	924.40	720.49
528.00	1350.8	I+ I I I I I	741.84	729.39	924.43	720.50
572.00	1350.8	I+ I I I I I	741.83	729.39	924.42	720.51
616.00	1350.8	I+ I I I I I	741.85	729.39	924.41	720.50
660.00	1350.8	I+ I I I I I	741.86	729.40	924.38	720.49
704.00	1350.8	I+ I I I I I	741.86	729.40	924.35	720.48
748.00	1350.9	I+ I I I I I	741.87	729.41	924.33	720.47
792.00	1350.9	I+ I I I I I	741.88	729.42	924.31	720.46
836.00	1350.9	I+ I I I I I	741.89	729.42	924.29	720.45
880.00	1350.9	I-----I-----O--X-I-----	741.89	729.42	924.27	720.44
924.00	1350.9	I+ I I I I I	741.89	729.42	924.26	720.44
968.00	1350.9	I+ I I I I I	741.89	729.42	924.25	720.43
1012.00	1350.9	I+ I I I I I	741.89	729.42	924.24	720.43
1056.00	1350.9	I+ I I I I I	741.89	729.42	924.24	720.42
1100.00	1350.9	I+ I I I I I	741.89	729.42	924.24	720.42
1144.00	1350.9	I+ I I I I I	741.89	729.42	924.24	720.42
1188.00	1350.9	I+ I I I I I	741.89	729.42	924.23	720.42
1232.00	1350.9	I+ I I I I I	741.89	729.42	924.23	720.42
1276.00	1350.9	I+ I I I I I	741.89	729.42	924.23	720.42
1320.00	1350.9	I-----I-----O--X-I-----	741.88	729.42	924.23	720.42
1364.00	1350.9	I+ I I I I I	741.88	729.42	924.23	720.42
1408.00	1350.9	I+ I I I I I	741.88	729.41	924.22	720.41
1452.00	1350.9	I+ I I I I I	741.88	729.41	924.23	720.42
1496.00	1350.9	I+ I I I I I	741.88	729.41	924.23	720.42
1540.00	1350.9	I+ I I I I I	741.88	729.41	924.23	720.42
1584.00	1350.9	I+ I I I I I	741.88	729.41	924.23	720.42
1628.00	1350.9	I+ I I I I I	741.88	729.41	924.23	720.42
1672.00	1350.9	I+ I I I I I	741.88	729.41	924.23	720.42
1716.00	1350.9	I+ I I I I I	741.87	729.41	924.23	720.42
1760.00	1350.9	I-----I-----O--X-I-----	741.87	729.41	924.23	720.42
1804.00	1350.9	I+ I I I I I	741.87	729.41	924.23	720.42
1848.00	1350.9	I+ I I I I I	741.87	729.41	924.23	720.42
1892.00	1350.9	I+ I I I I I	741.87	729.41	924.23	720.42
1936.00	1350.9	I+ I I I I I	741.87	729.41	924.23	720.42
1980.00	1350.9	I+ I I I I I	741.87	729.41	924.23	720.42
2024.00	1350.9	I+ I I I I I	741.87	729.41	924.23	720.42
2068.00	1350.9	I+ I I I I I	741.87	729.41	924.23	720.42
2112.00	1350.9	I+ I I I I I	741.87	729.41	924.23	720.42
2156.00	1350.9	I+ I I I I I	741.87	729.41	924.23	720.42
2200.00	1350.9	I-----I-----O--X-I-----	741.87	729.41	924.23	720.42

5 PERCENT STEP CHANGE IN GOVERNOR VALVE POSITION
GAS FLOW

TIME	GSP	128.8 1481. 500.0	'O'=GCBC 'K'=GGP2 'M'=GGP1 'A'=GGP	128.8 1481. 2500. 2500.	GSP1	GSP2	GCBC
0.0	1352.6	I	I	I	I	I	I
40.000	1352.6	I	O	I	I	I	I
80.000	1352.6	I	O	I	I	I	I
120.00	1352.6	I	O	I	I	I	I
160.00	1352.6	I	O	I	I	I	I
200.00	1352.6	I	O	I	I	I	I
240.00	1352.6	I	O	I	I	I	I
280.00	1352.6	I	O	I	I	I	I
320.00	1352.6	I	O	I	I	I	I
360.00	1352.6	I	O	I	I	I	I
400.00	1352.6	I	O	I	I	I	I
440.00	1352.6	I	O	I	I	I	I
480.00	1352.6	I	O	I	I	I	I
520.00	1352.6	I	O	I	I	I	I
560.00	1352.6	I	O	I	I	I	I
600.00	1352.6	I	O	I	I	I	I
640.00	1352.6	I	O	I	I	I	I
680.00	1352.6	I	O	I	I	I	I
720.00	1352.6	I	O	I	I	I	I
760.00	1352.6	I	O	I	I	I	I
800.00	1352.6	I	O	I	I	I	I
840.00	1352.6	I	O	I	I	I	I
880.00	1352.6	I	O	I	I	I	I
920.00	1352.6	I	O	I	I	I	I
960.00	1352.6	I	O	I	I	I	I
1000.00	1352.6	I	O	I	I	I	I
1040.00	1352.6	I	O	I	I	I	I
1080.00	1352.6	I	O	I	I	I	I
1120.00	1352.6	I	O	I	I	I	I
1160.00	1352.6	I	O	I	I	I	I
1200.00	1352.6	I	O	I	I	I	I
1240.00	1352.6	I	O	I	I	I	I
1280.00	1352.6	I	O	I	I	I	I
1320.00	1352.6	I	O	I	I	I	I
1360.00	1352.6	I	O	I	I	I	I
1400.00	1352.6	I	O	I	I	I	I
1440.00	1352.6	I	O	I	I	I	I
1480.00	1352.6	I	O	I	I	I	I
1520.00	1352.6	I	O	I	I	I	I
1560.00	1352.6	I	O	I	I	I	I
1600.00	1352.6	I	O	I	I	I	I
1640.00	1352.6	I	O	I	I	I	I
1680.00	1352.6	I	O	I	I	I	I
1720.00	1352.6	I	O	I	I	I	I
1760.00	1352.6	I	O	I	I	I	I
1800.00	1352.6	I	O	I	I	I	I
1840.00	1352.6	I	O	I	I	I	I
1880.00	1352.6	I	O	I	I	I	I
1920.00	1352.6	I	O	I	I	I	I
1960.00	1352.6	I	O	I	I	I	I
2000.00	1352.6	I	O	I	I	I	I
2040.00	1352.6	I	O	I	I	I	I
2080.00	1352.6	I	O	I	I	I	I
2120.00	1352.6	I	O	I	I	I	I
2160.00	1352.6	I	O	I	I	I	I
2200.00	1352.6	I	O	I	I	I	I

5 PERCENT STEP CHANGE IN GOVERNOR VALVE POSITION
INTEGRATION TIME PATTERN

TIME	DELT	.0 .6000	'M'=PASS 'A'=DELT	2.000E+04 3.600	PASS
0.0	2.7500	I	I	I	I
40.000	2.7930	I	I	I	I
80.000	1.9660	I	I	I	I
120.00	1.7474	I	I	I	I
160.00	1.2741	I	I	I	I
200.00	1.9745	I	I	I	I
240.00	1.1174	I	I	I	I
280.00	.94191	I	I	I	I
320.00	1.1099	I	I	I	I
360.00	3.5227	I	I	I	I
400.00	1.6406	I	I	I	I
440.00	1.1072	I	I	I	I
480.00	1.0352	I	I	I	I
520.00	1.1660	I	I	I	I
560.00	2.7609	I	I	I	I
600.00	2.8110	I	I	I	I
640.00	1.0492	I	I	I	I
680.00	1.9465	I	I	I	I
720.00	1.2674	I	I	I	I
760.00	1.7219	I	I	I	I
800.00	2.1979	I	I	I	I
840.00	.83462	I	I	I	I
880.00	1.3011	I	I	I	I
920.00	1.7503	I	I	I	I
960.00	1.0710	I	I	I	I
1000.00	1.8762	I	I	I	I
1040.00	1.1394	I	I	I	I
1080.00	1.0001	I	I	I	I
1120.00	1.4980	I	I	I	I
1160.00	1.7664	I	I	I	I
1200.00	1.2838	I	I	I	I
1240.00	.92456	I	I	I	I
1280.00	1.0395	I	I	I	I
1320.00	1.3846	I	I	I	I
1360.00	.96151	I	I	I	I
1400.00	1.1445	I	I	I	I
1440.00	1.5576	I	I	I	I
1480.00	1.0702	I	I	I	I
1520.00	1.1002	I	I	I	I
1560.00	3.4327	I	I	I	I
1600.00	1.8330	I	I	I	I
1640.00	2.8689	I	I	I	I
1680.00	1.8854	I	I	I	I
1720.00	3.0090	I	I	I	I
1760.00	1.0320	I	I	I	I
1800.00	1.4462	I	I	I	I
1840.00	1.0016	I	I	I	I
1880.00	1.8563	I	I	I	I
1920.00	1.2544	I	I	I	I
1960.00	1.7944	I	I	I	I
2000.00	1.2428	I	I	I	I

5 PERCENT STEP CHANGE IN GOVERNOR VALVE POSITION

TIME	.6480		.4720		QEB	TEB	RRT
	1545.	'O'=RRT	1551.	'O'=TEB			
0	5.378E+05	'X'=QEB	5.378E+05	'X'=QEB	5.3776E+05	1550.0	.65040
44.000	1093.	'M'=HEBS	1097.	'M'=HEBS	5.3776E+05	1549.8	.66776
88.000	1.185E+08	'M'=EEBM	1.191E+08	'M'=EEBM	5.3776E+05	1549.5	.66559
132.00					5.3776E+05	1549.2	.66021
176.00					5.3776E+05	1548.7	.65554
220.00					5.3776E+05	1548.3	.65233
264.00					5.3776E+05	1548.0	.65000
308.00					5.3776E+05	1547.7	.64937
352.00					5.3776E+05	1547.4	.64888
396.00					5.3776E+05	1547.2	.64869
440.00					5.3776E+05	1547.0	.64864
484.00					5.3776E+05	1546.8	.64867
528.00					5.3776E+05	1546.7	.64871
572.00					5.3776E+05	1546.6	.64875
616.00					5.3776E+05	1546.5	.64879
660.00					5.3776E+05	1546.4	.64880
704.00					5.3776E+05	1546.3	.64881
748.00					5.3776E+05	1546.2	.64881
792.00					5.3776E+05	1546.2	.64881
836.00					5.3776E+05	1546.1	.64880
880.00					5.3776E+05	1546.1	.64879
924.00					5.3776E+05	1546.0	.64878
968.00					5.3776E+05	1546.0	.64877
1012.00					5.3776E+05	1546.0	.64876
1056.00					5.3776E+05	1545.9	.64875
1100.00					5.3776E+05	1545.9	.64875
1144.00					5.3776E+05	1545.9	.64874
1188.00					5.3776E+05	1545.9	.64874
1232.00					5.3776E+05	1545.9	.64874
1276.00					5.3776E+05	1545.8	.64873
1320.00					5.3776E+05	1545.8	.64873
1364.00					5.3776E+05	1545.8	.64872
1408.00					5.3776E+05	1545.8	.64872
1452.00					5.3776E+05	1545.8	.64872
1496.00					5.3776E+05	1545.8	.64872
1540.00					5.3776E+05	1545.8	.64872
1584.00					5.3776E+05	1545.8	.64872
1628.00					5.3776E+05	1545.8	.64872
1672.00					5.3776E+05	1545.8	.64872
1716.00					5.3776E+05	1545.8	.64871
1760.00					5.3776E+05	1545.8	.64871
1804.00					5.3776E+05	1545.8	.64871
1848.00					5.3776E+05	1545.7	.64871
1892.00					5.3776E+05	1545.7	.64871
1936.00					5.3776E+05	1545.7	.64871
1980.00					5.3776E+05	1545.7	.64871
2024.00					5.3776E+05	1545.7	.64871
2068.00					5.3776E+05	1545.7	.64871
2112.00					5.3776E+05	1545.7	.64871
2156.00					5.3776E+05	1545.7	.64871
2200.00					5.3776E+05	1545.7	.64871

5 PERCENT STEP CHANGE IN GOVERNOR VALVE POSITION

TIME	1.942E+08		1.952E+08		QSB	TSB	HSB	ESBT
	1440.	'O'=ESBT	1440.	'O'=ESBT				
0	5.378E+05	'X'=HSB	5.378E+05	'X'=HSB	5.3776E+05	1547.7	1453.9	1.9504E+08
44.000		'M'=TSB		'M'=TSB	5.3776E+05	1546.1	1453.0	1.9485E+08
88.000		'M'=QSB		'M'=QSB	5.3776E+05	1543.8	1445.5	1.9455E+08
132.00					5.3776E+05	1542.2	1449.7	1.9435E+08
176.00					5.3776E+05	1541.6	1453.1	1.9428E+08
220.00					5.3776E+05	1541.7	1455.3	1.9429E+08
264.00					5.3776E+05	1542.2	1456.4	1.9435E+08
308.00					5.3776E+05	1542.0	1456.8	1.9443E+08
352.00					5.3776E+05	1543.4	1456.8	1.9450E+08
396.00					5.3776E+05	1543.8	1456.6	1.9456E+08
440.00					5.3776E+05	1544.2	1456.3	1.9460E+08
484.00					5.3776E+05	1544.5	1456.1	1.9464E+08
528.00					5.3776E+05	1544.7	1455.9	1.9466E+08
572.00					5.3776E+05	1544.7	1455.7	1.9467E+08
616.00					5.3776E+05	1544.8	1455.6	1.9468E+08
660.00					5.3776E+05	1544.8	1455.6	1.9468E+08
704.00					5.3776E+05	1544.8	1455.5	1.9468E+08
748.00					5.3776E+05	1544.8	1455.5	1.9468E+08
792.00					5.3776E+05	1544.8	1455.4	1.9468E+08
836.00					5.3776E+05	1544.8	1455.4	1.9468E+08
880.00					5.3776E+05	1544.8	1455.4	1.9468E+08
924.00					5.3776E+05	1544.8	1455.4	1.9468E+08
968.00					5.3776E+05	1544.7	1455.4	1.9468E+08
1012.00					5.3776E+05	1544.7	1455.4	1.9467E+08
1056.00					5.3776E+05	1544.7	1455.4	1.9467E+08
1100.00					5.3776E+05	1544.7	1455.4	1.9467E+08
1144.00					5.3776E+05	1544.7	1455.4	1.9467E+08
1188.00					5.3776E+05	1544.7	1455.4	1.9467E+08
1232.00					5.3776E+05	1544.7	1455.4	1.9467E+08
1276.00					5.3776E+05	1544.7	1455.4	1.9467E+08
1320.00					5.3776E+05	1544.7	1455.4	1.9467E+08
1364.00					5.3776E+05	1544.7	1455.4	1.9467E+08
1408.00					5.3776E+05	1544.7	1455.4	1.9467E+08
1452.00					5.3776E+05	1544.7	1455.4	1.9467E+08
1496.00					5.3776E+05	1544.7	1455.4	1.9467E+08
1540.00					5.3776E+05	1544.7	1455.4	1.9467E+08
1584.00					5.3776E+05	1544.7	1455.4	1.9467E+08
1628.00					5.3776E+05	1544.7	1455.4	1.9467E+08
1672.00					5.3776E+05	1544.7	1455.4	1.9467E+08
1716.00					5.3776E+05	1544.7	1455.4	1.9467E+08
1760.00					5.3776E+05	1544.7	1455.4	1.9467E+08
1804.00					5.3776E+05	1544.7	1455.4	1.9467E+08
1848.00					5.3776E+05	1544.7	1455.4	1.9467E+08
1892.00					5.3776E+05	1544.7	1455.4	1.9467E+08
1936.00					5.3776E+05	1544.7	1455.4	1.9467E+08
1980.00					5.3776E+05	1544.7	1455.4	1.9467E+08
2024.00					5.3776E+05	1544.7	1455.4	1.9467E+08
2068.00					5.3776E+05	1544.7	1455.4	1.9467E+08
2112.00					5.3776E+05	1544.7	1455.4	1.9467E+08
2156.00					5.3776E+05	1544.7	1455.4	1.9467E+08
2200.00					5.3776E+05	1544.7	1455.4	1.9467E+08

[illegible][illegible]

5 PERCENT STEP CHANGE IN GOVERNOR VALVE POSITION
FLUIDIZED CELL BED HEIGHTS (FT)

[illegible]5 PERCENT STEP CHANGE IN GOVERNOR VALVE POSITION
FLUIDIZED BED VOID FRACTION[illegible]

5 PERCENT STEP CHANGE IN GOVERNOR VALVE POSITION
CELL EXIT GAS TEMPERATURES

		718.8 1635. 1635. 1638.	'O' = TCBG 'X' = TRBG '*' = TSBG '+' = TSBG		720.4 1641. 1641. 1641.			
TIME	TEBG					TSBG	TRBG	TCBG
.0	1640.0	I-----I-----X-----I-----I-----O-----I				1640.3	1637.3	720.14
44.000	1639.7	I-----I-----I-----I-----I-----I-----I				1639.1	1636.0	719.04
88.000	1639.4	I-----I-----I-----I-----I-----I-----I				1638.9	1635.5	719.04
132.000	1639.2	I-----I-----I-----I-----I-----I-----I				1638.9	1635.2	719.02
176.000	1639.0	I-----I-----I-----I-----I-----I-----I				1638.9	1635.0	719.00
220.000	1638.8	I-----I-----I-----I-----I-----I-----I				1638.9	1635.1	719.00
264.000	1638.6	I-----I-----I-----I-----I-----I-----I				1638.6	1635.3	719.00
308.000	1638.5	I-----I-----I-----I-----I-----I-----I				1638.6	1635.5	719.01
352.000	1638.4	I-----I-----I-----I-----I-----I-----I				1638.6	1635.9	719.03
396.000	1638.3	I-----I-----I-----I-----I-----I-----I				1638.6	1636.2	719.06
440.000	1638.2	I-----I-----I-----I-----I-----I-----I				1637.0	1636.5	719.08
484.000	1638.1	I-----I-----I-----I-----I-----I-----I				1637.1	1636.9	719.10
528.000	1638.0	I-----I-----I-----I-----I-----I-----I				1637.1	1637.1	719.12
572.000	1638.0	I-----I-----I-----I-----I-----I-----I				1637.2	1637.4	719.13
616.000	1638.0	I-----I-----I-----I-----I-----I-----I				1637.2	1637.6	719.14
660.000	1637.9	I-----I-----I-----I-----I-----I-----I				1637.2	1637.8	719.14
704.000	1637.9	I-----I-----I-----I-----I-----I-----I				1637.2	1638.0	719.15
748.000	1637.9	I-----I-----I-----I-----I-----I-----I				1637.2	1638.1	719.15
792.000	1637.8	I-----I-----I-----I-----I-----I-----I				1637.2	1638.2	719.15
836.000	1637.8	I-----I-----I-----I-----I-----I-----I				1637.2	1638.3	719.15
880.000	1637.8	I-----I-----I-----I-----I-----I-----I				1637.2	1638.4	719.16
924.000	1637.8	I-----I-----I-----I-----I-----I-----I				1637.2	1638.5	719.15
968.000	1637.8	I-----I-----I-----I-----I-----I-----I				1637.2	1638.6	719.15
1012.000	1637.7	I-----I-----I-----I-----I-----I-----I				1637.2	1638.6	719.15
1056.000	1637.7	I-----I-----I-----I-----I-----I-----I				1637.2	1638.7	719.15
1100.000	1637.7	I-----I-----I-----I-----I-----I-----I				1637.2	1638.7	719.15
1144.000	1637.7	I-----I-----I-----I-----I-----I-----I				1637.2	1638.8	719.15
1188.000	1637.7	I-----I-----I-----I-----I-----I-----I				1637.2	1638.8	719.15
1232.000	1637.7	I-----I-----I-----I-----I-----I-----I				1637.2	1638.8	719.15
1276.000	1637.7	I-----I-----I-----I-----I-----I-----I				1637.2	1638.9	719.15
1320.000	1637.7	I-----I-----I-----I-----I-----I-----I				1637.2	1638.9	719.15
1364.000	1637.7	I-----I-----I-----I-----I-----I-----I				1637.2	1638.9	719.15
1408.000	1637.7	I-----I-----I-----I-----I-----I-----I				1637.2	1638.9	719.15
1452.000	1637.7	I-----I-----I-----I-----I-----I-----I				1637.2	1638.9	719.15
1496.000	1637.7	I-----I-----I-----I-----I-----I-----I				1637.2	1638.9	719.15
1540.000	1637.7	I-----I-----I-----I-----I-----I-----I				1637.2	1638.9	719.15
1584.000	1637.6	I-----I-----I-----I-----I-----I-----I				1637.2	1639.0	719.15
1628.000	1637.6	I-----I-----I-----I-----I-----I-----I				1637.2	1639.0	719.15
1672.000	1637.6	I-----I-----I-----I-----I-----I-----I				1637.2	1639.0	719.15
1716.000	1637.6	I-----I-----I-----I-----I-----I-----I				1637.2	1639.0	719.15
1760.000	1637.6	I-----I-----I-----I-----I-----I-----I				1637.2	1639.0	719.15
1804.000	1637.6	I-----I-----I-----I-----I-----I-----I				1637.2	1639.0	719.15
1848.000	1637.6	I-----I-----I-----I-----I-----I-----I				1637.2	1639.0	719.15
1892.000	1637.6	I-----I-----I-----I-----I-----I-----I				1637.2	1639.0	719.15
1936.000	1637.6	I-----I-----I-----I-----I-----I-----I				1637.2	1639.0	719.15
1980.000	1637.6	I-----I-----I-----I-----I-----I-----I				1637.2	1639.0	719.15
2024.000	1637.6	I-----I-----I-----I-----I-----I-----I				1637.2	1639.0	719.15
2068.000	1637.6	I-----I-----I-----I-----I-----I-----I				1637.2	1639.0	719.15
2112.000	1637.6	I-----I-----I-----I-----I-----I-----I				1637.2	1639.0	719.15
2156.000	1637.6	I-----I-----I-----I-----I-----I-----I				1637.2	1639.0	719.15
2200.000	1637.6	I-----I-----I-----I-----I-----I-----I				1637.2	1639.0	719.15

5 PERCENT STEP CHANGE IN GOVERNOR VALVE POSITION
DEED STEAM FLOWS

		978.0 690.0 980.0 621.7	'O' = TSBS 'X' = TRBS '*' = TRBS '+' = TCBM		1002.0 700.0 1004. 621.9			
TIME	TRBS					TRBS	TRMS	TSBS
.0	621.82	I-----I-----I-----I-----I-----I-----I				998.85	698.24	1001.8
44.000	621.83	I-----I-----I-----I-----I-----I-----I				999.39	695.34	982.00
88.000	621.81	I-----I-----I-----I-----I-----I-----I				989.92	693.38	984.78
132.000	621.78	I-----I-----I-----I-----I-----I-----I				991.31	692.01	990.45
176.000	621.75	I-----I-----I-----I-----I-----I-----I				993.43	691.17	995.25
220.000	621.73	I-----I-----I-----I-----I-----I-----I				995.54	690.49	998.29
264.000	621.72	I-----I-----I-----I-----I-----I-----I				997.39	690.59	999.97
308.000	621.73	I-----I-----I-----I-----I-----I-----I				998.66	690.58	1000.5
352.000	621.75	I-----I-----I-----I-----I-----I-----I				999.97	690.40	1000.4
396.000	621.78	I-----I-----I-----I-----I-----I-----I				1000.9	690.43	1000.1
440.000	621.81	I-----I-----I-----I-----I-----I-----I				1001.4	690.66	999.69
484.000	621.83	I-----I-----I-----I-----I-----I-----I				1001.8	690.69	999.32
528.000	621.85	I-----I-----I-----I-----I-----I-----I				1002.7	690.70	999.01
572.000	621.87	I-----I-----I-----I-----I-----I-----I				1002.3	690.71	998.77
616.000	621.88	I-----I-----I-----I-----I-----I-----I				1002.5	690.72	998.61
660.000	621.89	I-----I-----I-----I-----I-----I-----I				1002.6	690.72	998.50
704.000	621.89	I-----I-----I-----I-----I-----I-----I				1002.7	690.72	998.42
748.000	621.89	I-----I-----I-----I-----I-----I-----I				1002.8	690.71	998.37
792.000	621.89	I-----I-----I-----I-----I-----I-----I				1002.8	690.71	998.34
836.000	621.89	I-----I-----I-----I-----I-----I-----I				1002.8	690.71	998.33
880.000	621.89	I-----I-----I-----I-----I-----I-----I				1002.9	690.71	998.32
924.000	621.89	I-----I-----I-----I-----I-----I-----I				1003.0	690.71	998.31
968.000	621.89	I-----I-----I-----I-----I-----I-----I				1003.0	690.70	998.30
1012.000	621.89	I-----I-----I-----I-----I-----I-----I				1003.1	690.70	998.29
1056.000	621.89	I-----I-----I-----I-----I-----I-----I				1003.1	690.70	998.29
1100.000	621.89	I-----I-----I-----I-----I-----I-----I				1003.1	690.70	998.29
1144.000	621.89	I-----I-----I-----I-----I-----I-----I				1003.1	690.70	998.29
1188.000	621.89	I-----I-----I-----I-----I-----I-----I				1003.2	690.70	998.28
1232.000	621.89	I-----I-----I-----I-----I-----I-----I				1003.2	690.70	998.28
1276.000	621.89	I-----I-----I-----I-----I-----I-----I				1003.2	690.70	998.28
1320.000	621.89	I-----I-----I-----I-----I-----I-----I				1003.2	690.70	998.28
1364.000	621.89	I-----I-----I-----I-----I-----I-----I				1003.2	690.70	998.28
1408.000	621.89	I-----I-----I-----I-----I-----I-----I				1003.2	690.70	998.27
1452.000	621.89	I-----I-----I-----I-----I-----I-----I				1003.2	690.70	998.27
1496.000	621.89	I-----I-----I-----I-----I-----I-----I				1003.3	690.70	998.27
1540.000	621.89	I-----I-----I-----I-----I-----I-----I				1003.3	690.70	998.27
1584.000	621.89	I-----I-----I-----I-----I-----I-----I				1003.3	690.70	998.26
1628.000	621.89	I-----I-----I-----I-----I-----I-----I				1003.3	690.70	998.26
1672.000	621.89	I-----I-----I-----I-----I-----I-----I				1003.3	690.70	998.26
1716.000	621.89	I-----I-----I-----I-----I-----I-----I				1003.3	690.70	998.26
1760.000	621.89	I-----I-----I-----I-----I-----I-----I				1003.3	690.70	998.26
1804.000	621.89	I-----I-----I-----I-----I-----I-----I				1003.3	690.70	998.26
1848.000	621.89	I-----I-----I-----I-----I-----I-----I				1003.3	690.70	998.26
1892.000	621.89	I-----I-----I-----I-----I-----I-----I				1003.2	690.70	998.26
1936.000	621.89	I-----I-----I-----I-----I-----I-----I				1003.3	690.70	998.26
1980.000	621.89	I-----I-----I-----I-----I-----I-----I				1003.3	690.70	998.26
2024.000	621.89	I-----I-----I-----I-----I-----I-----I				1003.3	690.70	998.26
2068.000	621.89	I-----I-----I-----I-----I-----I-----I				1003.3	690.70	998.26
2112.000	621.89	I-----I-----I-----I-----I-----I-----I				1003.3	690.70	998.26
2156.000	621.89	I-----I-----I-----I-----I-----I-----I				1003.3	690.70	998.26
2200.000	621.89	I-----I-----I-----I-----I-----I-----I				1003.3	690.70	998.26

5 PERCENT STEP CHANGE IN GOVERNOR VALVE POSITION
BED TEMPERATURES

TIME	TEB	TSB	TRB	TCB
0	1550.0	1547.7	1541.0	1085.9
44.000	1549.8	1546.1	1541.4	1085.9
88.000	1549.5	1543.8	1540.6	1085.8
132.000	1549.2	1542.2	1540.0	1085.7
176.000	1548.7	1541.6	1539.7	1085.7
220.000	1548.3	1541.7	1539.9	1085.6
264.000	1548.0	1542.2	1540.3	1085.6
308.000	1547.7	1542.8	1541.0	1085.5
352.000	1547.4	1543.4	1541.7	1085.5
396.000	1547.2	1543.8	1542.5	1085.5
440.000	1547.0	1544.2	1543.3	1085.5
484.000	1546.8	1544.5	1544.0	1085.5
528.000	1546.7	1544.6	1544.4	1085.5
572.000	1546.6	1544.7	1545.2	1085.5
616.000	1546.5	1544.8	1545.7	1085.5
660.000	1546.4	1544.8	1546.1	1085.5
704.000	1546.3	1544.8	1546.5	1085.5
748.000	1546.2	1544.8	1546.9	1085.5
792.000	1546.2	1544.8	1547.1	1085.5
836.000	1546.1	1544.8	1547.4	1085.5
880.000	1546.1	1544.8	1547.6	1085.5
924.000	1546.0	1544.8	1547.8	1085.5
968.000	1546.0	1544.8	1547.9	1085.5
1012.000	1546.0	1544.7	1548.1	1085.5
1056.000	1545.9	1544.7	1548.2	1085.5
1100.000	1545.9	1544.7	1548.3	1085.5
1144.000	1545.9	1544.7	1548.4	1085.5
1188.000	1545.9	1544.7	1548.4	1085.5
1232.000	1545.9	1544.7	1548.5	1085.5
1276.000	1545.8	1544.7	1548.6	1085.5
1320.000	1545.8	1544.7	1548.6	1085.5
1364.000	1545.8	1544.7	1548.6	1085.5
1408.000	1545.8	1544.7	1548.7	1085.5
1452.000	1545.8	1544.7	1548.7	1085.5
1496.000	1545.8	1544.7	1548.7	1085.5
1540.000	1545.8	1544.7	1548.8	1085.5
1584.000	1545.8	1544.7	1548.8	1085.5
1628.000	1545.8	1544.7	1548.8	1085.5
1672.000	1545.8	1544.7	1548.8	1085.5
1716.000	1545.8	1544.7	1548.8	1085.5
1760.000	1545.8	1544.7	1548.8	1085.5
1804.000	1545.7	1544.7	1548.9	1085.5
1848.000	1545.7	1544.7	1548.9	1085.5
1892.000	1545.7	1544.7	1548.9	1085.5
1936.000	1545.7	1544.7	1548.9	1085.5
1980.000	1545.7	1544.7	1548.9	1085.5
2024.000	1545.7	1544.7	1548.9	1085.5
2068.000	1545.7	1544.7	1548.9	1085.5
2112.000	1545.7	1544.7	1548.9	1085.5
2156.000	1545.7	1544.7	1548.9	1085.5
2200.000	1545.7	1544.7	1548.9	1085.5

5 PERCENT STEP CHANGE IN GOVERNOR VALVE POSITION
FRACTION OF WATER, TWO PHASE, STEAM BOILING BED INLET TO RM OUTLET

TIME	XEBHSF	XEBHSF	XEBHSF	XEBHSF
0	.30399	.57313	.12288	.11061
44.000	.28720	.40219	.9988E-02	.92378E-02
88.000	.27655	.42346	.86041E-02	.56955E-02
132.000	.27053	.43709	.44416	.44747
176.000	.26780	.44416	.44747	.44747
220.000	.26684	.44747	.44747	.44747
264.000	.26681	.44747	.44747	.44747
308.000	.26701	.44747	.44747	.44747
352.000	.26725	.44747	.44747	.44747
396.000	.26746	.44747	.44747	.44747
440.000	.26761	.44747	.44747	.44747
484.000	.26769	.44747	.44747	.44747
528.000	.26772	.44747	.44747	.44747
572.000	.26773	.44747	.44747	.44747
616.000	.26772	.44747	.44747	.44747
660.000	.26770	.44747	.44747	.44747
704.000	.26768	.44747	.44747	.44747
748.000	.26764	.44747	.44747	.44747
792.000	.26764	.44747	.44747	.44747
836.000	.26763	.44747	.44747	.44747
880.000	.26761	.44747	.44747	.44747
924.000	.26761	.44747	.44747	.44747
968.000	.26760	.44747	.44747	.44747
1012.000	.26759	.44747	.44747	.44747
1056.000	.26759	.44747	.44747	.44747
1100.000	.26759	.44747	.44747	.44747
1144.000	.26759	.44747	.44747	.44747
1188.000	.26759	.44747	.44747	.44747
1232.000	.26759	.44747	.44747	.44747
1276.000	.26759	.44747	.44747	.44747
1320.000	.26759	.44747	.44747	.44747
1364.000	.26759	.44747	.44747	.44747
1408.000	.26759	.44747	.44747	.44747
1452.000	.26759	.44747	.44747	.44747
1496.000	.26759	.44747	.44747	.44747
1540.000	.26759	.44747	.44747	.44747
1584.000	.26759	.44747	.44747	.44747
1628.000	.26759	.44747	.44747	.44747
1672.000	.26759	.44747	.44747	.44747
1716.000	.26759	.44747	.44747	.44747
1760.000	.26759	.44747	.44747	.44747
1804.000	.26759	.44747	.44747	.44747
1848.000	.26759	.44747	.44747	.44747
1892.000	.26759	.44747	.44747	.44747
1936.000	.26759	.44747	.44747	.44747
1980.000	.26759	.44747	.44747	.44747
2024.000	.26759	.44747	.44747	.44747
2068.000	.26759	.44747	.44747	.44747
2112.000	.26759	.44747	.44747	.44747
2156.000	.26759	.44747	.44747	.44747
2200.000	.26759	.44747	.44747	.44747

5 PERCENT STEP CHANGE IN GOVERNOR VALVE POSITION
NET WATER AND TWO PHASE FLOW INVENTORIES

	1085	'0'=-MEBA	1105.			
	-8.000	'0'=-MEBMS	24.00			
	-4.500	'X'=-MEBH	1.500			
	-2.000E-04	'M'=-DXEBMS	6.000E-04			
	-4.500E-04	'+'=-DXEBMF	1.500E-04			
TIME	DXEBMF		DXEBMS	MEBH	MEBMS	MEBA
.0	-0	I	-0	-0	.0	1103.0
44.000	-3.0800E-04	I X	5.8055E-04	-3.9170	20.844	1086.1
80.000	-1.6344E-07	I	3.9107E-04	-2.3329	14.041	1091.3
132.000	-9.8109E-05	I	2.4139E-04	-1.2474	8.6550	1095.4
176.000	-3.4533E-05	I	1.0127E-04	-.43913	3.6359	1099.8
220.000	-1.0550E-05	I	5.0843E-05	-.13415	1.8255	1101.3
264.000	2.6822E-04	I	1.8060E-05	3.4107E-02	.64843	1102.3
308.000	5.2452E-06	I	4.2319E-06	6.6698E-02	.15194	1102.8
352.000	6.1393E-04	I	-3.3379E-06	7.8067E-02	-.11994	1103.0
396.000	4.5188E-06	I	-3.7551E-04	5.7461E-02	-.13482	1103.1
440.000	2.1458E-04	I	-1.4305E-06	2.7286E-02	-5.1361E-02	1103.0
484.000	5.9405E-08	I	-1.9678E-06	7.5793E-04	-7.0621E-02	1103.1
528.000	-1.1325E-04	I	2.9005E-07	-1.4401E-02	1.8700E-02	1103.0
572.000	-1.1921E-07	I	-1.7681E-06	-1.1559E-03	-.2001E-02	1103.0
616.000	3.5743E-07	I	3.0994E-06	4.5476E-03	-.11128	1103.1
660.000	-6.5565E-07	I	2.3842E-07	-8.3373E-03	8.5602E-03	1103.0
704.000	-1.2517E-06	I	2.1458E-06	-1.5917E-02	7.7042E-02	1102.9
748.000	-4.1723E-07	I	7.1526E-07	-5.3055E-03	2.5681E-02	1103.0
792.000	-5.9605E-08	I	4.1723E-07	-7.5793E-04	1.4980E-02	1103.0
836.000	2.9802E-07	I	-1.3131E-06	3.7897E-03	-4.7801E-02	1103.0
880.000	-2.6822E-07	I	8.3447E-07	-3.4107E-03	2.9961E-02	1103.0
924.000	-5.9605E-08	I	7.7486E-07	-7.5793E-04	2.7821E-02	1103.0
968.000	-5.3644E-07	I	1.7881E-07	-6.8214E-03	6.4201E-03	1103.0
1012.000	4.1723E-07	I	-7.7486E-07	5.3055E-03	-2.7821E-02	1103.0
1056.000	5.9605E-08	I	-1.4231E-07	7.5793E-04	-2.6001E-03	1103.0
1100.000	-1.1921E-07	I	3.5743E-07	-1.5159E-03	-1.2840E-02	1103.0
1144.000	.0	I	1.1921E-07	.0	4.2801E-03	1103.0
1188.000	1.1921E-07	I	-2.3042E-07	1.5159E-03	-8.5602E-03	1103.0
1232.000	1.5644E-07	I	-5.9605E-08	1.9896E-03	-2.1400E-03	1103.0
1276.000	-3.5763E-07	I	1.1921E-06	-4.5476E-03	4.2401E-02	1103.0
1320.000	-2.3842E-07	I	8.3447E-07	-3.0317E-03	2.9961E-02	1103.0
1364.000	-5.9405E-08	I	2.9802E-07	-7.5793E-04	1.0700E-02	1103.0
1408.000	-1.1921E-07	I	-1.1921E-07	-1.5159E-03	-4.2801E-03	1103.0
1452.000	-1.7881E-07	I	.0	-2.2730E-03	.0	1103.0
1496.000	1.1921E-07	I	-5.9605E-08	-1.5159E-03	-2.1400E-03	1103.0
1540.000	1.1921E-07	I	.0	1.5159E-03	.0	1103.0
1584.000	.0	I	-1.7881E-07	.0	-6.4201E-03	1103.0
1628.000	-5.3644E-07	I	1.3709E-06	-6.8214E-03	4.9221E-02	1103.0
1672.000	-2.9802E-07	I	-1.7881E-07	-3.7897E-03	-6.4201E-03	1103.0
1716.000	1.0058E-07	I	1.7881E-07	1.2790E-03	6.4201E-03	1103.0
1760.000	1.1921E-07	I	-1.7881E-07	1.5159E-03	-6.4201E-03	1103.0
1804.000	1.1921E-07	I	-1.7881E-07	1.5159E-03	-6.4201E-03	1103.0
1848.000	5.9405E-08	I	.0	7.5793E-04	.0	1103.0
1892.000	9.6858E-08	I	-1.7881E-07	1.2316E-03	-6.4201E-03	1103.0
1936.000	-1.1921E-07	I	5.9605E-08	-1.5159E-03	2.1400E-03	1103.0
1980.000	1.5270E-07	I	-1.1921E-07	-1.2316E-03	-2.1400E-03	1103.0
2024.000	-1.1921E-07	I	5.9605E-08	-1.5159E-03	1.2840E-02	1103.0
2068.000	-1.1921E-07	I	-2.9802E-07	-1.5159E-03	-1.0700E-02	1103.0
2112.000	.0	I	.0	.0	.0	1103.0
2156.000	-1.1921E-07	I	-1.7881E-07	-1.5159E-03	-6.4201E-03	1103.0
2200.000	-5.9405E-08	I	-1.7881E-07	-7.5793E-04	-6.4201E-03	1103.0

5 PERCENT STEP CHANGE IN GOVERNOR VALVE POSITION
PRESSURES IN BOILING, SUPERHEAT AND REHEAT BEDS

	568.0 2600. 2760.	'X' = PRH 'M' = PPS '*' = PRH	304.0 2740. 2920.		
TIME	PRM			PPS	PRH
.0	2894.0	I	I	I	2735.8
44.000	2851.9	I	I	I	2686.5
88.000	2822.6	I	I	I	2656.6
132.00	2805.0	I	I	I	2638.7
176.00	2795.6	I	I	I	2629.2
220.00	2784.1	I	I	I	2624.0
264.00	2769.0	I	I	I	2623.6
308.00	2769.6	I	I	I	2625.0
352.00	2769.9	I	I	I	2625.4
396.00	2790.3	I	I	I	2625.7
440.00	2790.7	I	I	I	2625.4
484.00	2791.0	I	I	I	2625.0
528.00	2791.3	I	I	I	2625.9
572.00	2791.4	I	I	I	2625.9
616.00	2791.4	I	I	I	2625.9
660.00	2791.4	I	I	I	2625.8
704.00	2791.4	I	I	I	2625.8
748.00	2791.4	I	I	I	2625.8
792.00	2791.4	I	I	I	2625.7
836.00	2791.4	I	I	I	2625.7
880.00	2791.3	I	I	I	2625.7
924.00	2791.3	I	I	I	2625.7
968.00	2791.2	I	I	I	2625.6
1012.00	2791.2	I	I	I	2625.6
1056.00	2791.2	I	I	I	2625.6
1100.00	2791.2	I	I	I	2625.6
1144.00	2791.2	I	I	I	2625.6
1188.00	2791.2	I	I	I	2625.6
1232.00	2791.2	I	I	I	2625.6
1276.00	2791.2	I	I	I	2625.6
1320.00	2791.2	I	I	I	2625.6
1364.00	2791.2	I	I	I	2625.6
1408.00	2791.2	I	I	I	2625.6
1452.00	2791.2	I	I	I	2625.6
1496.00	2791.2	I	I	I	2625.6
1540.00	2791.2	I	I	I	2625.6
1584.00	2791.2	I	I	I	2625.6
1628.00	2791.2	I	I	I	2625.6
1672.00	2791.2	I	I	I	2625.6
1716.00	2791.2	I	I	I	2625.6
1760.00	2791.2	I	I	I	2625.6
1804.00	2791.2	I	I	I	2625.6
1848.00	2791.2	I	I	I	2625.6
1892.00	2791.2	I	I	I	2625.6
1936.00	2791.2	I	I	I	2625.6
1980.00	2791.2	I	I	I	2625.6
2024.00	2791.2	I	I	I	2625.6
2068.00	2791.2	I	I	I	2625.6
2112.00	2791.2	I	I	I	2625.6
2156.00	2791.2	I	I	I	2625.6
2200.00	2791.2	I	I	I	2625.6

5 PERCENT STEP CHANGE IN GOVERNOR VALVE POSITION
HEAT FLUX

	2.150E+05	7.410E+04	7.410E+04	1.045E+05	'O'=QSBTS	'X'=QPSMA	'M'=QPSA	'+'=QGPHS	2.350E+05	7.530E+04	7.470E+04	1.065E+05	QPSA	QPSMA	QSBTS	
TIME	QGPMS															
.0	1.0457E+05	I	-	X	-	O	-	I	-	-	-	-	I	74196.	74237.	2.1875E+05
44.000	1.0466E+05	I											I	74191.	75133.	2.3215E+05
88.000	1.0635E+05	I											I	74130.	74954.	2.2197E+05
132.00	1.0636E+05	I											I	74130.	74942.	2.1750E+05
176.00	1.0623E+05	I											I	74155.	75000.	2.1604E+05
220.00	1.0599E+05	I											I	74202.	75057.	2.1603E+05
264.00	1.0574E+05	I											I	74263.	75107.	2.1650E+05
308.00	1.0549E+05	I											I	74329.	75114.	2.1722E+05
352.00	1.0525E+05	I											I	74394.	75093.	2.1764E+05
396.00	1.0506E+05	I											I	74454.	75053.	2.1832E+05
440.00	1.0492E+05	I											I	74504.	75003.	2.1866E+05
484.00	1.0483E+05	I											I	74547.	74951.	2.1890E+05
528.00	1.0476E+05	I											I	74582.	74900.	2.1904E+05
572.00	1.0473E+05	I											I	74610.	74854.	2.1913E+05
616.00	1.0471E+05	I											I	74631.	74815.	2.1917E+05
660.00	1.0470E+05	I											I	74647.	74788.	2.1919E+05
704.00	1.0470E+05	I											I	74649.	74759.	2.1920E+05
748.00	1.0471E+05	I											I	74649.	74740.	2.1921E+05
792.00	1.0472E+05	I											I	74677.	74725.	2.1920E+05
836.00	1.0472E+05	I											I	74682.	74715.	2.1920E+05
880.00	1.0472E+05	I											I	74685.	74706.	2.1919E+05
924.00	1.0473E+05	I											I	74689.	74704.	2.1919E+05
968.00	1.0473E+05	I											I	74691.	74699.	2.1918E+05
1012.00	1.0473E+05	I											I	74693.	74695.	2.1919E+05
1056.00	1.0474E+05	I											I	74694.	74695.	2.1919E+05
1100.00	1.0474E+05	I											I	74694.	74696.	2.1919E+05
1144.00	1.0474E+05	I											I	74694.	74696.	2.1918E+05
1188.00	1.0475E+05	I											I	74695.	74695.	2.1918E+05
1232.00	1.0475E+05	I											I	74695.	74695.	2.1918E+05
1276.00	1.0475E+05	I											I	74695.	74696.	2.1917E+05
1320.00	1.0475E+05	I											I	74695.	74696.	2.1918E+05
1364.00	1.0475E+05	I											I	74696.	74697.	2.1918E+05
1408.00	1.0475E+05	I											I	74695.	74697.	2.1918E+05
1452.00	1.0475E+05	I											I	74696.	74697.	2.1917E+05
1496.00	1.0475E+05	I											I	74696.	74697.	2.1917E+05
1540.00	1.0475E+05	I											I	74696.	74698.	2.1918E+05
1584.00	1.0475E+05	I											I	74696.	74697.	2.1918E+05
1628.00	1.0475E+05	I											I	74697.	74697.	2.1918E+05
1672.00	1.0475E+05	I											I	74697.	74698.	2.1918E+05
1716.00	1.0475E+05	I											I	74697.	74698.	2.1918E+05
1760.00	1.0475E+05	I											I	74697.	74698.	2.1917E+05
1804.00	1.0475E+05	I											I	74697.	74697.	2.1918E+05
1848.00	1.0475E+05	I											I	74697.	74698.	2.1918E+05
1892.00	1.0475E+05	I											I	74697.	74698.	2.1918E+05
1936.00	1.0475E+05	I											I	74697.	74698.	2.1918E+05
1980.00	1.0475E+05	I											I	74697.	74698.	2.1918E+05
2024.00	1.0475E+05	I											I	74697.	74698.	2.1918E+05
2068.00	1.0475E+05	I											I	74697.	74698.	2.1918E+05
2112.00	1.0475E+05	I											I	74697.	74698.	2.1918E+05
2156.00	1.0475E+05	I											I	74697.	74698.	2.1918E+05
2200.00	1.0475E+05	I											I	74697.	74698.	2.1918E+05

5 PERCENT STEP CHANGE IN GOVERNOR VALVE POSITION

	5.026E+04	2.150E+05	2.175E+05	6.980E+04	1.240E+05	'B'=QCBEC2	'O'=QSBTS	'X'=QSBT	'M'=QSBGMR	'+'=QSBTS	5.034E+04	2.350E+05	2.275E+05	9.060E+04	1.320E+05	QSBGMR	QSBT	QSBTS	QCBEC2	
TIME	QSBTS																			
.0	1.3141E+05	I	-	X	-	O	-	I	-	-	-	-	-	-	-	I	90511.	2.1878E+05	2.1875E+05	50330.
44.000	1.2945E+05	I														I	90163.	2.2090E+05	2.3215E+05	50287.
88.000	1.2739E+05	I														I	89987.	2.2518E+05	2.2197E+05	50286.
132.000	1.2594E+05	I														I	89869.	2.2242E+05	2.1750E+05	50285.
176.000	1.2503E+05	I														I	89826.	2.2001E+05	2.1604E+05	50284.
220.000	1.2462E+05	I														I	89839.	2.1853E+05	2.1603E+05	50284.
264.000	1.2449E+05	I														I	89879.	2.1781E+05	2.1650E+05	50283.
308.000	1.2451E+05	I														I	89928.	2.1766E+05	2.1722E+05	50281.
352.000	1.2462E+05	I														I	89975.	2.1782E+05	2.1784E+05	50279.
396.000	1.2458E+05	I														I	90014.	2.1809E+05	2.1832E+05	50278.
440.000	1.2491E+05	I														I	90043.	2.1837E+05	2.1866E+05	50276.
484.000	1.2506E+05	I														I	90064.	2.1862E+05	2.1890E+05	50275.
528.000	1.2519E+05	I														I	90077.	2.1881E+05	2.1904E+05	50274.
572.000	1.2520E+05	I														I	90086.	2.1895E+05	2.1913E+05	50273.
616.000	1.2520E+05	I														I	90090.	2.1905E+05	2.1917E+05	50273.
660.000	1.2543E+05	I														I	90093.	2.1911E+05	2.1919E+05	50272.
704.000	1.2556E+05	I														I	90093.	2.1915E+05	2.1920E+05	50272.
748.000	1.2561E+05	I														I	90093.	2.1917E+05	2.1921E+05	50272.
792.000	1.2567E+05	I														I	90093.	2.1918E+05	2.1920E+05	50272.
836.000	1.2571E+05	I														I	90092.	2.1919E+05	2.1920E+05	50272.
880.000	1.2583E+05	I														I	90091.	2.1919E+05	2.1919E+05	50272.
924.000	1.2579E+05	I														I	90090.	2.1919E+05	2.1919E+05	50272.
968.000	1.2581E+05	I														I	90089.	2.1919E+05	2.1918E+05	50272.
1012.000	1.2584E+05	I														I	90088.	2.1919E+05	2.1919E+05	50272.
1056.000	1.2586E+05	I														I	90088.	2.1919E+05	2.1919E+05	50272.
1100.000	1.2591E+05	I														I	90087.	2.1919E+05	2.1919E+05	50272.
1144.000	1.2589E+05	I														I	90087.	2.1918E+05	2.1918E+05	50272.
1188.000	1.2590E+05	I														I	90086.	2.1918E+05	2.1918E+05	50272.
1232.000	1.2593E+05	I														I	90086.	2.1918E+05	2.1918E+05	50272.
1276.000	1.2592E+05	I														I	90085.	2.1918E+05	2.1917E+05	50272.
1320.000	1.2593E+05	I														I	90085.	2.1918E+05	2.1918E+05	50272.
1364.000	1.2593E+05	I														I	90084.	2.1918E+05	2.1918E+05	50272.
1408.000	1.2594E+05	I														I	90084.	2.1918E+05	2.1918E+05	50272.
1452.000	1.2594E+05	I														I	90084.	2.1918E+05	2.1917E+05	50272.
1496.000	1.2593E+05	I														I	90084.	2.1918E+05	2.1917E+05	50272.
1540.000	1.2595E+05	I														I	90084.	2.1918E+05	2.1918E+05	50272.
1584.000	1.2596E+05	I														I	90083.	2.1918E+05	2.1918E+05	50272.
1628.000	1.2596E+05	I														I	90083.	2.1918E+05	2.1918E+05	50272.
1672.000	1.2596E+05	I														I	90083.	2.1918E+05	2.1918E+05	50272.
1716.000	1.2591E+05	I														I	90083.	2.1918E+05	2.1918E+05	50272.
1760.000	1.2597E+05	I														I	90083.	2.1918E+05	2.1917E+05	50272.
1804.000	1.2592E+05	I														I	90083.	2.1918E+05	2.1918E+05	50272.
1848.000	1.2597E+05	I														I	90083.	2.1918E+05	2.1918E+05	50272.
1892.000	1.2611E+05	I														I	90083.	2.1918E+05	2.1918E+05	50272.
1936.000	1.2597E+05	I														I	90083.	2.1918E+05	2.1918E+05	50272.
1980.000	1.2601E+05	I														I	90083.	2.1918E+05	2.1918E+05	50272.
2024.000	1.2597E+05	I														I	90083.	2.1918E+05	2.1918E+05	50272.
2068.000	1.2597E+05	I														I	90083.	2.1918E+05	2.1918E+05	50272.
2112.000	1.2597E+05	I														I	90083.	2.1918E+05	2.1918E+05	50272.
2156.000	1.2598E+05	I														I	90083.	2.1918E+05	2.1918E+05	50272.
2200.000	1.2598E+05	I														I	90083.	2.1918E+05	2.1918E+05	50272.

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APPENDIX V-B8

STEP IN UNIT LOAD

This section presents the detailed results in CSMP plot format for a 5% step change in unit load.

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5 PERCENT STEP CHANGE IN UNIT LOAD
CALCOMP PLOT VARIABLES

TIME	PGVN	-10.00				10.00			
		O=MGN				*O*=TRTO			
		-10.00				10.00			
		X=PHPISS				*X*=TGV			
		-10.00				10.00			
		O=PGVN							
						TGV	PHPISS	TRTO	MGN
.0	1.6120E-03	I	I	I	I	-1.2517E-04	6.9442	-2.9802E-05	1.2029
44.000	-1.4742	I	I	I	I	-6.4479	5.7817	-6.6479	1.5785
88.000	-1.8268	I	I	I	I	-7.0748	5.6845	-7.7871	1.6473
132.00	-1.4843	I	I	I	I	-8.9390	5.8691	-7.9943	1.8091
176.00	-1.4819	I	I	I	I	-1.2548	6.1433	-8.4223	2.0285
220.00	-1.3173	I	I	I	I	-1.6990	6.3905	-9.6142	2.2098
264.00	-1.2168	I	I	I	I	-2.1357	6.5659	-1.1328	2.3109
308.00	-1.1736	I	I	I	I	-2.5035	6.6645	-1.3211	2.3354
352.00	-1.1698	I	I	I	I	-2.7781	6.7017	-1.5029	2.3016
396.00	-1.1879	I	I	I	I	-2.9583	6.6997	-1.6564	2.2390
440.00	-1.2130	I	I	I	I	-3.0550	6.6773	-1.7736	2.1696
484.00	-1.2355	I	I	I	I	-3.0848	6.6482	-1.8570	2.1042
528.00	-1.2501	I	I	I	I	-3.0647	6.6247	-1.8941	2.0671
572.00	-1.2580	I	I	I	I	-3.0090	6.6086	-1.9041	2.0480
616.00	-1.2475	I	I	I	I	-2.9300	6.6024	-1.8897	2.0497
660.00	-1.2313	I	I	I	I	-2.8371	6.6070	-1.8552	2.0719
704.00	-1.2075	I	I	I	I	-2.7366	6.6199	-1.8061	2.1100
748.00	-1.1779	I	I	I	I	-2.6332	6.6407	-1.7468	2.1613
792.00	-1.1441	I	I	I	I	-2.5296	6.6666	-1.6817	2.2209
836.00	-1.1076	I	I	I	I	-2.4279	6.6968	-1.6102	2.2892
880.00	-1.0697	I	I	I	I	-2.3291	6.7295	-1.5372	2.3607
924.00	-1.0318	I	I	I	I	-2.2341	6.7632	-1.4634	2.4343
968.00	-99378	I	I	I	I	-2.1420	6.7975	-1.3894	2.5087
1012.00	-95606	I	I	I	I	-2.0539	6.8322	-1.3159	2.5835
1056.00	-91957	I	I	I	I	-1.9696	6.8664	-1.2437	2.6572
1100.00	-88438	I	I	I	I	-1.8890	6.8996	-1.1730	2.7294
1144.00	-85003	I	I	I	I	-1.8117	6.9322	-1.1039	2.8003
1188.00	-81781	I	I	I	I	-1.7380	6.9634	-1.0364	2.8690
1232.00	-78582	I	I	I	I	-1.6675	6.9939	-97144	2.9355
1276.00	-75564	I	I	I	I	-1.6004	7.0230	-90824	2.9998
1320.00	-72685	I	I	I	I	-1.5366	7.0513	-84743	3.0620
1364.00	-69915	I	I	I	I	-1.4759	7.0782	-78861	3.1218
1408.00	-67290	I	I	I	I	-1.4175	7.1039	-73197	3.1794
1452.00	-64776	I	I	I	I	-1.3621	7.1290	-67670	3.2354
1496.00	-62383	I	I	I	I	-1.3096	7.1523	-62554	3.2874
1540.00	-60118	I	I	I	I	-1.2598	7.1749	-57538	3.3381
1584.00	-57960	I	I	I	I	-1.2124	7.1962	-52740	3.3865
1628.00	-55906	I	I	I	I	-1.1673	7.2168	-48141	3.4328
1672.00	-53942	I	I	I	I	-1.1245	7.2366	-43680	3.4779
1716.00	-52066	I	I	I	I	-1.0841	7.2551	-39582	3.5193
1760.00	-50281	I	I	I	I	-1.0459	7.2742	-35167	3.5642
1804.00	-48604	I	I	I	I	-1.0093	7.2908	-31599	3.6002
1848.00	-47006	I	I	I	I	-97486	7.3059	-28210	3.6343
1892.00	-45495	I	I	I	I	-94206	7.3214	-24688	3.6698
1936.00	-44048	I	I	I	I	-91110	7.3360	-21372	3.7033
1980.00	-42678	I	I	I	I	-88185	7.3499	-18251	3.7348
2024.00	-41373	I	I	I	I	-85427	7.3634	-15218	3.7654
2068.00	-40153	I	I	I	I	-82772	7.3756	-12432	3.7934
2112.00	-39000	I	I	I	I	-80267	7.3874	-97013E-02	3.8208
2156.00	-37880	I	I	I	I	-77890	7.3987	-7.1514E-02	3.8465
2200.00	-36842	I	I	I	I	-75660	7.4093	-4.7463E-02	3.8707

5 PERCENT STEP CHANGE IN UNIT LOAD
STEAM LINE TO HP TURBINE VARIABLES

TIME	HSL	1140.				1164.			
		O=SGV				*O*=TGV			
		1960.0				1000.			
		X=PSL				*X*=HSL			
		2475.				2535.			
		1432.				1464.			
						PSL	TGV	SGV	
.0	1454.0	I	I	I	I	2530.7	995.06	1158.2	
44.000	1451.0	I	I	I	I	2488.3	988.60	1141.7	
88.000	1450.8	I	I	I	I	2484.5	988.02	1140.2	
132.00	1449.3	I	I	I	I	2488.1	986.17	1143.1	
176.00	1446.6	I	I	I	I	2493.2	982.57	1147.8	
220.00	1443.4	I	I	I	I	2497.4	970.15	1152.6	
264.00	1440.3	I	I	I	I	2499.9	973.81	1156.5	
308.00	1437.8	I	I	I	I	2501.0	970.15	1159.4	
352.00	1435.9	I	I	I	I	2501.1	967.42	1161.1	
396.00	1434.6	I	I	I	I	2500.6	965.62	1162.0	
440.00	1434.0	I	I	I	I	2500.0	964.66	1162.3	
484.00	1433.8	I	I	I	I	2499.4	964.36	1162.2	
528.00	1433.9	I	I	I	I	2499.1	960.54	1161.9	
572.00	1434.3	I	I	I	I	2499.0	965.12	1161.5	
616.00	1434.9	I	I	I	I	2499.1	965.90	1161.1	
660.00	1435.5	I	I	I	I	2499.5	966.83	1160.7	
704.00	1436.2	I	I	I	I	2500.1	967.83	1160.4	
748.00	1436.9	I	I	I	I	2500.9	968.86	1160.1	
792.00	1437.6	I	I	I	I	2501.7	969.89	1159.9	
836.00	1438.2	I	I	I	I	2502.7	970.90	1159.7	
880.00	1438.9	I	I	I	I	2503.6	971.88	1159.5	
924.00	1439.5	I	I	I	I	2504.6	972.83	1159.4	
968.00	1440.1	I	I	I	I	2505.6	973.75	1159.3	
1012.00	1440.7	I	I	I	I	2506.5	974.62	1159.2	
1056.00	1441.2	I	I	I	I	2507.4	975.46	1159.1	
1100.00	1441.8	I	I	I	I	2508.3	976.26	1159.1	
1144.00	1442.3	I	I	I	I	2509.2	977.03	1159.0	
1188.00	1442.7	I	I	I	I	2510.0	977.77	1158.9	
1232.00	1443.2	I	I	I	I	2510.8	978.47	1158.9	
1276.00	1443.6	I	I	I	I	2511.6	979.13	1158.8	
1320.00	1444.0	I	I	I	I	2512.3	979.77	1158.8	
1364.00	1444.4	I	I	I	I	2513.0	980.36	1158.8	
1408.00	1444.8	I	I	I	I	2513.7	980.98	1158.7	
1452.00	1445.2	I	I	I	I	2514.3	981.51	1158.7	
1496.00	1445.5	I	I	I	I	2514.9	982.03	1158.6	
1540.00	1445.8	I	I	I	I	2515.5	982.52	1158.6	
1584.00	1446.2	I	I	I	I	2516.0	983.00	1158.6	
1628.00	1446.4	I	I	I	I	2516.6	983.44	1158.6	
1672.00	1446.7	I	I	I	I	2517.0	983.87	1158.5	
1716.00	1447.0	I	I	I	I	2517.5	984.27	1158.5	
1760.00	1447.2	I	I	I	I	2518.0	984.65	1158.5	
1804.00	1447.5	I	I	I	I	2518.4	985.02	1158.5	
1848.00	1447.7	I	I	I	I	2518.8	985.36	1158.4	
1892.00	1447.9	I	I	I	I	2519.2	985.69	1158.4	
1936.00	1448.1	I	I	I	I	2519.6	985.99	1158.4	
1980.00	1448.3	I	I	I	I	2519.9	986.28	1158.4	
2024.00	1448.5	I	I	I	I	2520.2	986.56	1158.4	
2068.00	1448.6	I	I	I	I	2520.5	986.82	1158.4	
2112.00	1448.8	I	I	I	I	2520.8	987.07	1158.4	
2156.00	1449.0	I	I	I	I	2521.1	987.31	1158.3	
2200.00	1449.1	I	I	I	I	2521.4	987.53	1158.3	

5 PERCENT STEP CHANGE IN UNIT LOAD
HIGH PRESSURE TURBINE VARIABLES

		580.0	'S'=TRTSH	620.0			
		1020.	'O'=SHP	1064.			
		1900.	'X'=PHP1	1940.			
		592.0	'W'=PHP	620.0			
		1292.	'A'=HMP	1308.			
TIME	HMP				PHP	PHP1	SHP
.0	1304.9	I-----I-----I-----X-----I-----I			593.87	1925.4	1039.2
44.000	1305.7	I X O I * * I I I + I			605.07	1904.1	1024.5
88.000	1305.9	I X O I * * I I I + I			606.64	1902.3	1023.1
132.00	1304.7	I X O I * * I I I + I			607.84	1905.6	1025.7
176.00	1302.5	I X O I * * I I I + I			609.72	1910.6	1029.9
220.00	1299.8	I X O I * * I I I + I			611.75	1915.0	1034.2
264.00	1297.3	I X O I * * I I I + I			613.50	1918.2	1037.7
308.00	1295.3	I X O I * * I I I + I			614.76	1920.0	1040.3
352.00	1293.7	I X O I * * I I I + I			615.52	1920.6	1041.9
396.00	1292.8	I X O I * * I I I + I			615.87	1920.6	1042.7
440.00	1292.2	I X O I * * I I I + I			615.95	1920.2	1043.0
484.00	1292.1	I X O I * * I I I + I			615.84	1919.7	1042.9
528.00	1292.2	I X O I * * I I I + I			615.71	1919.2	1042.6
572.00	1292.5	I X O I * * I I I + I			615.54	1919.0	1042.2
616.00	1293.0	I X O I * * I I I + I			615.40	1918.8	1041.9
660.00	1293.5	I X O I * * I I I + I			615.31	1918.9	1041.5
704.00	1294.0	I X O I * * I I I + I			615.26	1919.2	1041.2
748.00	1294.6	I X O I * * I I I + I			615.27	1919.5	1041.0
792.00	1295.1	I X O I * * I I I + I			615.31	1920.0	1040.8
836.00	1295.7	I X O I * * I I I + I			615.39	1920.5	1040.6
880.00	1296.2	I X O I * * I I I + I			615.49	1921.1	1040.5
924.00	1296.7	I X O I * * I I I + I			615.61	1921.7	1040.3
968.00	1297.2	I X O I * * I I I + I			615.73	1922.4	1040.2
1012.00	1297.7	I X O I * * I I I + I			615.87	1923.0	1040.2
1056.00	1298.2	I X O I * * I I I + I			616.01	1923.6	1040.1
1100.00	1298.6	I X O I * * I I I + I			616.16	1924.2	1040.0
1144.00	1299.0	I X O I * * I I I + I			616.30	1924.8	1040.0
1188.00	1299.4	I X O I * * I I I + I			616.44	1925.3	1039.9
1232.00	1299.8	I X O I * * I I I + I			616.57	1925.9	1039.9
1276.00	1300.1	I X O I * * I I I + I			616.71	1926.4	1039.8
1320.00	1300.5	I X O I * * I I I + I			616.84	1926.9	1039.8
1364.00	1300.8	I X O I * * I I I + I			616.96	1927.4	1039.8
1408.00	1301.1	I X O I * * I I I + I			617.09	1927.9	1039.7
1452.00	1301.4	I X O I * * I I I + I			617.21	1928.3	1039.7
1496.00	1301.7	I X O I * * I I I + I			617.32	1928.7	1039.7
1540.00	1302.0	I X O I * * I I I + I			617.43	1929.1	1039.6
1584.00	1302.2	I X O I * * I I I + I			617.53	1929.5	1039.6
1628.00	1302.5	I X O I * * I I I + I			617.63	1929.9	1039.6
1672.00	1302.7	I X O I * * I I I + I			617.73	1930.3	1039.5
1716.00	1302.9	I X O I * * I I I + I			617.82	1930.6	1039.5
1760.00	1303.1	I X O I * * I I I + I			617.93	1930.9	1039.5
1804.00	1303.3	I X O I * * I I I + I			618.00	1931.2	1039.5
1848.00	1303.5	I X O I * * I I I + I			618.07	1931.5	1039.5
1892.00	1303.7	I X O I * * I I I + I			618.15	1931.8	1039.5
1936.00	1303.9	I X O I * * I I I + I			618.23	1932.0	1039.4
1980.00	1304.0	I X O I * * I I I + I			618.30	1932.3	1039.4
2024.00	1304.2	I X O I * * I I I + I			618.37	1932.5	1039.4
2068.00	1304.3	I X O I * * I I I + I			618.43	1932.8	1039.4
2112.00	1304.5	I X O I * * I I I + I			618.49	1933.0	1039.4
2156.00	1304.6	I X O I * * I I I + I			618.55	1933.2	1039.4
2200.00	1304.7	I X O I * * I I I + I			618.61	1933.4	1039.4

5 PERCENT STEP CHANGE IN UNIT LOAD
REHEATER LINE STATES

		975.0	'S'=TRT	995.0			
		980.0	'O'=SRT	1060.			
		1020.	'X'=SRB	1044.			
		504.0	'W'=PRT	576.0			
		1504.	'A'=HRT	1520.			
TIME	HRT				PH1	SRB	SRT
.0	1515.5	I-----I-----I-----X-----I-----I			569.11	1039.2	989.71
44.000	1511.6	I X O I * * I I I + I			562.22	1024.5	988.22
88.000	1510.9	I X O I * * I I I + I			563.99	1023.1	987.01
132.00	1510.8	I X O I * * I I I + I			565.02	1025.7	984.91
176.00	1510.5	I X O I * * I I I + I			566.61	1029.9	986.47
220.00	1509.8	I X O I * * I I I + I			568.38	1034.2	985.29
264.00	1508.9	I X O I * * I I I + I			569.92	1037.7	983.58
308.00	1507.0	I X O I * * I I I + I			571.05	1040.3	981.71
352.00	1506.8	I X O I * * I I I + I			571.72	1041.9	979.90
396.00	1506.0	I X O I * * I I I + I			572.05	1042.7	978.37
440.00	1505.4	I X O I * * I I I + I			572.13	1043.0	977.21
484.00	1504.9	I X O I * * I I I + I			572.08	1042.9	976.58
528.00	1504.7	I X O I * * I I I + I			571.93	1042.6	976.01
572.00	1504.7	I X O I * * I I I + I			571.79	1042.2	975.91
616.00	1504.7	I X O I * * I I I + I			571.67	1041.9	976.05
660.00	1504.9	I X O I * * I I I + I			571.60	1041.5	976.39
704.00	1505.2	I X O I * * I I I + I			571.57	1041.2	976.88
748.00	1505.5	I X O I * * I I I + I			571.59	1041.0	977.47
792.00	1505.7	I X O I * * I I I + I			571.63	1040.8	978.12
836.00	1506.2	I X O I * * I I I + I			571.72	1040.6	978.83
880.00	1506.6	I X O I * * I I I + I			571.82	1040.5	979.56
924.00	1507.0	I X O I * * I I I + I			571.94	1040.3	980.29
968.00	1507.4	I X O I * * I I I + I			572.07	1040.2	981.03
1012.00	1507.8	I X O I * * I I I + I			572.21	1040.2	981.76
1056.00	1508.2	I X O I * * I I I + I			572.35	1040.1	982.48
1100.00	1508.6	I X O I * * I I I + I			572.48	1040.0	983.18
1144.00	1508.9	I X O I * * I I I + I			572.63	1040.0	983.67
1188.00	1509.3	I X O I * * I I I + I			572.77	1039.9	984.54
1232.00	1509.6	I X O I * * I I I + I			572.91	1039.9	985.19
1276.00	1510.0	I X O I * * I I I + I			573.04	1039.8	985.81
1320.00	1510.3	I X O I * * I I I + I			573.17	1039.8	986.42
1364.00	1510.4	I X O I * * I I I + I			573.29	1039.8	987.00
1408.00	1510.9	I X O I * * I I I + I			573.41	1039.7	987.57
1452.00	1511.2	I X O I * * I I I + I			573.53	1039.7	988.12
1496.00	1511.5	I X O I * * I I I + I			573.64	1039.7	988.63
1540.00	1511.7	I X O I * * I I I + I			573.75	1039.4	989.17
1584.00	1512.0	I X O I * * I I I + I			573.85	1039.6	989.60
1628.00	1512.2	I X O I * * I I I + I			573.95	1039.6	990.06
1672.00	1512.5	I X O I * * I I I + I			574.05	1039.5	990.50
1716.00	1512.7	I X O I * * I I I + I			574.13	1039.5	990.91
1760.00	1512.9	I X O I * * I I I + I			574.24	1039.5	991.35
1804.00	1513.1	I X O I * * I I I + I			574.31	1039.5	991.71
1848.00	1513.3	I X O I * * I I I + I			574.38	1039.5	992.04
1892.00	1513.5	I X O I * * I I I + I			574.46	1039.5	992.39
1936.00	1513.6	I X O I * * I I I + I			574.54	1039.4	992.72
1980.00	1513.8	I X O I * * I I I + I			574.60	1039.4	993.03
2024.00	1514.0	I X O I * * I I I + I			574.67	1039.4	993.34
2068.00	1514.1	I X O I * * I I I + I			574.73	1039.4	993.61
2112.00	1514.3	I X O I * * I I I + I			574.79	1039.4	993.88
2156.00	1514.4	I X O I * * I I I + I			574.85	1039.4	994.14
2200.00	1514.5	I X O I * * I I I + I			574.90	1039.4	994.38

TIME	PPS	1.020E+05 7.600E+04 1100. 1100. 2700.	'*'=QGPHS 'O'=QPSPA 'X'=SPS '*'=SSL '+'=PPS	1.260E+05 6.400E+04 1180. 1180. 2760.	SSL	SPS	QPSPA	QGPHS	
.0	2735.8	I	O--S--	I--S--	I--S--	I	1101.8	76400.	1.0457E+05
44.000	2709.4	I	+	I	O	+	X	81	1.1923E+05
88.000	2704.6	I	+	I	O	+	X	18	1.2026E+05
132.00	2708.1	I	+	I	O	+	X	18	1.1709E+05
176.00	2713.4	I	+	I	O	+	X	18	1.1492E+05
220.00	2717.9	I	+	I	O	+	X	18	1.1550E+05
264.00	2720.9	I	+	I	O	+	X	18	1.155.0
308.00	2722.4	I	+	I	O	+	X	18	1.155.0
352.00	2722.8	I	+	I	O	+	X	18	1.155.0
396.00	2722.7	I	+	I	O	+	X	18	1.155.0
440.00	2722.3	I	+	I	O	+	X	18	1.155.0
484.00	2721.9	I	+	I	O	+	X	18	1.155.0
528.00	2721.7	I	+	I	O	+	X	18	1.155.0
572.00	2721.8	I	+	I	O	+	X	18	1.155.0
616.00	2722.1	I	+	I	O	+	X	18	1.155.0
660.00	2722.7	I	+	I	O	+	X	18	1.155.0
704.00	2723.4	I	+	I	O	+	X	18	1.155.0
748.00	2724.3	I	+	I	O	+	X	18	1.155.0
792.00	2725.3	I	+	I	O	+	X	18	1.155.0
836.00	2726.3	I	+	I	O	+	X	18	1.155.0
880.00	2727.4	I	+	I	O	+	X	18	1.155.0
924.00	2728.5	I	+	I	O	+	X	18	1.155.0
968.00	2729.6	I	+	I	O	+	X	18	1.155.0
1012.00	2730.6	I	+	I	O	+	X	18	1.155.0
1056.00	2731.7	I	+	I	O	+	X	18	1.155.0
1100.00	2732.6	I	+	I	O	+	X	18	1.155.0
1144.00	2733.6	I	+	I	O	+	X	18	1.155.0
1188.00	2734.5	I	+	I	O	+	X	18	1.155.0
1232.00	2735.4	I	+	I	O	+	X	18	1.155.0
1276.00	2736.2	I	+	I	O	+	X	18	1.155.0
1320.00	2737.0	I	+	I	O	+	X	18	1.155.0
1364.00	2737.8	I	+	I	O	+	X	18	1.155.0
1408.00	2738.5	I	+	I	O	+	X	18	1.155.0
1452.00	2739.2	I	+	I	O	+	X	18	1.155.0
1496.00	2739.9	I	+	I	O	+	X	18	1.155.0
1540.00	2740.5	I	+	I	O	+	X	18	1.155.0
1584.00	2741.1	I	+	I	O	+	X	18	1.155.0
1628.00	2741.7	I	+	I	O	+	X	18	1.155.0
1672.00	2742.2	I	+	I	O	+	X	18	1.155.0
1716.00	2742.7	I	+	I	O	+	X	18	1.155.0
1760.00	2743.2	I	+	I	O	+	X	18	1.155.0
1804.00	2743.7	I	+	I	O	+	X	18	1.155.0
1848.00	2744.1	I	+	I	O	+	X	18	1.155.0
1892.00	2744.6	I	+	I	O	+	X	18	1.155.0
1936.00	2745.0	I	+	I	O	+	X	18	1.155.0
1980.00	2745.3	I	+	I	O	+	X	18	1.155.0
2024.00	2745.7	I	+	I	O	+	X	18	1.155.0
2068.00	2746.0	I	+	I	O	+	X	18	1.155.0
2112.00	2746.3	I	+	I	O	+	X	18	1.155.0
2156.00	2746.6	I	+	I	O	+	X	18	1.155.0
2200.00	2746.9	I	+	I</					

TIME	NPS	1.020E+05	'0' = QEN	1.140E+05	TPS	TPSG	TPSM	QEN
.0	1255.5	I	I	I	778.31	1047.9	925.98	1.0478E+05
44.000	1252.3	I	I	I	774.74	1054.8	926.50	1.0748E+05
68.000	1247.1	I	I	I	771.15	1055.0	926.04	1.0869E+05
132.0	1242.3	I	I	I	768.33	1054.8	925.97	1.0952E+05
176.0	1238.9	I	I	I	766.47	1054.3	923.75	1.1015E+05
220.0	1236.8	I	I	I	765.44	1053.8	920.59	1.1042E+05
264.0	1235.9	I	I	I	765.09	1053.5	921.66	1.1095E+05
308.0	1235.9	I	I	I	765.18	1053.3	921.03	1.1117E+05
352.0	1236.5	I	I	I	765.56	1053.2	920.69	1.1132E+05
396.0	1237.4	I	I	I	766.12	1053.4	920.61	1.1143E+05
440.0	1238.5	I	I	I	766.76	1053.6	920.75	1.1150E+05
484.0	1239.6	I	I	I	767.44	1054.0	921.04	1.1156E+05
528.0	1240.7	I	I	I	768.12	1054.4	921.43	1.1161E+05
572.0	1241.7	I	I	I	768.77	1054.8	921.91	1.1165E+05
616.0	1242.7	I	I	I	769.39	1055.3	922.42	1.1169E+05
660.0	1243.6	I	I	I	769.98	1055.7	922.95	1.1173E+05
704.0	1244.4	I	I	I	770.54	1056.2	923.48	1.1177E+05
748.0	1245.1	I	I	I	771.06	1056.7	924.00	1.1181E+05
792.0	1245.8	I	I	I	771.55	1057.1	924.52	1.1184E+05
836.0	1246.4	I	I	I	772.02	1057.5	925.01	1.1188E+05
880.0	1247.0	I	I	I	772.46	1057.9	925.48	1.1192E+05
924.0	1247.6	I	I	I	772.87	1058.3	925.94	1.1196E+05
968.0	1248.1	I	I	I	773.27	1058.7	926.37	1.1199E+05
1012.0	1248.6	I	I	I	773.64	1059.1	926.78	1.1203E+05
1056.0	1249.1	I	I	I	773.99	1059.4	927.17	1.1206E+05
1100.0	1249.5	I	I	I	774.33	1059.7	927.55	1.1209E+05
1144.0	1249.9	I	I	I	774.65	1060.1	927.90	1.1213E+05
1188.0	1250.3	I	I	I	774.95	1060.3	928.24	1.1215E+05
1232.0	1250.7	I	I	I	775.24	1060.6	928.56	1.1218E+05
1276.0	1251.0	I	I	I	775.51	1060.9	928.86	1.1221E+05
1320.0	1251.4	I	I	I	775.76	1061.1	929.15	1.1224E+05
1364.0	1251.7	I	I	I	776.00	1061.4	929.42	1.1226E+05
1408.0	1252.0	I	I	I	776.23	1061.6	929.68	1.1229E+05
1452.0	1252.2	I	I	I	776.45	1061.8	929.93	1.1231E+05
1496.0	1252.5	I	I	I	776.66	1062.0	930.16	1.1234E+05
1540.0	1252.8	I	I	I	776.85	1062.2	930.36	1.1236E+05
1584.0	1253.0	I	I	I	777.03	1062.4	930.59	1.1238E+05
1628.0	1253.2	I	I	I	777.21	1062.6	930.79	1.1240E+05
1672.0	1253.4	I	I	I	777.37	1062.7	930.97	1.1242E+05
1716.0	1253.6	I	I	I	777.52	1062.9	931.15	1.1243E+05
1760.0	1253.8	I	I	I	777.67	1063.1	931.32	1.1245E+05
1804.0	1254.0	I	I	I	777.81	1063.2	931.48	1.1247E+05
1848.0	1254.1	I	I	I	777.94	1063.3	931.63	1.1248E+05
1892.0	1254.3	I	I	I	778.06	1063.5	931.77	1.1250E+05
1936.0	1							

5 PERCENT STEP CHANGE IN UNIT LOAD
REHEATER STATES

TIME	HRHS					TRMS	TRHG	TRHM
0	1387.6	I	I	I	I	760.10	675.28	816.30
44.000	1387.7	I	I	I	I	761.71	679.22	818.30
88.000	1388.5	I	I	I	I	763.51	681.57	820.43
132.000	1388.6	I	I	I	I	763.70	683.28	821.77
176.000	1387.7	I	I	I	I	762.26	683.78	821.97
220.000	1386.3	I	I	I	I	759.75	682.97	821.13
264.000	1386.6	I	I	I	I	756.84	681.13	819.57
308.000	1383.0	I	I	I	I	753.97	678.71	817.67
352.000	1381.5	I	I	I	I	751.48	676.12	815.76
396.000	1380.4	I	I	I	I	749.52	673.71	814.07
440.000	1379.7	I	I	I	I	748.15	671.68	812.72
484.000	1379.2	I	I	I	I	747.33	670.13	811.76
528.000	1379.0	I	I	I	I	746.98	669.08	811.18
572.000	1379.1	I	I	I	I	747.01	668.49	810.94
616.000	1379.2	I	I	I	I	747.33	668.28	810.98
660.000	1379.5	I	I	I	I	747.86	668.39	811.23
704.000	1379.9	I	I	I	I	748.54	668.73	811.64
748.000	1380.3	I	I	I	I	749.30	669.25	812.16
792.000	1380.8	I	I	I	I	750.12	669.88	812.76
836.000	1381.2	I	I	I	I	750.96	670.59	813.40
880.000	1381.7	I	I	I	I	751.81	671.34	814.06
924.000	1382.2	I	I	I	I	752.65	672.11	814.73
968.000	1382.6	I	I	I	I	753.47	672.88	815.39
1012.000	1383.1	I	I	I	I	754.26	673.64	816.04
1056.000	1383.5	I	I	I	I	755.03	674.39	816.67
1100.000	1383.9	I	I	I	I	755.78	675.11	817.28
1144.000	1384.3	I	I	I	I	756.49	675.81	817.87
1188.000	1384.6	I	I	I	I	757.17	676.49	818.44
1232.000	1385.0	I	I	I	I	757.83	677.13	818.98
1276.000	1385.3	I	I	I	I	758.46	677.76	819.51
1320.000	1385.7	I	I	I	I	759.05	678.35	820.00
1364.000	1386.0	I	I	I	I	759.63	678.92	820.48
1408.000	1386.3	I	I	I	I	760.17	679.47	820.94
1452.000	1386.6	I	I	I	I	760.69	679.99	821.37
1496.000	1386.8	I	I	I	I	761.19	680.49	821.79
1540.000	1387.1	I	I	I	I	761.66	680.96	822.19
1584.000	1387.3	I	I	I	I	762.10	681.41	822.56
1628.000	1387.6	I	I	I	I	762.53	681.84	822.92
1672.000	1387.8	I	I	I	I	762.94	682.25	823.26
1716.000	1388.0	I	I	I	I	763.32	682.63	823.58
1760.000	1388.2	I	I	I	I	763.68	683.00	823.89
1804.000	1388.4	I	I	I	I	764.03	683.35	824.10
1848.000	1388.6	I	I	I	I	764.35	683.68	824.46
1892.000	1388.7	I	I	I	I	764.66	683.99	824.72
1936.000	1388.9	I	I	I	I	764.96	684.29	824.97
1980.000	1389.1	I	I	I	I	765.23	684.57	825.20
2024.000	1389.2	I	I	I	I	765.50	684.84	825.43
2068.000	1389.3	I	I	I	I	765.75	685.10	825.64
2112.000	1389.5	I	I	I	I	765.99	685.34	825.84
2156.000	1389.6	I	I	I	I	766.21	685.56	826.03
2200.000	1389.7	I	I	I	I	766.43	685.78	826.21

5 PERCENT STEP CHANGE IN UNIT LOAD
ECONOMIZER STATES

TIME	TEC					TECG	TECH	MFM
0	539.25	I	I	I	I	720.26	552.98	1158.1
44.000	539.29	I	I	I	I	720.77	553.17	1158.1
88.000	539.49	I	I	I	I	725.38	553.41	1158.1
132.000	539.62	I	I	I	I	725.44	553.54	1158.1
176.000	539.88	I	I	I	I	725.67	553.82	1158.1
220.000	539.67	I	I	I	I	725.42	553.61	1158.1
264.000	539.61	I	I	I	I	725.00	553.53	1158.1
308.000	539.52	I	I	I	I	724.51	553.41	1158.1
352.000	539.41	I	I	I	I	724.03	553.27	1158.1
396.000	539.31	I	I	I	I	723.62	553.14	1158.1
440.000	539.22	I	I	I	I	723.31	553.04	1158.1
484.000	539.16	I	I	I	I	723.11	552.94	1158.1
528.000	539.12	I	I	I	I	723.05	552.91	1158.1
572.000	539.10	I	I	I	I	723.08	552.90	1158.1
616.000	539.11	I	I	I	I	723.19	552.91	1158.1
660.000	539.13	I	I	I	I	723.36	552.94	1158.1
704.000	539.17	I	I	I	I	723.58	553.00	1158.1
748.000	539.22	I	I	I	I	723.83	553.06	1158.1
792.000	539.20	I	I	I	I	724.10	553.13	1158.1
836.000	539.34	I	I	I	I	724.38	553.21	1158.1
880.000	539.41	I	I	I	I	724.66	553.29	1158.1
924.000	539.47	I	I	I	I	724.94	553.37	1158.1
968.000	539.54	I	I	I	I	725.22	553.45	1158.1
1012.000	539.60	I	I	I	I	725.48	553.53	1158.1
1056.000	539.66	I	I	I	I	725.74	553.60	1158.1
1100.000	539.72	I	I	I	I	725.99	553.68	1158.1
1144.000	539.78	I	I	I	I	726.23	553.75	1158.1
1188.000	539.83	I	I	I	I	726.47	553.82	1158.1
1232.000	539.88	I	I	I	I	726.69	553.88	1158.1
1276.000	539.93	I	I	I	I	726.90	553.95	1158.1
1320.000	539.98	I	I	I	I	727.10	554.01	1158.1
1364.000	540.03	I	I	I	I	727.29	554.06	1158.1
1408.000	540.07	I	I	I	I	727.47	554.12	1158.1
1452.000	540.12	I	I	I	I	727.65	554.17	1158.1
1496.000	540.15	I	I	I	I	727.81	554.22	1158.1
1540.000	540.19	I	I	I	I	727.97	554.27	1158.1
1584.000	540.23	I	I	I	I	728.12	554.31	1158.1
1628.000	540.28	I	I	I	I	728.26	554.36	1158.1
1672.000	540.30	I	I	I	I	728.40	554.40	1158.1
1716.000	540.33	I	I	I	I	728.52	554.43	1158.1
1760.000	540.36	I	I	I	I	728.65	554.47	1158.1
1804.000	540.38	I	I	I	I	728.76	554.51	1158.1
1848.000	540.41	I	I	I	I	728.87	554.54	1158.1
1892.000	540.43	I	I	I	I	728.97	554.57	1158.1
1936.000	540.46	I	I	I	I	729.07	554.60	1158.1
1980.000	540.48	I	I	I	I	729.16	554.63	1158.1
2024.000	540.50	I	I	I	I	729.25	554.65	1158.1
2068.000	540.52	I	I	I	I	729.34	554.68	1158.1
2112.000	540.54	I	I	I	I	729.42	554.70	1158.1
2156.000	540.56	I	I	I	I	729.49	554.72	1158.1
2200.000	540.58	I	I	I	I	729.56	554.75	1158.1

5 PERCENT STEP CHANGE IN UNIT LOAD
AIR HEATER STATES

	1645.	'B'=GAH	1646.				
	500.0	'O'=AAH	2500.				
	438.0	'X'=TAHH	444.0				
	637.5	'W'=TAHO	647.5				
	2.190E+05	'A'=GAHG	2.230E+05				
TIME	QAHG		TAHO	TAHH	AAH	GAH	
.0	2.1947E+05	X#-----I-----OI-----I-----I	637.78	438.12	1448.3	1644.9	
44.000	2.2197E+05	I I O OI +	640.46	439.81	1448.3	1645.3	
88.000	2.2184E+05	I X#OI + I	641.74	440.62	1448.3	1645.5	
132.00	2.2182E+05	I OX + I	642.35	441.01	1448.3	1645.6	
176.00	2.2174E+05	I OIX + I	642.62	441.18	1448.3	1645.7	
220.00	2.2159E+05	I OIX + I	642.61	441.18	1448.3	1645.7	
264.00	2.2141E+05	I OX + I	642.41	441.05	1448.3	1645.8	
308.00	2.2122E+05	I OOI + I	642.08	440.84	1448.3	1645.8	
352.00	2.2104E+05	I X OI + I	641.70	440.60	1448.3	1645.8	
396.00	2.2097E+05	I X OI + I	641.33	440.37	1448.3	1645.8	
440.00	2.2085E+05	I X OI + I	641.02	440.17	1448.3	1645.8	
484.00	2.2081E+05	I X OI + I	640.79	440.02	1448.3	1645.8	
528.00	2.2081E+05	I X OI + I	640.65	439.93	1448.3	1645.8	
572.00	2.2084E+05	I X OI + I	640.59	439.90	1448.3	1645.8	
616.00	2.2089E+05	I X OI + I	640.61	439.91	1448.3	1645.8	
660.00	2.2095E+05	I X OI + I	640.69	439.96	1448.3	1645.8	
704.00	2.2103E+05	I X O+ I	640.82	440.04	1448.3	1645.8	
748.00	2.2112E+05	I X OI+ I	640.98	440.15	1448.3	1645.8	
792.00	2.2120E+05	I X OI+ I	641.17	440.26	1448.3	1645.8	
836.00	2.2129E+05	I X OI+ I	641.38	440.39	1448.3	1645.8	
880.00	2.2138E+05	I X OI+ I	641.59	440.53	1448.3	1645.8	
924.00	2.2147E+05	I X OI+ I	641.80	440.66	1448.3	1645.8	
968.00	2.2155E+05	I XOI + I	642.01	440.80	1448.3	1645.8	
1012.00	2.2163E+05	I OI + I	642.22	440.93	1448.3	1645.8	
1056.00	2.2172E+05	I OX + I	642.42	441.05	1448.3	1645.8	
1100.00	2.2179E+05	I OIX + I	642.62	441.18	1448.3	1645.8	
1144.00	2.2186E+05	I OIX + I	642.81	441.30	1448.3	1645.8	
1188.00	2.2193E+05	I OI X + I	642.99	441.41	1448.3	1645.8	
1232.00	2.2200E+05	I OI X + I	643.17	441.53	1448.3	1645.8	
1276.00	2.2206E+05	I OI X + I	643.34	441.63	1448.3	1645.8	
1320.00	2.2212E+05	I OI X + I	643.49	441.73	1448.3	1645.8	
1364.00	2.2218E+05	I OI X + I	643.65	441.83	1448.3	1645.8	
1408.00	2.2224E+05	I OI X + I	643.79	441.92	1448.3	1645.8	
1452.00	2.2229E+05	I OI X + I	643.93	442.01	1448.3	1645.8	
1496.00	2.2234E+05	I OI X + I	644.07	442.09	1448.3	1645.8	
1540.00	2.2239E+05	I OI X + I	644.19	442.17	1448.3	1645.8	
1584.00	2.2247E+05	I OI X + I	644.31	442.25	1448.3	1645.8	
1628.00	2.2247E+05	I OI X + I	644.32	442.25	1448.3	1645.8	
1672.00	2.2251E+05	I OI X + I	644.54	442.39	1448.3	1645.8	
1716.00	2.2255E+05	I OI X + I	644.64	442.45	1448.3	1645.8	
1760.00	2.2259E+05	I OI X + I	644.74	442.52	1448.3	1645.8	
1804.00	2.2262E+05	I OI X + I	644.83	442.57	1448.3	1645.8	
1848.00	2.2266E+05	I OI X + I	644.92	442.63	1448.3	1645.8	
1892.00	2.2269E+05	I OI X + I	645.00	442.68	1448.3	1645.8	
1936.00	2.2271E+05	I OI X + I	645.08	442.73	1448.3	1645.8	
1980.00	2.2274E+05	I OI X + I	645.15	442.78	1448.3	1645.8	
2024.00	2.2277E+05	I OI X + I	645.23	442.82	1448.3	1645.8	
2068.00	2.2280E+05	I OI X + I	645.29	442.87	1448.3	1645.8	
2112.00	2.2282E+05	I OI X + I	645.35	442.91	1448.3	1645.8	
2156.00	2.2284E+05	I OI X + I	645.41	442.94	1448.3	1645.8	
2200.00	2.2286E+05	I OI X + I	645.47	442.98	1448.3	1645.8	

5 PERCENT STEP CHANGE IN UNIT LOAD
GAS PATH STATES

	720.0	'B'=TGP2	730.0				
	920.0	'O'=TGP1	940.0				
	714.0	'X'=TGPS	736.0				
	730.0	'W'=TGPM	750.0				
	1352.	'A'=TGP	1384.				
TIME	TGP		TGPM	TGPS	TGP1	TGP2	
.0	1352.7	I#-----O-----I-----I-----X-----I	747.68	735.24	923.71	720.25	
44.000	1361.8	I I + O# X#I	744.53	730.76	929.45	725.06	
88.000	1363.7	I I + X#IO# I	739.30	725.47	930.48	725.49	
132.00	1365.3	I X + I O# I	734.94	721.43	930.93	726.03	
176.00	1366.7	I X I + I O# I	732.11	718.96	930.83	726.09	
220.00	1367.9	I X I + O# I	730.69	717.02	930.28	725.69	
264.00	1368.9	I X I + OI# I	730.32	717.66	929.45	725.52	
308.00	1369.7	I X I + O# I	730.65	718.10	928.51	725.07	
352.00	1370.4	I X I + O# I	731.38	718.89	927.62	724.61	
396.00	1371.0	I X I + O# I	732.31	719.88	926.88	724.22	
440.00	1371.6	I X I + O# I	733.31	720.83	926.34	723.91	
484.00	1372.0	I X I + O# I	734.29	721.79	926.03	723.72	
528.00	1372.4	I X I + O# I	735.22	722.49	925.97	723.48	
572.00	1372.8	I X I + O# I	736.07	723.52	926.01	723.62	
616.00	1373.2	I X I + O# I	736.85	724.27	926.24	723.70	
660.00	1373.5	I X I + O# I	737.56	724.96	926.58	723.83	
704.00	1373.8	I X I + O# I	738.21	725.59	927.00	724.01	
748.00	1374.1	I X I + O# I	738.81	726.17	927.48	724.22	
792.00	1374.4	I X I + O# I	739.36	726.70	927.98	724.46	
836.00	1374.7	I X I + O# I	739.88	727.21	928.50	724.70	
880.00	1374.9	I X I + O# I	740.34	727.68	929.03	724.95	
924.00	1375.2	I X I + OI# X + I	740.81	728.12	929.55	725.19	
968.00	1375.4	I X I + O# X + I	741.24	728.54	930.05	725.43	
1012.00	1375.7	I X I + O# X + I	741.65	728.93	930.55	725.67	
1056.00	1375.9	I X I + O# X + I	742.03	729.31	931.03	725.90	
1100.00	1376.1	I X I + O# X + I	742.39	729.66	931.49	726.12	
1144.00	1376.3	I X I + O# X + I	742.74	730.00	931.93	726.33	
1188.00	1376.5	I X I + O# X + I	743.06	730.31	932.35	726.54	
1232.00	1376.7	I X I + O# X + I	743.37	730.61	932.76	726.73	
1276.00	1376.8	I X I + O# X + I	743.66	730.90	933.14	726.92	
1320.00	1377.0	I X I + O# X + I	743.94	731.16	933.51	727.10	
1364.00	1377.2	I X I + O# X + I	744.20	731.42	933.86	727.27	
1408.00	1377.4	I X I + O# X + I	744.44	731.66	934.20	727.43	
1452.00	1377.5	I X I + O# X + I	744.68	731.88	934.52	727.59	
1496.00	1377.6	I X I + O# X + I	744.90	732.10	934.82	727.74	
1540.00	1377.7	I X I + O# X + I	745.10	732.30	935.11	727.88	
1584.00	1377.8	I X I + O# X + I	745.30	732.49	935.38	728.01	
1628.00	1377.9	I X I + O# X + I	745.48	732.67	935.64	728.14	
1672.00	1378.1	I X I + O# X + I	745.64	732.84	935.89	728.26	
1716.00	1378.2	I X I + O# X + I	745.80	733.00	936.12	728.37	
1760.00	1378.3	I X I + O# X + I	745.98	733.15	936.35	728.48	
1804.00	1378.4	I X I + O# X + I	746.13	733.29	936.56	728.58	
1848.00	1378.5	I X I + O# X + I	746.27	733.43	936.76	728.68	
1892.00	1378.6	I X I + O# X + I	746.40	733.56	936.95	728.77	
1936.00	1378.6	I X I + O# X + I	746.52	733.68	937.13	728.86	
1980.00	1378.7	I X I + O# X + I	746.64	733.79	937.30	728.94	
2024.00	1378.8	I X I + O# X + I	746.75	733.90	937.46	729.02	
2068.00	1378.9	I X I + O# X + I	746.86	734.00	937.61	729.10	
2112.00	1378.9	I X I + O# X + I	746.96	734.10	937.76	729.17	
2156.00	1379.0	I X I + O# X + I	747.05	734.19	937.89	729.23	
2200.00	1379.1	I X I + O# X + I	747.14	734.28	938.02	729.30	

5 PERCENT STEP CHANGE IN UNIT LOAD
GAS FLOW

		139.2		'O'=-GCBC		135.2		
		1554.		'X'=-GGP2		1555.		
		500.0		'W'=-GGP1		2500.		
		500.0		'A'=-GGP		2500.		
TIME	GGP					GGP1	GGP2	GCBC
.0	1420.2	I---XO-----I		XO		I	1420.2	1554.6
44.000	1420.2	I		I		I	1420.2	1554.9
88.000	1420.2	I		I		I	1420.2	1555.1
132.00	1420.2	I		I		I	1420.2	1555.2
176.00	1420.2	I		I		I	1420.2	1555.3
220.00	1420.2	I		I		I	1420.2	1555.4
264.00	1420.2	I		I		I	1420.2	1555.4
308.00	1420.2	I		I		I	1420.2	1555.4
352.00	1420.2	I		I		I	1420.2	1555.4
396.00	1420.2	I		I		I	1420.2	1555.5
440.00	1420.2	I		I		I	1420.2	1555.5
484.00	1420.2	I		I		I	1420.2	1555.5
528.00	1420.2	I		I		I	1420.2	1555.5
572.00	1420.2	I		I		I	1420.2	1555.5
616.00	1420.2	I		I		I	1420.2	1555.5
660.00	1420.2	I		I		I	1420.2	1555.5
704.00	1420.2	I		I		I	1420.2	1555.5
748.00	1420.2	I		I		I	1420.2	1555.5
792.00	1420.2	I		I		I	1420.2	1555.5
836.00	1420.2	I		I		I	1420.2	1555.5
880.00	1420.2	I		I		I	1420.2	1555.5
924.00	1420.2	I		I		I	1420.2	1555.5
968.00	1420.2	I		I		I	1420.2	1555.5
1012.00	1420.2	I		I		I	1420.2	1555.5
1056.00	1420.2	I		I		I	1420.2	1555.5
1100.00	1420.2	I		I		I	1420.2	1555.5
1144.00	1420.2	I		I		I	1420.2	1555.5
1188.00	1420.2	I		I		I	1420.2	1555.5
1232.00	1420.2	I		I		I	1420.2	1555.5
1276.00	1420.2	I		I		I	1420.2	1555.5
1320.00	1420.2	I		I		I	1420.2	1555.5
1364.00	1420.2	I		I		I	1420.2	1555.5
1408.00	1420.2	I		I		I	1420.2	1555.5
1452.00	1420.2	I		I		I	1420.2	1555.5
1496.00	1420.2	I		I		I	1420.2	1555.5
1540.00	1420.2	I		I		I	1420.2	1555.5
1584.00	1420.2	I		I		I	1420.2	1555.5
1628.00	1420.2	I		I		I	1420.2	1555.5
1672.00	1420.2	I		I		I	1420.2	1555.5
1716.00	1420.2	I		I		I	1420.2	1555.5
1760.00	1420.2	I		I		I	1420.2	1555.5
1804.00	1420.2	I		I		I	1420.2	1555.5
1848.00	1420.2	I		I		I	1420.2	1555.5
1892.00	1420.2	I		I		I	1420.2	1555.5
1936.00	1420.2	I		I		I	1420.2	1555.5
1980.00	1420.2	I		I		I	1420.2	1555.5
2024.00	1420.2	I		I		I	1420.2	1555.5
2068.00	1420.2	I		I		I	1420.2	1555.5
2112.00	1420.2	I		I		I	1420.2	1555.5
2156.00	1420.2	I		I		I	1420.2	1555.5
2200.00	1420.2	I		I		I	1420.2	1555.5

5 PERCENT STEP CHANGE IN UNIT LOAD
INTEGRATION TIME PATTERN

		.0		'W'=-PASS		2.000E+04		
		.0		'A'=-DELT		3.000		
TIME	DELT					PASS		
.0	.10000	I		I		I	2.0000	
44.000	1.0250	I		I		I	384.00	
88.000	1.0984	I		I		I	644.00	
132.00	1.2705	I		I		I	914.00	
176.00	1.4300	I		I		I	1203.0	
220.00	1.2200	I		I		I	1541.0	
264.00	2.3301	I		I		I	1805.0	
308.00	1.2092	I		I		I	2153.0	
352.00	1.3265	I		I		I	2433.0	
396.00	.96794	I		I		I	2747.0	
440.00	1.6504	I		I		I	3070.0	
484.00	1.9137	I		I		I	3448.0	
528.00	1.7896	I		I		I	3805.0	
572.00	1.8669	I		I		I	4182.0	
616.00	1.4985	I		I		I	4497.0	
660.00	1.7706	I		I		I	4769.0	
704.00	1.0402	I		I		I	5163.0	
748.00	1.3783	I		I		I	5461.0	
792.00	2.1020	I		I		I	5742.0	
836.00	2.5543	I		I		I	6031.0	
880.00	1.5675	I		I		I	6346.0	
924.00	1.0073	I		I		I	6668.0	
968.00	1.7487	I		I		I	6964.0	
1012.00	1.5590	I		I		I	7328.0	
1056.00	.95362	I		I		I	7666.0	
1100.00	1.2254	I		I		I	7915.0	
1144.00	1.5033	I		I		I	8220.0	
1188.00	1.7054	I		I		I	8517.0	
1232.00	1.1439	I		I		I	8875.0	
1276.00	1.0009	I		I		I	9217.0	
1320.00	.99116	I		I		I	9507.0	
1364.00	1.0004	I		I		I	9822.0	
1408.00	1.2042	I		I		I	10103.0	
1452.00	1.3465	I		I		I	10407.0	
1496.00	1.4214	I		I		I	10705.0	
1540.00	.69321	I		I		I	11012.0	
1584.00	1.4570	I		I		I	11319.0	
1628.00	1.5157	I		I		I	11633.0	
1672.00	1.5299	I		I		I	11963.0	
1716.00	1.7208	I		I		I	12359.0	
1760.00	2.2108	I		I		I	12696.0	
1804.00	2.6555	I		I		I	12985.0	
1848.00	2.1322	I		I		I	13275.0	
1892.00	1.1384	I		I		I	13540.0	
1936.00	1.6085	I		I		I	13837.0	
1980.00	.97110	I		I		I	14216.0	
2024.00	1.2922	I		I		I	14514.0	
2068.00	.91862	I		I		I	14812.0	
2112.00	1.3545	I		I		I	15110.0	
2156.00	1.2465	I		I		I	15391.0	
2200.00	2.0451	I		I		I	15688.0	

TIME	EEBH	RTT	TEB	QEB	MEBS	RTT		
.0	1.1901E+08	0	X	0	1093.3	5.3776E+05	1550.0	.65040
44.000	1.1798E+08	I	O	I	X	1076.0	5.4711E+05	1552.4
88.000	1.1757E+08	I	O	I	X	1069.0	5.5321E+05	1556.4
132.00	1.1745E+08	I	+	I	X	1066.7	5.5719E+05	1561.1
176.00	1.1707E+08	I	+	I	X	1066.7	5.5978E+05	1566.2
220.00	1.1755E+08	I	+	I	X	1067.8	5.6148E+05	1571.1
264.00	1.1765E+08	I	+	I	X	1069.4	5.6258E+05	1575.9
308.00	1.1775E+08	I	+	I	X	1071.1	5.6330E+05	1580.2
352.00	1.1785E+08	I	+	I	X	1072.7	5.6377E+05	1584.2
396.00	1.1793E+08	I	+	I	X	1074.2	5.6408E+05	1587.8
440.00	1.1800E+08	I	+	I	X	1075.5	5.6428E+05	1591.0
484.00	1.1807E+08	I	+	I	X	1076.6	5.6441E+05	1593.8
528.00	1.1812E+08	I	+	I	X	1077.6	5.6449E+05	1596.3
572.00	1.1817E+08	I	+	I	X	1078.5	5.6455E+05	1598.6
616.00	1.1822E+08	I	+	I	X	1079.3	5.6458E+05	1600.6
660.00	1.1826E+08	I	+	I	X	1080.0	5.6461E+05	1602.3
704.00	1.1830E+08	I	+	I	X	1080.6	5.6462E+05	1603.9
748.00	1.1834E+08	I	+	I	X	1081.2	5.6463E+05	1605.3
792.00	1.1837E+08	I	+	I	X	1081.7	5.6464E+05	1606.5
836.00	1.1841E+08	I	+	I	X	1082.2	5.6464E+05	1607.6
880.00	1.1844E+08	I	+	I	X	1082.7	5.6465E+05	1608.6
924.00	1.1847E+08	I	+	I	X	1083.1	5.6465E+05	1609.5
968.00	1.1849E+08	I	+	I	X	1083.5	5.6465E+05	1610.3
1012.00	1.1852E+08	I	+	I	X	1083.9	5.6465E+05	1611.1
1056.00	1.1855E+08	I	+	I	X	1084.3	5.6465E+05	1611.7
1100.00	1.1857E+08	I	+	I	X	1084.6	5.6465E+05	1612.3
1144.00	1.1859E+08	I	+	I	X	1084.9	5.6465E+05	1612.8
1188.00	1.1861E+08	I	+	I	X	1085.2	5.6465E+05	1613.3
1232.00	1.1863E+08	I	+	I	X	1085.5	5.6465E+05	1613.8
1276.00	1.1865E+08	I	+	I	X	1085.8	5.6465E+05	1614.2
1320.00	1.1867E+08	I	+	I	X	1086.0	5.6465E+05	1614.5
1364.00	1.1869E+08	I	+	I	X	1086.3	5.6465E+05	1614.9
1408.00	1.1870E+08	I	+	I	X	1086.5	5.6465E+05	1615.2
1452.00	1.1872E+08	I	+	I	X	1086.7	5.6465E+05	1615.5
1496.00	1.1873E+08	I	+	I	X	1086.9	5.6465E+05	1615.7
1540.00	1.1875E+08	I	+	I	X	1087.1	5.6465E+05	1616.0
1584.00	1.1876E+08	I	+	I	X	1087.3	5.6465E+05	1616.2
1628.00	1.1877E+08	I	+	I	X	1087.4	5.6465E+05	1616.4
1672.00	1.1878E+08	I	+	I	X	1087.6	5.6465E+05	1616.6
1716.00	1.1879E+08	I	+	I	X	1087.7	5.6465E+05	1616.7
1760.00	1.1880E+08	I	+	I	X	1087.9	5.6465E+05	1616.9
1804.00	1.1881E+08	I	+	I	X	1088.0	5.6465E+05	1617.0
1848.00	1.1882E+08	I	+	I	X	1088.1	5.6465E+05	1617.2
1892.00	1.1883E+08	I	+	I	X	1088.2	5.6465E+05	1617.3
1936.00	1.1884E+08	I	+	I	X	1088.4	5.6465E+05	1617.4
1980.00	1.1885E+08	I	+	I</				

TIME	QSB	1.950E+08 1432. 1540. 5.360E+05	'O'=-ESBT 'X'=HSB '*'=TSB '+'=QSB	1.990E+08 1464. 1540. 5.680E+05	TSB	HSB	ESBT		
.0		5.3776E+05	O			1547.7	1453.9	1.9504E+08	
44.000		5.4711E+05	IO	*	I	1548.1		1.9510E+08	
88.000		5.5321E+05	I	O	I	1549.6		1.9528E+08	
132.00		5.5719E+05	I	O	I	1551.8		1.9556E+08	
176.00		5.5978E+05	I	O	I	1553.9		1.9583E+08	
220.00		5.6148E+05	I	O	I	1555.5		1.9639.7	
264.00		5.6258E+05	I	O	I	1556.4		1.9614E+08	
308.00		5.6303E+05	I	O	I	1556.8		1.9619E+08	
352.00		5.6377E+05	IX	I	O	I	1556.8	1.9619E+08	
396.00		5.6408E+05	X	I	O	I	1556.7	1.9618E+08	
440.00		5.6428E+05	X	I	O	I	1556.6	1.9616E+08	
484.00		5.6441E+05	IX	I	O	I	1556.5	1.9616E+08	
528.00		5.6449E+05	I	X	I	O	I	1556.6	1.9617E+08
572.00		5.6455E+05	I	X	I	O	I	1556.9	1.9620E+08
616.00		5.6458E+05	I	X	I	O	I	1557.2	1.9625E+08
660.00		5.6461E+05	I	X	I	O	I	1557.7	1.9631E+08
704.00		5.6462E+05	I	X	I	O	I	1558.4	1.9639E+08
748.00		5.6463E+05	I	X	I	O	I	1559.0	1.9647E+08
792.00		5.6464E+05	I	X	I	O	I	1559.8	1.9657E+08
836.00		5.6464E+05	I	X	I	O	I	1560.6	1.9670E+08
880.00		5.6465E+05	I	X	I	O	I	1561.4	1.9677E+08
924.00		5.6465E+05	I	X	I	O	I	1562.2	1.9687E+08
968.00		5.6465E+05	I	X	I	O	I	1563.0	1.9697E+08
1012.00		5.6465E+05	I	X	I	O	I	1563.8	1.9707E+08
1056.00		5.6465E+05	I	X	I	O	I	1564.5	1.9717E+08
1100.00		5.6465E+05	I	X	I	O	I	1565.3	1.9727E+08
1144.00		5.6465E+05	I	X	I	O	I	1566.1	1.9736E+08
1188.00		5.6465E+05	I	X	I	O	I	1566.8	1.9745E+08
1232.00		5.6465E+05	I	X	I	O	I	1567.5	1.9754E+08
1276.00		5.6465E+05	I	X	I	O	I	1568.2	1.9763E+08
1320.00		5.6465E+05	I	X	I	O	I	1568.9	1.9771E+08
1364.00		5.6465E+05	I	X	I	O	I	1569.5	1.9779E+08
1408.00		5.6465E+05	I	X	I	O	I	1570.1	1.9785E+08
1452.00		5.6465E+05	I	X	I	O	I	1570.7	1.9794E+08
1496.00		5.6465E+05	I	X	I	O	I	1571.3	1.9802E+08
1540.00		5.6465E+05	I	X	I	O	I	1571.8	1.9808E+08
1584.00		5.6465E+05	I	X	I	O	I	1572.3	1.9815E+08
1628.00		5.6465E+05	I	X	I	O	I	1572.8	1.9821E+08
1672.00		5.6465E+05	I	X	I	O	I	1573.3	1.9827E+08
1716.00		5.6465E+05	I	X	I	O	I	1573.7	1.9833E+08
1760.00		5.6465E+05	I	X	I	O	I	1574.2	1.9838E+08
1804.00		5.6465E+05	I	X	I	O	I	1574.6	1.9843E+08
1848.00		5.6465E+05	I	X	I	O	I	1575.0	1.9848E+08
1892.00		5.6465E+05	I	X	I	O	I	1575.3	1.9853E+08
1936.00		5.6465E+05	I	X	I	O	I	1575.7	1.9857E+08
1980.00		5.6465E+05	I	X	I	O	I	1576.0	1.9862E+08
2024.00									

5 PERCENT STEP CHANGE IN UNIT LOAD

		4.480E+04		4.800E+04		4.800E+04	
		1.200E+05		1.320E+05		1.320E+05	
		1530.		1590.		1590.	
		2.680E+05		2.840E+05		2.840E+05	
		1504.		1520.		1520.	
TIME	HRB					QRB	TRB
.0	1515.5	I	-0-0-X-I	I	-0-0-X-I	2.6808E+05	1541.8
44.000	1511.6	I	0 X I 0	I	0 X I 0	2.7355E+05	1543.2
88.000	1510.9	I	X 0	I	X 0	2.7660E+05	1545.5
132.00	1510.8	I	I X 0 0 I	I	I X 0 0 I	2.7859E+05	1548.4
176.00	1510.5	I	I X 0 0 I	I	I X 0 0 I	2.7989E+05	1551.6
220.00	1509.8	I	I X 0 0 I	I	I X 0 0 I	2.8074E+05	1554.6
264.00	1508.9	I	I X 0 0 I	I	I X 0 0 I	2.8129E+05	1557.1
308.00	1507.8	I	I X 0 0 I	I	I X 0 0 I	2.8165E+05	1559.2
352.00	1506.8	I	I X 0 0 I	I	I X 0 0 I	2.8188E+05	1560.8
396.00	1506.0	I	I X 0 0 I	I	I X 0 0 I	2.8204E+05	1561.9
440.00	1505.4	I	I X 0 0 I	I	I X 0 0 I	2.8214E+05	1562.7
484.00	1504.9	I	I X 0 0 I	I	I X 0 0 I	2.8220E+05	1563.2
528.00	1504.7	I	I X 0 0 I	I	I X 0 0 I	2.8224E+05	1563.5
572.00	1504.7	I	I X 0 0 I	I	I X 0 0 I	2.8227E+05	1563.7
616.00	1504.7	I	I X 0 0 I	I	I X 0 0 I	2.8229E+05	1564.0
660.00	1504.9	I	I X 0 0 I	I	I X 0 0 I	2.8230E+05	1564.2
704.00	1505.2	I	I X 0 0 I	I	I X 0 0 I	2.8231E+05	1564.4
748.00	1505.5	I	I X 0 0 I	I	I X 0 0 I	2.8231E+05	1564.7
792.00	1505.9	I	I X 0 0 I	I	I X 0 0 I	2.8232E+05	1565.0
836.00	1506.2	I	I X 0 0 I	I	I X 0 0 I	2.8232E+05	1565.4
880.00	1506.6	I	I X 0 0 I	I	I X 0 0 I	2.8232E+05	1565.8
924.00	1507.0	I	I X 0 0 I	I	I X 0 0 I	2.8232E+05	1566.3
968.00	1507.4	I	I X 0 0 I	I	I X 0 0 I	2.8232E+05	1566.8
1012.00	1507.8	I	I X 0 0 I	I	I X 0 0 I	2.8232E+05	1567.3
1056.00	1508.2	I	I X 0 0 I	I	I X 0 0 I	2.8232E+05	1567.9
1100.00	1508.6	I	I X 0 0 I	I	I X 0 0 I	2.8232E+05	1568.5
1144.00	1508.9	I	I X 0 0 I	I	I X 0 0 I	2.8232E+05	1569.1
1188.00	1509.3	I	I X 0 0 I	I	I X 0 0 I	2.8232E+05	1569.7
1232.00	1509.6	I	I X 0 0 I	I	I X 0 0 I	2.8232E+05	1570.3
1276.00	1510.0	I	I X 0 0 I	I	I X 0 0 I	2.8232E+05	1570.9
1320.00	1510.3	I	I X 0 0 I	I	I X 0 0 I	2.8232E+05	1571.4
1364.00	1510.6	I	I X 0 0 I	I	I X 0 0 I	2.8232E+05	1572.0
1408.00	1510.9	I	I X 0 0 I	I	I X 0 0 I	2.8232E+05	1572.6
1452.00	1511.2	I	I X 0 0 I	I	I X 0 0 I	2.8232E+05	1573.1
1496.00	1511.5	I	I X 0 0 I	I	I X 0 0 I	2.8232E+05	1573.7
1540.00	1511.7	I	I X 0 0 I	I	I X 0 0 I	2.8232E+05	1574.3
1584.00	1512.0	I	I X 0 0 I	I	I X 0 0 I	2.8232E+05	1574.8
1628.00	1512.2	I	I X 0 0 I	I	I X 0 0 I	2.8232E+05	1575.3
1672.00	1512.5	I	I X 0 0 I	I	I X 0 0 I	2.8232E+05	1575.8
1716.00	1512.7	I	I X 0 0 I	I	I X 0 0 I	2.8232E+05	1576.4
1760.00	1512.9	I	I X 0 0 I	I	I X 0 0 I	2.8232E+05	1576.9
1804.00	1513.1	I	I X 0 0 I	I	I X 0 0 I	2.8232E+05	1577.2
1848.00	1513.3	I	I X 0 0 I	I	I X 0 0 I	2.8232E+05	1577.6
1892.00	1513.5	I	I X 0 0 I	I	I X 0 0 I	2.8232E+05	1578.0
1936.00	1513.6	I	I X 0 0 I	I	I X 0 0 I	2.8232E+05	1578.4
1980.00	1513.8	I	I X 0 0 I	I	I X 0 0 I	2.8232E+05	1578.8
2024.00	1514.0	I	I X 0 0 I	I	I X 0 0 I	2.8232E+05	1579.1
2068.00	1514.1	I	I X 0 0 I	I	I X 0 0 I	2.8232E+05	1579.5
2112.00	1514.3	I	I X 0 0 I	I	I X 0 0 I	2.8232E+05	1579.8
2156.00	1514.4	I	I X 0 0 I	I	I X 0 0 I	2.8232E+05	1580.1
2200.00	1514.5	I	I X 0 0 I	I	I X 0 0 I	2.8232E+05	1580.4

5 PERCENT STEP CHANGE IN UNIT LOAD

		618.0		629.0		629.0	
		720.0		732.0		732.0	
		3.075E+04		3.135E+04		3.135E+04	
		9.820E+07		9.900E+07		9.900E+07	
		8.400E+07		9.000E+07		9.000E+07	
TIME	ECB					ELCB	ELCB
.0	8.4744E+07	I	-0-0-X-I	I	-0-0-X-I	9.8803E+07	30022.
44.000	8.4744E+07	I	0 X I 0	I	0 X I 0	9.9055E+07	31149.
88.000	8.4799E+07	I	X 0	I	X 0	9.9415E+07	31201.
132.00	8.4809E+07	I	I X 0 0 I	I	I X 0 0 I	9.9342E+07	31235.
176.00	8.5033E+07	I	I X 0 0 I	I	I X 0 0 I	9.9311E+07	31261.
220.00	8.5190E+07	I	I X 0 0 I	I	I X 0 0 I	9.9304E+07	31275.
264.00	8.5356E+07	I	I X 0 0 I	I	I X 0 0 I	9.9309E+07	31281.
308.00	8.5530E+07	I	I X 0 0 I	I	I X 0 0 I	9.9319E+07	31279.
352.00	8.5701E+07	I	I X 0 0 I	I	I X 0 0 I	9.9331E+07	31272.
396.00	8.5866E+07	I	I X 0 0 I	I	I X 0 0 I	9.9343E+07	31262.
440.00	8.6025E+07	I	I X 0 0 I	I	I X 0 0 I	9.9356E+07	31251.
484.00	8.6175E+07	I	I X 0 0 I	I	I X 0 0 I	9.9369E+07	31239.
528.00	8.6317E+07	I	I X 0 0 I	I	I X 0 0 I	9.9384E+07	31226.
572.00	8.6450E+07	I	I X 0 0 I	I	I X 0 0 I	9.9400E+07	31215.
616.00	8.6576E+07	I	I X 0 0 I	I	I X 0 0 I	9.9418E+07	31204.
660.00	8.6693E+07	I	I X 0 0 I	I	I X 0 0 I	9.9438E+07	31194.
704.00	8.6800E+07	I	I X 0 0 I	I	I X 0 0 I	9.9460E+07	31185.
748.00	8.6907E+07	I	I X 0 0 I	I	I X 0 0 I	9.9483E+07	31177.
792.00	8.7005E+07	I	I X 0 0 I	I	I X 0 0 I	9.9506E+07	31171.
836.00	8.7098E+07	I	I X 0 0 I	I	I X 0 0 I	9.9531E+07	31164.
880.00	8.7182E+07	I	I X 0 0 I	I	I X 0 0 I	9.9555E+07	31158.
924.00	8.7263E+07	I	I X 0 0 I	I	I X 0 0 I	9.9579E+07	31153.
968.00	8.7339E+07	I	I X 0 0 I	I	I X 0 0 I	9.9602E+07	31149.
1012.00	8.7410E+07	I	I X 0 0 I	I	I X 0 0 I	9.9625E+07	31144.
1056.00	8.7477E+07	I	I X 0 0 I	I	I X 0 0 I	9.9647E+07	31141.
1100.00	8.7541E+07	I	I X 0 0 I	I	I X 0 0 I	9.9668E+07	31137.
1144.00	8.7604E+07	I	I X 0 0 I	I	I X 0 0 I	9.9689E+07	31134.
1188.00	8.7656E+07	I	I X 0 0 I	I	I X 0 0 I	9.9709E+07	31131.
1232.00	8.7709E+07	I	I X 0 0 I	I	I X 0 0 I	9.9727E+07	31128.
1276.00	8.7759E+07	I	I X 0 0 I	I	I X 0 0 I	9.9745E+07	31125.
1320.00	8.7806E+07	I	I X 0 0 I	I	I X 0 0 I	9.9762E+07	31123.
1364.00	8.7850E+07	I	I X 0 0 I	I	I X 0 0 I	9.9780E+07	31118.
1408.00	8.7892E+07	I	I X 0 0 I	I	I X 0 0 I	9.9797E+07	31116.
1452.00	8.7932E+07	I	I X 0 0 I	I	I X 0 0 I	9.9808E+07	31114.
1496.00	8.7969E+07	I	I X 0 0 I	I	I X 0 0 I	9.9822E+07	31114.
1540.00	8.8004E+07	I	I X 0 0 I	I	I X 0 0 I	9.9835E+07	31113.
1584.00	8.8036E+07	I	I X 0 0 I	I	I X 0 0 I	9.9847E+07	31111.
1628.00	8.8068E+07	I	I X 0 0 I	I	I X 0 0 I	9.9859E+07	31109.
1672.00	8.8097E+07	I	I X 0 0 I	I	I X 0 0 I	9.9870E+07	31108.
1716.00	8.8125E+07	I	I X 0 0 I	I	I X 0 0 I	9.9881E+07	31107.
1760.00	8.8151E+07	I	I X 0 0 I	I	I X 0 0 I	9.9891E+07	31105.
1804.00	8.8175E+07	I	I X 0 0 I	I	I X 0 0 I	9.9900E+07	31104.
1848.00	8.8199E+07	I	I X 0 0 I	I	I X 0 0 I	9.9909E+07	31103.
1892.00	8.8221E+07	I	I X 0 0 I	I	I X 0 0 I	9.9917E+07	31102.
1936.00	8.8241E+07	I	I X 0 0 I	I	I X 0 0 I	9.9925E+07	31101.
1980.00	8.8261E+07	I	I X 0 0 I	I	I X 0 0 I	9.9933E+07	31100.
2024.00	8.8279E+07	I	I X 0 0 I	I	I X 0 0 I	9.9940E+07	31099.
2068.00	8.8297E+07	I	I X 0 0 I	I	I X 0 0 I	9.9947E+07	31098.
2112.00	8.8313E+07	I	I X 0 0 I	I	I X 0 0 I	9.9953E+07	31097.
2156.00	8.8329E+07	I	I X 0 0 I	I	I X 0 0 I	9.9960E+07	31097.
2200.00	8.8343E+07	I	I X 0 0 I	I	I X 0 0 I	9.9965E+07	31096.

5 PERCENT STEP CHANGE IN UNIT LOAD
FLUIDIZED CELL BED HEIGHTS (FT)

	.0	'Q'=PASS	1.600E+04				
	4.200	'O'=XCBH	4.400				
	4.215	'X'=XRBH	4.275				
	4.230	'M'=XSBH	4.290				
	4.225	'A'=XEBH	4.325				
TIME	XEBH			XSBH	XRBH	XCBH	PASS
.0	4.2351	OB--X-I-I-I-I-I-I-I-I-I	4.2322	4.2250	4.2304	4.2304	2.0000
48.000	4.2382	I 0 + X O I	4.2328	4.2268	4.2357	4.2357	384.00
88.000	4.2434	I 0 + X O I	4.2377	4.2297	4.2371	4.2371	649.00
132.000	4.2495	I 0 + X O I	4.2375	4.2374	4.2465	4.2465	914.00
176.000	4.2560	I 0 + X O I	4.2402	4.2375	4.2748	4.2748	1203.00
220.000	4.2624	I 0 + X O I	4.2422	4.2413	4.2824	4.2824	1541.00
264.000	4.2685	I 0 + X O I	4.2434	4.2447	4.2894	4.2894	1855.00
308.000	4.2742	I 0 + X O I	4.2439	4.2473	4.2959	4.2959	2153.00
352.000	4.2794	I 0 + X O I	4.2439	4.2494	4.3020	4.3020	2433.00
396.000	4.2840	I 0 + X O I	4.2438	4.2508	4.3076	4.3076	2747.00
440.000	4.2882	I 0 + X O I	4.2436	4.2518	4.3129	4.3129	3070.00
484.000	4.2919	I 0 + X O I	4.2436	4.2525	4.3178	4.3178	3448.00
528.000	4.2952	I 0 + X O I	4.2437	4.2529	4.3223	4.3223	3805.00
572.000	4.2981	I 0 + X O I	4.2440	4.2532	4.3266	4.3266	4182.00
616.000	4.3007	I 0 + X O I	4.2445	4.2535	4.3306	4.3306	4497.00
660.000	4.3030	I 0 + X O I	4.2451	4.2537	4.3343	4.3343	4769.00
704.000	4.3050	I 0 + X O I	4.2459	4.2541	4.3378	4.3378	5163.00
748.000	4.3068	I 0 + X O I	4.2468	4.2544	4.3410	4.3410	5461.00
792.000	4.3085	I 0 + X O I	4.2478	4.2548	4.3441	4.3441	5742.00
836.000	4.3099	I 0 + X O I	4.2488	4.2553	4.3470	4.3470	6013.00
880.000	4.3112	I 0 + X O I	4.2498	4.2559	4.3497	4.3497	6264.00
924.000	4.3124	I 0 + X O I	4.2508	4.2565	4.3522	4.3522	6496.00
968.000	4.3135	I 0 + X O I	4.2519	4.2572	4.3546	4.3546	6706.00
1012.000	4.3144	I 0 + X O I	4.2529	4.2579	4.3569	4.3569	6894.00
1056.000	4.3153	I 0 + X O I	4.2539	4.2586	4.3590	4.3590	7066.00
1100.000	4.3160	I 0 + X O I	4.2549	4.2593	4.3610	4.3610	7215.00
1144.000	4.3168	I 0 + X O I	4.2559	4.2601	4.3629	4.3629	7342.00
1188.000	4.3174	I 0 + X O I	4.2568	4.2608	4.3647	4.3647	7457.00
1232.000	4.3180	I 0 + X O I	4.2578	4.2616	4.3663	4.3663	7560.00
1276.000	4.3185	I 0 + X O I	4.2587	4.2624	4.3679	4.3679	7651.00
1320.000	4.3190	I 0 + X O I	4.2595	4.2632	4.3694	4.3694	7729.00
1364.000	4.3194	I 0 + X O I	4.2603	4.2639	4.3708	4.3708	7792.00
1408.000	4.3198	I 0 + X O I	4.2611	4.2647	4.3721	4.3721	7840.00
1452.000	4.3202	I 0 + X O I	4.2619	4.2654	4.3733	4.3733	7874.00
1496.000	4.3205	I 0 + X O I	4.2626	4.2661	4.3745	4.3745	7905.00
1540.000	4.3208	I 0 + X O I	4.2633	4.2668	4.3756	4.3756	7931.00
1584.000	4.3211	I 0 + X O I	4.2640	4.2675	4.3767	4.3767	7951.00
1628.000	4.3214	I 0 + X O I	4.2646	4.2682	4.3777	4.3777	7966.00
1672.000	4.3216	I 0 + X O I	4.2652	4.2688	4.3786	4.3786	7976.00
1716.000	4.3219	I 0 + X O I	4.2658	4.2694	4.3795	4.3795	7981.00
1760.000	4.3221	I 0 + X O I	4.2664	4.2700	4.3803	4.3803	7984.00
1804.000	4.3223	I 0 + X O I	4.2669	4.2706	4.3811	4.3811	7985.00
1848.000	4.3224	I 0 + X O I	4.2674	4.2711	4.3818	4.3818	7985.00
1892.000	4.3226	I 0 + X O I	4.2677	4.2717	4.3825	4.3825	7984.00
1936.000	4.3228	I 0 + X O I	4.2684	4.2722	4.3832	4.3832	7981.00
1980.000	4.3230	I 0 + X O I	4.2689	4.2727	4.3838	4.3838	7976.00
2024.000	4.3232	I 0 + X O I	4.2692	4.2731	4.3844	4.3844	7969.00
2068.000	4.3233	I 0 + X O I	4.2696	4.2736	4.3849	4.3849	7959.00
2112.000	4.3233	I 0 + X O I	4.2700	4.2740	4.3854	4.3854	7945.00
2156.000	4.3234	I 0 + X O I	4.2704	4.2744	4.3859	4.3859	7929.00
2200.000	4.3235	I 0 + X O I	4.2707	4.2748	4.3864	4.3864	7908.00

5 PERCENT STEP CHANGE IN UNIT LOAD
FLUIDIZED BED VOID FRACTION

	.0	'Q'=DELT	3.200				
	.6920	'O'=XCB	.7080				
	.6450	'X'=XRB	.6510				
	.6450	'M'=XEB	.6550				
	.6460	'A'=XSB	.6500				
TIME	XSB			XEB	XRB	XCB	DELT
.0	.64676	OB--X-I-I-I-I-I-I-I-I-I	.64701	.64616	.69211	.69211	1.0000
48.000	.64682	I 0 + X O I	.64727	.64631	.69322	.69322	1.0250
88.000	.64697	I 0 + X O I	.64770	.64656	.69404	.69404	1.0984
132.000	.64721	I 0 + X O I	.64821	.64687	.69472	.69472	1.2705
176.000	.64783	I 0 + X O I	.64874	.64721	.69531	.69531	1.6300
220.000	.64760	I 0 + X O I	.64927	.64753	.69585	.69585	1.2200
264.000	.64770	I 0 + X O I	.64977	.64701	.69634	.69634	1.3301
308.000	.64774	I 0 + X O I	.65024	.64803	.69680	.69680	1.2092
352.000	.64774	I 0 + X O I	.65066	.64820	.69723	.69723	1.3265
396.000	.64773	I 0 + X O I	.65104	.64831	.69763	.69763	1.4796
440.000	.64772	I 0 + X O I	.65138	.64840	.69800	.69800	1.6504
484.000	.64771	I 0 + X O I	.65168	.64845	.69834	.69834	1.9137
528.000	.64772	I 0 + X O I	.65195	.64849	.69866	.69866	1.7894
572.000	.64775	I 0 + X O I	.65218	.64851	.69895	.69895	1.8669
616.000	.64779	I 0 + X O I	.65239	.64853	.69923	.69923	1.4985
660.000	.64784	I 0 + X O I	.65258	.64856	.69949	.69949	1.7706
704.000	.64784	I 0 + X O I	.65274	.64858	.69973	.69973	1.0402
748.000	.64798	I 0 + X O I	.65289	.64861	.69986	.69986	1.3783
792.000	.64806	I 0 + X O I	.65302	.64865	.70017	.70017	2.1020
836.000	.64815	I 0 + X O I	.65314	.64869	.70037	.70037	2.5563
880.000	.64823	I 0 + X O I	.65324	.64873	.70055	.70055	1.5475
924.000	.64832	I 0 + X O I	.65334	.64878	.70073	.70073	1.0073
968.000	.64840	I 0 + X O I	.65342	.64884	.70089	.70089	1.7887
1012.000	.64849	I 0 + X O I	.65350	.64890	.70105	.70105	1.5590
1056.000	.64857	I 0 + X O I	.65357	.64896	.70119	.70119	.95362
1100.000	.64865	I 0 + X O I	.65363	.64902	.70133	.70133	1.2254
1144.000	.64873	I 0 + X O I	.65369	.64908	.70146	.70146	1.5033
1188.000	.64881	I 0 + X O I	.65374	.64914	.70158	.70158	1.7054
1232.000	.64889	I 0 + X O I	.65378	.64921	.70169	.70169	1.1939
1276.000	.64896	I 0 + X O I	.65383	.64927	.70180	.70180	1.0009
1320.000	.64903	I 0 + X O I	.65386	.64933	.70190	.70190	.99116
1364.000	.64910	I 0 + X O I	.65390	.64940	.70200	.70200	1.0884
1408.000	.64917	I 0 + X O I	.65393	.64946	.70209	.70209	1.2042
1452.000	.64923	I 0 + X O I	.65396	.64952	.70217	.70217	1.3665
1496.000	.64929	I 0 + X O I	.65399	.64958	.70225	.70225	1.4216
1540.000	.64935	I 0 + X O I	.65401	.64963	.70233	.70233	.93321
1584.000	.64940	I 0 + X O I	.65404	.64969	.70240	.70240	1.4570
1628.000	.64945	I 0 + X O I	.65406	.64974	.70247	.70247	1.5157
1672.000	.64950	I 0 + X O I	.65408	.64980	.70253	.70253	1.5599
1716.000	.64955	I 0 + X O I	.65410	.64985	.70259	.70259	1.7208
1760.000	.64960	I 0 + X O I	.65411	.64990	.70265	.70265	2.2108
1804.000	.64964	I 0 + X O I	.65413	.64994	.70270	.70270	2.6555
1848.000	.64968	I 0 + X O I	.65414	.64999	.70275	.70275	2.1322
1892.000	.64972	I 0 + X O I	.65416	.65003	.70280	.70280	1.1384
1936.000	.64976	I 0 + X O I	.65417	.65007	.70284	.70284	1.6085
1980.000	.64980	I 0 + X O I	.65418	.65011	.70288	.70288	.94710
2024.000	.64983	I 0 + X O I	.65419	.65015	.70292	.70292	1.2722
2068.000	.64986	I 0 + X O I	.65420	.65019	.70296	.70296	.91662
2112.000	.64989	I 0 + X O I	.65421	.65022	.70299	.70299	1.3545
2156.000	.64992	I 0 + X O I	.65422	.65026	.70303	.70303	1.2645
2200.000	.64995	I 0 + X O I	.65423	.65029	.70306	.70306	2.0451

5 PERCENT STEP CHANGE IN UNIT LOAD
CELL EXIT GAS TEMPERATURES

TIME	TEBG	720.0	'O' = TCBG	732.0	TSBG	TRBG	TCBG
		1630.	'X' = TRBG	1670.			
		1640.	'M' = TSBG	1672.			
		1635.	'A' = TEBG	1695.			
.0	1640.0	I	I	I	1640.3	1637.3	1640.14
44.000	1644.2	I	I	I	1642.4	1640.1	1642.24
88.000	1649.4	I	I	I	1646.4	1644.6	1644.00
132.000	1653.8	I	I	I	1649.4	1648.1	1648.00
176.000	1657.5	I	I	I	1652.0	1651.0	1651.00
220.000	1660.4	I	I	I	1653.7	1653.3	1653.00
264.000	1663.3	I	I	I	1654.7	1655.1	1655.00
308.000	1665.6	I	I	I	1655.3	1656.4	1656.00
352.000	1667.6	I	I	I	1655.4	1657.4	1657.00
396.000	1669.4	I	I	I	1655.7	1658.0	1658.00
440.000	1670.9	I	I	I	1655.8	1658.5	1658.00
484.000	1672.2	I	I	I	1655.8	1658.8	1658.00
528.000	1673.4	I	I	I	1655.9	1659.0	1659.00
572.000	1674.4	I	I	I	1656.1	1659.1	1659.00
616.000	1675.3	I	I	I	1656.3	1659.2	1659.00
660.000	1676.0	I	I	I	1656.5	1659.3	1659.00
704.000	1676.7	I	I	I	1656.6	1659.4	1659.00
748.000	1677.3	I	I	I	1657.1	1659.6	1659.00
792.000	1677.9	I	I	I	1657.4	1659.7	1659.00
836.000	1678.4	I	I	I	1657.8	1659.9	1659.00
880.000	1678.8	I	I	I	1658.1	1660.1	1660.00
924.000	1679.2	I	I	I	1658.5	1660.3	1660.00
968.000	1679.6	I	I	I	1658.9	1660.6	1660.00
1012.000	1679.9	I	I	I	1659.2	1660.8	1660.00
1056.000	1680.2	I	I	I	1659.6	1661.0	1661.00
1100.000	1680.5	I	I	I	1659.9	1661.3	1661.00
1144.000	1680.7	I	I	I	1660.3	1661.6	1661.00
1188.000	1680.9	I	I	I	1660.6	1661.8	1661.00
1232.000	1681.1	I	I	I	1660.9	1662.1	1662.00
1276.000	1681.3	I	I	I	1661.2	1662.4	1662.00
1320.000	1681.4	I	I	I	1661.5	1662.6	1662.00
1364.000	1681.4	I	I	I	1661.6	1662.9	1662.00
1408.000	1681.7	I	I	I	1662.1	1663.2	1662.00
1452.000	1681.9	I	I	I	1662.3	1663.4	1662.00
1496.000	1682.0	I	I	I	1662.6	1663.6	1662.00
1540.000	1682.1	I	I	I	1662.8	1663.8	1662.00
1584.000	1682.2	I	I	I	1663.0	1664.0	1662.00
1628.000	1682.3	I	I	I	1663.3	1664.3	1662.00
1672.000	1682.4	I	I	I	1663.5	1664.5	1662.00
1716.000	1682.4	I	I	I	1663.7	1664.8	1662.00
1760.000	1682.5	I	I	I	1663.9	1665.0	1662.00
1804.000	1682.6	I	I	I	1664.1	1665.2	1662.00
1848.000	1682.6	I	I	I	1664.2	1665.4	1662.00
1892.000	1682.7	I	I	I	1664.4	1665.6	1662.00
1936.000	1682.7	I	I	I	1664.6	1665.7	1662.00
1980.000	1682.8	I	I	I	1664.7	1665.9	1662.00
2024.000	1682.8	I	I	I	1664.8	1666.1	1662.00
2068.000	1682.9	I	I	I	1665.0	1666.2	1662.00
2112.000	1682.9	I	I	I	1665.1	1666.4	1662.00
2156.000	1682.9	I	I	I	1665.2	1666.5	1662.00
2200.000	1683.0	I	I	I	1665.3	1666.6	1662.00

5 PERCENT STEP CHANGE IN UNIT LOAD
BED STEAM FLOWS

TIME	TCBM	960.0	'O' = TSBG	1020.	TRBS	TRMS	TSBS
		994.0	'A' = TRBS	102.0			
		975.0	'M' = TRBS	995.0			
		618.0	'A' = TCBM	624.0			
.0	621.82	I	I	I	994.85	998.24	1001.8
44.000	620.26	I	I	I	998.22	998.24	998.24
88.000	619.38	I	I	I	997.01	996.46	992.52
132.000	618.92	I	I	I	996.94	996.41	992.49
176.000	618.73	I	I	I	996.47	996.26	992.57
220.000	618.68	I	I	I	995.29	997.30	997.04
264.000	618.71	I	I	I	995.58	997.55	997.36
308.000	618.77	I	I	I	995.71	997.71	997.09
352.000	618.85	I	I	I	995.90	997.80	997.25
396.000	618.93	I	I	I	996.37	997.84	997.61
440.000	619.01	I	I	I	997.21	997.87	998.05
484.000	619.09	I	I	I	997.58	997.89	998.68
528.000	619.18	I	I	I	997.01	997.92	998.86
572.000	619.29	I	I	I	997.01	997.95	998.00
616.000	619.40	I	I	I	997.05	998.01	997.59
660.000	619.53	I	I	I	997.39	998.07	997.95
704.000	619.66	I	I	I	997.68	998.15	997.25
748.000	619.81	I	I	I	997.47	998.23	997.47
792.000	619.95	I	I	I	997.12	998.32	997.60
836.000	620.11	I	I	I	997.83	998.41	997.66
880.000	620.26	I	I	I	997.56	998.51	998.65
924.000	620.41	I	I	I	998.29	998.60	998.57
968.000	620.56	I	I	I	998.03	998.69	998.44
1012.000	620.70	I	I	I	998.76	998.77	998.27
1056.000	620.84	I	I	I	998.48	998.86	998.04
1100.000	620.97	I	I	I	998.18	998.94	998.78
1144.000	621.10	I	I	I	998.87	999.02	998.49
1188.000	621.24	I	I	I	998.59	999.09	998.13
1232.000	621.34	I	I	I	998.19	999.16	998.79
1276.000	621.46	I	I	I	998.81	999.23	998.39
1320.000	621.56	I	I	I	998.42	999.29	998.97
1364.000	621.64	I	I	I	998.00	999.36	998.52
1408.000	621.76	I	I	I	998.57	999.41	998.03
1452.000	621.85	I	I	I	998.12	999.47	998.53
1496.000	621.94	I	I	I	998.63	999.52	998.00
1540.000	622.02	I	I	I	998.13	999.57	998.44
1584.000	622.10	I	I	I	998.60	999.62	998.86
1628.000	622.17	I	I	I	998.06	999.67	998.27
1672.000	622.24	I	I	I	998.51	999.71	998.64
1716.000	622.31	I	I	I	998.91	999.75	998.00
1760.000	622.37	I	I	I	998.35	999.79	998.34
1804.000	622.43	I	I	I	998.71	999.82	998.66
1848.000	622.49	I	I	I	998.04	999.86	998.97
1892.000	622.54	I	I	I	998.39	999.89	998.26
1936.000	622.59	I	I	I	998.72	999.92	998.53
1980.000	622.64	I	I	I	998.03	999.95	998.79
2024.000	622.69	I	I	I	998.34	999.98	998.03
2068.000	622.73	I	I	I	998.61	1000.01	998.27
2112.000	622.77	I	I	I	998.88	1000.03	998.49
2156.000	622.81	I	I	I	998.14	1000.06	998.70
2200.000	622.84	I	I	I	998.38	1000.08	998.89

5 PERCENT STEP CHANGE IN UNIT LOAD
BED TEMPERATURES

TIME	TEB	1875. 1530. 1540. 1540.	'O'=-TCB 'X'=-TRB 'M'=-TSB 'I'=-TEB	1975. 1590. 1580. 1620.	TSB	TRB	TCB
0	1550.0	I	I	I	1547.7	1541.8	1885.9
44.000	1552.4	I	I	I	1548.1	1541.2	1886.2
88.000	1554.4	I	I	I	1549.6	1545.5	1887.4
132.000	1561.1	I	I	I	1551.8	1548.4	1889.7
176.000	1566.2	I	I	I	1553.9	1551.6	1892.7
220.000	1571.1	I	I	I	1555.5	1554.6	1896.1
264.000	1575.9	I	I	I	1556.4	1557.1	1899.9
308.000	1580.2	I	I	I	1556.8	1559.2	1903.7
352.000	1584.2	I	I	I	1556.8	1560.8	1907.5
396.000	1587.8	I	I	I	1556.7	1561.9	1911.2
440.000	1591.0	I	I	I	1556.6	1562.7	1914.7
484.000	1593.8	I	I	I	1556.5	1563.2	1918.1
528.000	1596.3	I	I	I	1556.6	1563.5	1921.2
572.000	1598.6	I	I	I	1556.9	1563.7	1924.2
616.000	1600.6	I	I	I	1557.2	1564.0	1927.0
660.000	1602.3	I	I	I	1557.7	1564.2	1929.6
704.000	1603.9	I	I	I	1558.4	1564.4	1932.1
748.000	1605.3	I	I	I	1559.0	1564.7	1934.4
792.000	1606.5	I	I	I	1559.8	1565.0	1936.5
836.000	1607.6	I	I	I	1560.6	1565.4	1938.6
880.000	1608.6	I	I	I	1561.4	1565.8	1940.5
924.000	1609.5	I	I	I	1562.2	1566.3	1942.3
968.000	1610.3	I	I	I	1563.0	1566.8	1944.0
1012.000	1611.1	I	I	I	1563.8	1567.3	1945.6
1056.000	1611.7	I	I	I	1564.5	1567.9	1947.1
1100.000	1612.3	I	I	I	1565.3	1568.5	1948.5
1144.000	1612.8	I	I	I	1566.1	1569.1	1949.8
1188.000	1613.3	I	I	I	1566.8	1569.7	1951.0
1232.000	1613.8	I	I	I	1567.5	1570.3	1952.2
1276.000	1614.2	I	I	I	1568.2	1570.9	1953.3
1320.000	1614.5	I	I	I	1568.9	1571.4	1954.4
1364.000	1614.9	I	I	I	1569.5	1572.0	1955.4
1408.000	1615.2	I	I	I	1570.1	1572.4	1956.3
1452.000	1615.5	I	I	I	1570.7	1573.2	1957.2
1496.000	1615.7	I	I	I	1571.3	1573.7	1958.0
1540.000	1616.0	I	I	I	1571.8	1574.3	1958.8
1584.000	1616.2	I	I	I	1572.3	1574.8	1959.5
1628.000	1616.4	I	I	I	1572.8	1575.3	1960.2
1672.000	1616.6	I	I	I	1573.3	1575.8	1960.8
1716.000	1616.7	I	I	I	1573.7	1576.3	1961.5
1760.000	1616.9	I	I	I	1574.2	1576.7	1962.0
1804.000	1617.0	I	I	I	1574.6	1577.2	1962.6
1848.000	1617.2	I	I	I	1575.0	1577.6	1963.1
1892.000	1617.4	I	I	I	1575.3	1578.0	1963.6
1936.000	1617.4	I	I	I	1575.7	1578.4	1964.1
1980.000	1617.5	I	I	I	1576.0	1578.8	1964.5
2024.000	1617.6	I	I	I	1576.4	1579.1	1964.9
2068.000	1617.7	I	I	I	1576.7	1579.5	1965.3
2112.000	1617.8	I	I	I	1577.0	1579.8	1965.7
2156.000	1617.9	I	I	I	1577.2	1580.1	1966.0
2200.000	1618.0	I	I	I	1577.5	1580.4	1966.3

5 PERCENT STEP CHANGE IN UNIT LOAD
FRACTION OF WATER, TWO PHASE, STEAM BOILING BED INLET TO RM OUTLET

TIME	XEBMF	5.000E-02 .5400 .2960	'X'=-XEBMF 'M'=-XEBMF 'I'=-XEBMF	.1500 .6200 .3280	XEBMF	XEBMF
0	.30399	I	I	I	.57313	.12288
44.000	.31817	I	I	I	.60559	8.0234E-02
88.000	.32004	I	I	I	.61719	6.2764E-02
132.000	.32419	I	I	I	.61703	5.8782E-02
176.000	.32656	I	I	I	.61261	6.0830E-02
220.000	.32740	I	I	I	.60749	6.5105E-02
264.000	.32711	I	I	I	.60306	6.9827E-02
308.000	.32610	I	I	I	.59966	7.4240E-02
352.000	.32474	I	I	I	.59715	7.8113E-02
396.000	.32330	I	I	I	.59528	8.1428E-02
440.000	.32194	I	I	I	.59379	8.4275E-02
484.000	.32075	I	I	I	.59249	8.6759E-02
528.000	.31977	I	I	I	.59126	8.8976E-02
572.000	.31899	I	I	I	.59000	9.1004E-02
616.000	.31839	I	I	I	.59001	9.2903E-02
660.000	.31794	I	I	I	.58736	9.4702E-02
704.000	.31761	I	I	I	.58596	9.6431E-02
748.000	.31736	I	I	I	.58455	9.8094E-02
792.000	.31710	I	I	I	.58312	9.9694E-02
836.000	.31704	I	I	I	.58172	.10124
880.000	.31694	I	I	I	.58033	.10272
924.000	.31686	I	I	I	.57900	.10413
968.000	.31680	I	I	I	.57771	.10549
1012.000	.31675	I	I	I	.57647	.10678
1056.000	.31671	I	I	I	.57528	.10801
1100.000	.31668	I	I	I	.57414	.10917
1144.000	.31666	I	I	I	.57306	.11028
1188.000	.31664	I	I	I	.57204	.11131
1232.000	.31663	I	I	I	.57104	.11231
1276.000	.31662	I	I	I	.57013	.11324
1320.000	.31662	I	I	I	.56926	.11413
1364.000	.31661	I	I	I	.56842	.11497
1408.000	.31662	I	I	I	.56763	.11576
1452.000	.31662	I	I	I	.56689	.11650
1496.000	.31662	I	I	I	.56617	.11721
1540.000	.31663	I	I	I	.56550	.11787
1584.000	.31664	I	I	I	.56486	.11850
1628.000	.31665	I	I	I	.56426	.11909
1672.000	.31666	I	I	I	.56369	.11965
1716.000	.31667	I	I	I	.56314	.12019
1760.000	.31668	I	I	I	.56262	.12069
1804.000	.31669	I	I	I	.56214	.12117
1848.000	.31671	I	I	I	.56168	.12161
1892.000	.31672	I	I	I	.56125	.12204
1936.000	.31673	I	I	I	.56083	.12244
1980.000	.31674	I	I	I	.56044	.12282
2024.000	.31675	I	I	I	.56007	.12318
2068.000	.31676	I	I	I	.55972	.12352
2112.000	.31677	I	I	I	.55939	.12384
2156.000	.31678	I	I	I	.55907	.12415
2200.000	.31679	I	I	I	.55878	.12443

5 PERCENT STEP CHANGE IN UNIT LOAD
NET WATER AND TWO PHASE FLOW INVENTORIES

TIME	DXEBHF	1136.				1168.			
		-6.0000	'0'=-MEBA	18.00		6.000E-04	MEBM	MEBMS	MEBA
		-8.0000	'0'=-MEBMS			1.800E-04			
		-2.000E-04	'X'=-MEBM						
		-6.000E-05	'+'=-DXEBMS						
			'+'=-DXEBHF						
TIME	DXEBHF	0				DXEBMS	MEBM	MEBMS	MEBA
0	0	I	I	I	I	0	0	0	1158.1
44.000	1.5050E-04	I	I	I	I	0	0	0	1158.7
88.000	1.1448E-04	I	I	I	I	0	0	0	1159.5
132.000	7.3910E-05	I	I	I	I	0	0	0	1159.7
176.000	3.6120E-05	I	I	I	I	0	0	0	1162.0
220.000	4.7684E-06	I	I	I	I	0	0	0	1162.1
264.000	-1.6510E-05	I	I	I	I	0	0	0	1161.6
308.000	-2.0908E-05	I	I	I	I	0	0	0	1160.8
352.000	-3.3915E-05	I	I	I	I	0	0	0	1160.3
396.000	-3.3975E-05	I	I	I	I	0	0	0	1159.8
440.000	-2.9027E-05	I	I	I	I	0	0	0	1159.6
484.000	-2.5459E-05	I	I	I	I	0	0	0	1159.4
528.000	-1.9968E-05	I	I	I	I	0	0	0	1159.4
572.000	-1.4842E-05	I	I	I	I	0	0	0	1159.4
616.000	-1.2875E-05	I	I	I	I	0	0	0	1159.3
660.000	-9.1791E-06	I	I	I	I	0	0	0	1159.3
704.000	-7.2718E-06	I	I	I	I	0	0	0	1159.3
748.000	-5.6028E-06	I	I	I	I	0	0	0	1159.4
792.000	-3.9935E-06	I	I	I	I	0	0	0	1159.4
836.000	-2.2054E-06	I	I	I	I	0	0	0	1159.3
880.000	-2.6822E-06	I	I	I	I	0	0	0	1159.2
924.000	-2.2650E-06	I	I	I	I	0	0	0	1159.1
968.000	-5.9605E-07	I	I	I	I	0	0	0	1159.2
1012.000	-8.9407E-07	I	I	I	I	0	0	0	1159.1
1056.000	1.1325E-06	I	I	I	I	0	0	0	1159.2
1100.000	-5.9605E-07	I	I	I	I	0	0	0	1159.0
1144.000	-4.7684E-07	I	I	I	I	0	0	0	1158.9
1188.000	-4.1723E-07	I	I	I	I	0	0	0	1158.9
1232.000	8.9407E-07	I	I	I	I	0	0	0	1159.0
1276.000	-1.6093E-06	I	I	I	I	0	0	0	1158.8
1320.000	-1.1921E-06	I	I	I	I	0	0	0	1158.7
1364.000	9.5367E-07	I	I	I	I	0	0	0	1158.7
1408.000	-9.5367E-07	I	I	I	I	0	0	0	1158.7
1452.000	-2.3842E-07	I	I	I	I	0	0	0	1158.7
1496.000	-1.1921E-06	I	I	I	I	0	0	0	1158.6
1540.000	-9.5367E-07	I	I	I	I	0	0	0	1158.6
1584.000	5.9605E-07	I	I	I	I	0	0	0	1158.7
1628.000	3.5763E-07	I	I	I	I	0	0	0	1158.7
1672.000	-5.9605E-07	I	I	I	I	0	0	0	1158.5
1716.000	1.0433E-06	I	I	I	I	0	0	0	1158.6
1760.000	2.3842E-07	I	I	I	I	0	0	0	1158.6
1804.000	3.5763E-07	I	I	I	I	0	0	0	1158.6
1848.000	2.3842E-07	I	I	I	I	0	0	0	1158.6
1892.000	4.1723E-07	I	I	I	I	0	0	0	1158.6
1936.000	5.3644E-07	I	I	I	I	0	0	0	1158.4
1980.000	1.1921E-06	I	I	I	I	0	0	0	1158.4
2024.000	-2.9802E-07	I	I	I	I	0	0	0	1158.3
2068.000	1.9670E-06	I	I	I	I	0	0	0	1158.5
2112.000	1.1921E-07	I	I	I	I	0	0	0	1158.4
2156.000	7.1526E-07	I	I	I	I	0	0	0	1158.4
2200.000	4.1723E-07	I	I	I	I	0	0	0	1158.4

5 PERCENT STEP CHANGE IN UNIT LOAD
PRESSURES IN BOILING, SUPERHEAT AND REHEAT BEDS

TIME	PRM	568.0				600.0			
		2700.	'X'=-PRH	2760.		2760.	PPS	PPS	PRM
		2865.	'+'=-PPS			2925.			
			'+'=-PRM						
TIME	PRM	0				PPS	PPS	PPS	PRM
0	2894.8	I	I	I	I	2735.8	2735.8	2735.8	570.79
44.000	2879.1	I	I	I	I	2709.4	2709.4	2709.4	583.29
88.000	2874.4	I	I	I	I	2704.8	2704.8	2704.8	585.00
132.000	2877.3	I	I	I	I	2708.1	2708.1	2708.1	586.14
176.000	2888.2	I	I	I	I	2713.4	2713.4	2713.4	587.91
220.000	2886.6	I	I	I	I	2717.9	2717.9	2717.9	589.85
264.000	2889.6	I	I	I	I	2720.9	2720.9	2720.9	591.54
308.000	2891.3	I	I	I	I	2722.4	2722.4	2722.4	592.77
352.000	2892.0	I	I	I	I	2722.0	2722.0	2722.0	593.56
396.000	2892.2	I	I	I	I	2722.7	2722.7	2722.7	593.87
440.000	2892.2	I	I	I	I	2722.3	2722.3	2722.3	593.96
484.000	2892.2	I	I	I	I	2721.9	2721.9	2721.9	593.87
528.000	2892.4	I	I	I	I	2721.7	2721.7	2721.7	593.75
572.000	2892.7	I	I	I	I	2721.8	2721.8	2721.8	593.60
616.000	2893.3	I	I	I	I	2722.1	2722.1	2722.1	593.48
660.000	2894.1	I	I	I	I	2722.7	2722.7	2722.7	593.38
704.000	2895.0	I	I	I	I	2723.4	2723.4	2723.4	593.34
748.000	2896.0	I	I	I	I	2723.4	2723.4	2723.4	593.34
792.000	2897.2	I	I	I	I	2725.3	2725.3	2725.3	593.38
836.000	2898.4	I	I	I	I	2726.3	2726.3	2726.3	593.46
880.000	2899.6	I	I	I	I	2727.4	2727.4	2727.4	593.56
924.000	2900.8	I	I	I	I	2728.5	2728.5	2728.5	593.67
968.000	2901.9	I	I	I	I	2729.6	2729.6	2729.6	593.80
1012.000	2903.1	I	I	I	I	2730.6	2730.6	2730.6	593.93
1056.000	2904.2	I	I	I	I	2731.7	2731.7	2731.7	594.07
1100.000	2905.3	I	I	I	I	2732.4	2732.4	2732.4	594.21
1144.000	2906.3	I	I	I	I	2733.6	2733.6	2733.6	594.34
1188.000	2907.3	I	I	I	I	2734.5	2734.5	2734.5	594.48
1232.000	2908.2	I	I	I	I	2735.4	2735.4	2735.4	594.61
1276.000	2909.1	I	I	I	I	2736.2	2736.2	2736.2	594.74
1320.000	2910.0	I	I	I	I	2737.0	2737.0	2737.0	594.87
1364.000	2910.8	I	I	I	I	2737.8	2737.8	2737.8	594.99
1408.000	2911.6	I	I	I	I	2738.5	2738.5	2738.5	595.11
1452.000	2912.3	I	I	I	I	2739.2	2739.2	2739.2	595.23
1496.000	2913.0	I	I	I	I	2739.9	2739.9	2739.9	595.34
1540.000	2913.7	I	I	I	I	2740.5	2740.5	2740.5	595.44
1584.000	2914.3	I	I	I	I	2741.1	2741.1	2741.1	595.55
1628.000	2914.9	I	I	I	I	2741.7	2741.7	2741.7	595.64
1672.000	2915.5	I	I	I	I	2742.2	2742.2	2742.2	595.74
1716.000	2916.0	I	I	I	I	2742.7	2742.7	2742.7	595.83
1760.000	2916.5	I	I	I	I	2743.2	2743.2	2743.2	595.93
1804.000	2917.0	I	I	I	I	2743.7	2743.7	2743.7	596.01
1848.000	2917.5	I	I	I	I	2744.1	2744.1	2744.1	596.07
1892.000	2917.9	I	I	I	I	2744.6	2744.6	2744.6	596.15
1936.000	2918.4	I	I	I	I	2745.0	2745.0	2745.0	596.23
1980.000	2918.8	I	I	I	I	2745.3	2745.3	2745.3	596.29
2024.000	2919.1	I	I	I	I	2745.7	2745.7	2745.7	596.36
2068.000	2919.5	I	I	I	I	2746.0	2746.0	2746.0	596.42
2112.000	2919.8	I	I	I	I	2746.3	2746.3	2746.3	596.48
2156.000	2920.2	I	I	I	I	2746.6	2746.6	2746.6	596.54
2200.000	2920.5	I	I	I	I	2746.9	2746.9	2746.9	596.59

5 PERCENT STEP CHANGE IN UNIT LOAD
HEAT FLUX

	2.160E+05	'O'=QSBTS	2.320E+05			
	7.200E+04	'X'=QPSMA	8.400E+04			
	7.600E+04	'M'=QPSA	8.400E+04			
	1.020E+05	'A'=QGPHS	1.260E+05			
TIME	QGPHS		QPSA	QPSMA	QSBTS	
.0	1.0457E+05 I	I	76400.	74237.	2.1875E+05	
44.000	1.1923E+05 I	I	78474.	78527.	2.1826E+05	
88.000	1.2026E+05 I	I	78911.	80686.	2.1673E+05	
132.00	1.1784E+05 I	I	79387.	81995.	2.2084E+05	
176.00	1.1492E+05 I	I	79859.	82550.	2.2510E+05	
220.00	1.1251E+05 I	I	80282.	82586.	2.2804E+05	
264.00	1.1085E+05 I	I	80630.	82325.	2.2955E+05	
308.00	1.0984E+05 I	I	80897.	81929.	2.2997E+05	
352.00	1.0933E+05 I	I	81084.	81504.	2.2970E+05	
396.00	1.0914E+05 I	I	81210.	81117.	2.2907E+05	
440.00	1.0919E+05 I	I	81281.	80790.	2.2831E+05	
484.00	1.0933E+05 I	I	81312.	80533.	2.2755E+05	
528.00	1.0953E+05 I	I	81314.	80341.	2.2684E+05	
572.00	1.0975E+05 I	I	81298.	80205.	2.2629E+05	
616.00	1.0996E+05 I	I	81269.	80114.	2.2583E+05	
660.00	1.1015E+05 I	I	81233.	80056.	2.2547E+05	
704.00	1.1032E+05 I	I	81193.	80024.	2.2520E+05	
748.00	1.1047E+05 I	I	81152.	80007.	2.2500E+05	
792.00	1.1059E+05 I	I	81111.	80001.	2.2486E+05	
836.00	1.1072E+05 I	I	81071.	80003.	2.2476E+05	
880.00	1.1082E+05 I	I	81033.	80009.	2.2468E+05	
924.00	1.1092E+05 I	I	80996.	80018.	2.2463E+05	
968.00	1.1102E+05 I	I	80962.	80029.	2.2459E+05	
1012.00	1.1110E+05 I	I	80929.	80039.	2.2457E+05	
1056.00	1.1118E+05 I	I	80898.	80052.	2.2457E+05	
1100.00	1.1126E+05 I	I	80868.	80064.	2.2456E+05	
1144.00	1.1134E+05 I	I	80841.	80074.	2.2455E+05	
1188.00	1.1141E+05 I	I	80815.	80086.	2.2457E+05	
1232.00	1.1148E+05 I	I	80790.	80098.	2.2458E+05	
1276.00	1.1154E+05 I	I	80767.	80109.	2.2460E+05	
1320.00	1.1160E+05 I	I	80745.	80120.	2.2462E+05	
1364.00	1.1167E+05 I	I	80725.	80132.	2.2463E+05	
1408.00	1.1172E+05 I	I	80705.	80142.	2.2464E+05	
1452.00	1.1178E+05 I	I	80687.	80152.	2.2468E+05	
1496.00	1.1183E+05 I	I	80670.	80162.	2.2471E+05	
1540.00	1.1188E+05 I	I	80653.	80173.	2.2472E+05	
1584.00	1.1193E+05 I	I	80638.	80183.	2.2475E+05	
1628.00	1.1197E+05 I	I	80624.	80192.	2.2478E+05	
1672.00	1.1201E+05 I	I	80611.	80200.	2.2481E+05	
1716.00	1.1205E+05 I	I	80598.	80210.	2.2484E+05	
1760.00	1.1209E+05 I	I	80584.	80217.	2.2486E+05	
1804.00	1.1212E+05 I	I	80575.	80225.	2.2488E+05	
1848.00	1.1216E+05 I	I	80565.	80232.	2.2491E+05	
1892.00	1.1219E+05 I	I	80555.	80240.	2.2493E+05	
1936.00	1.1222E+05 I	I	80546.	80246.	2.2494E+05	
1980.00	1.1225E+05 I	I	80536.	80252.	2.2498E+05	
2024.00	1.1227E+05 I	I	80528.	80258.	2.2501E+05	
2068.00	1.1229E+05 I	I	80519.	80265.	2.2503E+05	
2112.00	1.1232E+05 I	I	80513.	80270.	2.2504E+05	
2156.00	1.1234E+05 I	I	80506.	80275.	2.2506E+05	
2200.00	1.1237E+05 I	I	80499.	80280.	2.2508E+05	

5 PERCENT STEP CHANGE IN UNIT LOAD

	5.100E+04	'O'=QCBEC2	5.700E+04			
	2.160E+05	'O'=QSBTS	2.320E+05			
	2.080E+05	'X'=QSBT	2.400E+05			
	9.000E+04	'M'=QSBGHR	9.600E+04			
	1.240E+05	'A'=QSBTS	1.320E+05			
TIME	QSBTS		QSBGHR	QSBT	QSBTS	QCBEC2
.0	1.3141E+05 I	I	90511.	2.0999E+05	2.1875E+05	51639.
44.000	1.2685E+05 I	I	90924.	2.1572E+05	2.1826E+05	52150.
88.000	1.2517E+05 I	I	91705.	2.1650E+05	2.1673E+05	52341.
132.00	1.2536E+05 I	I	92317.	2.1804E+05	2.2084E+05	52522.
176.00	1.2644E+05 I	I	92774.	2.2060E+05	2.2510E+05	52693.
220.00	1.2774E+05 I	I	93088.	2.2335E+05	2.2804E+05	52856.
264.00	1.2895E+05 I	I	93204.	2.2568E+05	2.2955E+05	53010.
308.00	1.2984E+05 I	I	93393.	2.2732E+05	2.2997E+05	53155.
352.00	1.3050E+05 I	I	93447.	2.2826E+05	2.2970E+05	53292.
396.00	1.3087E+05 I	I	93470.	2.2864E+05	2.2907E+05	53420.
440.00	1.3120E+05 I	I	93481.	2.2861E+05	2.2831E+05	53539.
484.00	1.3120E+05 I	I	93481.	2.2834E+05	2.2755E+05	53650.
528.00	1.3104E+05 I	I	93508.	2.2795E+05	2.2686E+05	53757.
572.00	1.3091E+05 I	I	93535.	2.2752E+05	2.2629E+05	53848.
616.00	1.3077E+05 I	I	93571.	2.2718E+05	2.2572E+05	53937.
660.00	1.3062E+05 I	I	93616.	2.2673E+05	2.2547E+05	54018.
704.00	1.3047E+05 I	I	93669.	2.2641E+05	2.2520E+05	54094.
748.00	1.3033E+05 I	I	93728.	2.2614E+05	2.2500E+05	54164.
792.00	1.3023E+05 I	I	93791.	2.2593E+05	2.2486E+05	54229.
836.00	1.3009E+05 I	I	93858.	2.2576E+05	2.2476E+05	54289.
880.00	1.2999E+05 I	I	93925.	2.2563E+05	2.2468E+05	54345.
924.00	1.2991E+05 I	I	93994.	2.2553E+05	2.2463E+05	54397.
968.00	1.2984E+05 I	I	94062.	2.2545E+05	2.2459E+05	54446.
1012.00	1.2978E+05 I	I	94130.	2.2538E+05	2.2457E+05	54492.
1056.00	1.2973E+05 I	I	94197.	2.2533E+05	2.2457E+05	54535.
1100.00	1.2969E+05 I	I	94262.	2.2529E+05	2.2456E+05	54575.
1144.00	1.2965E+05 I	I	94326.	2.2526E+05	2.2455E+05	54615.
1188.00	1.2962E+05 I	I	94388.	2.2524E+05	2.2457E+05	54649.
1232.00	1.2960E+05 I	I	94448.	2.2522E+05	2.2458E+05	54682.
1276.00	1.2959E+05 I	I	94506.	2.2521E+05	2.2460E+05	54713.
1320.00	1.2958E+05 I	I	94562.	2.2520E+05	2.2462E+05	54743.
1364.00	1.2957E+05 I	I	94617.	2.2519E+05	2.2463E+05	54770.
1408.00	1.2956E+05 I	I	94669.	2.2519E+05	2.2466E+05	54797.
1452.00	1.2954E+05 I	I	94719.	2.2518E+05	2.2468E+05	54821.
1496.00	1.2957E+05 I	I	94767.	2.2518E+05	2.2471E+05	54844.
1540.00	1.2957E+05 I	I	94813.	2.2519E+05	2.2472E+05	54866.
1584.00	1.2957E+05 I	I	94857.	2.2519E+05	2.2475E+05	54887.
1628.00	1.2958E+05 I	I	94899.	2.2519E+05	2.2478E+05	54906.
1672.00	1.2958E+05 I	I	94940.	2.2520E+05	2.2481E+05	54924.
1716.00	1.2960E+05 I	I	94978.	2.2520E+05	2.2484E+05	54941.
1760.00	1.2952E+05 I	I	95015.	2.2521E+05	2.2486E+05	54950.
1804.00	1.2950E+05 I	I	95050.	2.2522E+05	2.2488E+05	54972.
1848.00	1.2945E+05 I	I	95083.	2.2523E+05	2.2491E+05	54987.
1892.00	1.2945E+05 I	I	95115.	2.2523E+05	2.2493E+05	55001.
1936.00	1.2945E+05 I	I	95145.	2.2524E+05	2.2496E+05	55014.
1980.00	1.2946E+05 I	I	95174.	2.2525E+05	2.2498E+05	55026.
2024.00	1.2946E+05 I	I	95201.	2.2526E+05	2.2501E+05	55037.
2068.00	1.2949E+05 I	I	95227.	2.2527E+05	2.2503E+05	55046.
2112.00	1.2949E+05 I	I	95252.	2.2527E+05	2.2504E+05	55058.
2156.00	1.2971E+05 I	I	95275.	2.2528E+05	2.2506E+05	55068.
2200.00	1.2972E+05 I	I	95297.	2.2529E+05	2.2508E+05	55077.