STEAM GENERATOR

(BABCOCK & WILCOX CONTRACT)

WARRANTY AND CONTRACT OUTSTANDING ITEMS

Summary List: (Dated 1/90)

1. **BURNERS**

A. STRUCTURAL DETERIORATION - There is concern with the structural integrity of the burner components (outer air register assembly, inner air sleeve, throat sleeve, and throat sleeve casing) due to the high recommended out-of-service operating temperature of 1350°F. Concerns and deterioration of these items have been expressed and documented previously.
Please note that this deterioration has been getting progressively worse over time.

Continuing and some additional damage was indicated during the inspection from the Fall '89 Outage. Burner F2 on Unit 2 and several burners on Unit 1 showed new damage with the braces between the rear and front plate of the outer air register breaking at the welds due to thermal expansion and warpage of the outer register (reference Attachment B, Unit 1 Burner Inspection Report November '89).

Resolution - First, review burners back to an acceptable condition. Replace the original style outer register with the HD design on all burner levels (where not currently installed). Secondly, remove condition which is causing the degradation. Reduce out-of-service burner front temperatures from 1350 to 1200°F. Third, B&W should make concessions, since their burner design will not hold up satisfactorily at the level required for the boiler to make guaranteed performance.

These concessions may be for B&W to supply new HD Outer registers, provide an air tight throat sleeve casing seal and install compartmentalized windbox flow measurement (to be able to actually measure cooling air flow requirements).

B. BURNER FRONT TEMPERATURES - There is continuing concern with overheat due to the 1350°F operating

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temperature for the out-of-service burners, set to minimize cooling air flow requirements and obtain guaranteed boiler performance. This tradeoff is approximately 1/2 percent boiler efficiency per 100 F^{o} burner front temperature on the out-of-service burner.

The concern for operating at this temperature level is structural integrity and life of the burner. The tradeoff is a decrease in boiler and unit performance.

Resolution - (As stated previously in 1.A) Upgrade the structural integrity of the burner back to a new condition by upgrading to the new HD outer register design. Increase the cooling air requirements on out-of-service burners by lowering the burner front temperature levels (from $1350^{o}F$ to $1200^{o}F$) to minimize future damage. To optimize burner performance and offset this additional performance penalty, , provide an air tight burner to waterwall seal (throat sleeve seal) to prevent boiler casing leakage.

Due to the overall resulting decrease in boiler performance, B&W should provide one or more of the following options: provide secondary air flow measurement to each compartmentalized windbox, provide the boiler Diagnostics 140 performance software package, or make functional the pyrosonics temperature mapping system (with proper documentation and training on its use).

C. THROAT SLEEVE SEAL DETERIORATION - The seal between the burner and waterwall is in a major state of deterioration (Basically there's no seal). This seal needs to be airtight to prevent boiler casing leakage which has negative impact on combustion tuning (02 profiles) and boiler performance. Another problem being encountered is a more significant occurrence of eyebrow formations, above and around the burner, obstructing scanner observation, impacting flame profile and preventing lighter usage.

IPSC has submitted detailed outage reports in the past for review and documentation by B&W as to magnitude and severity of this problem. It also is gradually getting worse. B&W is testing a ceramic sock and rope packing installation on Unit 2 "A" level to determine if this combination is more effective in providing an airtight seal.

Resolution - Center the throat sleeve of the burner

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with the waterwall opening, reattach the seal ring, reweld all broken welds, and install ceramic sock and rope packing or equivalent to provide an airtight seal operable at the high temperatures. Lower the out-of-service burner front temperatures to reduce future deterioration and structural damage to the throat sleeve seal and rope packing.

D. OUTER AIR REGISTER LINKAGE - The trial spring assemblies installed on the outer air register linkages on Unit 1 3rd level (Burner Row "A"and "H") needs to be removed during the next available outage. This spring installation hampers outer air register movement.

Resolution - B&W to remove springs and restore outer air linkages (Unit 1, Burner "A" and "H") back to original linkage design during the Spring '90 Outage.

E. CONICAL COAL DIFFUSERS - IPSC Warehouse still has twelve (12) plasma torch style diffusers (hollow center without cone) in-stock which still needs to be swapped out to the silica-carbide or standard design diffuser.

Resolution - Exchange the 12 PT-style diffusers on hand with the silica-carbide standard conical diffusers.

F. BURNER AIR REGISTER HANDLES - IPSC installed hold-down bolts to the outer air register handles to prevent the movement of register handles (which has been occurring routinely within the last nine months).

Action was taken due to the impact on burner flame stability and combustion levels when register handles moved while the unit was on-line. On several occasions this created a burner flame-out condition and serious potential operational safety hazard.

Resolution - No further action required.

G. BURNER EVALUATION - IPSC would like to request a complete burner evaluation be conducted by B&W or third party to determine the magnitude of problems with the burners, as previously discussed in the 9/89 contract meeting. The remaining life of the burners, severity of problems, what potential problems are foreseen in five to ten years, burner life extension versus performance impact, penalties, etc., needs to be determined and clarified.

Resolution - Request B&W to make an extensive evaluation on the burners on both units during the next outage (3/90) and report on these findings.

The alternative would be to contract with an outside consultant to make an independent evaluation of the burners.

H. DOCUMENTATION AND DRAWINGS - Full documentation and drawings of all modifications made to the burners are required for future maintenance and inspection activities.

Resolution - Full Documentation update package is required from B&W on modifications to the burners.

2. **LIGHTERS**

A. LIGHTER SHROUDS - The lighter shroud reattachment, made by B&W during the Fall '89 Outage, has one shroud on both units (two total) which need to be realigned and reattached (U1-E2 / U2-F3). These two burner lines have been isolated due to the unavailability of the lighters which prohibits the operation of the burner.

Resolution - During Spring '89 Outage, B&W needs to realign and reattach lighter shrouds on Burner E2, Unit 1 and Burner F3, Unit 2 (may have outer air sleeve warped).

B. LIGHTER SHROUD OUTAGE INSPECTIONS - Due to the previous history of continuing failures on the lighter shroud attachments, a thorough inspection of all lighter shrouds needs to be conducted during the next available Outage.

Resolution - Full inspection of lighter shrouds is needed on both Units during Spring, 1990 Maintenance Outages.

3. **PULVERIZERS**

A. VIBRATIONAL PROBLEMS - Continued problems with pulverizer vibration is being experienced during low feed rate operation, shutdown and inerting.

Foundation bolts which hold down the pulverizer housing have been working loose on a regular basis. Pulverizers H and D on Unit 2 have been two of the worse, where their foundation bolt washers have actually broken out.

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Resolution - B&W to resolve pulverizer vibration problems.

B. VARIABLE LOADING (UNIT 1 - PULV F).

1. STATUS OF OPERATION / EVALUATION PERIOD - Pulverizer 1F with the test design alteration for addressing the vibration problem by unloading the roll wheels at the lower feeder speeds has been operating satisfactory. The modification has significantly reduced the vibration associated with lower pulverizer load operation.

   However, more run time is required to fully evaluate benefits and determine associated problems. The evaluation period needs to be extended to cover a full 6000 hours of operation. Currently the operating hours for Pulv F is 2770 (on 1/26/90). Expected 6000 hour inspection will be in Mid-June, 1990. The final report for evaluation and recommendations should be completed by Mid-July, 1990.

2. LOADING ROD BELLOWS SEAL - An alternate design on the pulverizer loading rod expansion joint/seal needs to be investigated. The present rubber bellows seal which is zippered, burnt up recently during a pulverizer pyrites fire. Don Dogan of B&W is currently looking into a metal bellows design.

3. LOADING ROD CYLINDER - This particular loading rod cylinder assembly is a concern for variable loading and movement application. There has been a seal failure on one of the cylinders, resulting in complete cylinder assembly changeout.

   Due to the dirty environment around the pulverizer it is impossible to keep the exposed shaft of the cylinder clean to prevent seal failures. Evaluate this cylinder assembly application for continuous movement plus consider enclosing the exposed shaft to prevent seal failures.

4. VARIABLE LOADING PERFORMANCE TEST RESULTS - Performance test results conducted by IPSC (12/89) to evaluate the performance impact of the variable loading modifications are enclosed in Attachment C.

   Coal fineness, bowl pressure differential, and motor amps all decreased as a result of unloading the roll wheels through 30 to 60 percent feeder

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speed. An important note is that the minimum fineness of 70 percent through 200 mesh (after HGI and moisture corrections are applied) could still be achieved through the lower feeder speed range.

5. LOCAL AND CONTROL ROOM ALARMS - If the variable loading modification is a permanent installation, local and control room alarms associated with the operation of the hydraulic skid needs to be fully evaluated and implemented.

   B&W to propose package for necessary alarms required locally and to the main control room to alert operations of pulverizer malfunctions. Main concern is pulverizer unloading while at feeder speed above 60 percent.

6. DOCUMENTATION AND DRAWINGS - A complete set of operating and maintenance instructions, plus drawings and documentation on all related variable loading modification components is required for the modification to become a permanent installation. B&W to submit a complete package for review as part of the full acceptance evaluation.

C. <u>STEAM INERT REQUIREMENTS</u> - Compliance with the steam inert requirements on oxygen suppression in the pulverizers still has not been demonstrated.

1. B&W'S WRITTEN RECOMMENDATION - IPSC is still awaiting B&W's written recommendations on changes to the inert sequence for intermittent steam admission.

2. INERT SEQUENCE CHANGE AND TESTING - IPSC will setup a test on one pulverizer to demonstrate the effectiveness of B&W's recommendation on the inert sequence modification, after B&W's written recommendations are received.

3. BAILEY CONTROLS SCHEME MODIFICATIONS - If this new inert scheme is successful and accepted as a permanent resolution, Bailey will need to make the permanent controls scheme modifications and documentation revisions.

4. B&W'S SWEEP AND CLEAR RECOMMENDATIONS - Still awaiting response and clarification on B&W's position on sweep and clear to furnace, after an inert sequence has been completed. Reference Attachment E, B&W letter dated 5/21/87.

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D. BURNER LINE FIRES - There has been repeated burner line fires on 1A05 on both Units 1 and 2 (3 total) plus fires on burner levels "E" and "F". Certain burner lines on these levels seem to have a problem with minimum burner line velocity and aren't adequately balanced in relation to the other six burner lines. B&W needs to investigate and resolve.

Resolution - B&W to conduct dirty air flow or equivalent (excluding clean air) tests on "A", "E" and "F" burner levels on both units to determine velocity profiles. Investigate and modify coal burner line restrictors to improve the velocity profiles (each burner line within +/5 percent of each other).

Additionally, B&W needs to evaluate modifying pulverizer operation to include a cold primary air flow purge and sweep of the burner lines during pulverizer startup and shutdown sequences. Reference Attachment E, B&W's 8/14/87 on burner line fires. This would require permanent Bailey control logic changes.

E. ROTATING THROATS (UNIT 1 - PULV H)

1. STATUS OF OPERATION / EVALUATION PERIOD - The test pulverizer with the rotating throat retrofit has been operating satisfactorily with the below mentioned exceptions. The modification has greatly reduced the isolated high erosion areas associated with the stationary air throat design.

   More run time, however, is needed to fully evaluate the benefits and determine associated problems. The evaluation period needs to be extended to cover 6000 hours of operation. Currently, the operating hours for Pulv 1H is 2900 (on 1/25/89). The next expected 6000 your inspection will be in early June, 1990. The final evaluation and report on a recommendation should be completed by early July, 1990.

2. THROAT SECTIONS / HOLD-DOWN BOLTS - Three throat section segments have recently been found broken around the hold-down bolts and at the corners. Cause of failure is not known but there is speculation that tramp iron got caught between the rotating vane and ledge plate which transmitted back to the corners. Additionally, the hex-head hold-down bolts for these sections have been working loose and are also showing heavy erosion.

   Erosion shields or a recessed hole in the section

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for the bolt head plus a more solid means of attachment is required. Due to the concerns of foreign material getting caught between the spacing between the rotating throat vanes and ledge plate plus, the problem with the pulverizer housings not being concentric, an overlaping ledge plate seal (above the air throat vane) needs to be investigated and implemented.

3. ROTATING THROATS PERFORMANCE EVALUATION - It is difficult to fully evaluate the performance impact due to just the rotating throat alteration on this pulverizer. The motor had to be replaced (changing the baseline power consumption levels), plus the roll wheels were changed out (altering baseline performance) for a true apples to apples comparison.

4. ALTERNATE SUPPLIERS - Alternate suppliers of (Non-OEM) rotating throats are also being evaluated due to:

   a). Costs of modification and initial components, plus the cost of routine wear replacement parts.

   b). Ease of initial installation and future installation of wear components (replaceable wear parts).

5. INSTALLATION AND SCHEDULE - Utilizing dedicated outside contractors for the rotating throat installation is being evaluated as a possible alternative to using IPSC personnel. This will factor into the overall evaluation as will scheduling considerations.

6. TURNOVER PACKAGE - A final turnover package is required from B&W containing all updates to Operating and Maintenance manuals plus final drawings and installation documentation for the rotating throat retrofit.

4. **FEEDERS**

A. <u>ELECTRONICS PROBLEMS</u> - There has been a recent higher incident of problems with the Merrick feeders which has been effecting their accuracy levels requiring significant a higher frequency of calibrations (every two to three weeks versus every two to three months).

1. ZERO SETPOINT DRIFT - The zero setpoint on the feeder controls has not been holding which is an indication of an electronics problem.

2. LOW FEED RATE READINGS - Unit 2 feeders have recently been indicating lower feed rates than expected. This may indicate several problems. One possibility is that there is a weigh bridge alignment problem or that the bridge linkage has been slipping. Another possibility is that there is a controls signal problem from the feeder cabinet to the controls system.

Resolution - B&W should provide a Merrick engineering field representative out during the Spring 1990 Outage to resolve the feeder electronics problems.

5. **AIR HEATERS**

A. AIR LEAKAGE CONTROL SYSTEM

1. U1 SAH 1B EAST SECTOR PLATE - The sector plate on Unit 1 Secondary Air Heater 1B gas side ejactuater rod is hang up in an extended position. There is concern that during a unit trip or when the unit comes down for its next scheduled maintenance outage, that when the rotor cools and straightens it will wipe out the radial seals and/or become physically bound up.

   Shutting the SAH off will also cause the air heater to become bound and unrepairable until a maintenance outage. Note if a SAH shutdown is required after a Unit trip, the Unit will have to be derated by 80 percent or more until an outage, where you can enter the air heater and resolve the problem.

   Resolution - During the Spring 1990 outage, have a CE engineering field representative available to assist and resolve sector plate and ejactuater rod problems and to prevent possible recurrence on the other air heaters. Evaluate the sector plate and air leakage control system for possible modifications or a design change to reduce ALCS related problems.

2. FLY ASH BUILDUP BETWEEN STRUCTURAL BEAM AND SECTOR PLATE - The field repair made during a previous outage due to previously because of the fly ash buildup between the structural beam and sector

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plate (made to prevent fly ash buildup which would prohibit retraction of the sector plate) is considered only a temporary solution. Holes drilled in the bottom of the sector plate to allow fly ash infiltration to drain out contributes directly to the overall air heater leakage.

Resolution - A more permanent solution to this fly ash problem needs to be investigated such as; enclosing the area above the sector plate and pressurizing it to prevent fly ash infiltration or investigate a new air leakage control system design. CE Air Preheater may have an alternative design that hinges the sector plate at the rotor which may eliminate some of these problems.

3. FLY ASH BUILDUP ABOVE SECTOR PLATES - A modification to prevent normal fly ash buildup above the sector plates also needs to be implemented. Routine maintenance activities are extensive to clean out this fly ash buildup during every Outage. Also if unit operation is extended to 12 month intervals before a maintenance outage, there is possibility that fly ash buildup would prohibit the air leakage control system sector plate from retracting.

   Resolution - (Reference Item 6.A.2) The resolution to the fly ash infiltration problem would encase the area above the sector to provide pressurization to prevent fly ash infiltration.

B. INFRARED DETECTION SYSTEM - The IDS is having continuing problems with the availability of the system due to unreliability of parts (preamplifiers) and high maintenance requirements to keep the system functioning. This System is becoming cost and manpower prohibitive to keep operational. Reference Attachment F for an estimated summary of costs and manpower. Spare parts and labor have costs running over K10,000 dollars.

   Resolution - Recommend upgrading to an all electronic component parts design to eliminate continuing problems with the mechanical parts. Improved system needs to be investigated and discussed with CE Air Preheater.

C. SECONDARY AIR HEATER FLUID COUPLINGS - Request two new Falk fluid couplings be supplied to replace the two remaining Voith couplings on the secondary air heaters. Changeouts were due to vibrational related problems and

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oil leakage, and based upon CE Air Preheater recommendations.

Resolution - CE to supply two Falk fluid couplings for replacement on the Secondary Air Heater drives.

D. SAH CENTER SECTION CASING CRACKS - There are continuing casing weld cracking and casing cracks on the center section casing of the Secondary Air Heater concentrated mainly in the area above the sector plates. These cracks are probably due to thermal expansion though temperatures are kept well below maximum limitations. These cracks have been present on almost every outage.

Resolution - CE or B&W to resolve casing failures by beefing up the areas prone to cracking with steel plate and additional structural supports.

E. DRAWINGS AND DOCUMENTATION - The air heater drawings that were to be supplied by the manufacturer (CE Air preheater) are not available. CE states these drawings were supplied to B&W. CE has them available and would supply them to IPSC at a cost. (Reference Attachment G for the CE listing of drawings).

Additionally, instruction manuals that were supplied by B&W on the Secondary and Primary Air Heaters, Infrared Detection System, and Air Leakage Control System are incomplete. Complete updated manuals on each of these four systems are required for the proper maintenance and operation of the air heaters.

Resolution - CE or B&W to provide complete updated drawings, documentation, and instruction manuals on the secondard air heaters, primary air heaters, air leakage control system, and infrared detection system and forwarded to the Project for manual updates.

6. **SOOTBLOWERS**

A. INDEXING PROBLEMS - Two sootblowers on Unit 1 (IK-54 and 64) are not indexing on their return travel path. The nozzles, therefore, clean in the same direction on both the forward and return paths. Reference Attachment H - Sootblower Inspection Report.

Resolution - Contact Diamond Power service representative for resolution of the indexing problems to correct the travel pattern of the lances.

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B. SOOTBLOWER PANEL FAILURE AND LOSS OF LANCES - In early November, 1989, the Diamond Power sootblower panel failed which resulted in the loss of fifteen sootblower lances. Reference Attachment I, Diamond Power Field Service Report, dated 11/18/89.

There is a question on whether this incident that occurred on 11/10/89, is covered under the warranty which is extended by B&W. Essentially all electronic components were replaced in the panel (since no one card could be traced as the root cause of the problem). Fifteen damaged sootblower lances were also replaced. An unplanned unit outage was required to correct the problem plus repair several tube leaks created by the failed lances. Reference Attachment J, Cost Summary of 11/10/89, Sootblower failure incident.

Several recommendations were made in the report to contract Diamond Power to modify the software to automatically turn on the printer and print out the time after any power loss and/or when the CPU is reset.

Resolution - B&W to honor the warranty considerations and consequent changes of the November 10, 1989 Sootblower Panel failure.

Have Diamond Power make the recommended Have Diamond Power make the recommended software changes and implement.

7. **PRIMARY AIR FANS**

A. UNRESOLVED CAPACITY PROBLEMS - The sixty percent load unit operation test with one half of all related boiler components out-of-service failed due to primary air fan capacity constraints. The PA fan motor goes into an overload condition (high amps) at fifty percent load. Numerous testing configurations with the PA fans, PA Heaters, pulverizers, and with various control setpoints such as PA duct pressure, etc. have yet to resolve the problem. The October, 1989, retests with B&W test personnel were also unsuccessful.

Resolution - B&W to resolve capacity deficiency of the PA fans by making fan or motor upgrades.

8. **CONTROLS (BAILEY)**

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A. DC GROUNDS TO BCS AND SCANNERS - DC grounds associated with the Bailey Control Cabinets have not been resolved. Additional outage activities are required to address some of Bailey's recommendations. Approximately, one half are not feasible at this time due to original installation, such as changing out all expansion bolts on all the Bailey cabinets so they're isolated. A/C safety grounds were loaded during the Fall '89 outage to help reduce problems. Reference Attachment K, Bailey Field Report and Recommendations (11/89).

Resolution - Continue to identify DC ground problems during the Spring 1990 Outage and address those issues for resolution.

B. FLAME SCANNER PHOTO CELLS - There are problems with the flame scanners requiring the sensitivity to be adjusted to maximum due to bad or unreliable photo cells. Bailey now has two styles of photo cells and IPSC will try the new style, higher sensitivity cell.

Resolution - Trial test and replace photo cells with new increased sensitivity style (to be replaced by Bailey) and monitor to determine effectiveness.

C. DRAWINGS AND DOCUMENTATION - A complete set of updated drawings and documentation of all changes made to the controls system (Burner Management System) needs to be submitted by Bailey. Please note all changes to the Burner Management System should go through Bailey so software and schematics are adequately documented.

Resolution - Bailey to supply complete update of all schematic diagrams and related documentation made to the Bailey Net 90 and Burner Management System. IPSC can supply marked up drawings if Bailey no longer have originals.

9. **PYROSONICS**

A. SYSTEM FUNCTIONALITY - The Pyrosonics, temperature mapping system utilizing sound waves at the furnace exit, is still not working satisfactorily. Due to continuing operational and software problems, the system has not been utilized. No correlations have been made during boiler performance testing, combustion tuning or during burner balancing to verify and test the temperature mapping scheme due to its continuing

problems.

1. PLUGGAGE OF TRANSMITTER/RECEIVER HORNS - Pluggage problems with the transmitter/receiver horns have been a routine problem. Scientific Engineering Inc. has proposed to supply a cleanout flange arrangement in the transition piece between the boiler and the wave guide to manually clean the fly ash out of the horns. This is not seen as a permanent solution to the fly ash pluggage problem which would require weekly rodding out of all air horns to keep the system functioning. A sufficient purge system or air horn design modification is required to fully resolve this pluggage problem.

   Resolution - SEI or B&W to implement a sufficient air purge system or make an airhorn design modification to eliminate the fly ash pluggage in the transmitter/receiver horns.

2. SOFTWARE PROBLEMS - The Pyrosonics still has software problems and needs a new revision update. It still has glitches in its mapping function where stray lines will appear when the triangulation calculations don't work out. Also, it seems that the individual temperature line of sight readings don't average out to the overall average displayed.

   Resolution - SEI to provide a software update to resolve mapping problems and verify averaging calculations.

B. PYROSONICS SYSTEM TEST CHECKOUT - The Pyrosonics System needs to be fully tested and demonstrated before any confidence can be put into the system. The system has been installed for over a year with a high degree of unavailability.

The system needs to be up and running and fully functional prior to the next series of boiler performance tests. These boiler performance tests will be conducted later this Spring. Hopefully, during these performance tests, the capability of the system can be demonstrated to be able to fully utilize the system.

Additionally, separate testing needs to be conducted with support from B&W specific to this system. Tests such as burner flame out and detection, uneven burner balancing, waterwall sootblowing diagnostics, plus other testing needs to be demonstrated.

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Resolution - During the Spring '90 Boiler Performance Testing and combustion tuning series, test and verify the Pyrosonics System information and calculations. Set up alternate tests to demonstrate other capabilities such as burner line balancing, detection of poor burner performance, and diagnostics information on waterwall sootblowing.

C. OPERATING INSTRUCTIONS AND TRAINING - Operations has requested instructions and training be provided for the system to be able to utilize its capabilities. Presently the system is just taking up space in the Control Room. Hopefully, at a point in time in the near future, its capabilities can be demonstrated. Operating instructions and training is required on how to actually use the information from the system to improve boiler operation.

Resolution - B&W to provide operating instructions and training on how to utilize the Pyrosonics System information on effecting and optimizing boiler operation and performance.

D. DRAWINGS AND DOCUMENTATION - A Pyrosonics Operations and Maintenance Instruction Manual is required covering all components, such as the computer system hardware and software, transmitter/receiver instrumentation, modifications made to the boiler, plus on how to utilize by Operations.

Resolution - B&W to supply all drawings and documentation related to the operation and maintenance of the Pyrosonics System in the form of one composite instruction manual.

10. **SAFETY VALVES**

A. RING PIN FAILURES - The ring pins continue to breakout of the main steam and steam drum safety relief valves. The break always occurs in the threaded portion of the pin and initiates at the root of the thread. There seems to be a fair amount of grooving in all the pens. The failure mechanism seems to be fatigue. Reference Attachment L which is a Boiler Safety Relief Valve Inspection Report on Unit 1 and 2 with Flickinger Company field service reports attached. Also vibration signatures are included, taken from the safety valves.

Resolution - Dresser needs to address and resolve the ring pin failure problems on the main steam and drum safety relief valves.

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B. LIVE TESTING OF SAFETIES - Live testing of the safety relief valves on Unit 2 showed that the drum safety reliefs lifted on the low side and had excessive long blowdown times indicating that the springs may be on the weak side and the ring settings are too low. Unit 1 safeties are scheduled for overhaul and live testing for the upcoming Spring '90 Outage.

Resolution - Investigate cause of low relief valve settings and longer than expected blowdown times and address so these concerns can be resolved.

11. BOILER TUBE & HEADER ATTACHMENTS

A. REHEAT SUPPORT CASTINGS - No visible broken casting were found during the Fall '89 Outage inspections. Three castings from Unit 1 were removed and sent out for analysis. Samples from Unit 2 will be removed during the Spring '90 Outage and will also be sent out for analysis. The laboratory examination on Unit 1 is enclosed in Attachment M.

The analysis shows that all three tube support clips contained cracks in the tube-to-clip weld. The cracks are characteristic of hot cracking which occurs during welding. The cracks originate in the inner weld passes, which are not open to the surface, and therefore, are difficult to detect using nondestructive examination techniques.

Resolution - B&W needs to evaluate, address and repair the reheat support casting cracking problem to determine long term solution. The next available inspection window is the Spring '90 Maintenance Outage scheduled 3/26-4/1/90 on Unit 1 and 4/9-15/90 on Unit 2. See Attachment H for the scheduled IGS Maintenance Outages.

B. REHEAT D-LINK ATTACHMENTS - Based upon the Fall '89 Outage Inspection, failures on the reheat outlet pendant D-link attachments are estimated at 17 percent on Unit 1 and one percent on Unit 2. Please note that 524 welds were repaired by B&W on Unit 1 during the Spring '89 Outage.

Resolution - B&W needs to analyze the cause of failure to the reheat D-links. The evaluation needs to determine whether this weld attachment is a factory

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welding problem with dissimilar metal welds. B&W also needs to determine best resolution of the weld failures such as gouging and rewelding all the D-line attachments on Unit 1.

C. SUPERHEAT AND REHEAT TIE BARS AND CLIPS - The spacer or tie bars on the Superheat and Reheat Outlet Pendants are falling off due to broken tube attachment clips. At least four more spacer bars have broken off Unit 1 Superheat Section since the Fall '89 Outage (within first two weeks). Typical failure is breaking off at the clips or breaking of the bars.

Three forced outages have resulted from clip casting attachments actually pulling out of the tubes. The problem seems to be an over-loading on the bars and clips. Design review shows that maximum loading should be 100 pounds and currently there is far more loading due to the misalignment of the superheat and reheat pendant areas. The solution seems to be in realigning the pendants by adjusting their respective hangers.

Resolution - B&W needs to evaluate the tie bar and clip failures on the superheat and reheat pendants to resolve this mode of failure. Serious consideration needs to be given to adjusting the hangers to realign the pendant sections to eliminate the loading on the bars and clips.

D. SUPERHEAT OUTLET HEADER SUPPORT BRACKETS - During the Fall '89 Outage inspection on Unit 1 showed cracks in the superheat outlet header support brackets or lug attachment welds to the header (no cracks observed on Unit 2). All lugs were either dye checked or magnetic particle tested by B&W.

Cracks were repaired or removed by B&W, as in previous outages. B&W indicates that the cracks do not reappear in the repaired areas. The recent cracks have been minor and reduced in number and are expected to diminish. These areas will continue to be surveyed in the future on an annual basis.

Resolution - Continued surveillance will be made on the superheat outlet header support brackets in future outages to determine if this problem has been resolved.

E. SCREEN TUBES / VIBRATION BARS - The front screen tube seal weld at the boiler casing continues to be a source of cracking. The vibration bars seem to be working

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satisfactorily on the screen tubes, but there are still problems with cracking in the welds and membrane around the tube.

Resolution - B&W needs to investigate and resolve the screen tube seal weld cracking at the boiler casing caused by stress either from vibration or thermal expansion.

F. LOWER WATERWALL INLET HEADER - Cracking in the stub to header welds was found during a previous outage in the lower waterwall inlet header, in the bottom ash area. The same tube in this area has failed three separate times. Due to the possibility of thermal shock concerns in this area, B&W Engineering had been requested to review their bottom ash splash shield design and make recommendations. A new design needs to be investigated to provide a more adequate and reliable tube leak protection to the lower waterwall inlet header. (Also see 13.A).

Resolution - B&W to make recommendations on their tube leak protection bottom ash splash shield design. To prevent thermal shock and possible cracking to the tubes on the lower waterwall inlet header.

G. PRIMARY SUPERHEAT OUTLET HEADER - There presently is a leak on the Primary Superheat Outlet header on Unit 1 in the rear west side of the penthouse which needs to be repaired during the next available outage.

B&W needs to investigate the leak and report on the cause and corrective action required to prevent future recurrences.

Resolution - Repair and stress relieve Unit 1 Primary Superheat Outlet header steam leak during the next available outage. Investigate cause and additional corrective action required.

12. BOILER TUBE EROSION AND WEAR

A. ECONOMIZER RUBBING - The economizer bundle is rubbing against the baffle wall and has flat spots on the contact tubes. Due to inaccessibility of the area, it is difficult to routinely conduct tube thickness evaluations to determine extend of rubbing.

The long term resolution would seem to be realigning

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the economizer bundle to prevent the rubbing from occurring. Short-term solution would be to install wear pads to prevent excessive rubbing. This area will be surveillanced in the future.

Resolution - B&W needs to investigate realigning the economizer tube bundle and install wearpads to prevent economizer rubbing causing future problems.

B. LOWER SLOPE WEAR - It was reported earlier that IPSC had concerns with Unit 2 having excessive lower furnace slope wear based upon tube thickness readings taken during the Fall '88 Outage Inspection.

During the Fall '89 inspection, a more extensive ultrasonic tube evaluation was conducted plus several tube samples were taken to substantiate the original readings. Based upon the second survey and confirmed by the tube samples taken, the lower slope thickness evaluation turned out satisfactory.

Resolution - No action required, item will be dropped.

13. **BOTTOM ASH SPLASH SHIELDS / DRIP LEDGES**

A. CONTINUING SPLASH SHIELD FAILURES - B&W needs to evaluate the bottom ash splash shield or drip ledge casting design to prevent recurring failure due to quenching from the bottom ash hopper plus to prevent thermal shock to the lower waterwall inlet header tubes. Reference Item 11.F, which discusses tube to header cracking concerns.

Resolution - B&W to recommend improved bottom ash splash shield design to prevent recurring shield failures.

14. **STRUCTURAL CONCERNS**

A. HANGERS - The hangers inside the main steam and reheat header enclosure need to be resolved as to if they should have a welded saddle support or swivel type support for the hanger rods. The saddle supports are currently spot welded making it a rigid installation.

Resolution - B&W to investigate and resolve the hanger question in the main steam and reheat header

enclosure. Should the spot weld on the saddle support for the hanger rods be left installed?

B. PENTHOUSE CASING FLOOR - The cracking in the penthouse casing floor is a continuing maintenance item but is greatly reducing in magnitude. Repairs are typically made by rewelding and in some cases overlaying with steel plate.

Resolution - The penthouse casing floor will continue to be monitored for cracking and buckling during future outage inspections.

C. BUCKSTAYS - There were concerns reported earlier to B&W with the buckstays in the lower furnace area causing the lower waterwalls to bow. B&W made corrections by removing erection bolts and lugs during the Fall '89 Outage, which seems to have resolved the problem.

Resolution - IPSC will continue surveillance on the buckstays and waterwall tube sections, but don't anticipate any additional problems.

D. SEISMIC BRACING TIES - During the Fall '89 Outage, earthquake bracing on the buckstays or seismic ties were checked and corrected by B&W due to concerns with the hot and cold alignment positions. The project installed twelve expansion marks to visually verify alignment positions in the future.

Resolution - IPSC will continue to monitor the seismic tie and hot and cold alignment positions, but don't anticipate additional problems.

15. **THERMOCOUPLES**

A. DAMAGED T/C'S IN PENTHOUSE - There are several thermocouples that have failed which are located in the penthouse and are attached to the inlet tubes or headers. these stainless steel sheathed thermocouples are buried under insulation blankets and chicken wire and are extremely difficult to identify and replace.

Resolution - The thermocouples should be considered a warranty item and replaced during the Spring '90 outage by B&W.

16. **INSTRUCTION MANUALS**

A. NON-B&W MANUFACTURED EQUIPMENT - The B&W supplied

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Operation and Maintenance Manuals for equipment not manufactured by B&W are typically incomplete and not updated with all current revisions.

Resolution - B&W or the project needs to solicit all the non-B&W equipment manufacturers to get complete revised Maintenance and Operation Instructions. Equipment to be included (but not limited to) are: Air heaters, feeders, boiler controls, scanners, etc.

17. **"AS-BUILT" DRAWINGS**

A. OUTSTANDING DRAWINGS - The Project still has not received the remaining "As-Built" drawings for the boiler.

18. **PERFORMANCE TESTING AND TUNING**

A. STATUS UNIT 1 - Need test results and report from B&W based upon the November, 1989 boiler testing series.

IPSC plans to contract with B&W to conduct another performance test series through the load range due to restrictions during the November '89 tests that were outside of B&W's control. Unit 1 test series will be conducted after Unit 2's testing which will take place late April or May of 1990 after the Unit Outages.

B. STATUS UNIT 2 - Boiler performance testing and burner combustion tuning is still scheduled to be conducted by B&W. testing will need to be done after the Outages due to burner line isolations (on both units) caused by lighter shroud misalignment. Scheduling for the boiler testing is in late April or May of 1990 after the Unit Outages.

C. O2/COMBUSTION CURVES - B&W still needs to supply 02 as steam flow curves reflecting cooling air requirements at 1) 1350°F, 2) 1200°F burner front temperatures for burner levels out-of-service.

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