Oconee Nuclear Site

Overview of the Oconee Recovery Plan

Revision 0

Duke Energy Corporation

November 18, 1997

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Executive Summary

Duke's standards for superior performance require a SALP 1 rating, INPO 1 rating, a capacity factor in the top quartile, competitive costs, a low personnel safety index, and event-free operation. Achieving these goals with a continuous focus on nuclear safety and conservative decision making will improve Oconee's standing in the industry, position the site for long-term operation via license renewal, and improve the site's relationship with the community. Performance at Oconee Nuclear Station (Oconee) is not currently meeting the expectations of Duke management. The events that have occurred at Oconee over the past year are not indicative of the performance levels expected by site management. At a July 23, 1997, meeting with Region II, Oconee management described several initiatives that are being implemented to improve performance. Collectively, these initiatives are referred to as the Oconee Recovery Plan. The Recovery Plan is a voluntary initiative which provides a focused process to manage the changes at the site that are necessary to attain and maintain performance improvements.

Improved performance must be measured by results. Measures have been established to monitor the results of each initiative in the Recovery Plan. In addition, global measures of site-wide performance are also being tracked. Examples of these global measures include lost generation days due to equipment failures, number of site mispositionings, corrective action backlog, and human performance LERs. The Recovery Plan is updated each month and distributed to site management. The Recovery Plan is a living document. Focus areas, plans and measures will be revised as necessary to ensure that Oconee's efforts continue to be aligned with those areas of utmost importance.

The purpose of this summary document is to provide an overview of the Recovery Plan. Background information is provided regarding performance issues. The causes for declining performance are addressed. The process used to develop the Recovery Plan is briefly described.

The basic elements of the Recovery Plan are:

- the implementation of short-term barriers to prevent events
- enhancements to the site management team as dictated by self assessments and recently completed management reviews
- initiatives in the following focus areas:
    - Design Basis
    - Equipment/System Reliability
    - Human Performance
    - Self Assessment
    - Operational Focus
    - Financial Management

This document also provides a brief summary of each of the elements in the Recovery Plan. Detailed information regarding the various milestones, measures, and results that are tracked in the site's monthly edition of the Recovery Plan are not addressed in this document. Oconee intends to provide information regarding the measures and the results achieved during the bi-monthly meetings with the NRC.

Oconee is committed to improving performance and keeping the NRC informed of progress via the bi-monthly meetings with Region II. Oconee believes that the bi-monthly updates proposed by Duke and agreed upon by Region II management provide a constructive means to share perspectives regarding performance trends at the site. The individual elements of the Recovery Plan may be changed as performance trends are continually being evaluated. As such, Oconee does not consider the specific initiatives, milestones, and focus areas to be regulatory commitments that require interaction with the staff prior to implementing changes. The Recovery Plan will continue to remain in effect until sufficient progress has been made and Oconee is on track to achieving superior performance levels. Closure of the bi-monthly progress updates will be pursued when both Oconee and Region II are satisfied that sustained performance improvements are evident.

Background

Oconee Nuclear Station (Oconee) consists of three pressurized water reactors (Babcock and Wilcox NSSS) with a total generating capacity of approximately 2600 megawatts. Oconee Unit 1 began commercial operation in July 1973, Oconee Unit 2 in September 1974, and Oconee Unit 3 in December 1974. Construction on all three units was completed in seven years.

Duke's standards for superior operation require a SALP 1 rating, INPO 1 rating, a capacity factor in the top quartile, competitive costs, a low personnel safety index, and event-free operation. Achieving these goals with a continuous focus on nuclear safety and conservative decision making will improve Oconee's standing in the industry, position the site for long-term operation via license renewal, and improve the site's relationship with the community.

Oconee has had a long history of successful operation. It was the first station to produce 100 million megawatt hours of electricity and has generated more electricity than any other nuclear site. The site achieved national capacity factor records for individual units in 1983, 1984, and 1990, set a world record with 439 days of continuous operation in 1985, and was ranked first in the country in thermal efficiency in 1993.

In April of 1996, Oconee received an overall SALP rating of 1.25 and had a long history of successful INPO evaluations. However, the SALP report emphasized a need to continue to improve in the areas of human performance and equipment reliability. Although initiatives were in place to further improve Oconee performance, past successes did not create a site-wide sense of urgency necessary to make rapid progress in critical areas.

Over the past year, several events have occurred at Oconee which clearly indicate that a rapid improvement in performance is necessary. On September 24, 1996, Oconee Unit 2 was starting up from an outage when a secondary-side water hammer caused a heater drain line rupture. Seven employees were injured and the unit was promptly tripped. A detailed investigation of the event concluded that the water hammer was caused by a lack of a general understanding of the potential consequences of water hammers experienced in the past, a design weakness in the affected secondary side system, and human performance. Post-event investigations also identified code issues regarding piping on the secondary side of the plant. Oconee Units 1 and 3 were shut down in October of 1996 to resolve these issues. Implementation of corrective actions to address the water hammer event and the piping code issues resulted in an extended three unit outage. This was the first time in the history of the site all three units had been shut down for an extended period of time. The extended three unit outage impacted the ability of the site to make progress on initiatives that were already in place to improve station performance. The three units were returned to service in February and March of 1997.

On April 21, 1997, Oconee Unit 2 was shut down due to a crack in one of the High Pressure Injection (HPI) System injection line welds. A detailed event investigation

concluded that the injection line crack was caused by a failure to effectively implement an augmented inspection program. On May 3, 1997, Oconee Unit 3 was shut down to inspect its HPI System injection lines when two of the three HPI pumps were rendered inoperable due to an inaccurate Letdown Storage Tank (LDST) level indication. Human performance issues and a design weakness in the LDST level instrumentation contributed to the event. Duke received its first ever Severity Level II violation as a result of the Unit 3 event.

Two events involving the Oconee electrical systems occurred on June 20 and June 23, 1997. These events involved the failure of Keowee Unit 1 to achieve rated voltage following a loss of the Lee Steam Station electrical power path on June 20, 1997, and failure of two Keowee air circuit breakers during testing on June 23, 1997. Human performance issues and equipment failures contributed to these events.

In each event, Oconee management maintained a strong focus on making conservative operating decisions. Duke has recognized that superior performance cannot be attained and maintained without event-free operation. Nuclear system event measures are established each year to monitor performance and focus each of Duke's nuclear sites on achieving event-free performance. The number and significance of the events over the past year is unacceptable. The Recovery Plan is a focused effort to achieve marked improvements in key areas. Initiatives already in place were reevaluated, new initiatives were developed, and measures were implemented to monitor the effectiveness of the plan.

Causes of Declining Performance

By many standards, Oconee has performed well through the years and has been recognized within the industry as a leader, setting several industry or world records. These years of success may have contributed to some complacency in being as critical as necessary to continue to strive for superior performance. Oconee has been too inwardly focused. Complacency is seen as a contributor to the decline in Oconee performance.

Oconee has traditionally had a very low personnel turnover rate and was able to develop a strong group of very experienced and knowledgeable personnel. This experience base helped Oconee maintain high performance levels. However, over time procedures and processes have become more detailed and complex and Oconee has been slow to fully integrate these increasing work standards into work processes. Human performance problems are a contributor to the decline in Oconee performance.

Oconee was designed and constructed in the late 1960's and early 1970's. There are numerous design features at Oconee that, while proven through approximately 25 years of safe operation, are not seen at other nuclear plants today. Among the unique design features are a hydro station that provides emergency power and numerous shared systems between the units. These unique design features have resulted in extensive NRC and Oconee interaction to clarify the design and licensing bases. Interactions to address NRC questions have required a commitment of substantial Oconee resources.

Over the last several years, equipment reliability problems have contributed to Oconee events, lost production, and operator work-arounds. These equipment problems can be traced to a number of sources. Maintenance practices, operating practices, and operating conditions can be attributed as the causes of some of the equipment reliability issues. The lack of responsiveness in addressing equipment issues early or decisively has had a negative impact on Oconee performance.

Collectively, complacency, human performance issues, design issues, and equipment performance / reliability issues have worked together to contribute to declining Oconee performance. Common themes within each of these areas are a need to: 1) raise standards, 2) communicate more focused management expectations and 3) increase accountability of both managers and workers.

Development of the Recovery Plan

In developing a plan to change the direction of Oconee performance, it was first necessary to understand what issues needed to be addressed that would have the most impact on improving performance. The previous section provides a general overview of the causes that led to declining performance. It was also believed that immediate actions were necessary to curtail the occurrence of events to provide the time and resources necessary to address longer standing issues.

To gather an understanding of the issues that needed to be addressed, many sources were reviewed and identified issues were grouped. Sources reviewed included such items as Duke's Nuclear Safety Review Board (NSRB) reports, in-house assessments, INPO assessments, NRC inspection reports, NRC SALP reports, NRC AIT reports, QA reports, design reviews, licensing issues, and independent assessments. The results of these reviews could be grouped into several major headings for clarity and focusing of improvement actions. These major headings became focus areas in the Oconee Recovery Plan. These focus areas are Design Basis, System/Equipment Reliability, Human Performance, Self Assessment, Operational Focus, and Financial Management. Management reviews were also used to validate the development of the Recovery Plan. It is felt that focused improvement initiatives in these six areas will significantly enhance Oconee performance now and in the future.

In determining what immediate actions were necessary to curtail the occurrence of events or issues that could lead to events, the sources of the most recent and recurring events or issues were identified. Actions were put in place that would add an additional defensive barrier in each of these areas to stop events. These barriers became part of the strategy to improve Oconee performance. The purpose of these barriers is to prevent events that would divert needed time and resources from those actions necessary to achieve and sustain long-term improvement .

The key elements of the Recovery Plan were discussed with the NRC during a July 23, 1997, meeting at the Region II offices in Atlanta. These elements include the following:

- Temporary Defenses
- Operations, Maintenance, and Engineering Management Reviews
- Recovery Plan Focus Areas
  - ⇒ Design Basis
  - ⇒ System/Equipment Reliability
  - ⇒ Human Performance
  - ⇒ Self Assessment
  - ⇒ Operational Focus
  - ⇒ Financial Management

Each element of the Recovery Plan is described in later sections of this report. Measures have been implemented to monitor the performance improvements expected from the various initiatives. The Recovery Plan is updated each month and distributed to site management. Although this summary document provides an overview of the plan, the monthly update includes details regarding each initiative, including specific action items, schedules, and trends on measures. Measures have been developed to capture real-time and leading indicators of performance. Standard lagging indicators such as human performance LERs and NRC violations are also incorporated into the plan.

Monthly performance updates are held with the Executive Vice President of Duke's Nuclear Generation Department and other senior departmental managers. Bi-monthly updates are scheduled with NRC management in Region II. Senior site management actively communicates the status of the recovery efforts to site teammates. Updates are provided in the Site Vice President's weekly Team Notes. Offsite meetings with the entire site management team were held in July of 1997 and with site teammates in August of 1997. Future offsite meetings have been scheduled to communicate progress on the plan to site management and teammates. The plan provides a focused method to raise standards, focus expectations, increase accountability, and monitor performance improvement in areas critical to achieve and sustain superior plant performance.

Temporary Defenses

One element of the Recovery Plan is to introduce additional barriers to minimize the potential for events. The site management team assessed key functions that could potentially impact plant operation and developed defenses to protect the "front line" workers from creating or contributing to site events. Fundamental principles followed in the development of the temporary defenses are a focus on a strong safety culture and conservative decision making. The primary objective of the temporary defenses is to introduce barriers to prevent events and allow time for the longer-term performance initiatives to positively influence plant performance. Site management is continuously assessing the adequacy of the current barriers and the need for new barriers. These temporary defenses will be phased out once longer-term initiatives and measures indicate that performance improvements have been achieved. A brief summary of the defenses currently implemented at Oconee follows:

Operations Activities

- Management oversight and feedback to Operations shifts during non-outage times has been implemented. Oversight is provided once a week for each shift by experienced managers with an Operations background. Feedback is provided to the Operations Shift Manager regarding key expectations (Operations Core Values).

- Continuous management oversight is provided during changes in reactor power level and reactor heatups or cooldowns. This oversight is from designated management personnel with operating experience.

- Continuous monitoring of Reactor Coolant System (RCS) inventory has been implemented during plant startups and shutdowns. Additional personnel are used to monitor RCS inventory using a computerized RCS inventory tracking program.

Engineering / Operations / Maintenance Communications

Processes have been implemented to improve communications among Engineering, Operations, and Maintenance. These processes include:

- Bi-weekly interface meetings between Engineering and Operations.

- Monthly interface meetings between Engineering and Maintenance.

- The Action Register process has been implemented to more formally assign ownership and track resolution of daily operational concerns.

Trouble Shooting Activities

The trouble shooting process was reviewed and revised to reduce the risk associated with trouble shooting activities. Changes include the following:

- Mechanical maintenance and I&C trouble shooting procedures were reviewed and revised to more formally implement trouble shooting activities.

- Trouble shooting activities require supervisory oversight.

Inservice Inspections (ISI)

ISI issues have occurred and are attributed to communication problems between involved organizations. Longer-term initiatives are addressing process improvements in this area and the following short-term barriers have been implemented:

- Subject matter experts provide an additional review of planned work for accuracy.

- Subject matter experts provide an additional review of completed work for accuracy.

Post-Maintenance / Modification Testing Process

A post-maintenance / modification testing team has been formed to improve and formally structure processes to assure that these tests are correctly designated, scheduled, and executed. As an interim barrier, subject matter experts are independently reviewing test plans to assure accuracy and completeness.

Chemistry / Operations Interfaces

Barriers have been implemented to minimize the potential for human performance errors in communications between Chemistry and Operations. Examples of these barriers include the following:

- Non-routine Chemistry requests are processed through Operations staff personnel.

- Shift turnover between Chemistry and Operations personnel has been improved.

- Supervisor job observations have been implemented with emphasis on risk activities.

- The condensate polisher procedure has been changed to require that the control room is notified immediately prior to using water from the upper surge tank and upon securing water from the upper surge tank.

Management Reviews

The Recovery Plan was developed based on an analysis of a wide variety of data, including self assessments, NRC inspection results, NSRB reports, discussions with site employees and managers, and independent assessments. In order to validate these inputs regarding the performance issues at Oconee, management reviews were conducted for Operations, Engineering, and Maintenance. These management reviews were completed in August 1997 and were performed by senior departmental managers from the General Office and Duke's other nuclear sites.

The findings from these reviews confirmed other inputs regarding the nature of the Oconee performance issues. Specific action items are being tracked via the Recovery Plan to address the findings from the reviews. Management changes have been and will be implemented to assure that key issues such as clearer expectations, ownership of problems, and accountability are improved in the site management team.

Recovery Plan Focus Areas

The vision for Oconee is to achieve a SALP 1 rating, INPO 1 rating, a capacity factor in the top quartile, competitive costs, a low personnel safety index and event-free operation. Each month, year-to-date performance is compared against this vision. This comparison provides a high level indication of progress. However, these are lagging indicators that do not necessarily reflect current performance.

For a better indication of real-time performance, progress associated with completing Recovery Plan focus areas is measured. A one page pictorial summary sheet was developed to reflect the site's progress. This sheet is referred to as the "Oconee Nuclear Site Recovery Focus Areas Annunciator Panel" (see Figure 1). A status color is assigned for each focus area and its initiatives. The colors are red, yellow, green or white. Red indicates that the initiative or focus area is a significant area of concern. Yellow indicates that the initiative or focus area is reflecting a trend in the right direction but is still an area of concern. Green indicates that the initiative or focus area is achieving the desired results. White indicates that the status of the initiative or focus area cannot be determined.

A process is used to determine the annunciator status for each initiative and focus area. The focus area sponsors assign a weighting factor for each initiative based on an assessment of its significance to the overall focus area. The sum of the initiatives' weights total 100% for each focus area. The initiative sponsors are responsible for assessing and reporting the color status of their initiatives each month. The color status is determined by assessing whether milestones are met in the specific action plan for a given initiative and evaluating measures against monthly targets.

The Recovery Plan is published each month to track the progress of the various performance measures.

Design Basis

Several initiatives are underway to further improve the design basis of Oconee. These initiatives provide further assurance that Oconee's design basis is accurate, well-documented and understood.

HPI System Review

The High Pressure Injection System is a dedicated safety system that is used to provide water to the reactor core in the event of a small break in the reactor coolant system. The design of the Oconee system is fairly unique compared to the rest of the industry. In light of these differences and the recent problems on this system, Oconee has undertaken a two phase review of the system and its design. Phase one will evaluate system reliability using equipment failure rates based on industry data. Various system configurations and design features will be modeled to determine if a more reliable design is possible. Phase two is an independent assessment of the system design and operation, following the format of an NRC Safety System Functional Inspection. This review will focus on ensuring the system meets licensing and design requirements. The combined result of these reviews will provide an integrated assessment of the High Pressure Injection System that can used to enhance system performance and reliability.

Oconee Safety-Related Designation Clarification (OSRDC) Project

The definition of "safety-related " is used throughout the industry to identify parts of a nuclear power plant that are important in safely responding to potential accidents or releases of radiation. The scope of equipment defined by this term is subject to more strict documentation requirements, increased testing, and greater procedural controls. At Oconee, the scope of safety-related equipment is somewhat smaller than the industry standard. The goal of this project was to ensure the scope of equipment identified as safety-related is understood and accepted both by Duke and the NRC. This phase of the project was completed and approved by NRC. Secondly, Oconee has been identifying the additional equipment that would be classified as safety-related per current day definitions. Then Oconee plans to increase, as appropriate, the procedural controls and testing requirements on the equipment that is not safety-related, but is important to plant safety.

SQUG Submittal to NRC, USI A-46, "Seismic Qualification of Equipment in Operating Plants"

Unresolved Safety Issue, USI A-46, was initiated by the NRC to review the seismic adequacy of certain equipment in operating nuclear power plants against seismic criteria not in use when the older plants were licensed. This safety issue generally applies to all operating plants which had construction permit (CP) applications docketed prior to 1972.

The assessment will review and evaluate the seismic adequacy of a select set of equipment as to its ability to survive and function in the event of a safe-shutdown earthquake. This assessment will be performed in accordance with an NRC approved

methodology that the utilities developed known as the SQUG GIP (Seismic Qualification Utilities Group, Generic Implementation Procedure). The GIP methodology was approved by the NRC in a Safety Evaluation Report dated May 22, 1992.

Duke Power submitted the Emergency Power System portion of this assessment effort in December 1996. The Oconee Nuclear Station portion of this project will be submitted by December 15, 1997. This will complete the assessment phase of the project. Then, as with all other operating plants, Oconee Nuclear Station will resolve any issues that were not screened "acceptable" by this generic assessment approach. Upon complete resolution of all "unscreened" issues, the older stations will have assured and documented sufficient seismic adequacy to close USI A-46.

Oconee Service Water Project

The Oconee Service Water Project is aimed at improving the readiness of the Emergency Condenser Circulating Water (CCW) System and resolving open items with the NRC. During a hypothetical accident, Low Pressure Service Water (LPSW) would receive its supply from the Emergency CCW System by siphon flow from Lake Keowee to the suction of the LPSW pumps. This siphon process can be interrupted if too much air accumulates in the CCW piping. To provide further assurance that the system will function as intended, a new QA-1 vacuum system is being designed and implemented to keep the air out of the CCW piping. A new QA-1 siphon sealing water system is also being designed and implemented. In addition, numerous configuration changes are being implemented on the LPSW System and the QA standards of existing equipment involved in supplying flow to the LPSW System are being upgraded.

Approximately 60% of the project has been completed to-date. Much of the outdoor infrastructure for the two new systems is already in place. During the current Unit 1 outage, significant changes have been implemented on the Units 1&2 LPSW System. The remaining infrastructure work will be completed in early 1998. The new systems will first be made operational on Unit 2 during its outage in early 1998. Subsequently, the new systems will be made operational on Unit 3 during its outage in late 1998 and on Unit 1 during its outage in early 1999.

Improved Technical Specifications

Oconee is in the process of converting from custom Technical Specifications to Improved Technical Specifications (ITS). This initiative has been endorsed by the NRC and will decrease the burden on operators associated with properly interpreting Technical Specifications. A commitment was made to the NRC to submit ITS for Oconee by October 31, 1997. The development phase of this project has been completed with the ITS submitted to the NRC on October 28, 1997.

Approval of the ITS has been requested by December 1998. Oconee is currently proceeding with implementation activities, such as procedure changes, new processes, and training, to support this implementation date. The December 1998 implementation

date is critical in that it falls within a window between refueling outages and licensed operator exams. NRC support during the review phase of the project is critical to successfully meeting the planned implementation schedule.

UFSAR Reverification

In March 1996, the NRC issued Information Notice 96-17, "Reactor Operation Inconsistent with the Updated Final Safety Analysis Report." As a result of this Information Notice, licensees were expected to appropriately review licensing basis documentation and consider actions necessary to avoid problems similar to those that occurred at Northeast Utilities' Millstone plant.

Duke has undertaken a project to verify the accuracy of the UFSAR at each nuclear site. The project was divided into two phases. The first phase performed a review of Chapter 5 of the UFSAR to validate the processes and methodology for conducting the complete UFSAR review. In addition, costs and schedules would be enhanced from the results of Phase 1. Phase 1 has been completed and review of its results are in progress to establish the schedule and cost for Phase 2.

The successful completion of Phase 2 of the project will result in an up-to-date and accurate UFSAR document.

Generic Letter 96-06

Generic Letter 96-06 identified the potential for water hammer occurring in the Low Pressure Service Water (LPSW) piping supplying the containment fan coolers during both LOOP and LOCA/LOOP events. Currently, the Oconee units are operating with LPSW isolated to the non-safety fan coolers. This results in higher than normal Reactor Building temperatures.

Extensive engineering analyses have been ongoing for approximately one year to quantify the nature of the loads resulting from a LOOP or LOCA/LOOP water hammer. The thermal-hydraulic and civil calculations will determine if any modifications are necessary to assure code compliance and return the non-safety coolers to service.

Emergency Power Project Closeout

The Emergency Power Project began in September 1994. All of the issues and activities associated with the Emergency Power System open at that time were consolidated and contractors were obtained to assist in completing the work. With the exception of a few items, the work was completed on November 1, 1995. Each open item was discussed with management and the NRC residents and it was agreed to track each one to completion. In addition, modifications associated with the power system for which a scope document had been developed as of November 1, 1995 would also be tracked to resolution. Status reports have been provided approximately monthly to NRC residents and site management.

Severe Accident Management Guidelines

The Three Mile Island Nuclear Station accident of 1979 resulted in part of the fuel melting. This accident resulted in fission product barrier degradation beyond that expected for a design basis accident. The nuclear industry recognized the need to manage and mitigate an accident of this degree.

The nuclear industry, through the Nuclear Energy Institute (NEI), committed to the Nuclear Regulatory Commission that a Severe Accident Management Guides Program would be implemented. Severe Accident Management Guides add another layer of protection in the emergency preparedness of a nuclear station. These guides will give direction, in addition to the Emergency Operating Procedures (EOP), for restoring a plant with a damaged core to a safe situation. This initiative includes additional training, engineering evaluations, and specific site guidelines written from industry generic documents. Efforts are on schedule to complete the Severe Accident Management Guides by December 1997.

System/Equipment Reliability

System and equipment reliability have had an adverse impact on Oconee operation in recent years. The most recent SALP report states that equipment failures remain as a key challenge before overall improvement can be realized. This focus area includes several initiatives aimed at significantly improving equipment reliability at the site.

OAC Replacement Project

The Operator Aid Computer (OAC) is being replaced because the existing Honeywell OAC hardware for Oconee and Keowee is obsolete, presents a maintenance burden to the site, and is unable to expand with the growing needs of increased equipment monitoring. The OAC replacement is an initiative because it has a major impact on Operations (Operational Focus issue) and represents a significant resource investment.

The scope of this initiative is to replace the Honeywell OACs with a robust, reliable, and flexible OAC to accommodate future growth of increased equipment monitoring, provide enhanced graphics and printing capabilities, new saturation margin meters, and new Input/Output (IO) equipment. The OAC has been replaced on Unit 3, is in the process of being replaced on Unit 1 during the current refueling outage, and is scheduled to be replaced on Unit 2 during its next refueling outage in early 1998.

ICS Replacement Project

The primary reason for the Integrated Control System (ICS) Replacement project is to reduce the number of Oconee Unit trips associated with ICS failures. A major driving force for the ICS replacement was the B&WOG Safety and Performance Improvement Program (SPIP). This program identified the existence of complex transients associated with ICS and non-nuclear instrumentation failures.

The original ICS is sensitive to a loss of single power source and single component failures. The modification addresses these issues by reconfiguration of the ICS power sources and modification to the control algorithm to eliminate dependency on a single power source for any critical function. The control algorithm is modified to incorporate the essential features of the B&W Owners Group designed Plant Control System. The new algorithm offers numerous operating advantages over the original ICS, and will result in increased reliability, improved control performance, improved fault tolerance, and reduced operator burden during all operating modes.

In an effort to simplify and enhance the ICS / OAC communications, the ICS Replacement is being implemented in parallel with the OAC Replacement Project. This parallel effort presents immediate schedule and engineering resource challenges for Modification Engineering.

The ICS focus area initiative provides a mechanism for measuring progress and improving performance in order to ensure successful completion of the modification.

The Unit 2 ICS replacement is currently the critical item for this initiative because of the schedule for developing the engineering implementation package. Unit 2 will be the last Oconee unit to have its ICS replaced.

Control Rod Drive Mechanism (CRDM) Concerns

The Unit 1 and 2 Type A CRDMs have experienced degradation of rod insertion times attributed to precipitant build up in the thermal barrier region of the CRDMs exacerbated by the design of the Type A thermal barriers. Replacement of the thermal barriers by a modified design has had temporary success but at an excessive maintenance cost. Repairs and maintenance to the existing equipment have caused both forced outages and numerous critical path outage delays as well as rapidly increasing costs associated with repairs and parts procurement for obsolete equipment. The Type A CRDMs are obsolete, with limited repair parts available.

The upgrade to the CRD system will consist of replacing the Type A CRDMs on Units 1 and 2 with Type C CRDMs. The upgrade will consist of the 61 shim CRDMs, plus possibly the 8 Axial Power Shaping Rod (APSR) CRDM assemblies. The upgrade includes new motor tubes, internals and bolting hardware, stator/water jacket assemblies, and position indicator (PI) tubes. Seismic plates and PI amplifier cards will be replaced to interface the new components with the existing structures.

Emergency Power System Continued Reliability/Availability Assurance

A charter for a comprehensive assessment was developed to maintain and improve the reliability and availability of the Emergency Power System for the life of the site. The assessment is focused on equipment condition, maintenance and surveillance programs and procedures, Operations and Maintenance training programs, use of operating experience in the maintenance program, replacement/refurbishment plans for equipment, and the availability of spares. The team was also asked to recommend cost-effective equipment and system upgrades as appropriate. Although much work has been done internally in each of these areas, this assessment is a comprehensive review using knowledgeable resources outside Duke Power. The assessment is being performed by Systems Research International with Dr. Omar S. Mazzoni as the Team Leader. Work began in October 1997 and will be completed by the end of 1997. Improvement items resulting from this review will be planned and scheduled as appropriate.

ONS Materiel Condition Upgrade

Feedback from benchmarking visits and other inspections indicated that, over a period of time, materiel condition and housekeeping at Oconee had not been maintained consistent with industry best practices. One symptom was that areas more frequently accessed on the secondary side of the plant, such as the Turbine Building operating level, were maintained to a higher standard than some of the equipment areas on the primary side of the plant.

High standards of materiel condition tend to reinforce high standards of human performance. Improvements have been made in the full-length corridors that span the second and third floor elevations of the Auxiliary Building. As the next step, three equipment rooms in the lower Auxiliary Buildings were selected as pilots for refurbishment, to serve as a model for other spaces and to provide input into cost estimates for future upgrades. This initiative will identify, control, and correct materiel condition and housekeeping deficiencies. Area owners have been identified and trained. Resources are being directed to promote high standards consistently throughout the site and to upgrade safety-related equipment spaces such as the Reactor Building and areas of the Auxiliary Building.

Top Equipment Problem Resolution (TEPR) Process

The TEPR process is one of the keys to Oconee's Recovery Plan, supporting both System/Equipment Reliability and Operational Focus. TEPR provides operationally focused priorities for four levels of equipment issues as follows:

Major Equipment Problems:
This area addresses long term significant issues, such as steam generator reliability. Project leaders provide updates to a management team on a monthly basis.

Operator Work Arounds:
This area addresses intermediate term problems affecting operator jobs at their work stations. Engineers provide updates to Operations on a weekly basis.

Action Register:
This area addresses short term plant problems, carried by the Operations Shift Manager on plan-of-the-day status sheets with weekly updates by engineers until resolution.

Plant Concerns:
This area addresses immediate threats to safety or unit reliability, carried by the Operations Shift Manager on plan-of-the-day status sheets with continuous work by support groups until resolution.

The four elements of this program are in place at Oconee with the Action Register and Plant Concerns being the newest elements. A formal directive defining the overall program will be implemented.

Equipment Aging Program

The detection and prevention of age-related degradation is very important for ensuring high system and equipment reliability. The integration of component aging and life cycle management issues will aid in optimizing component service life and replacement. This initiative will develop a comprehensive "umbrella" program for equipment aging which describes how equipment aging and life cycle management issues are addressed at

Oconee. This program will provide a roadmap to the individual programs which actually detect the indicators of component aging.

System Team Development

System teams have been formed in response to an internally identified lack of coordination and communication among site groups and a lack of focus on system performance. The creation of a site directive for system teams will formalize those teams already in existence, expand the number of system teams, and document the criteria for the selection of those systems for which the station will maintain teams. The goal of these teams will be to maximize reliability and optimize availability of station systems through better coordination and communication among the various engineering and station groups. The system team will bring together the parties with a vested interest in a system to dedicate their attention to the discussion and evaluation of its performance and trends.

Fluid Leak Management Program

Through benchmarking, Oconee management recognized that the best performing plants have very high standards of leak-tightness for process fluid systems. Minimizing fluid system leaks will reduce liquid waste processing costs, avoid an important type of personnel safety hazard, reduce contaminated floor space, and improve overall site appearance. Maintaining leakage at very low levels also promotes early detection of new leaks which can signal pending failure of a pressure boundary.

The purpose of this initiative is to establish a formal process that identifies, tracks, controls, and mitigates fluid leaks. The vision is "no water or oil on the floor", leaks are to be prevented, or repaired promptly, or properly contained and channeled to waste and tracked until resolved. The program uses existing data base tools such as the Work Management System and the Problem Investigation Process, but assures these are focused specifically on leak reduction. Program elements include an inventory of existing leaks, development of tracking software, and procurement of catch containers and drains as needed.

Management of Temporary Modifications

Oconee has a larger number of Temporary Modifications than typically found in other nuclear stations. The larger number suggests system and component problems are not being addressed in a timely fashion resulting in operational workarounds and increased equipment unavailability. In addition, the increased number is placing an unnecessary burden on Operations from a configuration control and normal system alignment /operations perspective. This initiative is intended to reduce the number of Temporary Modifications installed in the plant and to better align Oconee with industry standards. This effort will be accomplished by an extensive review and assessment of existing Oconee temporary modification processes and modification directives.

Control Room Instrument Problem (CRIP) Management

The main thrust of this initiative is to provide additional focus on out of service instruments in the Control Room. Oconee's philosophy is to minimize the number of Control Room instruments, annunciators, alarms, and indications that are out of service. This philosophy maximizes the availability of accurate instruments and controls for the Operator. This process includes weekly meetings where the CRIP's are discussed and action items are assigned to plan, schedule and return to service the instruments in an expeditious manner. Oconee has included in the CRIP listing not only instruments but computer points and fire protection indications. Also, the list includes outage CRIP's which give a more realistic picture of the total backlog. At the present time, Oconee is developing a more structured process for the repair of outage related CRIP's when an outage occurs. The process includes having the work packages along with the parts pre-staged and ready to be worked when the predetermined shutdown conditions are reached.

Monthly System Health Review

Oconee Engineering has implemented a process where engineers perform monthly system walkdowns with Operations personnel. These walkdowns, along with data collected and documented via the Engineering Support Program, provide the information necessary to assess system health. Single page system health reports for key systems are distributed monthly for station personnel to review. These reports summarize the availability and reliability of the system and are used to focus attention on corrective actions needed to improve both system and unit performance. This process is an enhancement over the previous system reporting that occurred semi-annually. The data from the monthly reports serve as input to the semi-annual reports that will continue to be distributed.

Secondary System / Component Reliability

Problems with secondary systems and components can contribute to reactor trips, reduced power operation, or lost megawatts. This initiative will clearly identify those systems or components that have historically caused these occurrences and will also identify systems or components that could cause these occurrences if not adequately maintained.

The goal of this initiative is to improve secondary system reliability, thus improving the site capacity factor and megawatts generated. A team will analyze past events and determine which systems and components have historically contributed to unit trips, power reductions, and megawatt losses. The team will make recommendations to modify, repair, or change maintenance practices for affected systems and components.

Human Performance

As part of a department-wide initiative several years ago, Oconee purchased human error reduction technology from a consulting firm. This technology covers prevention, detection and correction of conditions that predispose workers to make mistakes. A majority of site supervision and a "critical mass" of workers were trained in these techniques. While improvement was noted in some areas, overall site performance did not improve as much as was desired.

In mid-1997, new site leadership reestablished the objective of event free human performance. The importance of the human error reduction tools has been reinforced, especially those tools best suited to control the types of human errors being seen most often at this site. For individuals, self checking and questioning attitude are being emphasized. For supervisors, job observations and pre-job / post-job briefings have been highlighted. Expectations have been broadly communicated face-to-face, by electronic means, and in print. Human Performance Review Committees established in each major site group are helping to translate the error reduction tools into specific behaviors to be used when performing the exact scopes of work done by the group. Recognizing that a growing portion of site work is to be done by non-assigned (contractor) workers, a form of error reduction training will be extended to these workers next year.

Tracking the use of these tools is providing a real time indicator of human error reduction efforts. This is a useful complement to the lagging indicator of counting events such as certain Licensee Event Reports and NRC Violations which have human error as their cause. A leading indicator is also in place--periodic sample surveys of self-improvement culture at the site.

These initiatives are expected to evolve into a new real-time behavior based monitoring approach, intended to put Oconee at the state of the art level for human error reduction. Real-time behavior based monitoring provides a method for standards feedback and reinforcement, and for real time human error rate monitoring by management.

Self Assessment

The Self Assessment Focus Area is intended to enhance the current self assessment process that is defined by nuclear system directives. The self assessment process identifies opportunities to improve the quality, effectiveness, and efficiency of work processes and products. Self assessment is founded on the principle that ownership, accountability, and involvement at the point closest to the work are the most effective ways to ensure quality, acceptance, and efficiency. It is based on the philosophy that individuals and organizations continually:

- examine their operational effectiveness
- identify strengths and findings
- identify and correct the root cause(s) for identified findings
- develop, implement, and evaluate the effectiveness of the corrective actions
- incorporate and share lessons learned
- implement practices that achieve continuous improvement toward excellence

One aspect of a strong self assessment culture is an outwardly focus that strives to adopt industry best practices. This focus area also encourages benchmarking activities to learn from the experiences of other utilities.

Corrective Action PIP Backlog

The Problem Investigation Process (PIP) is the corrective action program for Oconee. This process is intended to properly identify, evaluate, and correct problems to the extent needed to prevent recurrence of events or issues. One measure of the effectiveness of the correction program is PIP activities open longer than six months. The intent of this measure is to assure that problems are promptly corrected and/or addressed. A large inventory of uncorrected PIPs increases the likelihood that a problem will recur prior to correction and possibly result in a higher level event.

It has been noted that Oconee's PIP activity backlog (open longer than six months) was increasing. It was also noted the PIP backlog number was greater than that of the other Duke stations. It is felt that a Recovery Plan focus measure should be oriented toward reducing the PIP activity backlog open greater than six months. The measure established was to reduce the backlog by 1/3 (33%) by the end of 1997. Further reductions are planned for 1998.

Manager Observation/Group Assessment Effectiveness

The Manager Observation and Group Assessment processes are an integral part of Oconee's Self Assessment process. The Manager Observation process is a mechanism for key managers to observe work in the field and utilize their experience to find opportunities to improve quality. The Group Assessment process is oriented toward key groups critically reviewing their own work for opportunities for improvement.

As the Recovery Plan was being developed, it was noted that the number of Manager Observations and Group Assessment was too low. For this reason, a focus measure was drafted that would establish a goal that 95% of the scheduled Manager Observations and Group Assessments would be performed each quarter. Overall, this initiative is intended to raise the number and quality such that trending and feedback can be used to help the station improve.

PIP Quality

PIP quality is considered paramount to having an effective corrective action program. Problems with PIP quality have been noted during previous performance assessments of the corrective action program. These problems involved items such as weak problem identification, inadequate cause analysis, inadequate corrective action, and actual corrective action different from proposed corrective action. For these reasons, it was considered appropriate to establish a program and measure to improve PIP quality.

On August 1, the Oconee Safety Review Group (SRG) initiated a program to screen completed PIP activities and reopen those deemed deficient. Feedback is provided to the responsible PIP group to aid in improving PIP quality. The short-term goal for this initiative is that an external performance assessment at the end of the year will find that no more than 10% of the PIPs reviewed have a quality problem.

In-Plant Review and SRG Job Observation Process

Like Manager Observations and Group Self Assessments, In-Plant Reviews and SRG Job Observations are considered an integral part of Oconee's self assessment process. This focus measure is intended to emphasize and refocus Oconee's efforts on the Independent Safety Engineering Group (ISEG) functions performed by the SRG.

The measure established is the number of In-Plant Reviews and SRG Job Observations performed, with the goal being 18 and 30, respectively, from August 1, 1997, to the end of the year. This goal is also contingent on these efforts meeting the quality expectations established by directive.

Benchmarking Activities

Benchmarking was developed as a focus measure to establish a reference point for Oconee's standing in the industry and to adopt the best industry practices. This initiative is consistent with Oconee's philosophy to become more outwardly focused in its assessment efforts. It is felt that reviewing plant operations against other plants provides an extra level of assurance that the self assessment initiatives are correctly targeted. This focus measure involved establishing a definition for benchmarking and setting a goal for the number of benchmarking activities to be completed in each area by the end of the year. A goal of 17 total benchmarking activities was established.

Operational Focus

Efforts have been underway at Oconee for the last few years to improve operational focus. The most recent SALP report encouraged Oconee "to continue efforts already underway to further improve operational focus and to strengthen operations' command and control of the plant." This area of the Recovery Plan builds on actions already in place at Oconee to improve operational focus.

Effective Root Cause Analysis and Corrective Actions for all Operational Related Events

Oconee experienced a series of significant events during the first half of 1997. A common theme for some of these events was the existence of previous operating experience, which if recognized and acted upon, might have precluded the event. Management realized the need for an initiative directed at promptly learning lessons from operating experience.

Although significant events are the main concern, it is certainly hoped that these will be rare. Therefore, they might not provide a useful data base for tracking the effectiveness of lessons learned. Instead, it was decided to focus on operating events that typically do occur more often: mispositions. All mispositions are undesirable but most do not cause significant events. The working definition of a misposition is an active component whose desired position is defined by a program or procedure, but which is inadvertently placed in or is found in the wrong position. Whatever can be learned about the site's effectiveness in responding to misposition events should be applicable to avoiding significant events.

Individual mispositions are documented in the PIP Program and investigated in proportion to their significance. In addition, in the spring of 1997, a Continuous Improvement Team (CIT) was chartered to review recent mispositions for common cause. The CIT made extensive recommendations, some of which directly influenced the contents of the Recovery Plan in the human performance and operational focus areas. An example is the Operations group's local expectations regarding how the error reduction tools are to be applied during operation of valves. One objective of this initiative is to reduce the number of mispostioned components by 30% by the end of 1997 through focused efforts on improving root cause evaluations and corrective actions.

Prompt Response to Operational Concerns

Like many other U.S. nuclear plants, Oconee developed programs to respond to INPO's lessons on Operator workarounds. It became clear that a long standing culture of living with hardware or procedure shortcomings was difficult to turn around. More sense of ownership by Operations, more visible support by Engineering and more status feedback to Operators were needed. These items have been addressed as part of the Recovery Plan.

This initiative provides for clear ownership of equipment or procedure problems that have the potential to affect performance of the plant operating crews or chemistry technicians. Significant problems identified by operations watchstanders are to be promptly addressed and the status of their resolution made readily available for their review. Operations and Chemistry watchstanders are expected to actively pursue resolution of problems affecting their area of responsibility. Operations Shift personnel are to be given opportunity for input into work schedules prior to the schedule commitment meeting.

New tracking tools are in place to support this initiative. Emergent problems that are important in the eyes of the Operations Shift Manager are entered as Plant Concerns; a status update is demanded prior to the end of that shift. Problems not yet resolved but of lesser urgency are entered on an Action Register, with a time frame agreed to for the next update. Problems whose resolution will take longer, such as by a plant modification, are moved into the Work Management Process and tracked there to closure. Success in the use of the tools is defined by the OSMs' level of satisfaction, as measured by a periodic survey sheet.

Enhance Operating Experience Program

One of the lessons learned from the Oconee Unit 3 HPI pump damage event was that operating experience had not been used effectively in that case. For this reason, the Recovery Plan includes an emphasis on frequent dial-in to the department's Operating Experience Data Base (OEDB). The OEDB was recently upgraded to incorporate thousands of NRC, INPO and in-house documents in electronic form, all accessed by a powerful search engine.

The purpose of this initiative is to encourage a positive real-time behavior, with the expectation of making it a habit. Since the OEDB is electronic based, it is possible to track and measure OEDB usage. Guidance and expectations were issued to reinforce the site wide use of the OEDB. A goal of 3200 total accesses was established as the measure to be obtained by the end of the year with the intent being to increase the review of industry operating experience for its applicability in preventing or resolving Oconee issues. The actual effectiveness of the OE Program can continue to be measured by the lagging indicator of plant events.

Effective Daily Risk Assessments

This portion of the Recovery Plan has improved and formalized the emergent risk assessment process. Higher risk activities that could adversely affect unit operation are to be consistently identified and communicated with appropriate compensatory actions taken.

One tool is a list of special emphasis codes which can be incorporated into the Work Management System. These are then displayed on daily work lists to allow for

heightened awareness of slight increases in risk. Supervisors and managers can use these flags to bias their field presence toward the more risk significant tasks.

Another tool will be the SENTINEL software, which builds on previous successful application of the ORAM software for detailed risk assessment of complex, parallel evolutions.

Since the Recovery Plan was issued, a critical maintenance oversight process has been used successfully on service water pipe stoppel insertions on Unit 1, repairs to the decay heat removal isolation valve on Unit 2, repair of the main generator seal oil system on Unit 3, and emergency power transformer tap setting changes on all units.

Success in this initiative will be measured by periodic independent audit of the standards being applied to risk assessment, effective identification of special emphasis items, and proper use of compensatory measures. The goal is no events or incidents on high risk activities.

Work Management Backlog

The Work Management System at Oconee includes a large number of indicators that show the progress of various categories of work through the system. Four specific measures were selected for inclusion in the Recovery Plan. The most important of these are the age and quantity of outstanding non-outage corrective maintenance tasks. These have not necessarily been a weakness for Oconee in the past, but benchmarking shows that the best performing plants have moved in the direction of approximately 120 outstanding work orders per unit or less. Controlling the number of older work orders assures that a latent problem will not linger in the system unaddressed.

The other two specific measures have to do with better administration of the Work Management System. Prompt closeout of work packages for which field labor is complete, will avoid cluttering the backlog list and will strengthen configuration control. Prompt closeout of Priority 'E' (emergency) work orders, and reclassification of those which do not deserve this label, will promote timely response to urgent plant problems.

Financial Management

Update Oconee Long Range Plan

Oconee has an initiative to gather all known data concerning future plans and to store this data in a common manner. This information will allow more accurate models to be available in evaluating different long range operating scenarios. These scenarios will be used to develop future operating strategies for the station.

Improve Financial Performance of 201 Level Projects

Oconee has an initiative to establish a consistent and enhanced process for choosing project managers, for managing the scope and tracking the cost of projects, and for performing cost estimates. The project will also establish a philosophy for out-sourcing some of the major modification projects.

Conclusions

Oconee is committed to achieving its vision of SALP 1, INPO 1, a capacity factor in the top quartile, competitive costs, a low personnel safety index, and event-free operation. The Recovery Plan provides a focused process to achieve marked improvements in site performance. Performance improvement is a continuous, evolving process. As initiatives are completed and performance gains are realized, additional initiatives will be pursued to further improve the safe and reliable operation of the station.

Oconee believes that the bi-monthly updates proposed by Duke and agreed upon by Region II management provide a constructive means to share perspectives regarding performance trends at the site. The initiatives, measures, and results associated with the Recovery Plan provide a convenient mechanism for both organizations to monitor performance trends at the site.

The Recovery Plan will continue to remain in effect until sufficient progress has been made and Oconee is on track to achieving superior performance levels. Closure of the bi-monthly progress updates will be pursued when both Oconee and Region II are satisfied that sustained performance improvements are evident.

Figure 1

Oconee Nuclear Site Recovery Focus Areas Annunicator Panel

KEY

RED		1.0-1.99 POINTS
YELLOW		2.0 - 2.69 POINTS
GREEN		2.7 - 3.0 POINTS
WHITE		0 POINTS

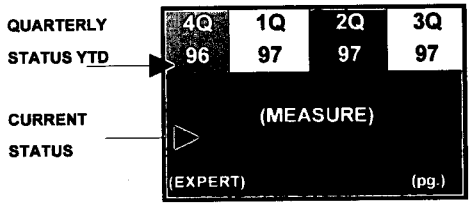
DESIGN BASIS	SYSTEM/ EQUIPMENT RELIABILITY	HUMAN PERFORMANCE	SELF ASSESSMENT	OPERATIONAL FOCUS	FINANCIAL MANAGEMENT
NAZAR	NAZAR	McCOLLUM	FOSTER	PEELE	MARTIN

KEY

RED		1.0 POINT
YELLOW		2.0 POINTS
GREEN		3.0 POINTS
WHITE		0 POINTS

Progress on Site Level Design Basis Initiatives D B Coyle 100%	Lost Generation Days due to Equipment Failures R L Dobson 40%	Field Involvement/Job Observation T K McQuarrie 20%	PIP Activity Backlog (> 6 months old) R S Matheson 15%	Number of Site Mispositionings R T Bond 20%	Long Range Plan Milestones Met C C Turner 50%
	TEPR Process Implemented D B Coyle 15%	Pre-Job/ Post-Job Briefs T K McQuarrie 20%	Manager Observations Conducted and Group Self Assessments H R Lowery 20%	Prompt Response to Equipment Problems O C Kohler 20%	201 Projects Initiative Milestones Met S D Capps 50%
	System Teams Meetings Implemented D B Coyle 15%	Human Performance LERs NGD measure 45%	PIP Quality R T Bond 25%	Effective Daily Risk Assessments D G Hayes 20%	
	1997 Milestones Met for Four Key Projects R L Dobson 30%	Human Performance NRC Violations NGD measure 9%	Number on In-Plant Reviews and SRG Job Observations R T Bond 25%	OEDB Accesses R T Bond 20%	
		Culture Index NGD measure 6%	Number of Benchmarking Activities Completed R T Bond 15%	Work Backlog Quantities and Age B K Millsaps 20%	

KEY



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