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U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

Subject: Waterford SES Unit 3
Docket No. 50-382
Waterford 3 First Refueling Outage

Gentlemen:

Waterford 3 is currently conducting low power physics testing in preparation for power ascension following the first refueling outage. We would like to take this opportunity to provide you with an early review of the outage preparation and implementation as well as a discussion of the key elements which contributed to the overall outage success.

As you know, the first cycle of operation for Waterford 3 ended with a cumulative capacity factor of 82.3% and a sharp reduction in plant trips in 1986 over that experienced during the startup testing in 1985. Waterford 3 management was determined to bring the same standard of excellence demonstrated in plant operations to our outage activities. With the completion of the March, 1986 outage and the refueling outage activities, save for power ascension, we are confident that our goal has been successfully met.

Attachment I provides a narrative description of the refueling outage including pre-outage preparation, major implementation milestones and the primary factors contributing to a safe and efficient outage. Attachment II includes the functional organization for the pre-outage preparation. Attachment III reviews in more detail certain of the major refueling outage activities.

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This submittal is intended to present information relative to the successful completion of Waterford's first refueling outage. While LP&L's formal internal verification process has not yet been completed, LP&L believes it presents an accurate picture of the outage. In the event that verification identifies a significant discrepancy LP&L will notify the NRC staff.

Please feel free to contact me should you wish to further discuss any aspect of the refueling outage.

Yours very truly,

KW Cook

K.W. Cook
Nuclear Safety and
Regulatory Affairs Manager

KWC/NSC/MJM/ssf

Attachments

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ATTACHMENT I

Waterford 3 First Refueling Outage

The successful completion of the Waterford 3 first refueling outage was due primarily to the following factors (which are discussed in more detail later):

1. Availability and use of key experienced and trained personnel to manage both plant operation and outage preparation,
2. Creation of a functional outage preparation organization,
3. Early definition of outage scheduling and scope,
4. Reorganization which allowed the Plant Manager to also assume the function of Outage Manager,
5. Limiting the outage work scope to manageable proportions,
6. Extending the outage start date to the end of the Cycle 1 core burnup window, and
7. Close monitoring of outage progress to ensure that resources were efficiently reallocated upon experiencing delays.

The following discussions provide a brief description of the pre-outage planning and organization, a narrative of the outage activities, and some indication of the successful resolution of various problems encountered.

Pre-Outage Planning and Preparation

Recognizing that the successful accomplishment of the first refueling outage at Waterford 3 required a comprehensive preparation program with strong management oversight, Louisiana Power and Light established an Outage Preparation Team. A senior plant staff manager was designated to head a functional organization comprised of Corporate, Site and Plant Groups with direct reporting to the Plant Manager (see Attachment II). This manager had been the Outage Manager for the successful mid-cycle outage in March 1986. The major obstacles to overcome in preparing for the first refueling included the need to perform a planned mid-cycle outage and an earlier than predicted refueling outage commencement.

The mid-cycle shutdown was required to perform Technical Specification surveillances whose testing frequencies would not extend to the refueling outage. Waterford 3 management also wanted to enhance plant operations through implementation of several station modifications and selected maintenance. For instance, maintenance was performed on auxiliary systems to minimize gaseous and liquid leakage, and a major modification to the CEA rod control system was implemented to reduce the potential for dropped and misaligned rods (the major remaining cause of reactor trips at that time). Extensive outage pre-planning combined with good communications with NRC personnel were responsible for limiting the scope and duration of the mid-cycle outage.

Waterford 3 entered the first refueling outage with an 82.3% cumulative capacity factor compared to a projection of 67% when commercial operation began. This excellent plant performance and availability reduced the

initial estimates of time available for refueling outage preparation. Through the early planning and organization efforts of Waterford 3 management, however, the reduced preparation time had little impact on the quality of the refueling outage.

Outage preparation was managed in three distinct but overlapping phases: Scoping, Planning and Mobilization. Realizing the necessity and benefit of having a controlled outage scope, the Outage Preparation Team provided the focal point for all groups to engage in scope review, adjustments and finalization. The approved scope document became known as "The Master Activity List for Refuel No. 1" and encompassed design modifications, maintenance work orders and preventive maintenance tasks, surveillance tests, commitments and major evolutions.

Finalization of the outage scope began in early summer with initial reviews. Guidelines were developed for the outage scope which required documentation of any scope adjustments and management approval. Mechanisms to adjust and prioritize the scope based on safety significance and operational considerations were maintained through the end of the refueling outage. Management initiated various administrative controls to ensure that the outage scope remained on track, including: labeling work orders with a red "Refuel No. 1" stamp prior to requesting on-shift Operations approval for work; denoting approved refueling outage work by specific fields in computerized data bases; and maintaining Operations and Scheduling review and tracking of outage-related work orders initiated during the outage.

Concurrently with preparations for the physical modifications of the outage, steps were taken to coordinate, with NRC/NRR, the Technical Specification changes and reload analysis approvals necessary for Cycle 2. Beginning in May, 1986 a series of briefings were held with NRR staff to outline the submittals expected for the reload. Firm schedules were provided to NRR for transmittal of the Technical Specification change requests and the Reload Analysis Report in order that NRR could allocate their personnel resources. The submittal schedules were met and timely responses to NRC questions were provided as necessary.

Several significant management changes occurred during the outage preparation. In August, 1986 a new Senior Vice President for Nuclear Operations was appointed by the LP&L Board of Directors. Two months later the Board confirmed the previous Plant Manager as the new Vice President-Nuclear. At that time, the new Plant Manager assumed the role of Outage Manager and the Outage Preparation Manager became the Operations and Maintenance Assistant Plant Manager. The Outage Preparation Manager function was dissolved upon successful completion of outage preparations.

The net effect of the management organization changes was to elevate the importance of the outage preparation and implementation. Through direct management attention and involvement, the outage preparation and scope was focused to provide an outage of reasonable duration. Design modifications were reviewed to ensure optimum usage of outage time and resources. Activities which could be performed on-line were scheduled for pre-outage implementation or postponed. Selection criteria for outage work were based on previous commitment, safety, ALARA, and economic benefit when examined

against achievement of the baseline refueling schedule. From an initial scope of 94 modifications, the outage scope was narrowed to 47 modifications. On October 1, 1986 the baseline schedule was frozen within the management directed duration of 60 days, and the "frozen scope" published shortly thereafter.

The approved outage scope was translated into the outage implementation schedule in coordination with the respective users and work package planners. The planning and work coordination process was strengthened by several initiatives. LP&L staff employees were designated as Project Leads and Lead Area Coordinators on the major outage activities based on their expertise and organizational responsibility (without relieving the line organizations of any responsibilities). The Project Leads acted as functional managers to ensure proper preparation and implementation of the outage plans and schedule. Specific activities requiring containment polar crane and containment nautilus crane support were reviewed with the Containment Coordinators, and laydown and staging areas were designated for specific groups and tasks. Operations Shift Supervisors were dedicated to review the outage schedules and ensure proper sequencing and durations for the operational evolutions and surveillance testing. To coordinate these activities, the Outage Preparation Manager held weekly planning conferences and individually reviewed the major activities to confirm decision making and the appropriate prioritization of resources.

Below the management level, Design Group Action Engineers held review conferences with support and implementation groups for their assigned modifications. These reviews facilitated the planning, material expediting, staging, procedure revisions and selected pre-outage work in parallel with final design review and approval. The Maintenance Department dedicated outage planning support under a Planning Supervisor to perform work package development and parts staging. Radiation Protection planning was performed during the actual work package development in close interface with Maintenance Planners.

The processing of new employees and the increased training requirements made extensive use of the new Skills Training Center almost immediately after its completion in September 1986. Outage specific training was performed on control element latching mechanisms, and steam generator and reactor coolant pump mock-ups. Given the large influx of people and increased activity expected during the outage, management felt it prudent to re-emphasize and strengthen our safety program. As a result, LP&L supervisors to be involved in the outage were given initial training on the proven Safety Training Observation Program (STOP) techniques with specific focus on the outage. Site employees were also made aware of the program principles and safety benefits.

The outage goals, specific rules and general information were incorporated into an Outage Manual which was given senior management support. The Senior Vice President, Vice President, and Plant Manager addressed virtually all of the first line supervision on site about outage goals, safety, security, and health physics considerations, followed by a question and answer period that allowed free exchange of information and concerns between senior management and the supervisory chain. This meeting was followed by several meetings in which the same subjects were covered by the

Plant Manager with the supervisors and their respective craft personnel.

During the Mobilization phase (pre-outage) several large projects were performed: Fuel Handling Building equipment was readied; a supplemental fuel pool heat exchanger was installed; new fuel was received; and, several larger modifications were partially implemented. This facilitated a gradual ramp-up of craft forces and reduced scheduling concerns on having the Associated Circuits Analysis upgrades and Main Steam Isolation Valve enhancements impact the outage duration. Temporary facilities needed for outage support were reviewed prior to erection to ensure proper Security and Fire Protection controls.

Outage Implementation

In mid-September the optimum shutdown date based on fuel consumption, plant performance and outage readiness had been selected as Thanksgiving Day. Operating to the very end of the Cycle 1 fuel burnup window allowed Waterford 3 staff the maximum outage preparation time and provided NRC staff with additional time to process the Technical Specification changes necessary for Cycle 2.

Waterford 3 was taken off the grid on November 26, 1986, at the end of the fuel burnup window, only a few hours earlier than the scheduled outage start time. Initial efforts were directed to the safe and orderly shutdown of the plant, performing containment decontamination, establishing radiological controls and preparing plant systems and outage equipment for work activities following the Thanksgiving weekend.

The original outage critical path included the performance of turbine generator and auxiliaries inspections, testing and enhancements. The containment activities and operational surveillance testing, however, only had two days float and were considered the major obstacles in achieving the outage goals within the challenging schedule target.

The outage schedule was maintained current by reviewing, each shift, the status of activities on or impacting the critical path. Schedule variances were prioritized with the outage team focusing on recovery from specific obstacles through: reallocation of technical, Operations, Health Physics, Radwaste, craft and equipment resources; developing schedule work-arounds; expediting material; and obtaining industry and vendor information and assistance. Dedicated Containment Coordinators and Schedulers maintained around the clock duty supporting on-shift Project Leads and forces to achieve the daily plan. Three formal planning conferences and selected detailed follow-up reviews were held daily. During certain periods the Duty Plant Managers and Outage Supervisors provided additional management coverage of the backshift.

The reactor coolant pump (RCP) seals were removed, the RCP heat exchangers were lifted and all temporary covers installed by December 10, 1986. This allowed reactor coolant system (RCS) fill for refuel while efforts continued on the removal of heat exchanger studs and leak repairs of the reactor coolant pump oil piping. The RCP heat exchanger reinstallation with new studs, gaskets and seals was accomplished within the tight schedule for motor to pump alignments.

Due to excellent results on steam generator No. 2 secondary sludge lancing (only about 25 lbs. of wet sludge) and visual inspections of both steam generators, on December 9th sludge lancing was terminated. The small amount of sludge is attributed to management foresight in the installation of a full flow condensate polisher prior to initial startup, coupled with careful secondary chemistry control.

On December 6th, five previously installed plugs were discovered missing from the hot leg side of Steam Generator No. 1; the respective cold leg plugs were intact. While reviewing the significance of this inspection, on the following day the tube plug rerolling was delayed when the communication link between the rerolling equipment and its controller began malfunctioning. After initial troubleshooting did not correct the equipment, plant staff installed temporary nozzle dams in the steam generators in parallel with troubleshooting the tube plug rerolling equipment. After final testing of the nozzle dam seals on December 14th, reactor cavity flood-up resumed and the reactor vessel head was removed. The tube plug rerolling devices were corrected and the remaining plugs rerolled December 17th.

Fuel movement commenced on December 17th with 92 new assemblies eventually placed. All 217 assemblies were moved or lifted to inspect for missing steam generator plugs, one of which was located and retrieved on December 25th. An extensive search for the missing plugs was also conducted beneath the lower core plate and on the bottom of the reactor vessel. Fuel assembly movement concluded on December 31st, four days over the original projection.

An in-depth safety review was conducted to determine the safety significance of the missing steam generator plugs. The safety review concluded that no significant adverse impact to the reactor coolant system (such as flow blockage, fuel cladding damage, etc.) would result from the presence of the plugs.

The reactor cavity draindown and vessel reassembly recovered from delays and the vessel head was set on January 1st. The plant entered Mode 5 "Cold Shutdown" on January 7, 1987.

The manufacturer's recommended internal examinations were performed on Emergency Diesel Generator A. Enhancements were added to increase the engine's governor responsiveness and to allow increased testing with the unit in service. The maintenance engine analysis was performed on schedule, however, difficulties with the governor control circuit delayed operability by 7 days over the predicted schedule. A work-around allowed B train work on the shutdown cooling suction isolation valve to commence and prevent critical schedule impact. Using experience gained on Unit "A", the Unit "B" had similar tasks performed well within the scheduled 14 days.

Under the management of LP&L Maintenance and Operations Engineers, two of the low pressure turbine rotors had disc and blade inspections with excellent results. The generator hydrogen cooler was replaced with a unit constructed with restricted lead to minimize the formation of lead carbonate deposits. Scope increases included the replacement of the main turbine lube oil pump impeller and the replacement of the turbine turning

gear mechanism. Following a lube oil flush the turbine was placed on the turning gear on January 18, 1987, a three day extension to the predicted schedule with no outage impact.

The main feedwater pumps were changed from hydraulic to electronic governor controls for improved automatic control. The 'B' feedwater pump turbine was inspected and the bearings replaced.

While installing the charcoal filter deluge systems management attention and close coordination between support and work groups improved on the original schedule. Had the predicted schedule of 25 days continuous work (based on preoperational data) been required, containment working conditions would have been prohibitive and extended the outage.

Major enhancements for the main steam isolation valves were implemented with the relocation of instrumentation and the addition of new hydraulic control skids. This modification will provide extended life of the instrumentation and minimize personnel safety hazards when performing maintenance. Other major secondary items included dredging of the intake structure, performing an eddy current examination of over 1500 condenser tubes, and selected secondary system In Service Inspections including piping inspected as a result of the Surry industrial accident.

Major Technical Specification testing included approximately 130 separate local leak rate tests directed by LP&L Operations Engineers. The amount of rework approximated our contingency planning. In Service Inspection (visual) of over 280 piping supports revealed only minor concerns on which prompt corrective action was taken. Additionally approximately 130 piping and vessel welds received non- destructive examination with no failures. Performing this number of inspections will provide a balanced ISI program for the second refueling outage. Snubber testing was extended, due to testing failures, to include 100% of the small bore snubbers with over 200 total tested, however, engineering analyses demonstrated that there was no significant impact on system operability.

The Core Protection Calculators (CPCs) were upgraded for Cycle 2 through implementation of the CPC Improvement Program and the Reload Data Block. The CPC Improvement Program has incorporated various algorithm and other changes to reduce the potential for CPC-induced plant trips due to single CEA drops, misaligned CEAs or axial shape anomalies at low power levels. The Reload Data Block enhancements will reduce the need for future CPC software changes and the corresponding lengthy NRC review.

As the outage progressed, operators were provided training covering the outage station modifications, procedure changes, and core and Technical Specification changes. Similar training on station modifications and Technical Specification changes was provided for plant management, including the Senior Vice President and Vice President. During the startup testing period operators will be allowed time for acclimation to the plant changes introduced during the outage.

Management control and coordination of the daily work increased during the completion of the operational surveillances for startup. The Duty Plant Managers and Outage Supervisor personally reviewed many of the already approved outage work orders to minimize the scheduling burden on the Operations Staff. The Plant Manager developed an Operational Mode signoff

document requiring Design Modification Action Engineers, Plant Department Heads and designated key staff to confirm that the plant was ready for startup.

Reactor coolant system fill commenced on January 13th and, although the operational surveillances for startup were accomplished ahead of schedule, two days were lost due to local leak rate testing failures on the component cooling water system (which was needed to run the Reactor Coolant Pumps). The RCS was vented on January 19th and the plant entered Mode 4 "Hot Shutdown" on January 25, 1987.

Reactor coolant pump lube oil and thrust bearing temperatures became a concern on January 21st. Pump run sequencing for troubleshooting continued as the plant achieved Mode 3 "Hot Standby" on January 27, 1987. On January 28, 1987, the RCP problem was identified as the upper thrust bearing on RCP 1A and the decision to cooldown for repairs was made immediately. After replacement of the thrust bearing and additional lift oil system and instrumentation repairs, the plant heated up to Mode 3 "Hot Standby" on February 1, 1987.

By February 2 the plant was heated up to normal operating temperature and pressure. Following completion of rod drop testing and reactor trip system response time testing the primary system was diluted, achieving criticality on February 4, 1987. Following low power physics testing, it is anticipated that the generator will be synchronized to the grid for the first time about February 7. The plant is in good condition for extended operation only about 1½ weeks behind the original schedule despite the expanded scope of work in areas such as emergency diesel generators, five days delay because of missing steam generator tube plugs, tube rerolling, equipment problems, and several days delay due to reactor coolant pump startup problems.

In summary, we would attribute the overall success of the outage to the following:

1. Availability and use of key experienced and trained personnel to manage both plant operation and outage preparation at the same time. The use of management personnel experienced in the initial plant startup, and who then participated in an aggressive management training program (SRO and SRO certification), has paid off. We have a permanent extra top management position for training on the plant staff. This position was occupied by our Refueling Outage Preparation Manager, who had finished SRO Certification Training prior to the March mid-cycle outage. This allowed us to train and prepare for the refueling outage without having to "rob" such a person from another important plant staff position.

2. Creation of a second "matrixed" outage preparation organization (see Attachment II) with centralized responsibility and control for the purposes of outage preparation. Personnel were involved in this functional organization regardless of plant or corporate staff affiliation. Teamwork and cooperation of all members in this unique organization resulted in a coordinated effort to prepare for a common goal.

3. Early scoping of the outage and definition of outage scheduling goals (i.e., 60 days).

4. Reorganization prior to the outage relieving the Plant Manager of some direct responsibilities (Training and Site Quality) thus allowing him to take on other responsibilities - direct management of Plant Planning and Scheduling and the outage itself, as Outage Manager.

5. Limiting the scope of the work so it could be reasonably accomplished in the desired time frame in a controlled manner.

6. Extending the outage start date to the end of the burnup window to ensure maximum preparation time by both NRR (Technical Specification processing) and LP&L.

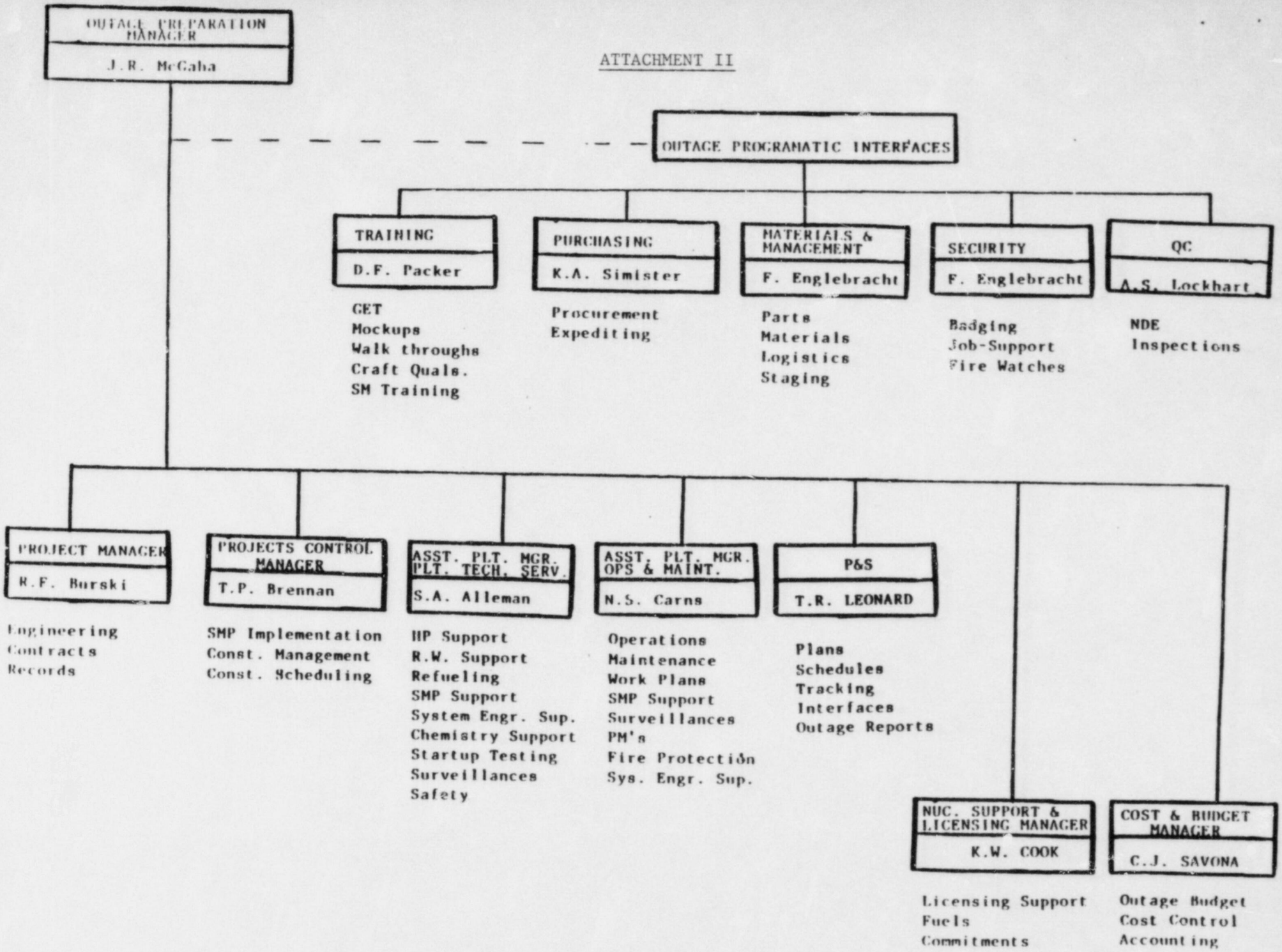
7. Close monitoring of progress during the outage to ensure work-arounds and alternate use of resources were initiated as soon as delay was experienced in any potential critical path job.

Post-Outage

The first refueling outage for Waterford 3 included a number of successes - both in the as-planned implementation of station modifications as well as the successful resolution of equipment and implementation problems.

In order to preserve the knowledge gained during this outage, Waterford 3 management intends to conduct an in-depth critique of the outage planning and implementation phases. The goal of the critique will be the identification of successful techniques and lessons learned for incorporation into future planned and unplanned outages.

ATTACHMENT II



ATTACHMENT III

First Refueling Outage

Major Activities

O REFUELING

- Loaded more enriched fuel in the core in preparation for a nominal 18 month cycle.
- Modified control element drive cooling ducts to allow easier removal and storage and reduce exposure during refueling.
- Improved the operability of the reactor vessel level monitoring system.
- Performed an extensive search for missing steam generator tube plugs.

O REACTOR COOLANT PUMPS

- Replaced heat exchanger hold down studs and gaskets to reduce leakage, and installed new seals.
- Reworked motor oil piping, added remote oil addition capability, and improved oil level indication to increase unit availability, reduce exposure and improve safety of working conditions.

O STEAM GENERATOR PRIMARY

- Conducted eddy current In Service Inspection testing and baseline data collection on the batwing region. Rerolled tube plugs for increased reliability.

O STEAM GENERATOR SECONDARY

- Steam Generator No. 2 was sludge lance cleaned with excellent results. As a result, sludge lancing was not required on Steam Generator No. 1.
- Conducted Steam Generator No. 2 vessel weld ISI.

O TURBINE GENERATOR AND AUXILIARIES

- Refueling interval rotor, bearing and valve inspections were conducted.
- Replaced the generator hydrogen cooler with a unit constructed with restricted lead to minimize the formation of lead carbonate deposits.
- The main steam reheater efficiency was upgraded.

- The supervisory instrumentation (e.g. eccentricity, radial vibration, differential expansion, etc.) was replaced to improve equipment protection and reduce the potential for turbine-induced plant trips.

O MAIN STEAM ISOLATION VALVES

- Installed new hydraulic skids and relocated instrumentation for extended component life and personnel safety.

O EMERGENCY DIESEL GENERATORS

- Performed refueling interval inspections and enhanced the controls in order to increase reliability and availability.

O MOTOR OPERATED VALVES (MOVs)

- The inspection and testing for the MOVs covered under IE Bulletin 85-03 was conducted.

O FEEDWATER PUMPS

- The feedwater pump control circuits were changed from mechanical controllers to solid state electronic controllers to improve reliability and reduce the potential for feedwater pump initiated plant trips.

O HUMAN ENGINEERING DEFICIENCIES

- Enhanced operator responsiveness by performing control board background shading, annunciator tile matrixing, meter and recorders scale upgrading.

O ASSOCIATED CIRCUIT UPGRADE

- License condition requirements to ensure safe shutdown of the plant in the event of a control room/cable vault fire were implemented.

O CHARCOAL DELUGE SYSTEM

- Appendix R modification to enhance fire suppression on existing charcoal filter units was implemented.

O POST ACCIDENT SAMPLING

- Replaced existing tubing and skids for gaseous sampling to provide improved operator controls and analysis capability.

O GASEOUS WASTE SYSTEM

- Replaced isolation valves to gas decay tanks with improved design for enhanced operator control.

O CPC SOFTWARE UPGRADES

- Implemented the results of the CPC Improvement Program including various upgrades to reduce the potential for plant trips due to control rod drops/misalignments or ASI problems at low power.

- Implemented the Reload Data Block concept to reduce the need for future CPC software changes.

O Conducted refueling interval surveillances per Technical Specification requirements.

- Added capability to test containment purge isolation valves at power and component cooling water penetration during refueling.

O Replaced packing in over 400 valves with improved material to minimize primary system leakage, reduce exposure and increase efficiency.

O Completed over 500 outage Corrective Maintenance Work Orders.

O Completed over 1200 outage Preventive Maintenance Tasks.