50-416

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

November 21, 1996

LICENSEE: ENTERGY OPERATIONS, INC.

FACILITY: Grand Gulf Nuclear Station, Unit 1

SUBJECT: SUMMARY OF OCTOBER 3, 1996, MEETING ON THE EIGHTH REFUELING OUTAGE

A meeting was held on Thursday, October 3, 1996, between the Nuclear Regulatory Commission (NRC) staff and the licensee to discuss the licensee's upcoming eighth refueling outage (RFO 8) for Grand Gulf Nuclear Station, Unit 1 (GGNS). The unit is scheduled to shut down on October 19, 1996. The meeting was held at the request of the license at NRC headquarters in Rockville, Maryland. A notice of this meeting was issued on September 10, 1996.

Attachment 1 is the list of attendees. Attachment 2 is the licensee's handouts on the refueling outage, the shutdown operations protection plan, and the safety assessment for RFO 8 (dated September 17, 1996). There were no handouts by the staff.

The meeting was conducted for the staff to understand the major work that the licensee had planned for RFO 8 and the application of risk assessment to schedule the work. No decisions were made during the meeting.

MEETING SUMMARY:

The agenda for the meeting is page 1 of the handout on RFO 8 in Attachment 2. The licensee presented an overview of the outage, the outage scope, the outage performance, selected engineering initiatives, outage safety assessment, and the Cycle 8 reload.

RFO 8 is scheduled for 32 days from October 19 to November 20, 1996. The goals for the outage are the 32 days duration, a continuous run of 60 days after startup from the outage, less than 8 Occupational Safety and Health Administration (OSHA) recordables (i.e., an occupational accident that is above the OSHA threshold for "recording" the accident), less than 255 person-rem of occupational radiation exposure, less than 2 reportable engineered safety feature (ESF) events during the outage, no unplanned loss of key safety functions during the outage, and costs within the budget.

The outage scope was broken down to the work conducted for the refueling floor, turbine building floor, and ESF systems. The major items are replacing 24 jet pump beams and 28 control rod drive mechanisms, completion of the first 10-year inservice interval, upgrade of the first-stage low pressure turbine (LPI) and 8 turbine generator (T/G) modifications, lateral piping replacement for standby service water (SSW) "C", suppression pool cleaning, changing out

DF01 1/1

6 safety/relief valves (SRVs), erosion/corrosion pipe replacement, and changing the main steam isolation valve (MSIV) liquid control system (LCS) from an active to a passive system.

The table on page 13 of Attachment 2 shows a comparison between the seventh and eighth refueling outages at GGNS in terms of the number of modifications planned for the outages. RFO 8 has less planned work. The significant modifications and startup testing for RFO 8 are listed on pages 14 and 15 of Attachment 2.

The slides on the outage performance begin on page 16 of Attachment 2 with the following:

- Shutdown protection plan on page 17,
- Improvements made since refueling outage No. 7 on pages 18 and 20 through 22, and
- Number of contractors on page 19.

Revision 1 of the shutdown operations protection plan for GGNS dated September 26, 1996, and the safety assessment for RFO 8 dated September 17, 1996, are at the end of Attachment 2. These two documents were not discussed in the meeting.

The slides for the design engineering initiatives begin on page 23 of Attachment 2. These initiatives are finishing work on upgrading Thermo-Lag fire barriers, SRV lo-lo set logic, digital feedwater control system (DFWCS) upgrade from an analog system, a turbine upgrade by replacing the rotors in the low pressure and high pressure turbines, and the MSIV LCS change. Each of these initiatives are described separately on pages 25 through 29 of Attachment 2.

The safety assessment for the outage is described on pages 30 through 45 of Attachment 2. The licensee stated that the purpose of the safety assessment is to manage the outage risk, identify relative risk issues, identify contingency plans that are needed, and recommend changes to the schedule to reduce outage risk. Tables of key safety function inventory control and the refueling outage risk damage core profile are shown on pages 33 and 37. The key safety function inventory control is a deterministic evaluation for each safety function of whether the systems providing that safety function are operable or not operable. The relative risk profile for the outage, based on the deterministic evaluation, is shown on page 34 (where SBO = station blackout, LOCA = loss-of-coolant accident, and KSF risk = key safety function risk). The risk damage core profile is based on the shutdown probabilistic risk assessment for GGNS. The licensee stated that this profile provides insights that are not available by other means. The chart of core damage contributions on page 38 shows a 99.77% contribution for LOCAs, 0.22% for SBO, and 0.01% for isolations and pump failures. The boiling risk profile and the contributors to this profile are shown on pages 39 and 40, respectively. The major contributors are shutdown cooling (SDC) line isolation, reactor pressure vessel (RPV) isolation, decay heat removal (DHR) pump failure, and SSW pump failure.

The licensee stated that the purpose of shutdown risk management (page 42 of Attachment) is the following:

- Develop contingency plans for concerns as the recirculation pump A replacement due to concerns about lifting heavy loads.
- Recommend schedule changes to reduce risk, although this was not needed for this refueling outage because of the use of risk assessment in the preplanning of the outage.

The average core damage risk that was calculated by the licensee for refueling outages No.s 4 through 8 and is shown on page 44 of Attachment 2. The probabilities of an event per hour during these 5 refueling outages were shown to be between 2×10^{-11} and 4×10^{-09}.

The licensee stated that shutdown risk management can result in significant risk reduction without adverse effects on the schedule for the outage.

The licensee completed its presentation with a summary of the refueling outage. This is given on pages 46 through 48 of Attachment 2. The core for the next operating cycle (Cycle 9) will consist of 272 General Electric (GE) fuel assemblies and 528 Siemens Power Corporation (SPC) assemblies. The licensee then discussed the analyses that have been performed for this core and that the maximum critical power ratio (MCPR) safety limit in the Technical Specifications has been increased from 1.06 for two loop operations to 1.12 for operating cycle 9.

The meeting was adjourned.

J N Donohew

Jack N. Donohew, Senior Project Manager
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Division of Reactor Projects III/IV
Office of Nuclear Reactor Regulation

Docket No: 50-416

Attachments: As stated
cc w/atts: See next page

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ATTENDEES AT MEETING OF OCTOBER 3, 1996

ON THE EIGHTH REFUELING OUTAGE

NAME	AFFILIATION
E. Adensam	NRC/NRR/DRPW
W. Beckner	NRC/NRR/PDIV-1
J. Donohew	NRC/NRR/PDIV-1
R. Lobel	NRC/NRR/SCSB
W. Long	NRC/NRR/SCSB
W. Lyon	NRC/NRR/SRXB
J. Schiffgens	NRC/NRR/SPSB
M. Pohida	NRC/NRR/SPSB
J. Hagan	EOI - Grand Gulf
C. R. Hutchinson	EOI - ANO
M. Meisner	EOI - Grand Gulf
M. Wright	EOI - Grand Gulf
J. Burton	EOI - Grand Gulf
C. Smith	EOI - Grand Gulf
R. Collins	EOI - Grand Gulf

where:
EOI = Entergy Operations, Inc.
ANO = Arkansas Nuclear One
NRC = Nuclear Regulatory Commission
NRR = Office of Nuclear Reactor Regulation
DRPW = Division of Reactor Projects III/IV
PDIV-1 = Project Directorate IV-1
SCSB = Containment Systems and Severe Accident Branch
SPSB = Probabilistic Safety Assessment Branch
SRXB = Reactor Systems Branch

ATTACHMENT 1

NRC/Grand Gulf Meeting
Eighth Refueling Outage

October 3, 1996

ATTACHMENT 2

Joe Burton
Riley Collins
Joe Hagan
Mike Meisner
Charlie Smith
Mike Wright
Grand Gulf Nuclear Station

Agenda

• Introduction	Joe Hagan
• RF08 Overview	Charlie Smith
• Outage Scope	Mike Wright
• Outage Performance	Riley Collins
• Selected Engineering Initiatives	Joe Burton
• Outage Safety Assessment	Mike Meisner
• Cycle 8 Reload	Joe Burton

RF08 Overview

Grand Gulf
Refueling Outage 8

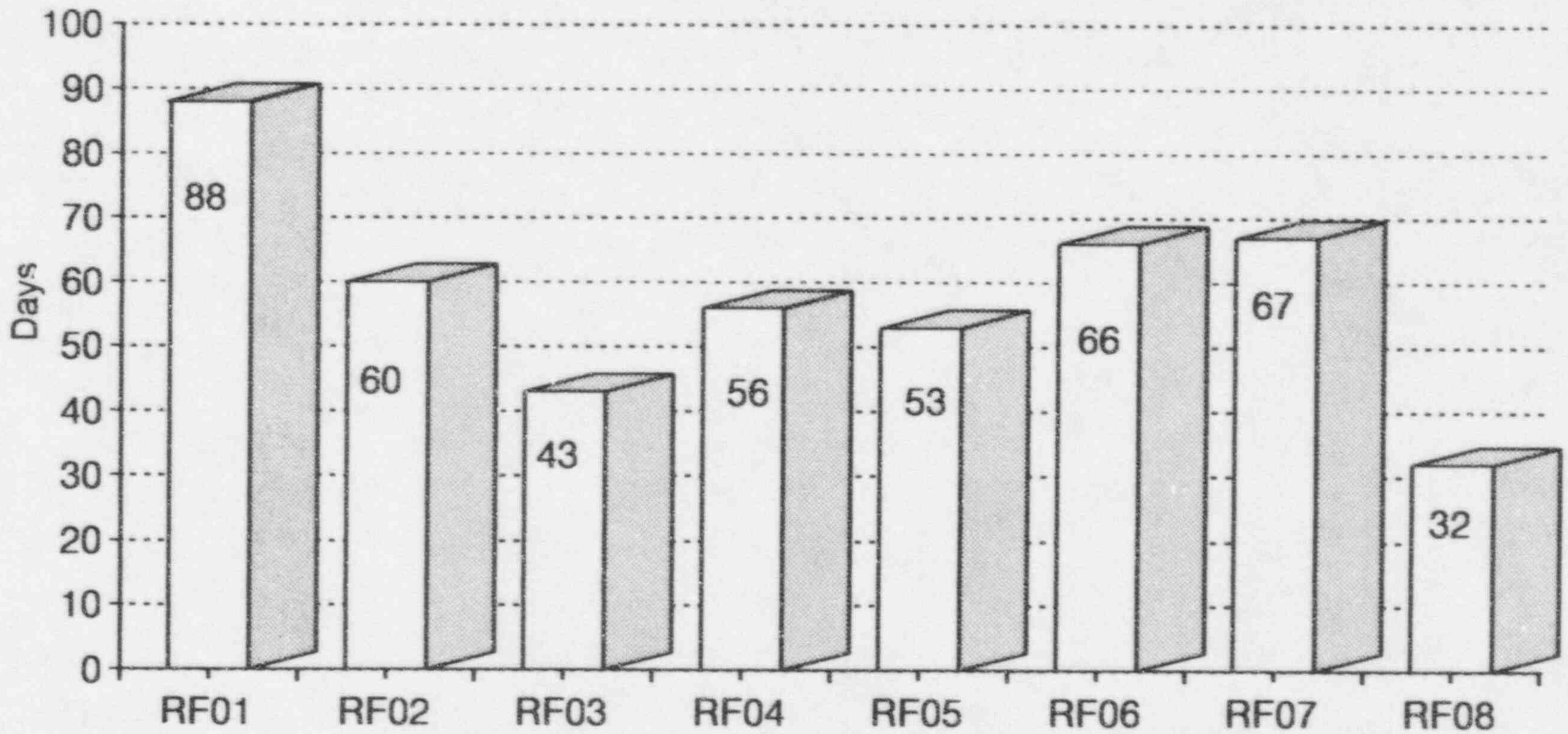
32 Days

October 19 - November 20, 1996

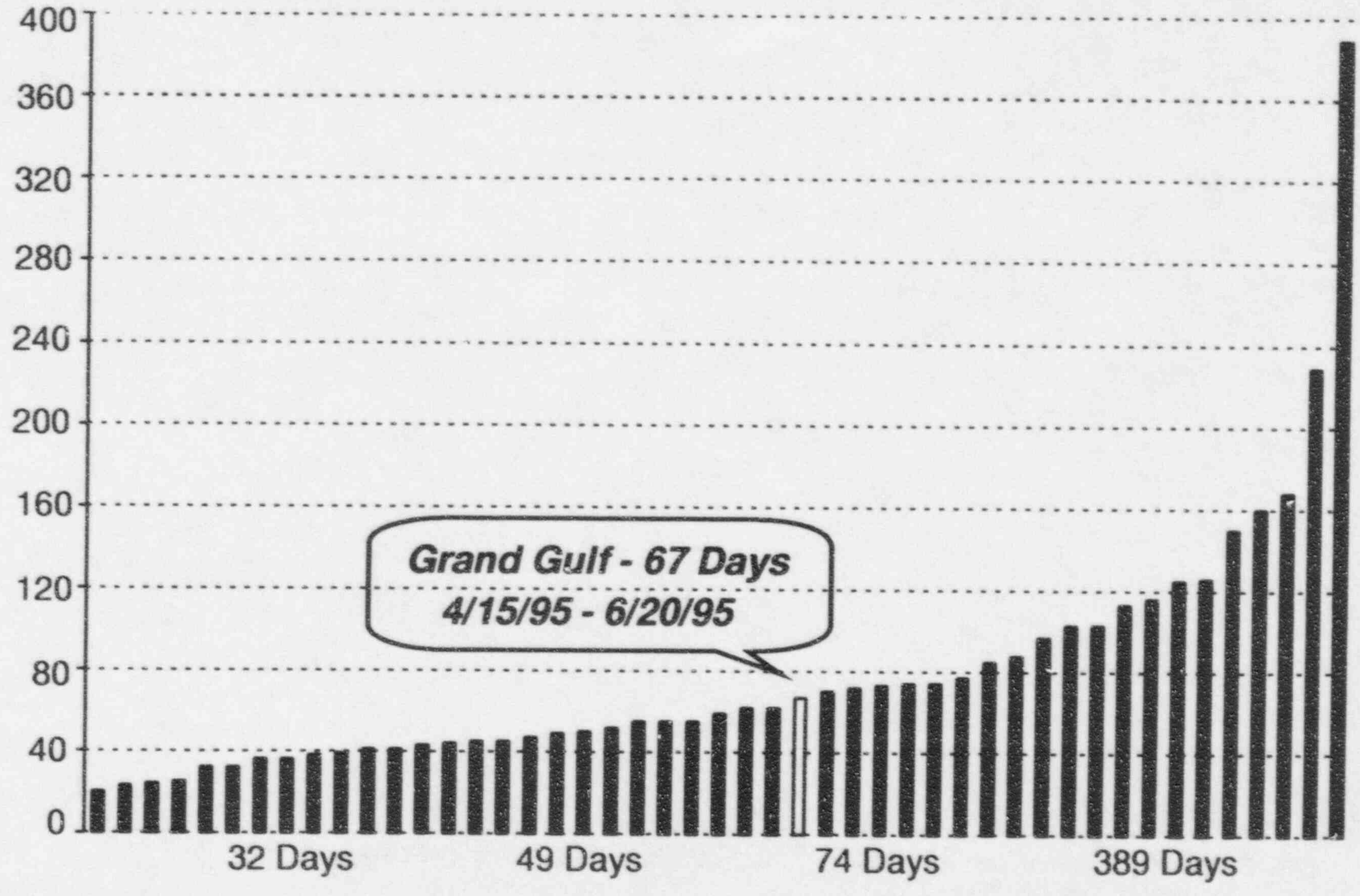
RF08 Outage Goals

♦ Duration	=	$\leq$ 32 days
♦ Continuous run time after startup	=	> 60 days — no power interruptions
♦ Personnel safety	=	$\leq$ 8 OSHA recordables
♦ Exposure	=	$\leq$ 255 person REM
♦ Reportable ESF actuation events	=	$\leq$ 2
♦ Unplanned loss of key safety function	=	0
♦ Within budget	=	$\leq$ 20M

Grand Gulf
Outage Durations



BWR Industry Outages



Outage Scope

Outage Scope
Refuel Floor

- Shuffle method

does not do full core offload

  - 272 new fuel bundles
- Replace 24 jet pump beams
- Replace 8 control rod blades
- Replace 28 control rod drive mechanisms
- Normal IVVI invessel vessel inspection
  - Completion of 1st ten year interval

Outage Scope
Turbine Floor

- Critical path
- LPI upgrade — replace low pressure turbine
- 8 T/G related mods — turbine generator
- Bearing Number 11 inspection

Outage Scope
ESF System

- SSW 'C' lateral piping replacement — replace pipe with thinning walls
- ECCS systems
  - PMs, Votes
  - LPCS pump inspection
- EDGs — preventitive maintenance
  - PMs, no major teardown
- ESF busses
  - No major outages

Outage Scope

- Suppression pool cleaning
- Change out 6 SRVs
- Erosion/Corrosion pipe replacement
  - 4 mods (N11 major scope)
  - Rework 500 KV switchyard breaker J5236

PLANNED

Outage Scope

~ 20% scope reduction compared to 7

	RF07	RF08
Mods	48	39
Design Change MNCRs	12	1
Total MNCRs	81	57
Votes Tests	52	33
Relief Valves	90	33
Check Valves	58	45
Snubbers	241	93
Corrective Maintenance	756	793
Preventive Maintenance	2273	1747
Surveillances	750	394
TSTIs	60	26

39 days 32 days

Significant Modifications

- MSIV LCS becomes passive — leakage control system
- Drywell insulation (air receivers) — remove fibrous insulation from
- Feedwater check valve B21F010A — remove cobalt seats
- Feedwater upgrade (C34) — going to a digital
- Lo-Lo set power supply
- Moves F bus to K&L (non-safety DC buses) — for better ground detection
- Enclosure building roof

Start-up Testing

- Digital FW Upgrade
  - 7 test plateaus (5, 15, 30, 40, 50, 65, 100% CTP)
  - 13 test configurations
  - Will include level step changes and system response testing
  - Testing already performed on stand alone simulator
- Normal S/U Testing
  - Turbine overspeed
  - Turbine vibrational data

Outage Performance

Shutdown Protection Plan

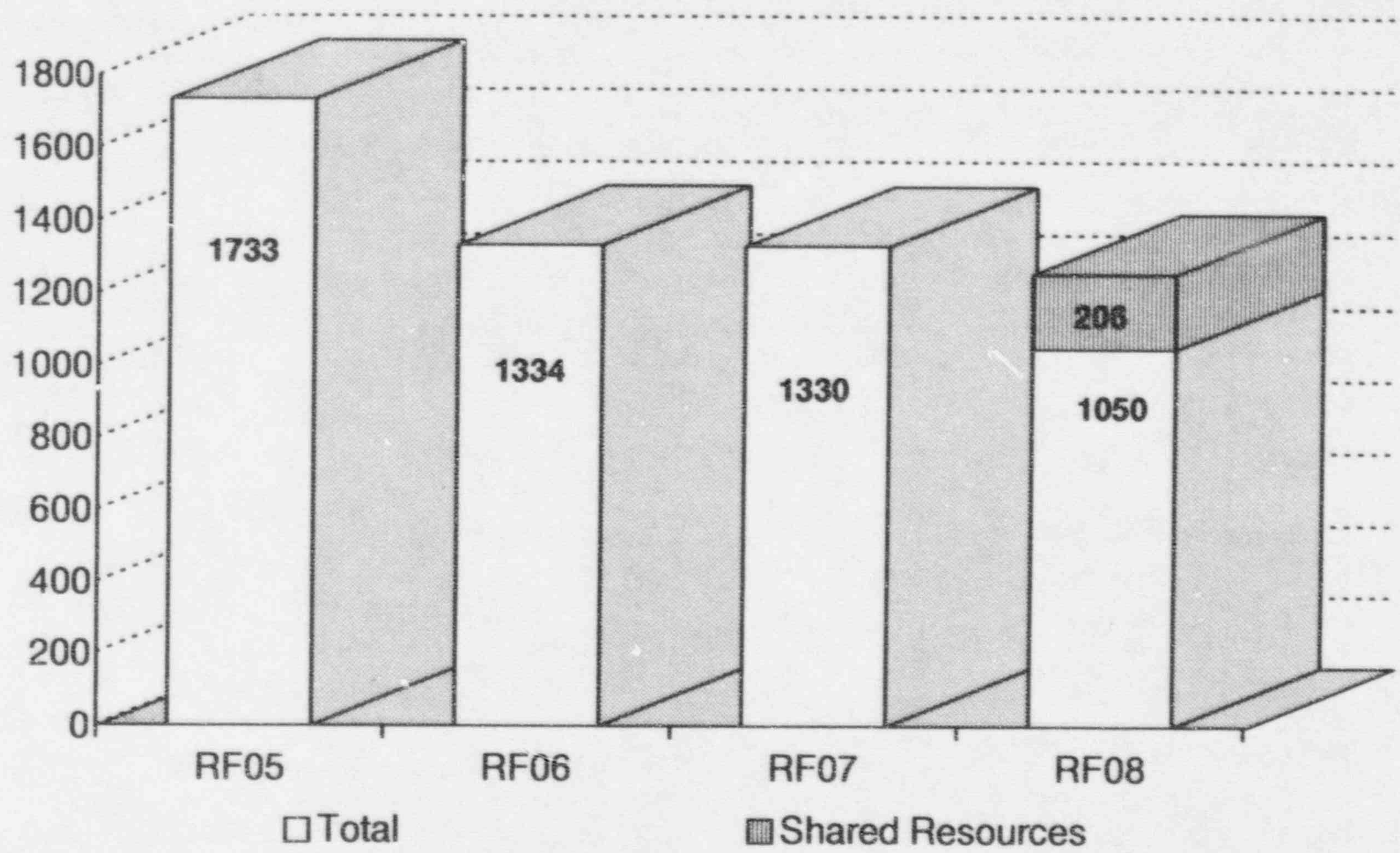
- Identifies shutdown risk management as a key element of the planning of outage activities
- Specifies outage management philosophy and guidelines
- Developed as an organized approach for managing key safety functions
- Maximizes "Defense in Depth" concept
- Serves as the focal point for conduct of outage
- Integrates industry experience

Improvements Made Since RF07

drywell

- Containment/DW controls for suppression pool cleanliness
- Resource sharing
- Contractor Control
- Site integrated schedule

Number of Contractors



Improvements Made
Since RF07

- One Stop Shop Concept
  - Provide single point of contact for:
  - redtags, emergent work, ALARA planning, scheduling, paper closeout, operability reviews, personnel safety, welding/burning permits, etc.

- One Stop Shop Objectives
  - Improving overall outage implementation by enhancing communications and clarifying roles
  - Utilizing operations personnel resources more effectively
  - Reducing burden on control room personnel
  - More efficiently, handling the administrative portion of the work control process

Improvements Made Since RF07

- Work moved to power operations
  - Selected pressure locking mods
  - I&C surveillances (e.g., IRM calibrations)
  - CTMT air lock maintenance
  - D/G testing (24 hr run) on-line
- Well coordinated and based on risk management considerations

Improvements Made Since RF07

- Work destruction
  - Burden reduction efforts (LLRT's, D/W bypass, DRQR)
  - Relief valves/check valves

Design Engineering Initiatives

Design Engineering Initiatives

- Thermolag
- SRV Lo-Lo Set Logic
- DFWCS Upgrade
- Turbine Upgrade
- MSIV LCS

Thermo-Lag Resolution

- 1-hour Barriers - Upgrade to 1-hour
  - Add stress skin, improve joint configuration
  - Full Appendix R compliance
- 3-hour Barriers - Upgrade to 1-hour
  - Add stress skin, improve joint configuration
  - Provide local area suppression
  - Deviations to Appendix R
- Space Separator
  - Evaluated to demonstrate adequacy
- Ampacity
  - GGNS configurations bounded by TU and TVA testing

SRV Lo-Lo Set Logic

- Manual Reactor Scram
  - 6 - LLS SRVs open for 2.5 - 3 minutes
- Capacitor Failure on C11 Trip Unit
  - Fuse 1E12-F38 opened
  - Power supply variation affected SRV trip units
- RF08 install separate power supplies for each channel of SRV trip units

Digital Feedwater Control System

- RF06
  - RFP turbine speed control upgraded to digital Electro-hydraulic system
- RF07
  - Condensate system loop controllers upgraded to digital
- RF08
  - Feedwater control system upgraded to digital
- Same stability/transient performance criteria as original plant design

Turbine Upgrade

- HP Rotor (RF07) - 35 Mwe
- LP Rotors (RF08, RF09, RF010) - 14 Mwe each
- Increase disk inspection intervals from 50,000 hrs. to 100,000 hrs.

MSIV Leakage Control System

- BWROG method eliminated the function and took an increase in offsite dose
- GGNS method did not eliminate the function
  - Redesigned MSIV LCS
  - Eliminated obsolete equipment
  - Did not increase offsite dose
- Technical Specification change approved via SER
- Implement in RF08

Outage Safety Assessment

Purpose of Outage Safety Assessment

- Manage outage risk
- Identify relative risk issues
- Identify needed contingency plans
- Recommend schedule improvements

Schedule Review
Deterministic Evaluation

- Definition of relative risk condition:

  One equipment failure or operator action can cause a loss of or a reduction in the plant's ability to:

  - remove decay heat
  - provide electrical power
  - maintain inventory control
  - establish/maintain secondary containment
  - ensure adequate reactivity control

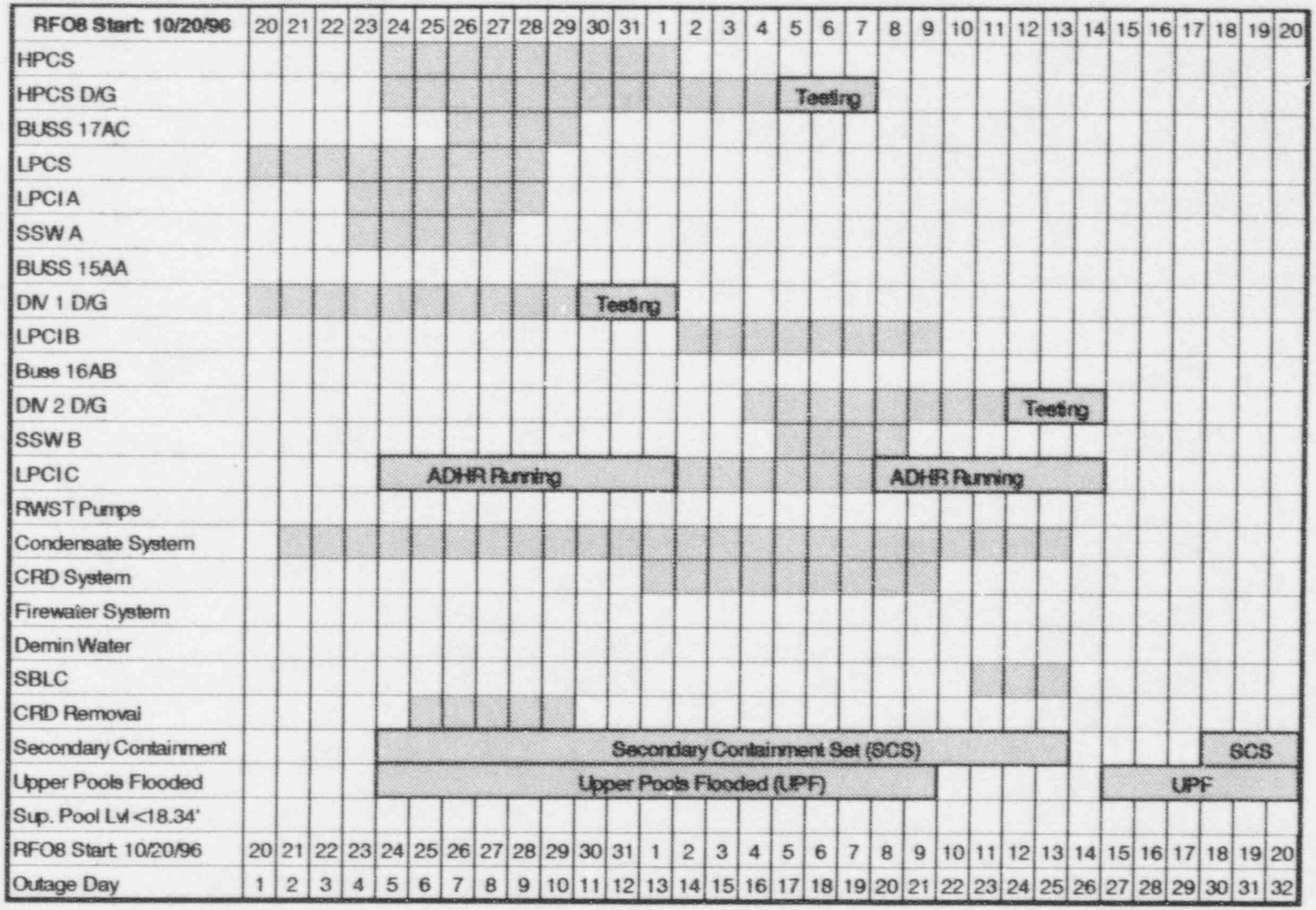
- Day-by-day review for:

  - Each safety function
  - SAR events (SBO, LOCA, fire)

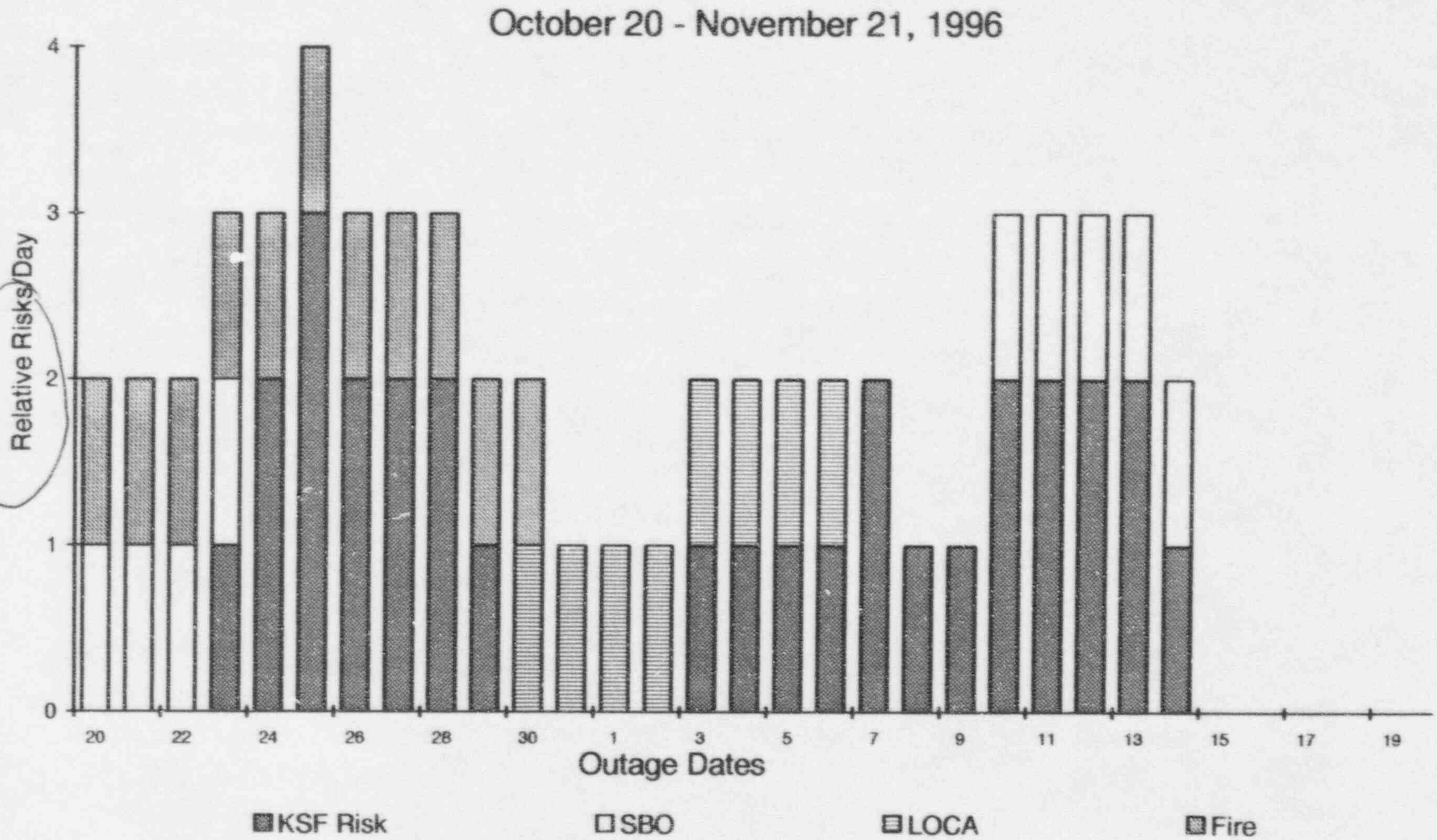
deterministic
look
not using IPE

This is <u>not</u> applying
the analyses in chapter
to shutdown.

Key Safety Function
Inventory Control



RF08
Relative Risk Comparison



deterministic

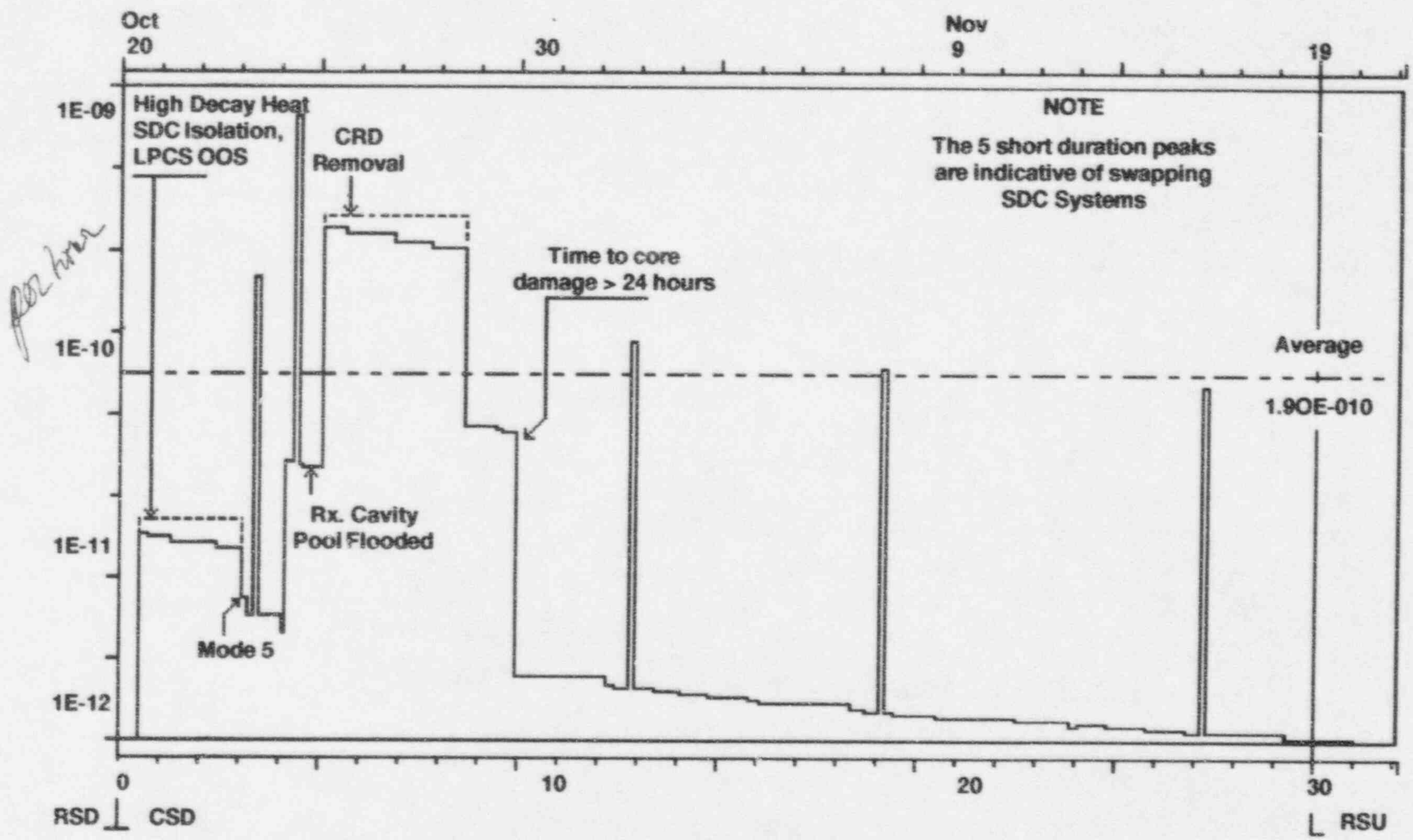
Schedule Review
Relative Risks

- Outage schedule changes for selected evolutions
- Contingency planning for remaining relative risks
- Enhanced daily outage sensitivity to relative risk factors for that day

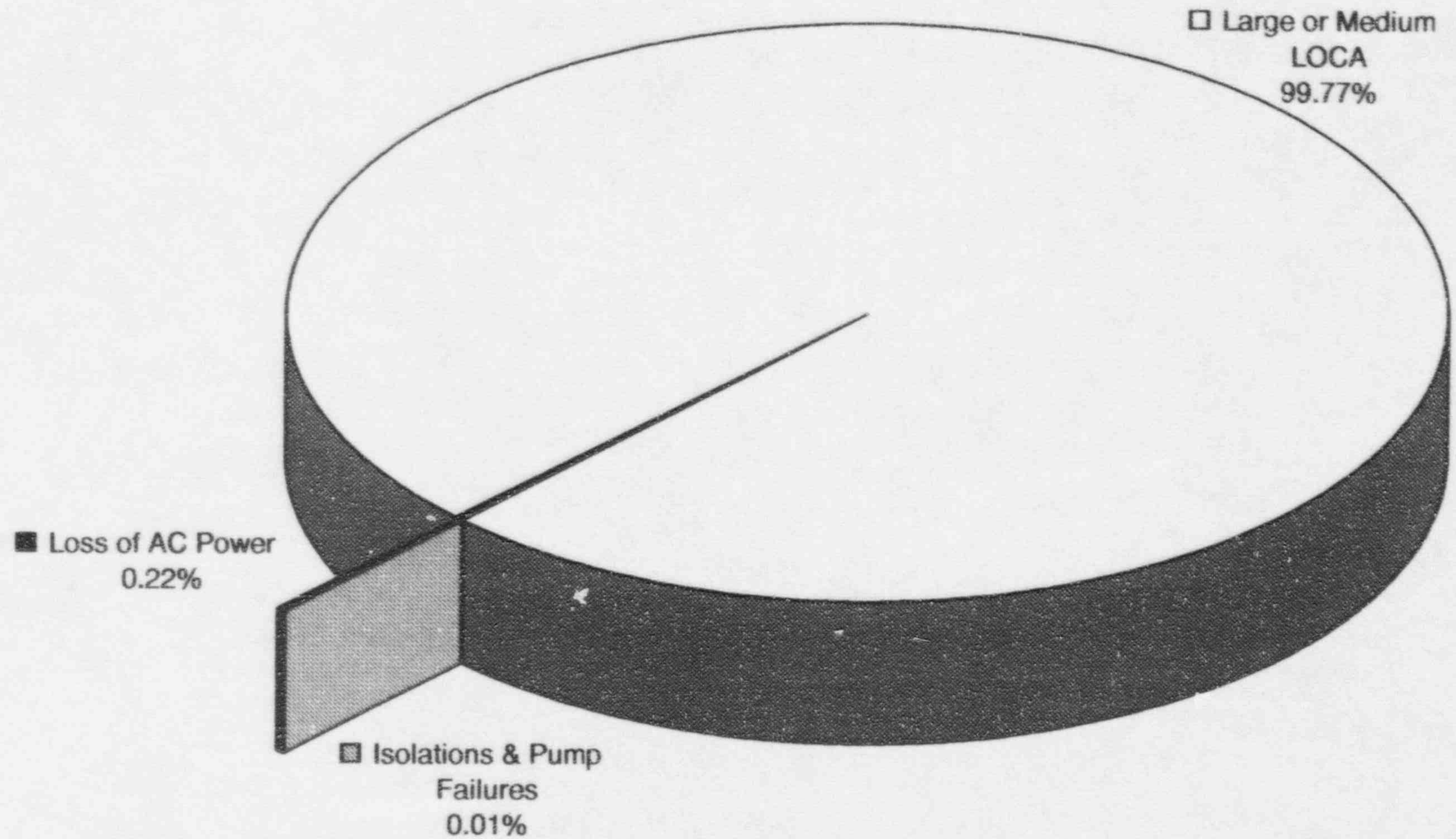
Schedule Review
Shutdown PRA

- ORAM-TIP model
- Quantitative risk effects of varying plant configuration and time dependent phenomena
- Evaluates
  - Core damage frequency
  - RCS boiling frequency
- Provides insight unavailable by other means and relative significance of deterministic review

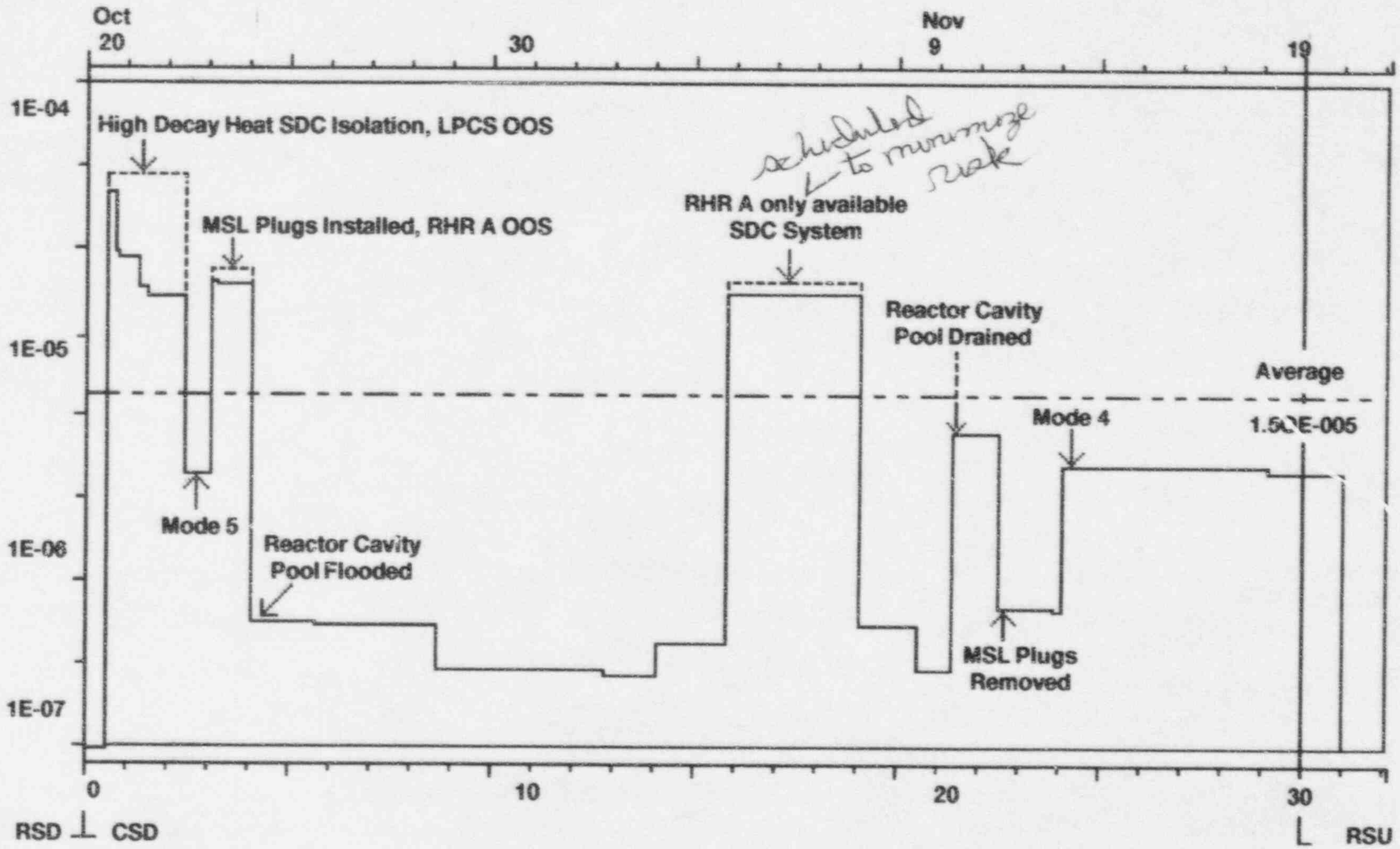
RF08 Risk Damage Core Profile



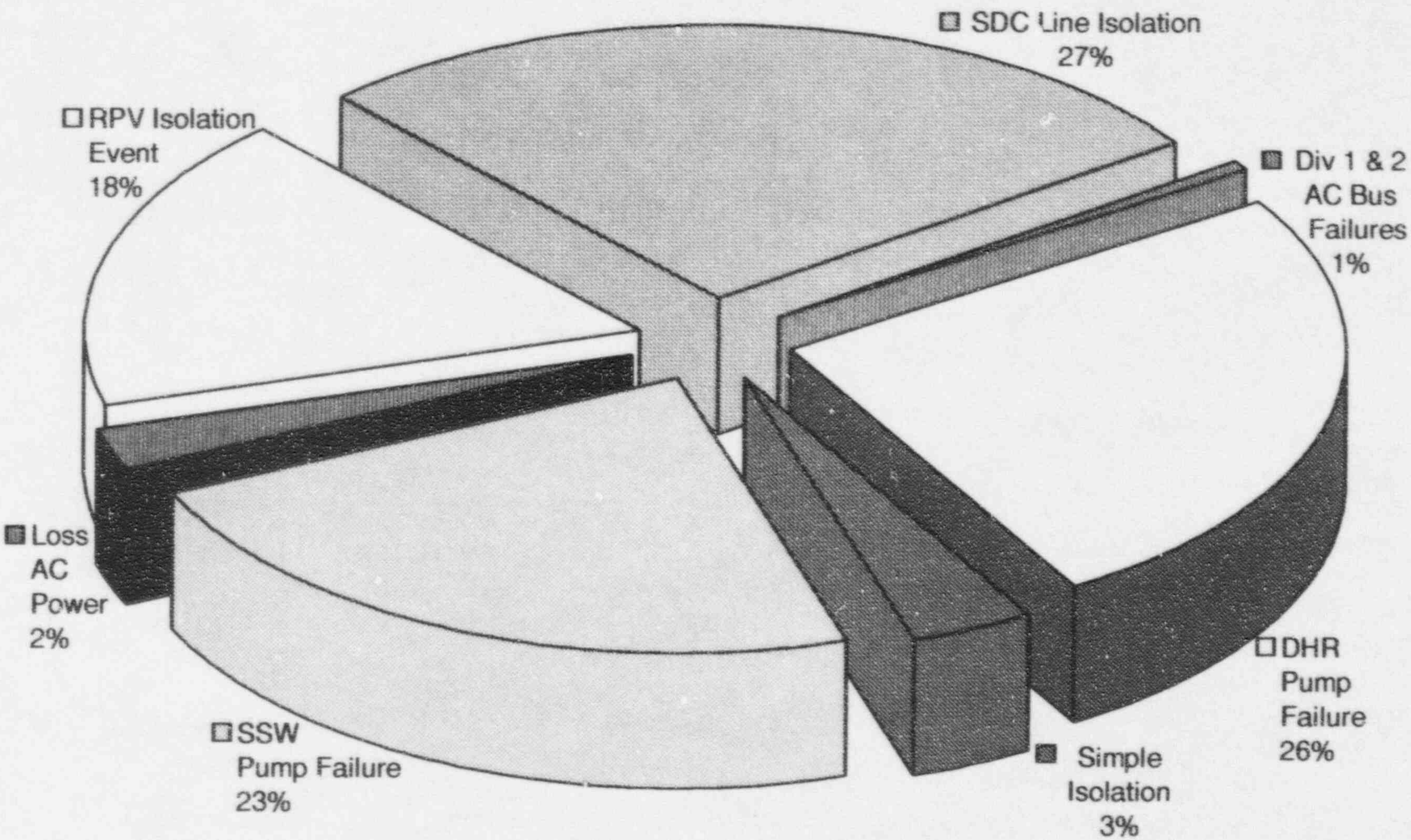
RF08
Core Damage Contributions



RF08 RCS Boiling Risk Profile



RF08
RCS Boiling Contributors



Other Assessment Considerations

- NRC documents/issues
- INPO documents/issues
- Internal operating experience

Shutdown Risk Management

- Develop contingency plans for relative risk concerns commensurate with identified risk, for example:

  this outage

  - Recirculation pump A replacement (management of heavy loads)

- Recommend schedule changes to reduce risk, for example:

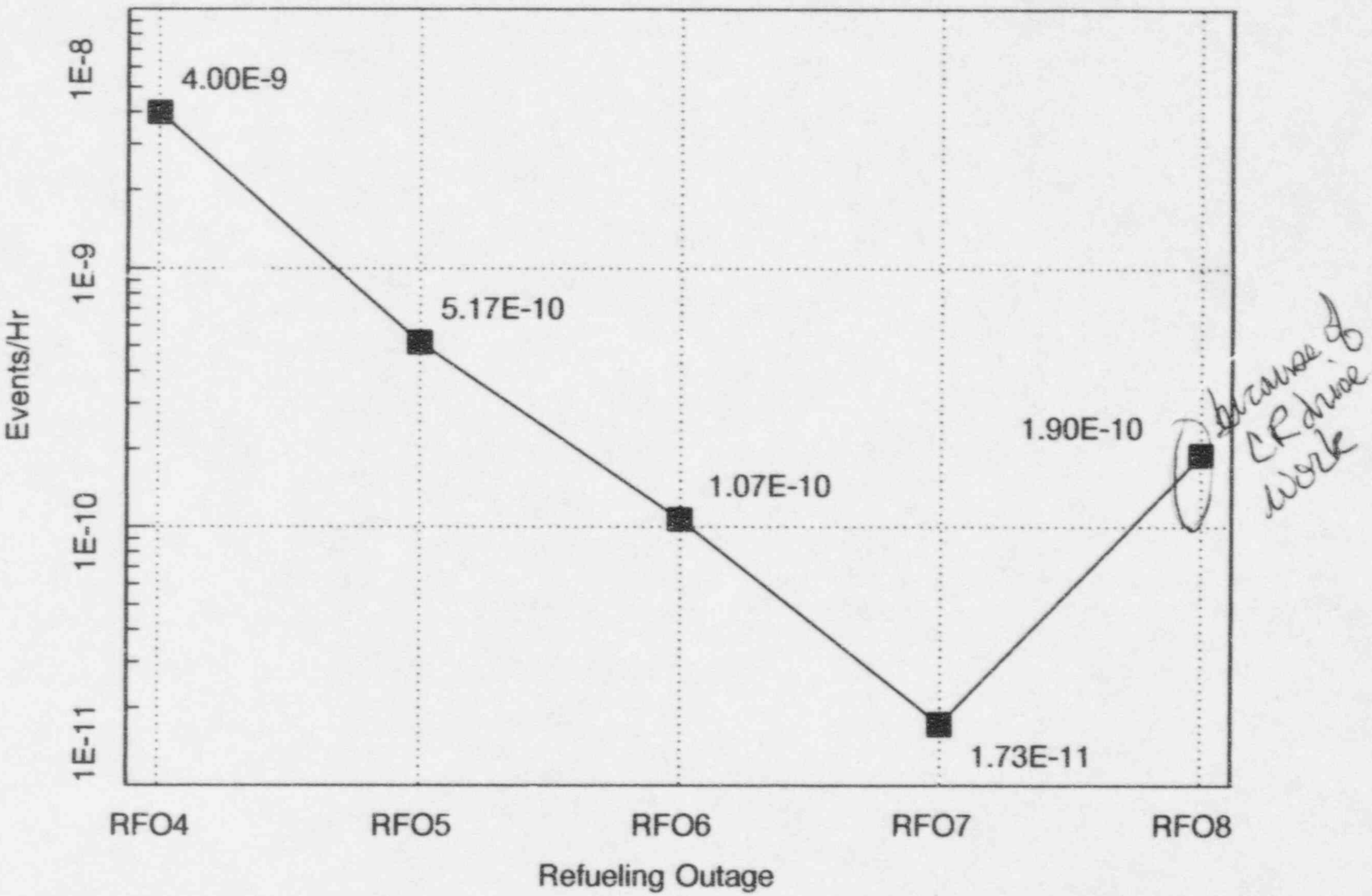
  - None needed due to Outage Scheduling's use of ORAM-tip in pre-planning

low freq. vibration
replace shaft/impeller

Internal Event Comparison

Comparison of RF01 through RF07						
	Outage Dates	Length	# IRs	# LERs	IR/day	LER/day
RF01	09/05/86 - 12/03/86	88 days	52	20	0.591	0.23
RF02	11/07/87 - 01/06/88	61 days	46	12	0.754	0.20
RF03	03/18/89 - 04/30/89	44 days	25	5	0.568	0.11
RF04	09/30/90 - 11/26/90	57 days	27	9	0.474	0.16
RF05	04/17/92 - 06/09/92	52 days	20	4	0.385	0.08
RF06	09/28/93 - 12/04/93	67 days	27	8	0.403	0.12
RF07	04/15/95 - 06/20/95	66 days	17	2	0.258	0.03

Average Core Damage Risk



Outage Safety Assessment Conclusions

Effective shutdown risk management can result in significant risk reduction without adverse effects on outage schedule

Cycle Reload Summary

Overview

- The cycle 9 core will consist of 272 GE 11 fuel assemblies and 528 SPC 9x9-5 assemblies

- NRC approved GE methodologies are used to perform transient/accident analyses and to calculate MCPR safety limits. Some exceptions to the GE methodologies have been taken to accommodate analysis of the mixed vendor core and to maintain the GGNS current licensing basis.

- Cycle length remains at 18 months with a nominal cycle energy of 1,886 GWd (492 EFPD)

- Maximum assembly exposures < limit (45,000 Mwd/t)

Cycle 9 Reload Summary
Safety Analyses Results

- Accident Analysis
  - Current MAPLHGR limits applied for SPC fuel
  - GE B/E LOCA methods applied for GE fuel and SPC fuel
  - Control rod drop accident bounded by GGNS UFSAR radiological assessment (1026 failed rods)
- Transient Analysis
  - In review
  - Acceptable shutdown margin
  - Consistent with previous transient analyses
- The MCPR safety limit in tech specs is increased from 1.06 for two loop operation to 1.12

GRAND GULF NUCLEAR STATION

SHUTDOWN OPERATIONS PROTECTION PLAN

REVISION 1
09/26/96

REVIEWED BY:______________________________ Date:__________
Outage Supt.

REVIEWED BY:______________________________ Date:__________
Operations Supt.

REVIEWED BY:______________________________ Date:__________
Operations Manager

REVIEWED BY:______________________________ Date:__________
PSRC

Table of Contents

I. Introduction

Shutdown operations present the plant with a set of unique risks. Proper management of outage activities can reduce both the likelihood and consequences of shutdown events. The Grand Gulf Nuclear Station Shutdown Operations Protection plan (SOPP) provides a set of specific outage equipment requirement guidelines for maintaining nuclear safety during shutdown operations.

The Protection Plan guidelines are based on the "Defense in Depth" outage management philosophy and are contained in Section II of this document. Section III is a list of common terms and definitions as they apply to shutdown protection. Section IV provides general outage risk management quidelines. Section V gives a set of minimum equipment requirements for the specific Reactor shutdown conditions. Section VI is a list of contingency plans. Section VII is a list of references used in the preparation of this document. Time-to-Boil curves for various initial water level configurations can be found in Attachment #2.

The SOPP assumes the plant is in Mode 4 (Cold Shutdown) or Mode 5 (Refuel) or in the defueled condition. "Requirements" or "Required," as used in this document, is intended to mean available. Additional equipment "operability" requirements are contained in Plant Technical Specifications and are assured of being met by use of the unit Operating Procedures.

The guidelines and minimum equipment requirements contained in this document provide guidance for scheduled, forced (unscheduled), and refueling outages. Attachment 1, Approval for Departure from the Requirements of Shutdown Operations Protection Plan, is used to document deviations from the requirements contained in Section IV. Deviations from quidelines containing a "should" or a "shall" require approval from the Outage Director or his designee. This approval does not allow deviations from the Improved Technical Specifications or TRM.

II. Outage Management Nuclear Safety Philosophy

Grand Gulf's safety philosophy for the conduct of shutdown operations is to integrate nuclear safety into the planning, scheduling and implementation of outage activities. The key attribute of this process is the Defense-in-Depth which includes: identification of shutdown risk as an element of the planning of outage activities, minimization of shutdown risk through the scheduling of activities, and providing systems, structures and components to provide backup for key safety functions through redundant, alternate or diverse methods. Successful safe and efficient implementation of outage activities depends on the dedication and teamwork among the outage team including contractors, and meticulous performance of outage activities as scheduled in the master outage schedule. The following principles are used to assure the successful management of outages at Grand Gulf.

- <u>OUTAGE MANAGEMENT STRATEGY</u>

  - Planned outages are conducted to perform corrective maintenance, preventative maintenance, required surveillance, and plant modifications to allow the plant to operate safely until it's next planned outage, and for the remainder of it's forty year operating license. Outage activities are selected consistent with this purpose to: reduce radiation exposure, improve personnel safety, improve plant operation, and meet regulatory requirements. Lists of approved activities are developed in advance to allow adequate time for design, procurement, and pre-installation activities. The Grand Gulf goal for outage durations is to conduct the shortest outage possible while accomplishing the outage scope with the highest level of both personnel and plant safety.

  - NUMARC 91-06, "Guidelines for Industry Actions to assess shutdown Management" is used to assess and improve outage safety by minimizing shutdown risk. The key element of this approach is the concept of Defense-in-Depth.

  - Defense in Depth is the concept of ensuring that the systems and alternates that perform key safety functions are available when needed, particularly during high risk evolutions. The use of the High Impact Area methodology, coupled with an understanding of plant conditions and risk conditions, is an enhancement element in minimizing shutdown risk.

  - The recommendations contained in SOER 91-01 will be used to assure the safe conduct of Infrequently Performed Tests and Evolutions. These recommendations include the use of: pre-test briefings, clear and concise test procedures, and the establishment of criteria for terminating the test.

- Conservative decision making should be used to guide the day to day management of Grand Gulf, including outages. Conservative decision making applies to outage planning functions such as selection of corrective maintenance and design changes as well as to the operational decisions to support outage activities. A high priority should be placed on equipment problems that require operator compensatory actions (workarounds). Equipment deficiencies should be periodically reviewed to assess the cumulative or aggregate effects of degraded equipment on operator ability to respond effectively to plant transients. Priorities for resolution should be adjusted if needed. Compensatory measures for special outage conditions should be clearly communicated to the Operating shift. The procedure and conditions require closure of the containment hatch are one example of a compensatory measure.

- <u>OUTAGE PLANNING</u>

  - Outage planning is the process of selecting and reviewing outage activities to establish scheduling requirements based on the Improved Technical Specifications, operational, and implementation requirements and shutdown risk considerations.

  - Outage planning must include a review of Infrequently Performed Tests and Evolutions to ensure adequate precautions are taken. Management oversight during test review and performance, pre-shift briefings, and the establishment of test termination criteria are some of the measures employed to ensure proper test conduct.

- <u>OUTAGE SCHEDULING</u>

  - Outage scheduling is the process of integrating outage activities into a coordinated schedule which efficiently and safely accomplishes the outage scope within the restraints identified through outage planning.

  - Key milestones are established to identify pre-outage activities, such as the scope freeze date, Design Change Package issue date, and work package issue date. These milestones will be established in advance to allow time for shutdown risk assessment, work implementation planning, and parts procurement and staging. It is the responsibility of all managers to identify all required outage scope prior to the applicable scope freeze milestone date.

- Input for the detailed outage schedule is provided by past outage successes and a review of outage projects and scope, and the resources available. The schedule must take into account an assumed reserve of resources to deal with emergent issues. The reserve is based on past outage performance and management judgment of the potential for emergent work based on the planned outage activities. The detailed outage resource loading must consider the need for personnel to have a reasonable amount of time off.

- The detailed outage schedule is developed to meet the Improved Technical Specifications, operational and implementation requirements in a manner that provides for Defense-in-Depth under all shutdown conditions. The minimum combination of safety equipment required to maintain critical safety functions is established for each phase of the outage. Projects representing special risk conditions will be scheduled during periods when the risk is minimized through a combination of plant conditions and equipment availability. Special emphasis will be given to the scheduling of work with the potential to adversely affect Shutdown Cooling, the availability of AC power sources, and periods when the combination of reactor inventory and decay heat load could result in a short time to boiling. An independent review of shutdown risk conditions and the final equipment providing critical safety functions is performed as part of the final schedule.

• <u>OUTAGE IMPLEMENTATION</u>

- The outage organization will be structured to provide clear project responsibility and a clear reporting relationship for both pre-outage and outage activities. This organization and the project responsibilities will be communicated to all outage personnel. Outage management shift coverage will be structured to provide outage oversight and decision making capability available on site when necessary. Clear communications through the use of scheduled outage meetings and management tours of outage work areas are used to keep the outage team informed, and to emphasize the importance of safe and efficient outage conduct.

- While the completion of outage activities generally reduces the shutdown risk, as the plant is returned to a normal operational alignment, the period just before plant restart presents a time of high activity with a heightened potential for personnel errors. Continued management shift coverage, equivalent to that employed during the major portion of the outage, should be considered during this period and the startup testing period. This enhanced coverage may be beneficial until the unit reaches a stable point in the post-outage power ascension.

- OUTAGE CRITIQUE

    - A comprehensive critique is used following each planned outage to provide a mechanism for continued improvement. The input for these critiques is structured to facilitate input from all levels of plant personnel. The critique items are tracked between outages and reviewed as part of the planning process for the next outage to ensure that corrective actions are taken. The critiques are shared between the plant sites to allow each plant to benefit from the lessons learned.

    - Outage risk minimization depends upon all departments carefully following the pre-approved outage schedule. Risk minimization is inherent in performing each task in the scheduled logic and in scheduled time period. For these considerations emergent additions to outage scope shall be limited to those tasks which require an outage and which are necessary for safe and efficient operations in the succeeding fuel cycle.

III. Terms and Definitions

Available

The status of a system, structure or component that is in service or can be placed in service within a reasonably short period of time (consistent with its intended functional need). This condition recognizes that applicable technical specification requirements or licensing/design basis assumptions may not be maintained.

Adequate ECCS Inventory

Exists when there is sufficient volume of water to maintain Suppression Pool level above 11.5 ft. during steady state ECCS injection following a draindown or LOCA event to the Drywell. (see Risk Management Guidelines, Inventory Control Guidelines)

Containment Closure

A containment condition where a barrier to the release of radioactive material exists. For GGNS, this means primary containment exists for a boiling event leading to core damage.

Decay Heat Removal Capability

The ability to maintain reactor coolant system temperature and pressure and spent fuel pool temperature below specified limits following a shutdown.

Defense-in-Depth

For the purpose of managing risk during shutdown, defense-in-deptn is the concept of:

- Providing systems, structures and components to ensure backup of key safety functions using redundant, alternate or diverse methods;
- Planning and scheduling outage activities in a manner that optimizes safety availability;
- Providing administrative controls that support and/or supplement the above elements.

Defueled

All fuel assemblies have been removed from the reactor vessel and placed in the Spent Fuel Pool and/or the Upper CTMT Pool.

Higher Risk Evolution

Outage activities, plant configurations or conditions where the plant is more susceptible to an event causing the loss of a key safety function.

Plant Key Safety Function Equipment & Systems

Equipment that is being relied upon to ensure a Key Safety Function is maintained available. This equipment is designated by a shutdown condition checksheet. This equipment is identified locally by signs on the door leading onto the protected equipment warning plant personnel to contact the Operations plant supervisor prior to entry.

Inventory Control

Measures established to ensure that irradiated fuel assemblies remain covered with coolant to maintain heat transfer and shielding requirements.

Key Safety Functions

During shutdown operations, the key safety functions are decay heat removal capability, inventory control, electrical power availability, reactivity control and containment.

Operable

The ability of a system to perform its specified function with all applicable Technical Specification requirements satisfied.

Reactivity Control

Procedures and processes used to prevent inadvertent criticalities, power excursions and loss of shutdown margin. These include methods to predict and monitor reactor core behavior.

Readily Established

For Primary and Secondary containment means that all tracking LCO's for inop valves are written and being tracked. For Primary containment this also means that procedures, work documents, equipment and personnel required to establish primary containment are prepared and available.

Safety Significant Change

Any change to the outage schedule that has a meaningful or notable impact on the required equipment, systems, or flowpaths.

Examples include:

1. The condition and/or equipment established specifically for a High Risk Evolution change.
2. The systems listed in the Hammock section of the integrated schedule that are used to meet or exceed the Technical Specifications change.
3. Any unplanned degradation of an ESF function required to be Operable in Modes 3, 4, or 5.
4. An off-normal or unscheduled change to the water movement plan that affects suppression pool level, reactor vessel level or reactor cavity level.
5. Rescheduling an AC or DC bus outage that affects ESF systems.
6. If in the determination of the Outage Director, a Shutdown Operations Protection Plan, Outage Risk Management Guideline (section IV) cannot be met.

Shutdown Conditions

For the purpose of establishing defense-in-depth requirements, an outage is divided into four possible configurations. These configurations are referred to as Shutdown Conditions. The Shutdown Conditions are numbered from the least impact to plant safety to the most significant safety impact. The four Shutdown Conditions are defined below:

1. The reactor is in Mode 4.

2. The reactor is in Mode 5 with cavity level low or flooded with the Gates installed.

3. The reactor is in Mode 5 with cavity flooded and gates not installed.

4. The reactor is defueled.

Shutdown Safety Level

GREEN: Considered minimal risk configuration. All minimum equipment requirements are satisfied. Generally, this condition will signify a TS+1 condition for Tech Spec related safety equipment.

YELLOW: Considered an acceptable risk. Increased awareness for the safety function is all that should be required for these conditions. Generally, this condition signifies a Tech Spec minimum requirement for safety related equipment.

ORANGE: Considered high risk. Written and pre-planned guidance/contingency plans should be made before entering a pre-planned condition of this type. These may be as complex as temporary systems or structures with associated written procedures, or as simple as a note in the War Room turnover sheets and the Operations night orders.

RED: Considered an unacceptable risk for a planned evolution or a probable Improved Technical Specification violation. Changes should be made to the schedule or equipment availability to further ensure maintainability of safety functions.

IV. Outage Risk Management Guidelines

A. General

1. Planning

a. The outage schedule should be developed through interaction with involved organizations and disciplines to assure that the planning provides Defense-in-Depth throughout the outage. Activities in the outage schedule should be sufficiently detailed and organized to accurately convey the impact on complex evolutions, plant conditions, and equipment availability.

b. The outage work scope and schedule should realistically match resources to activities. Additional resources should be available to meet anticipated changes, such as increases to the outage scope.

c. Surveillance testing and preventative maintenance activities associated with key shutdown operations protection equipment or systems should be incorporated into the detailed outage schedule.

d. A detailed safety review of the outage schedule shall be performed by personnel knowledgeable in management expectations for outage nuclear safety and plant operations for all planned outages. The review should not be conducted solely by those directly involved in preparation of the outage schedule. A review shall be performed prior to the outage and prior to any safety significant changes to the outage schedule after the initial review. Major outage activities shall be controlled and implemented in accordance with the approved schedule.

e. Outage planning and execution should consider potential introduction of hazards (e.g., fire, flooding, etc.) posed by the level and/or scope of activities in a given area of the plant and establish compensatory measures as appropriate.

2. Training

a. Operator training should be performed on the shutdown safety issues described herein. To the extent practicable, simulator training for shutdown conditions should be performed.

b. Plant personnel, including contractors and others temporarily assigned to support the outage, should be trained in areas that are applicable to their particular role in outage activities and that contribute to the safe conduct of the outage.

c. Personnel who may be required to implement a contingency plan should be familiar with the plan.

3. Implementation

a. War Room personnel should verify the availability of the minimum required equipment for the current Shutdown Condition once per 12 hours and prior to entering any new Shutdown Condition. The check sheets will then be reviewed with the oncoming Shift Superintendent prior to his shift turnover. Section IV of this document contains those minimum equipment requirements.

b. The current plant status, including the availability of Key Safety Function systems or equipment, should be communicated on a regular basis to personnel who may affect plant safety. Higher risk evolutions should be conveyed including any appropriate precautions or compensatory actions during these periods.

c. Areas around protected Key Safety Function Equipment and their power supplies should be controlled by physical barriers with "High Impact Area," signs near or at the entrance to the operable equipment areas. Special precautions should be taken and pre-job briefings should be conducted for activities taking place within these controlled areas.

d. Key Safety Function Equipment that is removed from service for maintenance or testing should be returned to service as soon as the maintenance or testing is completed. When the equipment is returned to service, its availability should be assured by post maintenance testing, monitoring of key parameters, verification of alignment and/or administrative control by Operations, as appropriate.

e. The Outage Director has the responsibility to monitor scheduled activities with respect to the initial schedule sequence and approve any significant variations. Any changes will follow the guidelines contained in Section IV of this document. Any changes that deviate from these guidelines require completion of Attachment 1, Approval for Departure from the Requirements of the Shutdown Operations Protection Plan.

4. Post Outage

a. A post-outage critique should be conducted that assesses outage performance from a safety perspective. The results of the critique should be used as a basis for improvements to planning and control of future outages.

B. Shutdown Cooling Guidelines

1. Guidelines

a. The Emergency Diesel Generator associated with the operable Residual Heat Removal System shall remain operable.

b. When credit is taken for an alternate means of decay heat removal (e.g., ADHR, RWCU, Natural Circ, etc.), one RHR system shall be available as a backup.

c. The outage will be structured such that no work will be performed on the operable RHR system. (Except snubber inspections and testing).

d. The RHR systems should be recovered to an Operable status as soon as possible following modifications or maintenance.

C. Inventory Control Guidelines

a. The Emergency Diesel Generator associated with the operable ECCS shall remain operable.

b. Emergency Core Cooling systems should be returned to an operable status as soon as possible following system maintenance or modifications.

c. Activities on the Emergency Core Cooling systems should be scheduled in detail.

d. Work activities will not be allowed on the operable Emergency Core Cooling systems. (Except snubber inspections and testing)

e. Adequate ECCS Inventory exists when there is sufficient volume of water available for ECCS injection to maintain at least 11.5 feet in the suppression pool plus have 49,261 ft^3 of water available to compensate for the drawdown volume in the event of a LOCA in modes 4 or 5.

Adequate ECCS Inventory exists when suppression pool level is ≥ 13.5 ft AND plant is in Mode 5, vessel head, separator and dryer removed, cavity flooded, and reactor cavity and separator pool weir gates installed.

Adequate ECCS Inventory exists when suppression pool level is ≥ 13.3 ft and the normal volume of water from the upper containment pool is available via SPMU.

If the reactor cavity has been drained, then Adequate ECCS Inventory exists whenever any of the following conditions exist:

1) The suppression pool level is ≥ 18.34 ft.

2) The suppression pool level is ≥ 16.60 ft
   AND the Separator Pool[1] water is available via SPMU.

3) The suppression pool level is ≥ 15.20 ft
   AND HPCS is available;
   AND CST level is ≥ 18 ft.

4) The suppression pool level is ≥ 13.50 ft
   AND the Separator Pool[1] water is available via SPMU;
   AND HPCS is available;
   AND CST level is ≥ 18 ft.

[1] Separator Pool level ≥ elevation 202 ft with or without the separator in the pool.

D. Electrical Power Distribution

1. Guidelines

a. Two offsite sources of power will be maintained available at all times during the shutdown period.

b. The Emergency Diesel Generator associated with the operable ECCS and Residual Heat Removal System shall remain operable.

c. Activities scheduled during an ESF division outage window should be directed away from the other operable ESF division.

d. Offsite power sources should be clearly identified on the refueling outage schedule.

e. Refueling outages will be divisional. This means the major work of an outage will be concentrated on one division only. 15AA ESF buss will be de-energized for maintenance during a Div I outage and 16AB ESF bus de-energized during a Div II outage.

f. A coordinator should be assigned to specifically plan the divisional bus outages and help identify temporary power requirements.

E. Reactivity Control

1. Guidelines

a. To ensure adequate neutron instrument monitoring (e.g. coupling) at least two fuel bundles should be maintained around each required operable detector string. For the purpose of criticality monitoring only the Source Range Monitors are required to be coupled.

b. Detailed shutdown margin assessments should be obtained to ensure adequate shutdown exists, assuming control rod withdrawal errors, fuel load errors and mis-orientation errors.

c. If the core has been completely offloaded, rod movement should not be allowed in a cell loaded with fuel once core loading has commenced, until after core verification.

d. Once fuel shuffling (one or more new fuel bundles or one or more old fuel bundles relocated within the core) has begun, rod movement should not be allowed in a cell loaded with fuel until core verification has been completed.

F. Containment Closure

1. Guidelines

a. Operations will maintain a list of all breaches to Primary and Secondary Containment.

b. The Mechanical Supervisors are assigned responsibility for the closure of the 166' containment equipment hatch, the 119' airlock and the 208' airlock should action be initiated by the Shift Superintendent or Outage Director.

c. Primary containment is assumed to NOT be available during Modes 4 and 5 and therefore increased awareness is required during OPDRV's, Core Alts and handling irradiated fuel.

G. Fuel Pool Cooling

1. Guidelines

a. Work on the Fuel Pool Cooling System should be done non-outage if possible. If work is required on this system during the outage, it should be done as early as possible in the outage and not after spent fuel from the reactor is transferred to the Spent Fuel Pool when the heat load will be higher. If work is required after the spent bundles are transferred to the SFP, a contingency plan should be in place prior to removing the system from service.

H. Fire

1. Guidelines

a. The Fire Protection System should be operable per Technical Specifications.

b. Work on the P64 Fire Protection system should be done non-outage if possible. This is to allow the P64 system to remain operable to provide an alternate emergency water source for RPV level control and decay heat removal.

c. Fire brigade requirements of Technical Requirement Manual should be met.

d. All personnel, including contractors, are trained in the proper fire notification procedures.

2. Risk Associated with a Fire in the Main Control Room.

a. A fire is a risk when the Div I equipment is OOS. This is because Division I is the protected division for a fire in the main control room. The risk condition only applies to a fire in the main control room.

b. With Division I equipment out of service, a fire in the Division II equipment could remove the ability to operate equipment from the Remote Shutdown Panel.

V. Equipment Requirements by S/D Condition

This section lists the minimum required equipment within each safety function for each Shutdown Condition. There are four Shutdown Condition Tables corresponding to the four identified Shutdown Conditions within the Grand Gulf ORAM model. The tables give equipment requirements by Safety Function. The requirements given are those necessary to yield a GREEN color, ie- lowest risk within the Safety Function. A GREEN condition of an analyzed Safety Function is generally achieved by having the required number of Tech Spec equipment plus one more. This is known as Tech Spec + 1 or TS+1. There are, however, some Safety Functions within some Shutdown Conditions in which the lowest risk attainable is YELLOW. These are noted in the attached tables. Also, the presence of a Higher Risk Evolution (HRE) activity will result in a non-GREEN color even if all the requirements for that Safety Function are satisfied. For instance, an activity that has a potential for a loss of decay heat removal will be YELLOW during it's scheduled time span even if TS+1 exists.

The Shutdown Conditions identified in this section are based on three Reactor variables:

a. Location of the fuel (any in the reactor vessel or all in the spent fuel pool).
b. Reactor Pressure Vessel head is off or installed. (Mode 4 or 5)
c. The amount of inventory in the Reactor Coolant System.

Condition 1 - The reactor is in Mode 4.

Condition 2 - The reactor is in Mode 5 with cavity level low or flooded with the Gates installed.

Condition 3 - The reactor is in Mode 5 with cavity flooded and gates not installed.

Condition 4 - The reactor is defueled.

SHUTDOWN CONDITION 1

MODE: 4 **STATE:** Cold S/D **FUEL STATUS:** Fueled
RPV LEVEL: Any **POOL GATES:** N/A

DECAY HEAT REMOVAL (SDC)

Circle appropriate color

[ ] 1. Of the following three available for decay heat removal.
( ) RHR A
( ) RHR B
( ) ADHR

-OR-

[ ] 2. RWCU if in Ops Hydro

```
Green - Three available
Yellow- Two available
Orange- One available
Red   - Zero available
```

T.S. Requires 2 RHR SDC systems operable.

Comment/Contingency: ______

FUEL POOL COOLING (FPC)

[ ] 1. Sufficient Fuel Pool Cooling Trains available for current heat load.

```
Green - Available FPC
   Trains are sufficient
Yellow- RHR in FPC
   assist
Red - nothing avail
```

T.R.M. Requires maintaining pool temp <140F.

Comment/Contingency: ______

SHUTDOWN CONDITION 1 (cont.)

Circle appropriate color

AC POWER CONTROL (AC)

[ ] 1. Of the following three offsite power sources:
( ) a. Baxter Wilson
( ) b. Franklin
( ) c. Port Gibson

-AND-

[ ] 2. Of the following three ESF transformers:
( ) a. ESF11/ST11
( ) b. ESF21/ST21
( ) c. ESF12

-AND-

[ ] 3. Emergency Diesel Generators
( ) a. Div I
( ) b. Div II

For offsite power sources and ESF xfmrs:

Green - >= Two available
Yellow - One available
Red - Zero available

For Div 1 & 2 D/G's:

Green - Two available
Yellow - One available
Red - Zero available

T.S. Requires 1 offsite feeder and Div 1 or Div 2 EDG.

Comment/Contingency: ____

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____

____

INVENTORY CONTROL (IC)

[ ] 1. Adequate ECCS Inventory exists and of the following five systems:
( ) a. RHR LPCI A
( ) b. RHR LPCI B
( ) c. RHR LPCI C
( ) d. LPCS
( ) e. HPCS

Green - >=Three available
Yellow- Two available
Orange- One available OR less than adequate ECCS inventory exists.
Red - Zero available

T.S. Requires 2 systems operable AND SP level >12'8" OR, for HPCS only-CST level >18'.

Comment/Contingency: ____

____

____

____

SHUTDOWN CONDITION 1 (cont.)

Circle appropriate color

CONTAINMENT CONTROL (CON)

[ ] 1. Of the following if not handling irradiated fuel, core alts or performing OPDRV's:

( ) Secondary Containment operable and and SBGT A and SBGT B operable.

[ ] 2. Of the following if handling irradiated fuel, core alts or performing OPDRV's:

( ) a. Secondary CTMT Operable
( ) b. SBGT A operable
( ) c. SBGT B operable

T.S. Requires Sec CTMT and A&B SBGT if handling irradiated fuel or performing OPDRV's.

Not handling irr. fuel, core alts or not performing OPDRVS:

Green - All three operable.
Yellow- < All operable.

Handling irr. fuel, core alts or performing OPDRVS:

Yellow- Sec CTMT operable and two SBGT trains operable.
Orange- Sec CTMT operable and one SBGT train operable.
Red - Sec CTMT not operable or two SBGT trains not operable.

Comment/Contingency: ______________________________
____
____
____

REACTIVITY CONTROL (RC)

[ ] 1. All control rods fully inserted or one rod out interlock is operable.

T.S. Shutdown Margin must always be met. Control Rods fully inserted during fuel loading. Control rods maybe withdrawn under T.S. 3.10

Green - All Inserted

Yellow- Not all inserted AND one rod out interlock operable AND TS 3.10 for single rod removal met.

Red - SDM not met or not all inserted AND one rod out interlock not operable OR TS 3.10 for single rod removal not met.

Comment/Contingency:
____
____
____

Performed By:______________________ **Date/Time:**______________

SHUTDOWN CONDITION 2

MODE: 5 **STATE:** Refuel **FUEL STATUS:** Fueled
RPV LEVEL: Not Flooded OR Flooded **POOL GATES:** Installed

DECAY HEAT REMOVAL (SDC)

Circle appropriate color

[ ] 1. Of the following three available for SDC.
( ) RHR A
( ) RHR B
( ) ADHR

```
Green - Three available
Yellow- Two available
Orange- One available
Red   - Zero available
```

T.S. Requires 2 RHR systems operable if not flooded. This does not depend on pool gates installed or not installed.

Comment/Contingency: ______________________

FUEL POOL COOLING (FPC)

[ ] 1. Sufficient Fuel Pool Cooling Trains available for current heat load.

```
Green - Available FPC
   Trains are sufficient
Yellow- RHR in FPC
   assist
Red - nothing avail
```

T.R.M. Requires maintaining pool temp <140F.

Comment/Contingency: ______________________

SHUTDOWN CONDITION 2 (cont.)

Circle appropriate color

INVENTORY CONTROL (IC)

[ ] 1. Adequate ECCS Inventory exists and three out of the following five items:

( ) a. RHR LPCI A
( ) b. RHR LPCI B
( ) c. RHR LPCI C
( ) d. Low Pressure Core Spray
( ) e. High Pressure Core Spray

```
Green - >=Three available
Yellow- Two available
Orange- One available OR
        less than adequate
        ECCS inventory
        exists.
Red   - Zero available
```

T.S. Requires 2 ECCS systems operable AND SP level > 12'8" OR, for HPCS only-CST level >18ft.

Comment/Contingency: ______________________________

____

____

____

AC POWER CONTROL (AC)

[ ] 1. Of the following three offsite power sources:
( ) a. Baxter Wilson
( ) b. Franklin
( ) c. Port Gibson

-AND-

[ ] 2. Of the following three ESF transformers:
( ) a. ESF11/ST11
( ) b. ESF21/ST21
( ) c. ESF12

-AND-

[ ] 3. Emergency Diesel Generators
( ) a. Div I
( ) b. Div II

```
For offsite power
sources and ESF xfmrs:

Green - >= Two available
Yellow - One available
Red    - Zero available
```

```
For Div 1 and 2 D/G's:

Green - Two available
Yellow - One available
Red    - Zero available
```

T.S. Requires 1 offsite feeder and Div 1 or Div 2 EDG.

Comment/Contingency: ______________________________

____

____

____

SHUTDOWN CONDITION 2 (cont.)

Circle appropriate color

CONTAINMENT CONTROL (CON)

[ ] 1. Of the following if not handling irradiated fuel, core alts or performing OPDRV's:

( ) Secondary Containment operable and and SBGT A and SBGT B operable.

[ ] 2. Of the following operable if handling irradiated fuel, core alts or performing OPDRV's:

( ) a. Secondary CTMT Operable
( ) b. SBGT A operable or running
( ) c. SBGT B operable or running

T.S. Requires Secondary CTMT and A&B SBGT if handling irradiated fuel, performing core

Not handling irr. fuel, core alts or not performing OPDRVS:

Green - All three operable.
Yellow- < All operable.

Handling irr. fuel, core alts or performing OPDRVS:

Yellow- Sec CTMT operable and two SBGT trains operable.
Orange- Sec CTMT operable and one SBGT train running.
Red - Sec CTMT not operable or two SBGT trains not operable or running.

Comment/Contingency: ____

____

____

____

REACTIVITY CONTROL (RC)

[ ] 1. All control rods in fueled cells are fully inserted or one rod out interlock is operable.

T.S. Shutdown Margin must always be met. All Control Rods fully inserted during fuel loading. Control rods maybe withdrawn under T.S. 3.10.4.

Green - All Inserted

Yellow- Not all inserted AND one rod out interlock operable AND TS 3.10.5 for single rod removal met.

Red - SDM not met or not all inserted AND one rod out interlock not operable OR TS 3.10 for single rod removal not met.

Comment/Contingency:

____

____

____

Performed By:______________________ **Date/Time:**______________

SHUTDOWN CONDITION 3

MODE: 5 **STATE:** Refuel **FUEL STATUS:** Fueled
RPV LEVEL: Flooded **POOL GATES:** Not installed

SHUTDOWN COOLING (SDC)

Circle appropriate color

A. Not within natural circulation heat removal capacity.

[ ] 1. Two of the following three available for SDC.
- ( ) RHR A
- ( ) RHR B
- ( ) ADHR

See attached logic diagram SDC-3 for color assignments.

T.S. Requires 1 RHR system operable.

B. Within natural circulation heat removal capacity.

[ ] 1. Two of the following four available for SDC.
- ( ) RHR A
- ( ) RHR B
- ( ) ADHR
- ( ) Natural Circulation and two loops FPCCU trains plus RWCU (RWCU not req after 22 days after shutdown.

See attached logic diagram SDC-3 for color assignments.

T.S. Requires 2 ECCS systems operable.

Comment/Contingency:

FUEL POOL COOLING (FPC)

[ ] 1. Sufficient Fuel Pool Cooling Trains available for current heat load.

Green - Available FPC Trains are sufficient
Yellow- RHR in FPC assist
Red - nothing avail

T.R.M. Requires maintaining pool temp <140F.

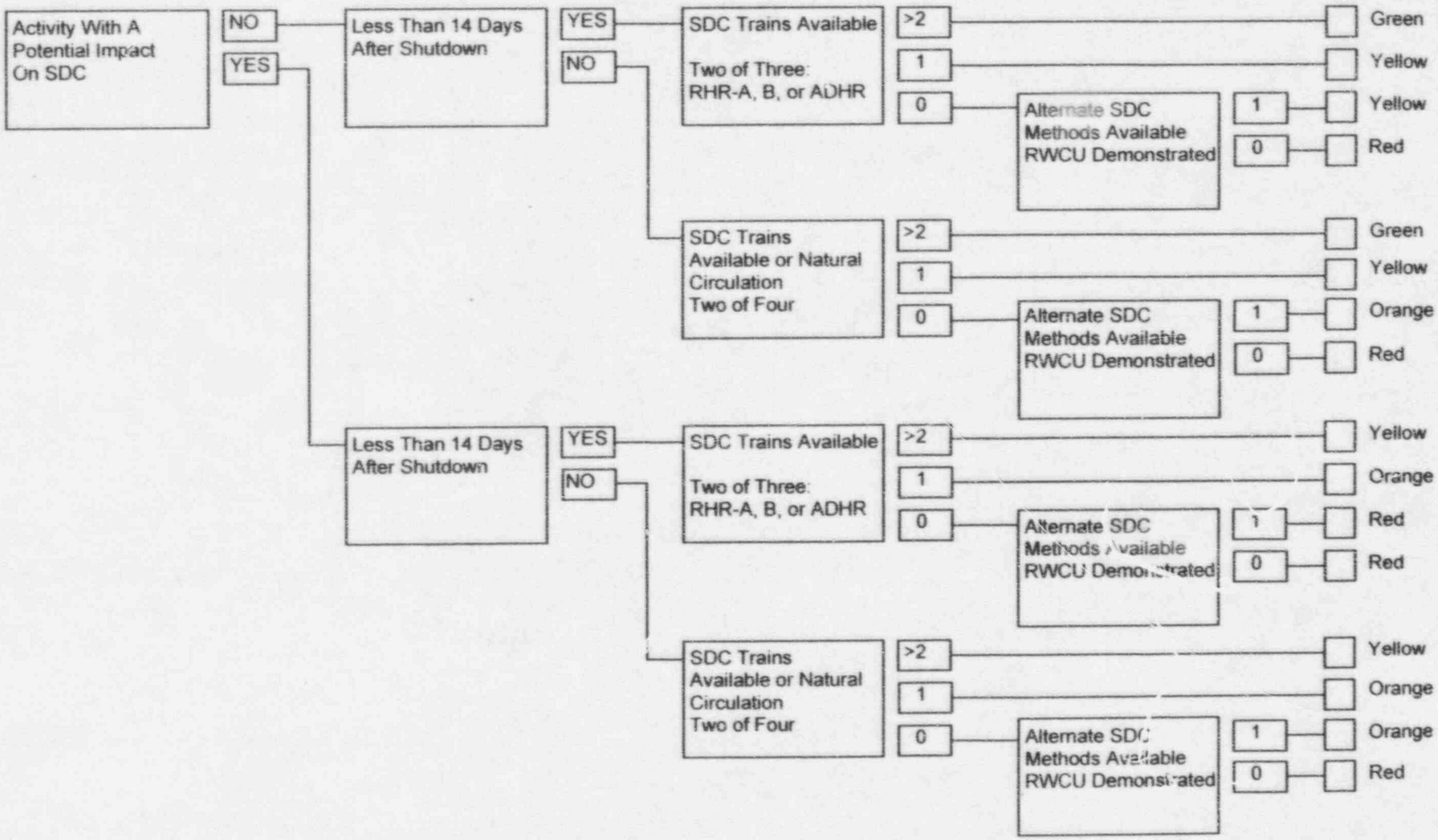
Comment/Contingency:

RF0 Shutdown Operations Protection Plan

SHUTDOWN CONDITION 3

Logic SDC-3 Shut Down Cooling

Revision 0



SHUTDOWN CONDITION 3 (cont.)

Circle appropriate color

INVENTORY CONTROL (IC)

[ ] 1. Adequate ECCS inventory exists and of the following five systems:

( ) a. RHR LPCI A
( ) b. RHR LPCI B
( ) c. RHR LPCI C
( ) d. LPCS
( ) e. HPCS

```
Green - >= 1 available
Yellow- 0 available
Orange- <than adequate
     ECCS inventory.
```

T.S. No ECCS required with cavity flooded and gates removed.

Comment/Contingency: ______________________________

____

____

____

AC POWER CONTROL (AC)

[ ] 1. Of the following three offsite power sources:

( ) a. Baxter Wilson
( ) b. Franklin
( ) c. Port Gibson

-AND-

[ ] 2. Of the following three ESF transformers:

( ) a. ESF11/ST11
( ) b. ESF21/ST21
( ) c. ESF12

-AND-

[ ] 3. Emergency Diesel Generators

( ) a. Div I
( ) b. Div II

```
For offsite power
sources and ESF xfmrs:

Green - >= Two available
Yellow - One available
Red    - Zero available
```

```
For Div 1 and 2 D/G's:

Green - Two available
Yellow - One available
Red    - Zero available
```

T.S. Requires 1 offsite feeder and Div 1 or Div 2 EDG.

Comment/Contingency: ______________________________

____

____

____

SHUTDOWN CONDITION 3 (cont.)

Circle appropriate color

CONTAINMENT CONTROL (CON)

[ ] 1. Of the following if not handling irradiated fuel, core alts or performing OPDRV's:

( ) Secondary Containment operable and and SBGT A and SBGT B operable.

[ ] 2. Of the following operable if handling irradiated fuel, core alts or performing OPDRV's:

( ) a. Secondary CTMT Operable
( ) b. SBGT A operable
( ) c. SBGT B operable

T.S. Requires Secondary CTMT and A&B SBGT if handling irradiated fuel, performing core

Not handling irr. fuel, core alts or not performing OPDRVS:

Green - All three operable.
Yellow- < All operable.

Handling irr. fuel, core alts or performing OPDRVS:

Yellow- Sec CTMT operable and two SBGT trains operable.
Orange- Sec CTMT operable and one SBGT train operable.
Red - Sec CTMT not operable or two SBGT trains not operable.

Comment/Contingency: ____________________

____

____

____

REACTIVITY CONTROL (RC)

[ ] 1. All control rods in fueled cells are fully inserted or one rod out interlock is operable.

T.S. Shutdown Margin must always be met. Control Rods fully inserted during fuel loading. Control rods maybe withdrawn under T.S. 3.10

Green - All Inserted

Yellow- Not all inserted AND one rod out interlock operable AND TS 3.10.X for single rod removal met.

Red - SDM not met or not all inserted AND one rod out interlock not operable OR TS 3.10.X for single rod removal not met.

Comment/Contingency:

____

____

____

Performed By:____________________ **Date/Time:**____________________

SHUTDOWN CONDITION 4

MODE: N/A **STATE:** N/A **FUEL STATUS:** Defueled
RPV LEVEL: N/A **POOL GATES:** N/A

DECAY HEAT REMOVAL (SDC)

Circle appropriate color

NONE

T.S. None.

FUEL POOL COOLING (FPC)

A. High/Medium Decay Heat (<14 Days After Shutdown)
[ ] 1. Two Fuel Pool Cooling Trains

B. Low Decay Heat (≥14 Days After Shutdown)
[ ] 1. One Fuel Pool Cooling Train

See attached logic diagram FPC-4 for color assignments.

T.S. Maintaining pool temp <140 F.

Comment/Contingency:

AC POWER CONTROL (AC)

[ ] 1. Two Offsite Power Sources
( ) a. Baxter Wilson
( ) b. Franklin
( ) c. Port Gibson

-AND-

[ ] 2. Two Emergency Diesel Generators
( ) a. Div I D/G
( ) b. Div II D/G
( ) c. Div III D/G

For offsite power sources:

Green - Three available
Green - Two available
Yellow - One available
Red - Zero available

For Div 1 and 2 D/G's:

Green - Two available
Yellow - One available
Red - Zero available

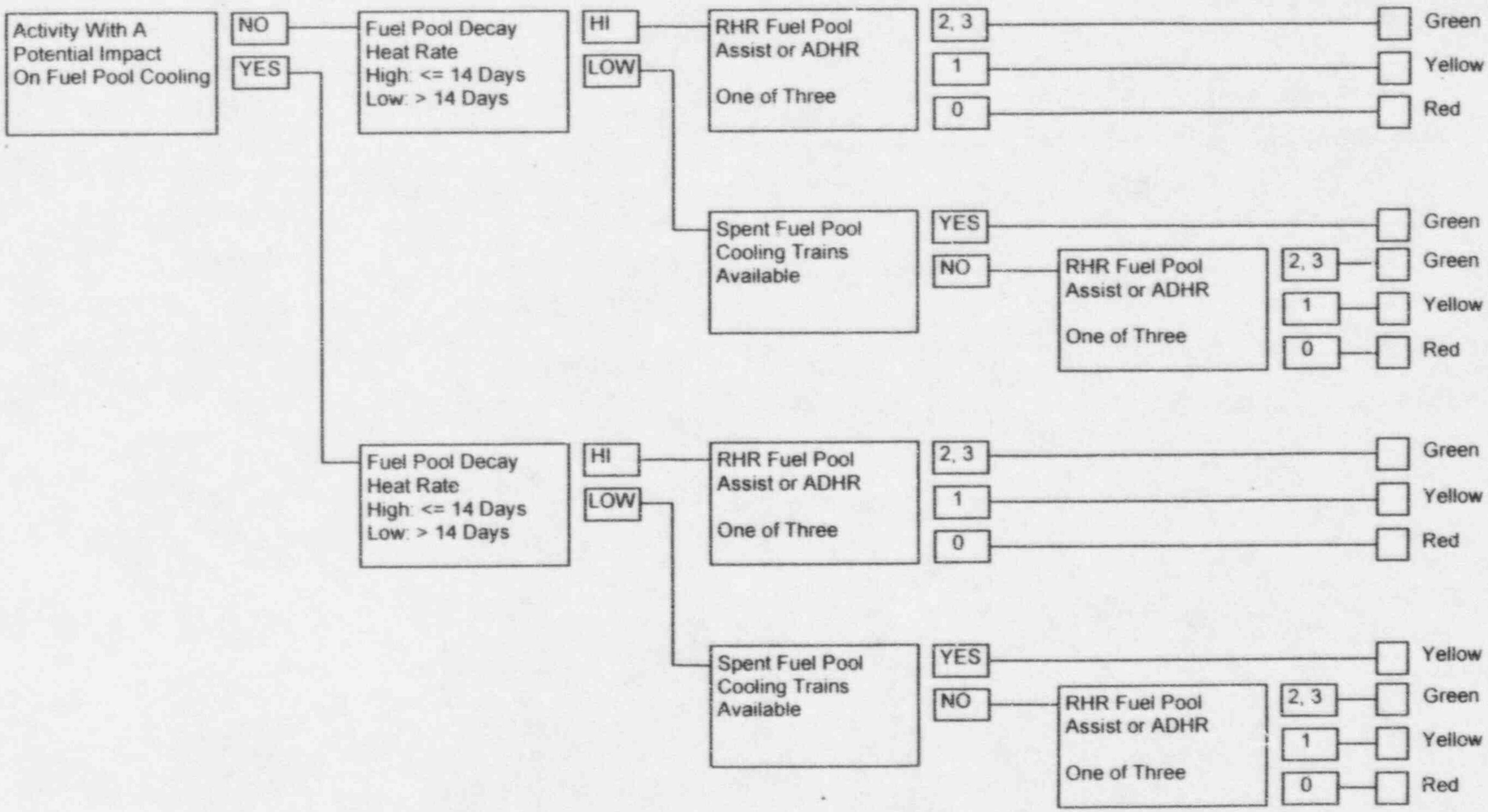
T.S. Requires 1 offsite feeder and Div 1 or Div 2 EDG if moving irradiated fuel in the Primary or Secondary CTMT.

RF0 Shutdown Operations Protection Plan

SHUTDOWN CONDITION 4

Logic FPC-4 Fuel Pool Cooling

Revision 0



SHUTDOWN CONDITION 4 (cont)

Circle appropriate color

Comment/Contingency for AC POWER CONTROL (AC):

INVENTORY CONTROL (IC)

[ ] 1. One ECCS System Available

( ) a. RHR LPCI A
( ) b. RHR LPCI B
( ) c. RHR LPCI C
( ) d. LPCS
( ) e. HPCS

```
Green - >= 1 available
Yellow- 0 available
```

T.S. No ECCS required if fuel is offloaded.

Comment/Contingency:

CONTAINMENT CONTROL (CON)

[ ] 1. Secondary Containment established.

[ ] 2. SBGT A & B operable or running.

T.S. Required if moving irradiated fuel in

```
Handling irr. fuel:

Green - Sec CTMT operable
  and two SBGT trains
  operable.
Orange- Sec CTMT operable
  and <two SBGT trains
  operable.
Orange- Sec CTMT not
  operable and two SBGT
  trains running.
Red   - Sec CTMT not
  operable and <2 SBGT
  trains running.
```

Comment/Contingency:

SHUTDOWN CONDITION 4 (cont)

REACTIVITY CONTROL (RC)

NONE

T.S. SDM must be met. T.S. 3.10.4 allows rod movement

Performed By:_______________________________ **Date/Time:**_________________

VI. Contingency Plans

Contingency Plans should be developed for situations where the system availability drops below the planned defense-in-depth and should be available when entering the higher risk evolution for which they were developed. The personnel required to implement the contingency plan should be identified and be familiar with the plan.

A. Decay Heat Removal

1. Reactor Coolant System Decay Heat Removal

Decay Heat Removal contingencies are covered in ONEP (Off Normal Event Procedure) 05-1-02-III-1 Inadequate Decay Heat Removal. This procedure references SOI 04-1-01-E12-1 Residual Heat Removal which contains guidance for shutdown cooling operations and the line up and start of Alternate Decay Heat Removal if the required shutdown cooling is not available. The operators will be aware at all times which systems are available to provide Reactor Coolant System Decay Heat Removal to meet Technical Specification Requirements.

2. Containment Pool Cooling

Containment Pool Cooling contingencies are covered in ONEP 05-1-02-III-1, Inadequate Decay Heat Removal. This procedure references SOI 04-1-01-G41-1, Fuel Pool Cooling and Cleanup System as the primary method for cooling. SOI 04-1-01-E12-1, Residual Heat Removal System operating procedure is also referenced as a backup method when operated in the Fuel Pool Cooling assist mode.

3. Spent Fuel Pool Cooling

Spent Fuel Pool Cooling contingencies are covered in ONEP 05-1-02-III-1, Loss of Decay Heat Removal. This procedure also contains procedural guidance for providing SSW backup cooling to FPC heat exchangers in the event of a loss of Plant Service Water.

B. Reactor Coolant System Inventory Makeup

Reactor coolant system inventory contingencies are covered in different locations. Guidance is provided by EP-2, RPV Control, which identifies emergency makeup sources.

C. Electrical Power Distribution

Electrical Power contingencies are provided in ONEP 05-1-02-I-4 Loss of AC Power. This includes guidelines for a station blackout. This procedure also provides instruction for energizing Division I or Division II from Division III if required to maintain adequate core cooling or to maintain the plant in a safe shutdown condition. Specific guidance for loss of electrical power to the FPC pumps are contained in SOI 04-1-01-G41-1.

D. Reactivity Control

Reactivity control is maintained during the refueling outage using the rules and guidelines contained in Operations section procedures, Reactor Engineering procedures 17-S-02-100 Criticality Rules and 17-S-02-300 SNM Movement and Inventory Control. In addition, reactor coolant temperature is monitored by the Control Room Tech Spec rounds sheets 06-OP-1000-D-0001 att II (mode 4) and III (mode 5). Reactor Engineering is notified if temperature falls below 70°F.

E. Containment

Containment closure contingencies include Operations tracking inoperable penetrations with LCO's. The Operations Shift Superintendent will notify the Maintenance Department to take necessary actions to establish primary containment integrity should the need occur.

F. Fire

Communicate high risk evolution at the shift turnover meetings. Do not allow potential fire hazards occur in or around Div II equipment. Hang "High Risk Impact Area" signs as necessary.

Specific contingency plans are located in an attached memo designated for a specific outage.

VII. References

01-S-06-42	Refueling Outage Organization
05-1-02-III-1	Inadequate Decay Heat Removal
05-1-02-I-4	Loss of AC Power
04-1-01-E12-1	Residual Heat Removal System
04-1-01-E12-1	Alternate Decay Heat Removal
04-1-01-G41-1	Fuel Pool Cooling and Cleanup System
EP-2	RPV Control
05-1-02-I-4	Loss of AC Power
17-S-02-100	Criticality Rules
17-S-02-300	SNM Movement and Inventory Control 06-OP-1000-D-0001 att II (mode 4) and III (mode 5) CNTL RM Tech Spec rounds sheets.
UFSAR	1.2.2.8.20
UFSAR	3.1.2.6.2
UFSAR	9.1.3.1.2
UFSAR	9.1.3.3
UFSAR Table	6.5-1a
UFSAR Table	6.5-3
ORAM	EPRI ORAM (Outage Risk Assessment & Management) integrated software version 1.5 DOS and 2.0 Windows
NUMARK	91-06 'Guidelines for Industry Actions to Assess Shutdown Management.'
INPO	INPO Outage Management Guidelines.
EPRI	NSAC 173 "Survey of BWR Plant Personnel on Shutdown Safety Practices and Risk Management Needs.'
EPRI	NSAC 175L "Safety Assessment of BWR Risk During Shutdown Operations."
EPRI	TR-102973 "Contingency Strategies for BWRs During Potential Shutdown Operation Events."
EPRI	TR-102971 "Generic Outage Risk Management Guidelines for BWRs."
GIN 95/01275	Memo from M. Withrow to T. Jablonski dated 4/11/95. Subject "Minimum Suppression Pool Level During RFO's."

ATTACHMENT 1

APPROVAL FOR THE DEPARTURE FROM THE REQUIREMENTS OF THE SHUTDOWN OPERATIONS PROTECTION PLAN

The intent of the Shutdown Operations Protection Plan is to document a set of specific guidelines and minimum equipment requirements by which to conduct outages and thereby maintain nuclear safety during shutdown operations. Approval for departure from requirements contained in the Shutdown Operations Protection Plan is obtained by filling out this attachment and obtaining the appropriate signatures. Deviations from guidelines containing a "should" and a "shall" require approval from the Outage Director. This approval does <u>not</u> allow the deviation from Technical Specifications.

1. Description of departure - what specific requirement will not be satisfied?

2. Why is this departure necessary?

3. Estimated duration departure will be in effect?

4. Will compensatory measures be taken? If not, why not? If so, what are they?

______________________ / __________ ______________________ / __________
Originator Date Supervisor Review Date

______________________ / __________
Approved By Outage Director

ATTACHMENT 2

THERMAL HYDRAULIC CURVES

The attached curves represent the time to boil and time to top of active fuel for various initial fuel pool water level configurations for a specific Grand Gulf Refuel Outage. Also attached is the fuel pool curve for time to reach 140.0 Fahrenheit based on the specific outage heat load.

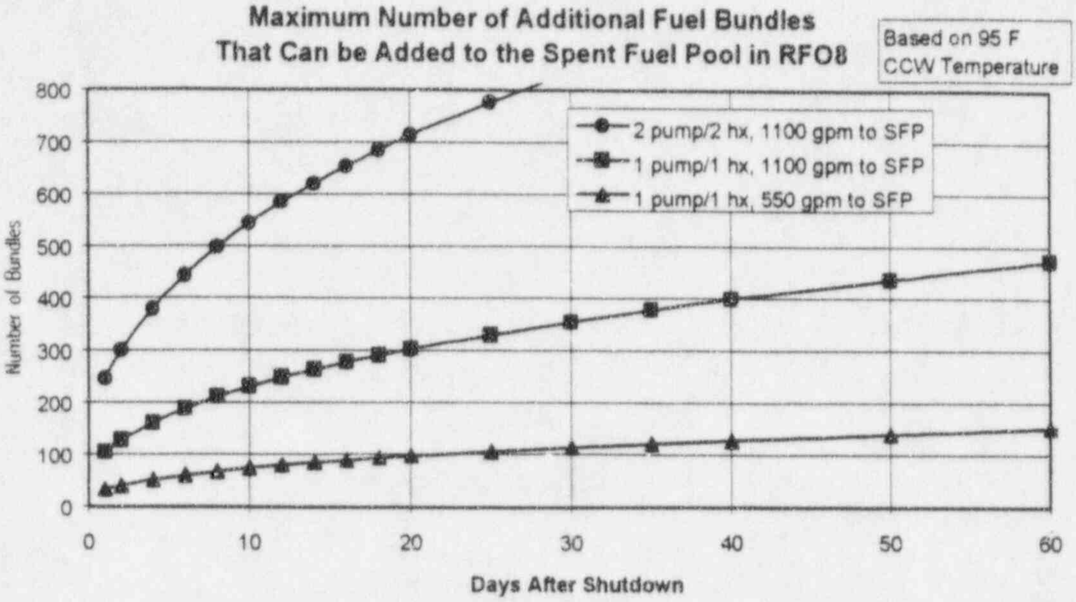
The design temperature limits for containment and spent fuel pools are:

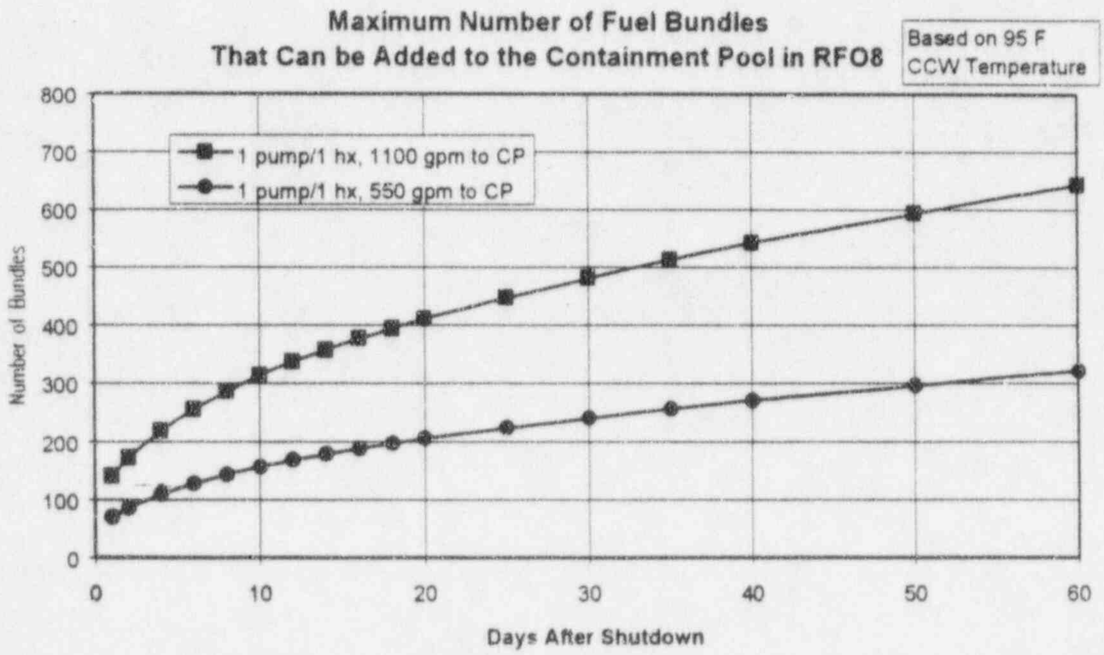
Spent fuel pool maximum design temperature is 140.0 F

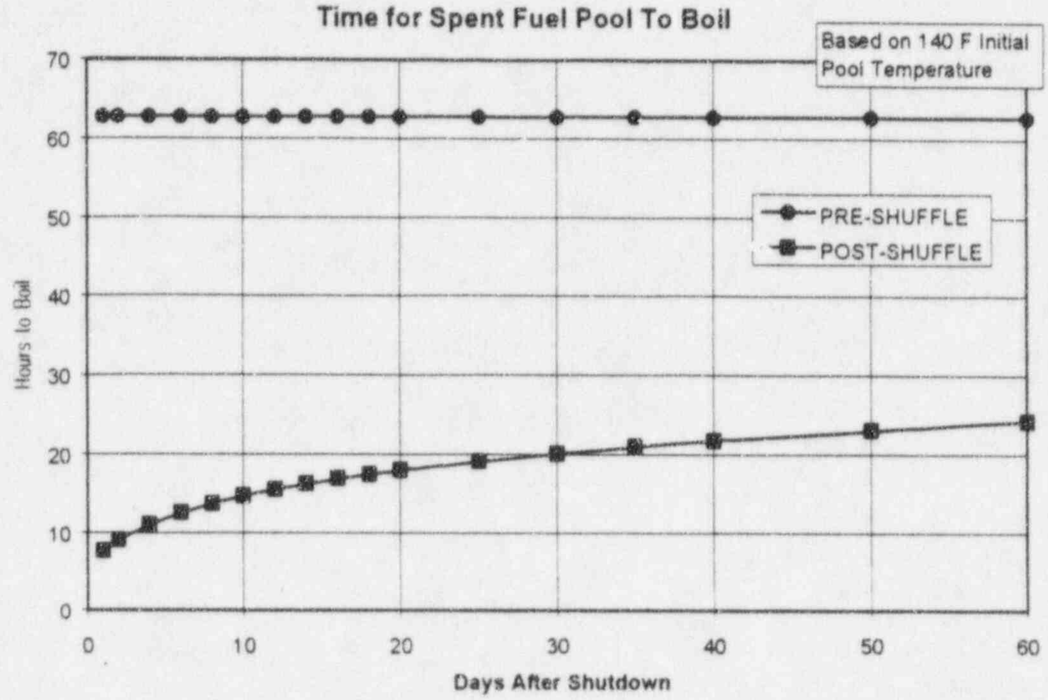
ref: UFSAR section: 1.2.2.8.20
3.1.2.6.2
9.1.3.1.2
9.1.3.3

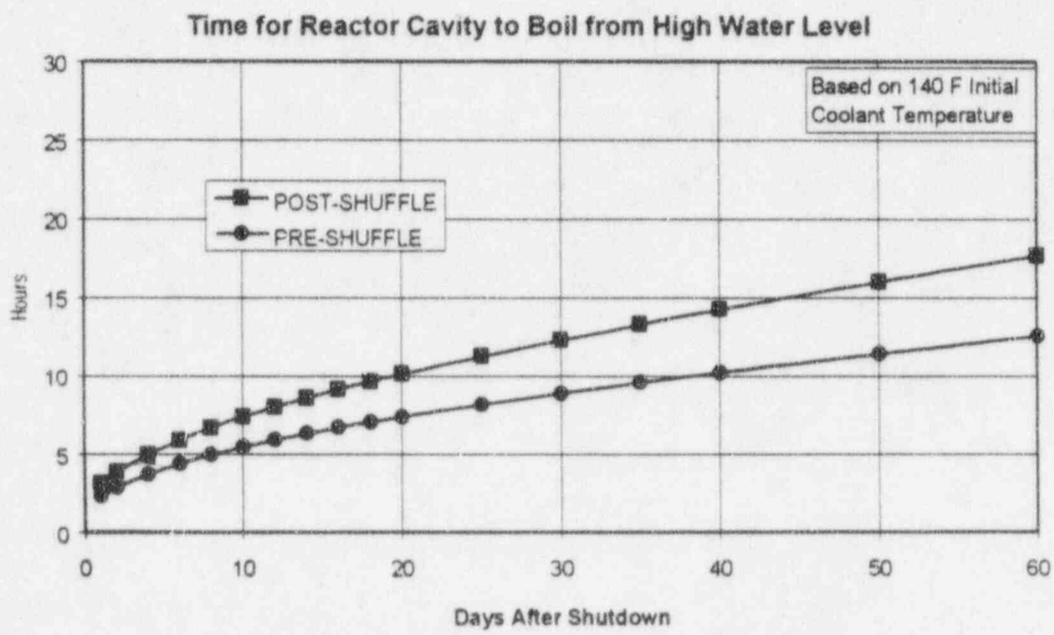
Containment maximum design temperature is 140.0 F

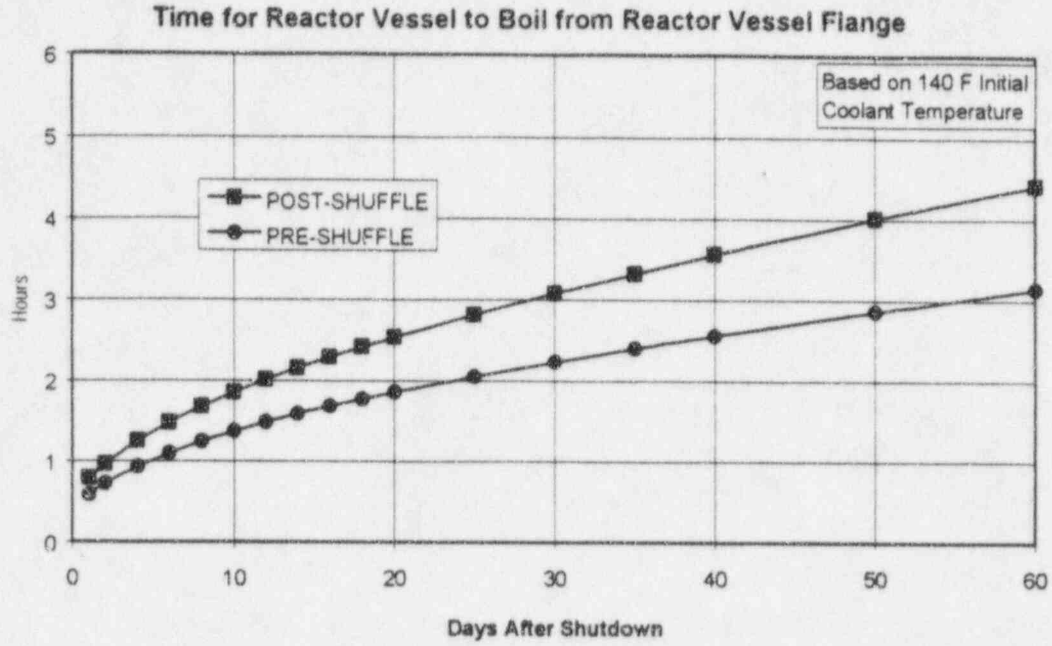
(ref: UFSAR table 6.2-1a and 6.5-3)

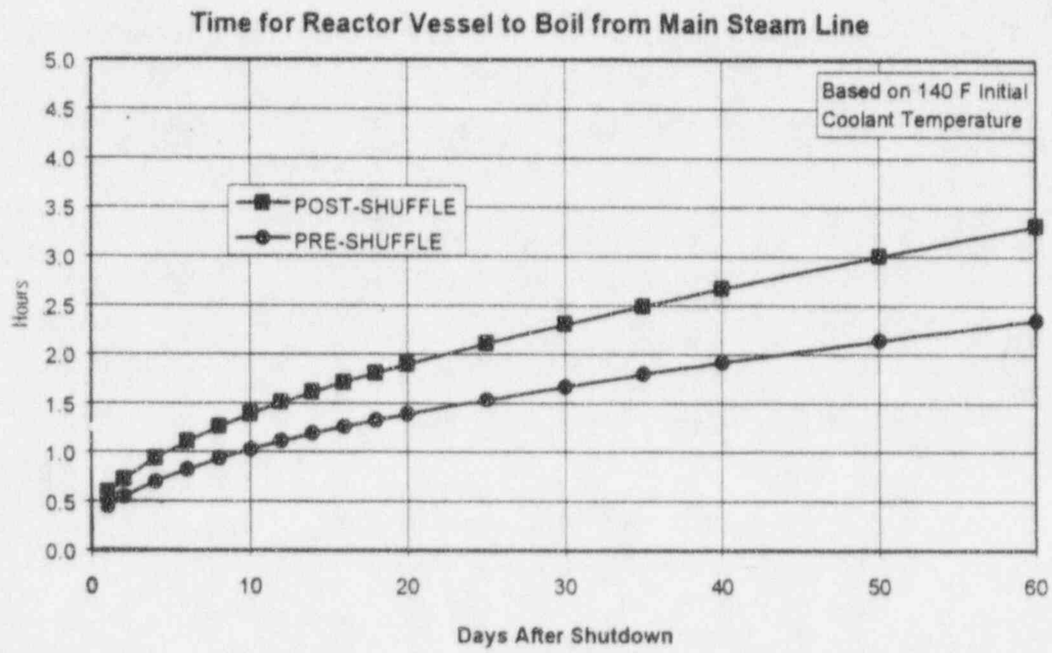

Maximum Number of Additional Fuel Bundles
That Can be Added to the Spent Fuel Pool in RFO8
Based on 95 F
CCW Temperature
2 pump/2 hx, 1100 gpm to SFP
1 pump/1 hx, 1100 gpm to SFP
1 pump/1 hx, 550 gpm to SFP
Number of Bundles
Days After Shutdown
0
100
200
300
400
500
600
700
800
10
20
30
40
50
60

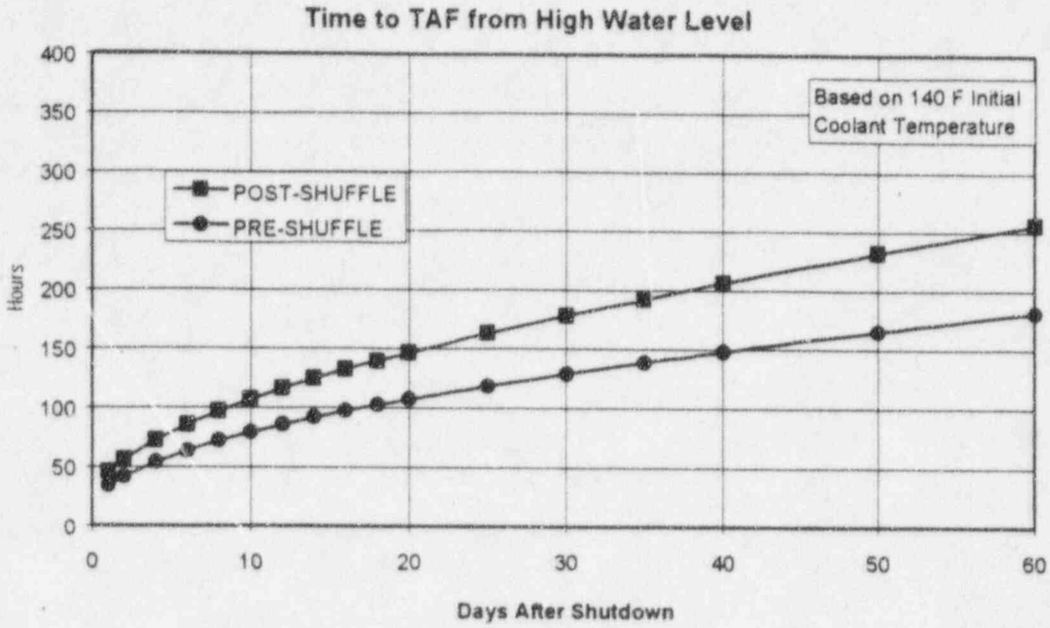

Maximum Number of Fuel Bundles
That Can be Added to the Containment Pool in RFO8
Based on 95 F
CCW Temperature
1 pump/1 hx, 1100 gpm to CP
1 pump/1 hx, 550 gpm to CP
Number of Bundles
Days After Shutdown
0
100
200
300
400
500
600
700
800
10
20
30
40
50
60

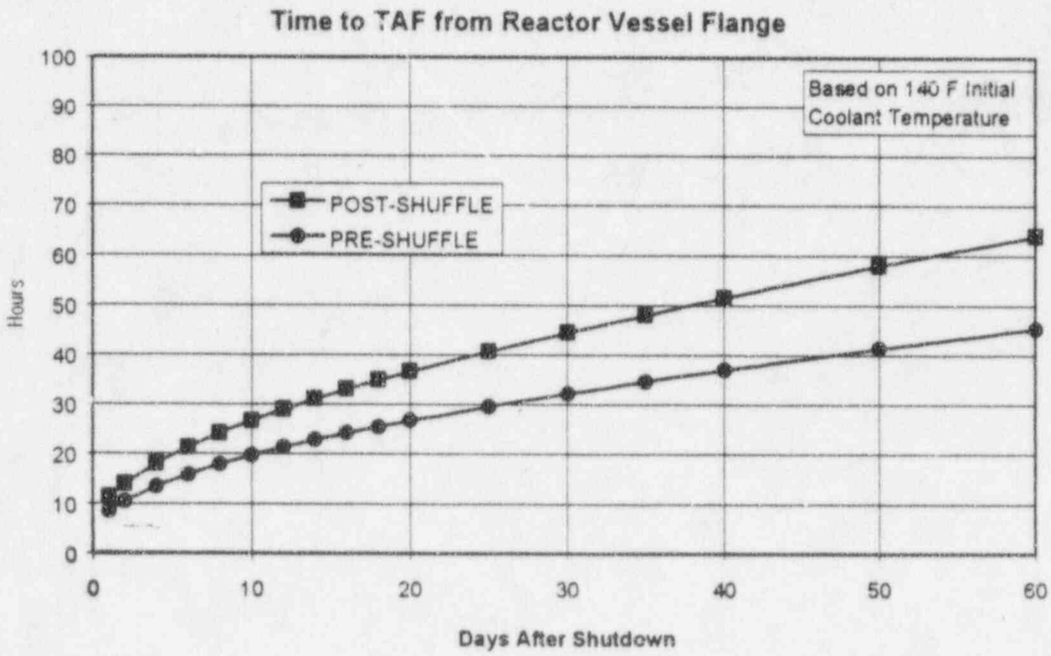

Time for Spent Fuel Pool To Boil
Based on 140 F Initial Pool Temperature
PRE-SHUFFLE
POST-SHUFFLE
Hours to Boil
Days After Shutdown
0
10
20
30
40
50
60
70

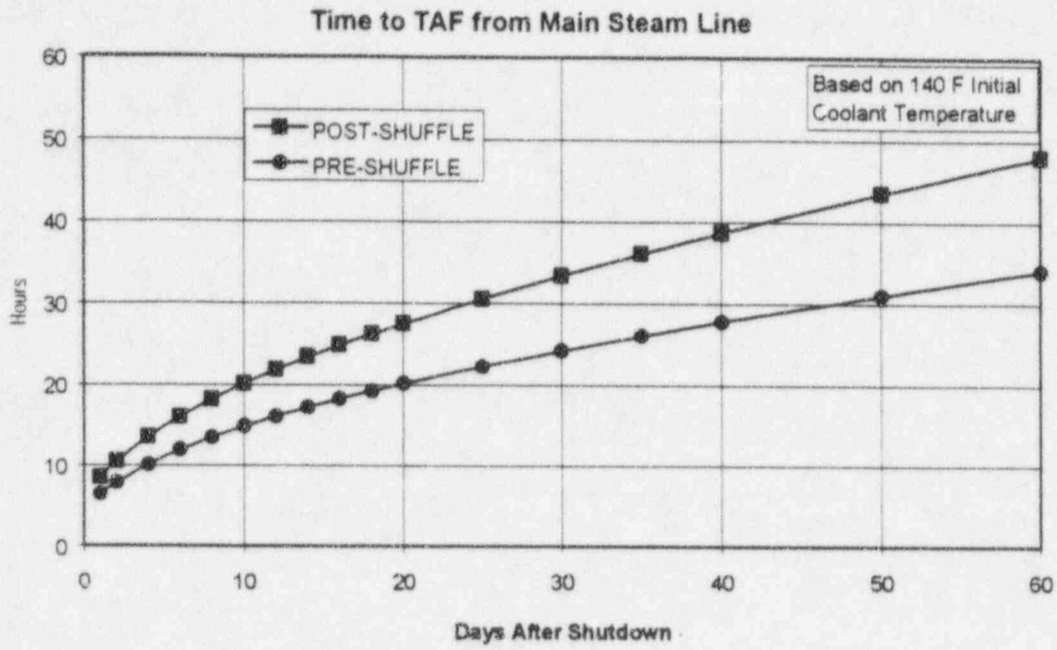

Time for Reactor Cavity to Boil from High Water Level
Based on 140 F Initial Coolant Temperature
POST-SHUFFLE
PRE-SHUFFLE
Hours
Days After Shutdown
0
5
10
15
20
25
30
40
50
60


Time for Reactor Vessel to Boil from Reactor Vessel Flange
Based on 140 F Initial Coolant Temperature
POST-SHUFFLE
PRE-SHUFFLE
Hours
0
1
2
3
4
5
6
0
10
20
30
40
50
60
Days After Shutdown


Time for Reactor Vessel to Boil from Main Steam Line
Based on 140 F Initial Coolant Temperature
POST-SHUFFLE
PRE-SHUFFLE
Hours
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
0
10
20
30
40
50
60
Days After Shutdown


Time to TAF from High Water Level
Based on 140 F Initial Coolant Temperature
POST-SHUFFLE
PRE-SHUFFLE
Hours
Days After Shutdown
0
50
100
150
200
250
300
350
400
0
10
20
30
40
50
60


Time to TAF from Reactor Vessel Flange
Based on 140 F Initial Coolant Temperature
POST-SHUFFLE
PRE-SHUFFLE
Hours
Days After Shutdown
0
10
20
30
40
50
60
70
80
90
100
0
10
20
30
40
50
60


Time to TAF from Main Steam Line
Based on 140 F Initial Coolant Temperature
POST-SHUFFLE
PRE-SHUFFLE
Hours
Days After Shutdown
0
10
20
30
40
50
60

Date: September 17, 1996

To: J. J. Hagan, Vice President Operations GGNS

From: R. D. Ingram, NS&RA Safety Issues Supervisor

Subject: Report OA-96-07, Safety Assessment of the RFO8 Outage Schedule

GIN: 96-02276

Attached for your review is the RFO8 Outage Schedule Safety Assessment Report. All risk conditions identified during the assessment including appropriate contingency plans were issued to Riley Collins in GIN 96-02274. Section 3.0 of the RFO8 Safety Assessment report contains these identified risk days and contingency plans. Section 3.6 contains the ORAM-TIP analysis.

Questions or concerns with the report can be directed to me at extension 2238 or George Lee at extension 6214.

RDI

GHL/RDI

Attachments: OA-96-07, Safety Assessment of the RFO8 Outage Schedule

cc: R. B. Collins, w/a
R. T. Errington, w/a
M. D. McDowell, w/a
M. J. Meisner, w/a
W. M. Shelly, w/a
C. F. Smith, w/a
Ken Walker, w/a
J. E. Venable, w/a

File (NS&A), w/a
Central File {23}, w/a

NUCLEAR SAFETY & REGULATORY AFFAIRS
SAFETY ASSESSMENT SECTION

SAFETY ASSESSMENT OF THE RFO8 OUTAGE SCHEDULE

NS&RA REPORT NUMBER: OA-96-07

DATE: September 17, 1996

Prepared:	DH Lee **Cognizant Engineer/Specialist**	9-17-96 **Date**
Reviewed:	Michael A. Dorsett **Cognizant Engineer/Specialist**	9-17-96 **Date**
Approved:	[signature] **Safety Assessment Supervisor**	9/17/96 **Date**

EXECUTIVE SUMMARY

The Nuclear Safety and Regulator Affairs Safety Issues Group is required by NS&RA Section Procedure 09-S-03-14, Administration of ISEG Activities, to perform an assessment of the refueling outage schedule prior to starting the outage. The RFO8 Outage Schedule Assessment was performed using NUMARC 91-06, Guidelines for Industry Actions to Assess Shutdown Management, and other applicable industry documents as guides.

The purpose of the RFO8 Outage Schedule Assessment was to identify risk conditions and present the findings so that required contingency plans could be completed prior to the start of RFO8. A secondary purpose was to identify schedule improvements and provide immediate feedback to the Outage Scheduling Group as required.

The data used for the ORAM-TIP portion of Section 3.6 utilized the August 18 RFO8 Outage Schedule data while Sections 3.1 through 3.5 (Key Safety Function Analysis) used the August 13 schedule data. The differences in the two schedules are minor and did not affect the Key Safety Function (KSF) analysis.

The assessment team performed a review of the KSFs for Decay Heat Removal, Reactivity Control, Vessel Inventory Control, Containment Control and Electrical Power and also included a review of UFSAR events applicable to outage conditions - SBO, LOCA and Fire in the Control Room. The assessment team used the single failure concept to determine risk conditions. If a single failure could result in the loss of a KSF then a risk classification was assigned for the appropriate time frame.

Twenty-six days of the projected 32 day outage contain one or more risk conditions. No risk conditions were identified with the Reactivity Control KSF. The Decay Heat Removal KSF analysis identified the largest number of risk days. The ORAM-TIP model indicates that the average overall event frequency during the outage for RCS boiling is 1.50 E-5 events/hour and for core damage is 1.90 E-10 events/hour. Contingency plans were recommended commensurate with the identified risk conditions for each KSF and UFSAR Event and presented to plant staff for concurrence. Section 3.0 provides a detailed analysis of the KSFs and associated contingency plans.

During RFO8 the Safety Issues Group will observe the outage schedule progression and provide input as necessary on schedule changes. Any major change to the schedule that meets re-evaluation criteria will be analyzed to determine if a risk condition exists. Additional contingency plans will be written as needed. Outage schedule changes will also be input into the ORAM-TIP outage risk model for evaluation of risk conditions.

Following RFO8, NS&RA Safety Issues Group will provide a post-outage critique that details the adequacy of the outage review including a comparison of planned to actual risk. An update of the ORAM-TIP model analysis is also planned and will be provided as part of the critique. No recommendations were issued as a result of the RFO8 Outage Schedule Safety Assessment other than those contained within the contingency plans.

TABLE OF CONTENTS

1.0 INTRODUCTION

NS&RA Section Procedure 09-S-03-14, Administration of ISEG Activities, requires an assessment of the refueling outage schedule be performed prior to starting the outage. The RFO8 Outage Schedule Assessment was performed using the August 13, 1996 run of the outage schedule. The ORAM analysis performed utilized the August 18, 1996 run of the outage schedule. No significant changes were made to the outage schedule between August 13 and August 18.

The purpose of the RFO8 Outage Schedule Assessment was to identify risk issues and to ensure that required contingency plans were in place prior to the start of the outage. Additionally, the review serves to identify schedule improvements and provide feedback to the Outage Scheduling Group so that changes can be made to the outage schedule as required.

A day by day matrix was developed for each of the Key Safety Function (KSF) areas - Decay Heat Removal, Inventory Control, Reactivity Control, and Electrical Power Availability. An additional matrix was developed for selected UFSAR events that are applicable to shutdown conditions. All matrices are provided as attachments to this report.

2.0 METHODOLOGY

A list of critical systems and components associated with each Key Safety Function was developed and put into a matrix form that shows the dates associated with the unavailability of each system/component. The list of critical systems/components are located in Attachment 1, Tables 1 through 4. The tables were developed such that each would stand without reliance on any condition other than those listed on the specific table. A table exists for each of the Key Safety Functions analyzed, and contains all components, systems and plant conditions that are applicable to that Key Safety Function. The same system, component or plant condition was used on more than one table if it was applicable to that particular Key Safety Function.

In order to identify when a risk condition exists, a definition was developed for use during the outage schedule assessment. This definition is shown below.

> A Risk Condition Exists if one equipment failure or operator action can cause a loss of or a reduction in the plant's ability to:
>
> a. remove decay heat,
> b. provide electrical power,
> c. maintain inventory control,
> d. establish/maintain primary or secondary containment integrity when required, or
> e. ensure adequate reactivity control.

Once factors affecting the Key Safety Functions were identified, the dates that the systems, components and/or plant conditions were not available for use were documented in each matrix. The tables were also reviewed against the final outage schedule to ensure that no significant schedule changes had occurred and that the analyzed data was still valid.

A comparison was made of the risks identified for RFO8 by the ORAM-TIP Risk Model and those identified by the assessment team. The purpose of the comparison was to provide a cross-validation of the assessment. Each analysis is performed independently and each uses different analysis techniques. When compared, the results of both analysis should be similar. If a similarity does not exist, an error may be indicated which would then lead to a re-analysis of that particular time in the outage. Graphs have been developed that show the comparison of the ORAM-TIP Model and the outage assessment team's findings.

An analysis of significant UFSAR transients and accidents is also performed as part of the RFO8 Outage Schedule Assessment. Those accidents and transients that may be applicable during outage activities are:

Station Blackout
Loss of Coolant Accident
Fire

Attachment 1 Table 5 identifies those dates during RFO8 that each of the above transients could be applicable.

3.0 INVESTIGATION

Sections 3.1 through 3.5 present the risk conditions identified for each of the KSFs and UFSAR events along with the applicable contingency plans.

3.1 Reactivity Control Analysis

During an outage reactivity is controlled in several ways. These include the fuel movement plan, control rods, management of changes to the movement plan and personnel training.

Control rods, when fully inserted in the core, provide the neutron absorption needed to maintain the required Shut Down Margin (SDM). SDM is a value of negative reactivity required to be maintained at all times assuming the highest worth control rod is withdrawn from the core. Procedure 17-S-02-13, Control Rod Lifetime Estimation, provides assurance that the control rods do not become depleted during operation prior to refuel. Additionally, the rod control system limits non-maintenance rod withdrawal to a single rod to prevent approaching the SDM limit. The reload analysis calculates a single rod withdrawal for all cells, a four bundle array and their associated control rod, under the maximum reactivity conditions possible and assumes worst case planned placement of fuel bundles. A conservative SDM is calculated by assuming that each cell contains the four highest worth bundles that could possibly occur among the four original and replacement bundles. Each calculated cell is

then analyzed for a rod withdrawal, either normal or inadvertent. In the event that adequate SDM is not calculated for a cell, it is designated to be one of the final cells loaded. This assures that, for these final cells, the highest worth configuration does not occur.

GGNS uses computer generated quality-controlled movement sheets to track and control the fuel during fuel movements. The important issue in movement control is the prevention of criticality by maintaining a minimum SDM. The assumption that the highest worth rod is withdrawn for SDM calculations provides protection against accidental rod movement. The SDM value may be analytically or empirically determined.

In the case of the various pools where fuel may be stored an infinite rack containing highest worth bundles is assumed. This is a worst case scenario which assures an adequate SDM in the pools.

Once fuel movement starts the movement plan is controlled by an SRO. The movements are made by qualified, experienced personnel and checked by a representative of Reactor Engineering.

The personnel representing Reactor Engineering on the refuel floor during vessel fuel movements have completed training associated with fuel tracking, movement and verification.

To ensure proper reactivity control, several procedures are used. These procedures are:

17-S-02-5, Post Refueling Recirculation System Flow Instrumentation Calibration

17-S-02-13, Control Rod Lifetime Estimation

17-S-02-100, Criticality Rules

17-S-02-108, Core Loading Verification

17-S-02-300, Special Nuclear Material Movement and Inventory Control

During RFO8 eight control rods will be replaced. This activity was reviewed to verify that the control rod blades scheduled for replacement did not coincide with those CRD mechanisms that will be replaced. No conflicts existed. Additionaly, control rod blade replacement is adequately contolled by procedure 04-S-03-C11-1, Control Rod Blade Removal And Installation.

A review of the outage schedule shows no indication of an unacceptable or unanticipated risk concerning reactivity control. Additionally, the requirements of Technical Specifications concerning reactivity control have been adequately addressed and met. The systems and/or plant conditions used to assess reactivity control can be found in Attachment 1, Table 1.

3.2 Inventory Control Analysis

The Inventory Control KSF was analyzed and risk conditions were identified for four days during RFO8. The remaining days of the outage do not pose any risk conditions due to the availability of a minimum of two ECCS having separate divisional power sources throughout the outage.

The systems and/or plant conditions used to assess Inventory Control are contained in Attachment 1, Table 2.

10/25-28 **A RISK CONDITION EXISTS FOR 10/25 through 10/28** due to a potential fault that results in a loss of LPCI B during a time when CRD removal is in progress. An electrical fault that affects 15AA or a fault on RHR B would prevent the availability of LPCI B. ADHR is in service and ST11 and all remaining ECCS are unavailable during these four days.

CONTINGENCY PLAN: Inadequate Decay Heat Removal ONEP 05-1-02-III-1, Loss of AC Power, ONEP 05-1-02-I-4, and Emergency Procedure, EP-2 RPV Control.

NOTE

While no additional days were determined to contain significant risk conditions, the periods when the upper pool is drained pose an unusual situation. The upper pool will be drained to the suppression pool and to the RWST. If RPV makeup is needed due to draindown event concerns during these time periods (10/20 - 10/23 and 11/10 - 11/14) it may be necessary to gravity drain the RWST to the suppression pool per the P11 SOI (Section 5.9) to prevent uncovering the ECCS suctions. HPCS with a CST suction is available 10/20-23, however, the HPCS suction will be shifted to the suppression pool due to a high suppression pool level and will require operator over-ride to ensure the CST suction path is maintained.

3.3 Power Availability Analysis

The systems and/or plant conditions used to perform the Power Availability analysis can be found in Attachment 1, Table 3.

The Power Availability Analysis criteria for evaluating each day considered the following:

* A single component failure which causes a loss of BOP or ESF power is considered a RISK and would require a CONTINGENCY PLAN,

* Power availability was considered unacceptable if at least one on-site or two off-site power sources were not maintained.

10/24-29 **A RISK CONDITION EXISTS ON 10/24, 25, 26, 27, 28, and 29.** ST11 and ESF 11 are removed from service. A fault that causes the loss of ST21 will cause a loss of all BOP as well as a loss of ESF power for those buses not being powered from ESF 12. Precautionary actions should be taken to protect the power supply to ESF bus 15AA to prevent an inadvertent isolation of the operating shutdown cooling system. Additional precautions should be taken to prevent power loss to the 16AB bus to prevent inadvertent isolations.

CONTINGENCY PLAN: ONEP 05-1-02-I-4, Loss of AC Power. Additionally, the area around Division 2 D/G, ST21 and associated feeder breakers should be posted with HIGH IMPACT signs and no work should be performed on or around this equipment.

11/7 - 13 **A RISK CONDITION EXISTS ON 11/7, 8, 9, 10, 11, 12, and 13.** ST21 and ESF 21 are out of service. A single fault that causes a loss of ST11 will cause a complete loss of BOP power and ESF power not being supplied by ESF 12.

CONTINGENCY PLAN: ONEP 05-1-02-I-4, Loss of AC Power. Additionally, the area around ST11, it associated feeder breakers, and Division 1 D/G should be posted with HIGH IMPACT signs and no work should be performed on this equipment until ST21 is returned to service.

ADDITIONAL CONSTRAINTS DURING SWITCHYARD MAINTENANCE

* Switchyard activities are in progress from 10/20 through 11/14 and work is being performed on switchyard breaker J5236, October 20 through November 6. During these times, the pedestrian/vehicular traffic in the general switchyard and more specifically in the area around the J5228 and J5232 breakers should be posted for increased awareness.

* The area around the AVAILABLE Station Transformer and any single failure breakers should be conspicuously posted as the single plant off-site power source. Also, if for any reason the on-site power source becomes INOPERABLE, all switchyard activities should be halted.

3.4 Decay Heat Removal Analysis

The majority of the risk conditions during RFO8 are attributed to loss of the Decay Heat Removal KSF. Attachment 1, Table 4 is a listing of systems, components and plant conditions that were considered during the analysis.

10/23 **A RISK CONDITION EXISTS on 10/23** due to a potential fault that causes a loss of the common suction. The reactor cavity pool is drained, RHR A is removed from service, and the MSL plugs are installed. A loss of the Shutdown Cooling common suction line from the RPV would remove all normal means of decay heat removal.

CONTINGENCY PLAN: Inadequate Decay Heat Removal ONEP 05-1-02-III-1

10/24-25 **A RISK CONDITIONS EXIST FOR 10/24 & 25.** Dual risk condition exists during these dates due to the potential for a loss of common suction and loss of electrical power. ADHR is operating with its suction from the spent fuel pool. A loss of the spent fuel pool suction (F348 and/or F226) will remove all normal methods of decay heat removal. Additionally, ST21 is out of service and a loss of ST11 would cause a loss of BOP and subsequently ADHR. During these dates the reactor decay heat is high and time to boil is approximately 1.5 to 2 hours. The Reactor Cavity Pool is flooded and the E12-F008 and F009 valves are removed from service. RHR B is available as an alternate shutdown cooling system. During the time that ADHRS is in service, vessel temperature monitoring by use of in-vessel thermocouples is necessary whenever RWCU or RHR B is not in service.

CONTINGENCY PLAN: Inadequate Decay Heat Removal ONEP 05-1-02-III-1 and/or ONEP 05-1-02-I-4, Loss of AC Power.

11/3-7 **A RISK CONDITION EXISTS ON 11/3, 4, 5, 6, & 7** due to a single failure which causes a loss of the RHR A pump. The E12-F008/F009 valve suction path and the Spent Fuel Pool suction path are available, however, ADHR and RHR B are tagged out for maintenance and an electrical fault that removes the power for the RHR A pump or a fault on the pump will cause a loss of all normal methods of decay heat removal.

CONTINGENCY PLAN: Inadequate Decay Heat Removal ONEP 05-1-02-III-1 and/or ONEP 05-1-02-I-4, Loss of AC Power.

11/10-14 **A RISK CONDITION EXISTS ON 11/10, 11, 12, 13, & 14** due to the potential loss of the common shutdown suction from the RPV. The reactor cavity pool is drained and the MSL plugs remain installed through 11/12. A loss of the common suction (11/10 - 11/12) could require re-flooding the reactor cavity pool in order to establish a communications path with the suppression pool for the removal of decay heat. Personnel in the reactor cavity pool along with inspection equipment must be removed prior to flooding the reactor cavity pool. Decay heat is significantly reduced on day 22 of the outage and the time to boil has increased to 5 to 6 hours.

CONTINGENCY PLAN: Inadequate Decay Heat Removal ONEP 05-1-02-III-1 and/or ONEP 05-1-02-I-4, Loss of AC Power.

CAUTION:

Should the need arise, a coordinated effort will be required to evacuate personnel from the 208' Containment elevation and to ensure the removal of equipment and tools from the reactor cavity pool in order to re-flood the reactor cavity pool. Pre-planning should be performed to ensure that all individuals orking on the 208' Containment elevation are prepared to take appropriate actions.

3.5 UFSAR Event Analysis

The UFSAR was reviewed for those accidents/transients that may be applicable during an outage and for outage activities that may have altered the design basis. Station Blackout, Loss of Coolant Accident, and Fire were determined to require further review.

The UFSAR analysis is an "event based" approach in identifying **RISK CONDITIONS** instead of a "component based" approach as was used for the KSFs. Contingency plans are shown for the risk conditions identified for SBO, LOCA, and Fire. The actions taken by the operators will not be as obvious as those used for the KSF single failure faults due to the multiple faults that occur in these three events. The contingency plans identified for SBO, LOCA and Fire are designed to make the operator aware of the special conditions surrounding the event and to aid them in making proper decisions during shutdown conditions while using ONEPs, EPs, or temporary procedures.

3.5.1 Station Blackout

Assumption: The SBO lasts for 8 hours, then: the issue for SBO becomes core boiling, and with core boiling, Secondary Containment is n[illegible]lid because the SBGTS is not designed to process steam, therefore, Primary [illegible]inment is the only viable control.

Conclusion: If the upper pools are not flooded and with Primary Containment not set, SBO is a viable accident during shutdown.

10/20-23 **A RISK CONDITION EXISTS FOR SBO ON 10/20 - 10/23** due to low water level conditions. An SBO will remove all normal means of decay heat removal, however, the HPCS and its associated D/G, LPCI B and LPCI C are available on a continuous basis during these dates.

CONTINGENCY PLAN: ONEP 05-1-02-I-4, Loss of AC Power and Inadequate Decay Heat Removal ONEP 05-1-02-III-1.

11/10-14 **A RISK CONDITION EXISTS FOR SBO ON 11/10 - 11/14** due to a low water level in the Reactor Cavity Pool. The HPCS D/G is available to supply necessary power to Division 1 or 2 electrical bus and energize required ECCS pumps for decay heat removal. All ECCS are available during this time frame.

CONTINGENCY PLAN: ONEP 05-1-02-I-4, Loss of AC Power and Inadequate Decay Heat Removal ONEP 05-1-02-III-1.

3.5.2 Loss Of Coolant Accident

Assumptions: One or more ECCS are operable and the LOCA is due to a double ended shear of the Recirculation suction piping, then: the issue for LOCA becomes core damage.

Conclusion: Reactor water level must be maintained equal to or greater than TAF to prevent fuel damage, therefore: A risk exists when the lower containment hatches and doors are open. This is compounded when lines and hoses obstruct the rapid closure of these openings thereby making it extremely difficult to flood the containment to a water level at or above TAF.

There are two ways to provide adequate core cooling in this situation.

1. Seal the containment and flood to >TAF, or
2. Establish a flow path from the Suppression Pool through the reactor vessel and back to the suppression pool over the weir wall or through the drywell equipment hatch and door.

In order to establish a recirculation path, either the upper pools must be flooded and suppression pool level >18.34 feet or, during low water level conditions, the Suppression Pool level must be >18.34 feet and HPCS with CST suction available. Since containment integrity is not set during the majority of a refueling outage, this combined with a low water level condition (Reactor Cavity Pool drained) and suppression pool level <18.34 feet or suppression pool level >18.34 feet and HPCS not available dictate the days in the outage that are considered to be a risk with respect to a LOCA.

At no time during RFO8 will the Suppression Pool be at a level or equivalent level of less than 18.34 feet. Additionally, during both time frames when the upper cavity pool is drained, the HPCS is operable. On the basis of above criteria no LOCA concerns exist for RFO8. However, the "A" Recirculation pump is scheduled to be replaced during RFO8. The recirculation pump motor will be moved and suspended in the area of the B Recirculation System piping. Due to the movement and storage of heavy loads inside the drywell in the near vicinity of the recirculation system piping a LOCA concern exists during the time that the motor is initially moved from its normal mount until it is returned and mounted as designed.

CAUTION

The suppression pool level is maintained >18.34 feet throughout the time frame that the A recirculation pump is being replaced and the reactor cavity pool is flooded, which eliminates the LOCA Risk Condition. However, during the dates that work activities are being performed on the A Recirculation pump and motor, October 30 through November 6, special precautions should be taken to prevent inadvertent damage to the recirculation system piping as a result of the movement of the A recirculation pump and motor and storage of the motor.

3.5.3 Fire

A **RISK CONDITION** due to a fire exists when the Division 1 equipment is out of service. This is due to Division 1 being the division that is protected during a fire in the control room. The risk condition only applies to a fire in the control room. The days associated with a fire risk are **October 20 through 30**.

10/20-30 **A RISK CONDITION EXISTS ON OCTOBER 20 THROUGH 30** due tothe potential of a fire in the Control Room that affects the Division 2 equipment with a major portion of Division 1 equipment being out of service during these dates. Should a fire occur during this time the ability to maintain cold shutdown could be lost due to a fire in the control room. A fire that affects Division 2 could remove the plants ability to operate a single division from the Remote Shutdown Panel.

CONTINGENCY PLAN: Implement applicable portions of ONEP 05-1-02-II-1, Shutdown from the Remote Shutdown Panel and refer to and implement the appropriate Decay Heat Removal contingency plans for the applicable dates.

Additionally, precautions should be taken to protect the Division 2 equipment from potential fire hazards. These actions should include daily tours by plant fire protection personnel to identify fire hazards located in and around the Division 2 equipment. Absolute control of Cutting, Grinding and Welding Permits in and around Division 2 equipment. The Division 2 equipment areas should be posted with **HIGH IMPACT** signs and roped off as necessary to warn personnel of the significance of the equipment.

3.6 ORAM-TIP Model vs Shutdown Risk Analysis Comparison

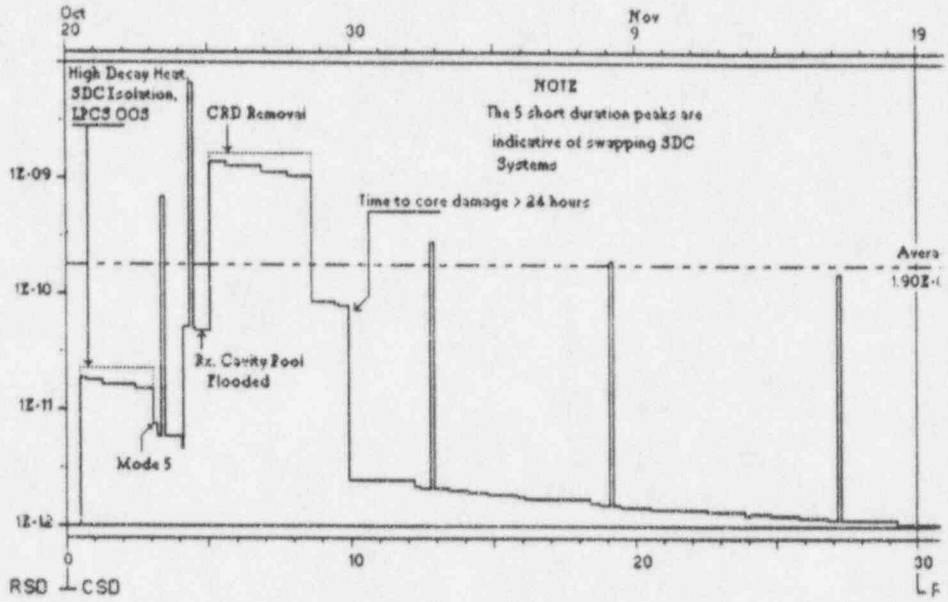
The EPRI Outage Risk Assessment and Management Technical Integration Package (ORAM-TIP) software is one of the tools used to assess the shutdown risk for RFO8. Outage scheduling information such as key plant activities, equipment availability, and their associated time frames is down-loaded from the outage scheduling software and is loaded into the ORAM-TIP software. This information is then analyzed by the model software to provide an assessment of the **CORE DAMAGE** and **RCS BOILING RISK** associated with the outage activities. Some of the events considered for the CORE DAMAGE analysis are loss of decay heat removal, loss of normal AC power, large or medium LOCA, SSW pump failures, shutdown cooling isolation events, reactor vessel isolation events, and draindown events. In addition to these, the RCS BOILING RISK analysis also considers Division 1 and 2 AC/DC bus failures.

The probabilistic shutdown safety assessments (PSSA) module within ORAM provides a probabilistic risk assessment (PRA) like approach to analyzing outage related risk profiles. The PSSA is the primary process that generates the risk-related information used in viewing the outage, and in particular the Core Damage Risk and RCS Boiling Risk graphs.

The ORAM-TIP model indicates that the average overall event frequency during the outage for RCS Boiling Risk is 1.43 E-5 events/hour and for Core Damage Risk is 1.90 E-10 events/hour. This average is controlled throughout RFO8 by the potential for a large or medium LOCA. As in past outages, the risk for RCS boiling in RFO8 is significantly greater than that of core damage.

3.6.1 Core Damage Model

Figure 1 shows the Core Damage Risk for RFO8 based on the current outage schedule. The key sensitivities are water inventory in the reactor cavity pool, decay heat levels, the potential for inadvertent drain down events and swapping decay heat removal systems. Review of Figure 1 reveals two main peaks and five short duration peaks in core damage frequency.



RFO8 CORE DAMAGE RISK PROFILE

Figure 1

The first peak occurs during October 20 - 23. During this time the Reactor Cavity Pool is drained for removal of RPV internal components, decay heat levels are high, and LPCS is removed from service. These factors increase the Core Damage Risk due to a large/medium LOCA and loss of decay heat removal ability to 1.25 E-11 events/hour. The risk shows a decrease to 5.08 E-12 events/hour when the plant enters Mode 5. This decrease is primarily due to the change in the ORAM-TIP assumed temperature of 200 °F in Mode 4 to 140 °F in Mode 5.

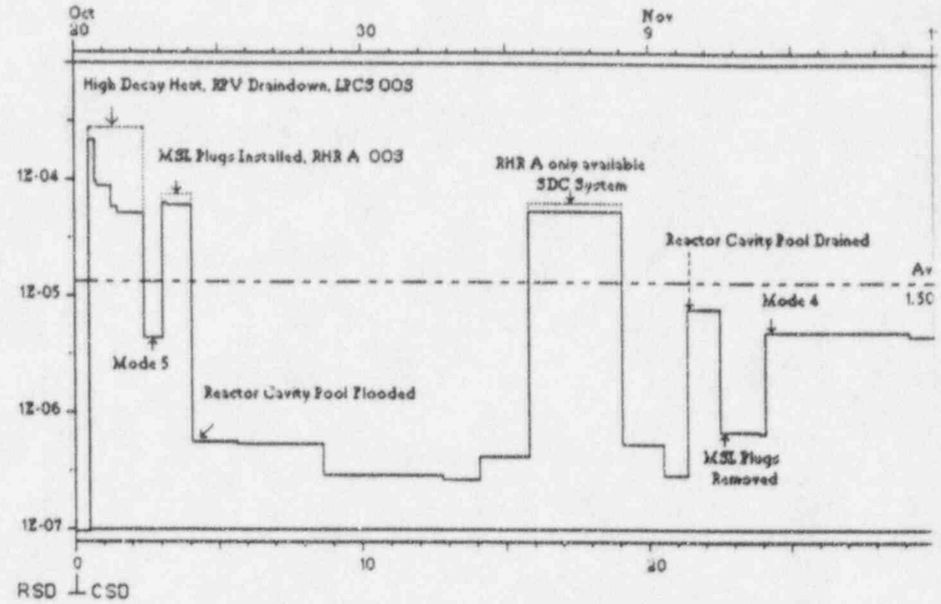
The second and largest peak in Core Damage Risk occurs during the time that CRDs are being removed. The risk increases to 1.27 E-9 events/hour is due to the potential for a drain down event. Following the CRD removal peak, the Core Damage Risk profile decreases to 2.41 E-12 due to the time to reach core damage exceeding 24 hours. The continual reduction in Core Damage Risk is due to the reducing reactor decay heat levels.

The five short duration peaks that occur throughout RFO8 are caused by placing a decay heat removal system in service. These peaks are controlled by an inadvertent drain down event and take into account the probability that the protective logic will not function properly and the probability that operators will not perform the evolution properly.

3.6.2 RCS Boiling Risk Model

Figure 2 is the RCS Boiling Risk profile for RFO8. As expected, the RCS Boiling Risk is relatively high at the beginning of the outage due to high decay heat loads.

The first peak occurs on October 20 when the RCS Boiling Risk increases to approximately 2.14 E-4 events/hour due to entering Mode 4 and draining the Reactor Cavity Pool. The main initiators for RCS Boiling Risk are a RPV isolation event or a loss of decay heat removal event.



RFO8 RCS BOILING RISK PROFILE

Figure 2

The risk drops off to 4.24 E-6 events/hour when mode 5 is entered. This is because the calculated time to RCS boiling increases due to ORAM-TIP's assumption that RCS temperature decreases to the technical specification limit of 140° F when the mode change occurs.

The next peak for RCS Boiling Risk during RFO8 occurs on October 23 when the Main Steam Line plugs are installed. The risk increases to 5.99 E-5 events/hour and remains at this level until the Reactor Cavity Pool is flooded. Pool flood causes a decrease in RCS Boiling Risk to 5.49 E-7 events/hour. The boiling risk during this period is controlled by a loss of divisional electrical power and failure of the decay heat removal pump and/or SSW pump.

The third peak in RCS Boiling Risk equates to 5.36 E-5 events/hour and is due to only one decay heat removal system, RHR "A" available. On November 8, the ADHR system is available for service and RCS Boiling Risk returns to approximately 3 E-7 events/hour.

The fourth peak (7.54 E-6 events/hour) is caused by the Reactor Cavity Pool being drained for reinstallation of RPV components. Boiling risk decreases to 6.17 E-7 when the main steam line plugs are removed.

The final peak occurs on November 13 with the change to Mode 4. The RCS Boiling Risk increases to 4.91E-6 events/hour due to ORAM-TIP assuming a higher RCS temperature of 200° F. During this time RWCU is the primary system controlling RCS temperature making the plant more susceptible to vessel isolation events. The RCS Boiling Risk remains essentially at this level through the end of the outage.

3.6.3 Comparison of The Two Risk Assessment Models

The ORAM-TIP model indicates that the overall event frequency for RCS Boiling Risk during the outage 1.50 E-5 events/hour and for Core Damage is 1.90 E-10 events/hour. As in past outages, the risk for RCS boiling in RFO8 is significantly greater than that of core damage.

Figure 3 is a stacked bar chart that shows the total number of identified risks per day during RFO8. The KSF Risk bar is a summation of the risks associated with the Inventory Control, Electrical Power, and Decay Heat Removal KSFs.

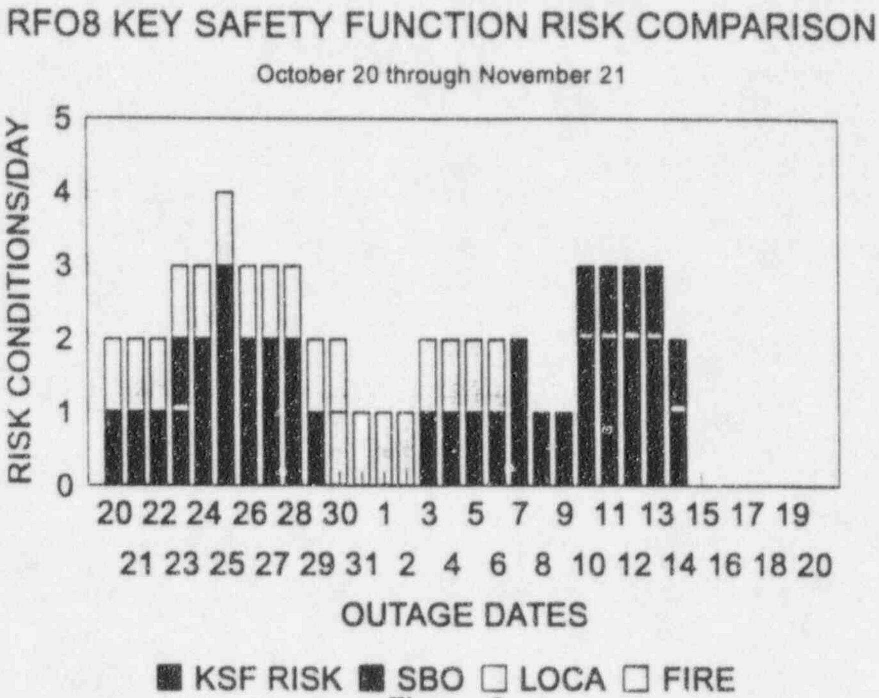


Figure 3

The potential for a an event which causes the loss of decay heat removal during RFO8 is the largest single contributor to the total number of risk days. Thirteen days of the outage have a risk condition associated with the Decay Heat Removal KSF.

The first peak, 10/23-28, is caused by a combination of risks from the Decay Heat Removal and Electrical Power KSFs and Fire in the Control Room. The peak on 10/23 is caused by the Decay Heat Removal KSF, SBO and Fire in the Control Room each contributing a risk condition. The peak on 10/25 is due the Decay Heat Removal, Inventory Control and Electrical Power KSFs each contributing one risk condition and Fire in the Control Room the 4th of November.

The total risk conditions per day drops to one on 10/31 and remains at a low level until the second significant peak, 11/10-14. This second peak is the result of the risk from loss of the Decay Heat Removal KSF, Inventory Control KSF and SBO potentials during the later part of RFO8 when only one decay heat removal system is available and pool level is drained for vessel internals replacement. The specific risks associated with each identified date can be found in Section 3.0 of this assessment report.

Figure 4 is a line chart that represents the same information contained in Figure 3. The peaks and dips associated with the risk conditions per day are more easily identified in the RFO8 KSF Risk Comparison graph.

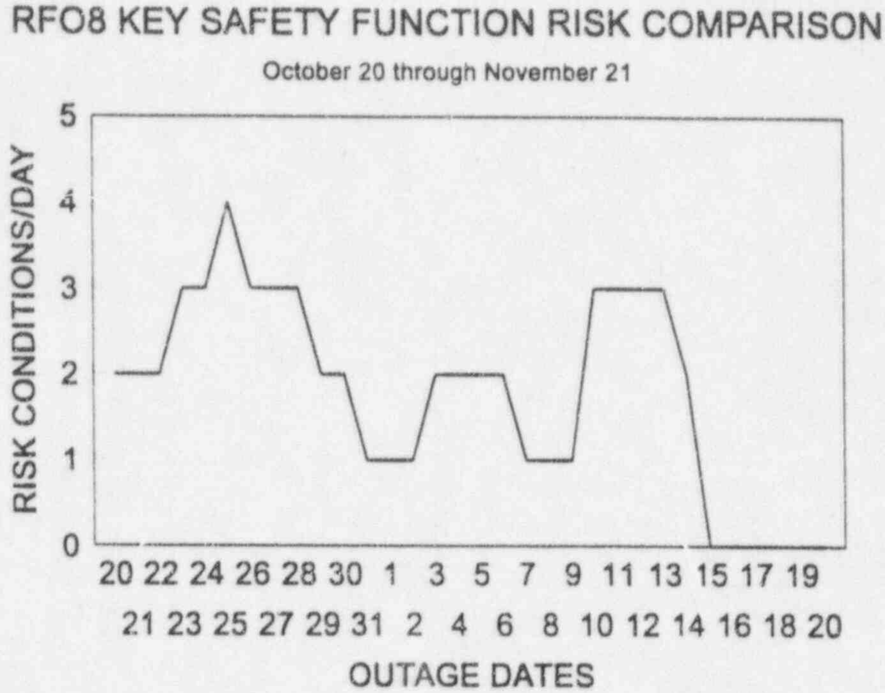


Figure 4

While the graphs for Core Damage Risk and RCS Boiling Risk, Figures 1 and 2, do not exactly match the shapes of the Risk Comparison graphs, Figures 3 and 4, it can be seen that the graph shapes are similar and that the risks presented with each occur at relatively the same time throughout RFO8.

No major variations between the two sets of graphs exists which indicates that the two methods of assessing risk conditions for RFO8 reached the same basic conclusions. This comparison provides a cross-validation for each method used in the assessment.

The ORAM-TIP model and the RFO8 Outage Schedule tables will be utilized to re-analyze significant schedule changes as they arise during RFO8.

4.0 CONCLUSIONS

As in the previous two refueling outages, the NS&RA Safety Issues Group used the concept of single failure to determine Risk Conditions. If a single failure would result in the loss of a required system or function then a risk condition classification was assigned for the appropriate time frame.

The assessment identified one issue concerning the replacement of the "A" Recirculation System pump. The motor and pump internals will have to be removed and moved to a suitable storage location inside the drywell during this modification. The movement and storage of heavy loads around and near the Recirculation System piping was addressed as a area where additional planning and precautions should be taken during RFO8. This is addressed in the attached contingency plans.

The ORAM-TIP model indicates that the average overall event frequency during the outage for RCS boiling is 1.50 E-5 events/hour and for core damage is 1.90 E-10 events/hour. These average risk value in RFO8 for RCS Boiling Risk is approximately the same as the final boiling risk for RFO7 (1.2 E-5 events per hour). The RFO8 Core Damage Risk Profile is approximately 73 times higher that the final RFO7 Core Damage Risk and only 11 times higher than the initial RFO7 Core Boiling Risk. This increase in Core Damage Risk is a function of the time spent for CRD removal and changes made to the ORAM-TIP software that identifies the risk associated with swapping shutdown cooling systems.

Twenty-six days of the projected 32 day outage contain one or more Risk Conditions. Of the areas reviewed, the Reactivity Control KSF had no safety concerns and the Decay Heat Removal KSF analysis identified the largest number of risk condition days. Contingency plans were written commensurate with the identified risk conditions.

In addition to the contingency plans listed in sections 3.1 through 3.5, the practice of "posting" the operable/available train or equipment used in past refueling outages should be continued. Special consideration should be given to posting those electrical panels that contain normal power or logic power for shutdown cooling and the shutdown cooling isolation logic.

During the outage NS&RA will make observations concerning how the outage schedule is being implemented. Any major changes to the outage schedule that meet the re-evaluation criteria of Plant Administrative Procedure 01-S-06-42 will be scrutinized to ensure additional risk conditions do not develop and that the changes do not affect the existing risk days. These changes will also be input into the ORAM-TIP model for confirmation on risk conditions. The group will also attend outage scheduling meetings to ensure emergent work activities are addressed from a risk perspective.

5.0 RECOMMENDATIONS

No specific recommendations other than those contained in the contingency plans were issued as a result of the RFO8 Outage Schedule Safety Assessment.

6.0 ATTACHMENT

The following pages contain Attachment 1 Tables 1 through 5. These tables show the times that equipment and systems necessary to meet one of the Key Safety Functions are not available to perform that function. Tables 1 through 5 were use to analyze the RFO8 Outage Schedule for risk conditions.

ATTACHMENT 1 **TABLE 1** **REACTIVITY CONTROL KEY SAFETY FUNCTION**

RFO8 Start: 10/20/96	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
All Rods In	ALL RODS FULLY INSERTED																															
SBLC A																																
SBLC B																																
In Core Fuel Movements																																
CRD Removal																																
Core Alterations																																
SRMs																																
Under Vessel Actibities				UNDER VESSEL ACTIVITIES IN PROGRESS																												
C11 System																																
Shorting Links	INSTALLED																															
RFO8 Start: 10/20/96 .	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Outage Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32

ATTACHMENT 1 **TABLE 2** **INVENTORY CONTROL KEY SAFETY FUNCTION**

RFO8 Start: 10/20/96	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
HPCS																																
HPCS D/G																	Testing															
BUSS 17AC																																
LPCS																																
LPCI A																																
SSW A																																
BUSS 15AA																																
DIV 1 D/G											Testing																					
LPCI B																																
Buss 16AB																																
DIV 2 D/G																								Testing								
SSW B																																
LPCI C																																
RWST Pumps																																
Condensate System																																
CRD System																																
Firewater System																																
Demin Water																																
SBLC																																
CRD Removal																																
Secondary Containment					Secondary Containment Set (SCS)																									SCS		
Upper Pools Flooded					Upper Pools Flooded (UPF)																						UPF					
Sup. Pool Lvl < 18.34'																																
RFO8 Start: 10/20/96	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Outage Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32

ATTACHMENT 1 **TABLE 3** **POWER AVAILABILITY KEY SAFETY FUNCTION**

RFO8 Start: 10/20/96	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
DIV. 1 D/G											Testing																					
BUSS 15AA																																
DIV. 2 D/G																								Testing								
BUSS 16AB																																
DIV. 3 D/G																	Testing															
BUSS 17AC																																
ESF 11																																
ESF 12																																
ESF 21																																
ST 11																																
J5236																																
J5232																																
J5228																																
ST 21																																
J5212																																
J5208																																
J5204																																
BUSS 11HD																																
BUSS 12HE																																
BUSS 13AD																																
BUSS 14AE																																
Baxter Wilson																																
J5224																																
J5220																																
J5216																																
Franklin																																
J5240																																
J5244																																
J5248																																
Switchyard Activities	Switchyard Activities In progress																															
RFO8 Start: 10/20/96	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Outage Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32

ATTACHMENT 1 TABLE 4 DECAY HEAT REMOVAL KEY SAFETY FUNCTION

RFO8 Start: 10/20/96	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
RHR Pump A				■	■	■	■	■	■																							
SSW A				■	■	■	■	■																								
Division I D/G	■	■	■	■	■	■	■	■	■	■	■	Testing	■																			
Buss 15AA																																
RHR Pump B														■	■	■	■	■	■	■	■											
SSW B																	■	■	■	■												
Division II D/G																■	■	■	■	■	■	■	■	■	Testing	■						
Buss 16AB																																
SRVs				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■									
ADHRS															■	■	■	■	■													
Buss 14AE																																
PSW															■	■	■	■	■													
Buss 18 AG					■																											
Buss 28AG															■	■																
Division I SDC: E12-F009					■	■																										
Division II SDC: E12-F008					■	■																										
MSL Plugs Installed				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■									
RWCU														■	■	■	■	■	■	■	■	■	■									
CCW															■	■	■	■	■													
Active SDC System	■	RHR	■					ADHR						■	■	RHR A	■	■	■				ADHR				■	■	RHR A	■	■	
Recirc Pump 'A'		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■									
Recirc Pump 'B'					■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■									
LPCS	■	■	■	■	■	■	■	■	■																							
LPCI A				■	■	■	■	■	■																							
LPCI B														■	■	■	■	■	■	■	■											
LPCI C														■	■	■	■	■	■													
HPCS					■	■	■	■	■	■	■	■	■																			
HPCS D/G					■	■	■	■	■	■	■	■	■	■	■	■	■	Testing	■													
Firewater																																
Fuel Pool Cooling																																
Suppression Pool Cooling																																
Mode 5			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■								
Mode 4	■	■																							■	■	■	■	■	■	■	
ESF 11					■	■	■	■	■	■																						
ESF 12																										■						
ESF 21																			■	■	■	■	■	■	■							
ST11					■	■	■	■	■	■																						
ST21																			■	■	■	■	■	■	■							
Franklin Line																																
Baxter Wilson																																
Secondary Containment					■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■					■	SGS	■
Upper Pools Flooded					■	■	■	■	■	UPPER POOLS FLOODED	■	■	■	■	■	■	■	■	■	■	■						■	■	■	UPF	■	■
Sup. Pool Lvl < 18.34'																																
RFO8 Start: 10/20/96	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Outage Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32

ATTACHMENT 1 TABLE 5 UFSAR EVENTS AND KEY SAFETY FUNCTION COMPARISON

DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
DATE	10/20	21	22	23	24	25	26	27	28	29	30	31	11/1	2	3	4
KSF RISK				1	2	3	2	2	2	1					1	1
SBO	X	X	X	X												
LOCA											X	X	X	X	X	X
FIRE	X	X	X	X	X	X	X	X	X	X	X					
TOTALS	2	2	2	3	3	4	3	3	3	2	2	1	1	1	2	2

DAY	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
DATE	11/5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
KSF RISK	1	1	2	1	1	2	2	2	2	1						
SBO						X	X	X	X	X						
LOCA	X	X														
FIRE																
TOTALS	2	2	2	1	1	3	3	3	3	2						