Risk Informed Technical Specifications

CEOG Task 849

December 1- 3, 1999

Summary Status of Task 849 Activities

SUBTASK

- CSS AOT Extension JAR (CENPSD-1041)
  - JAR Completed; RAIs submitted, NRC SER in progress
- HPSI AOT Extension (CENPD-1045)
  - JAR Completed;RAIs submitted, NRC review In progress: SER being developed
- CIV AOT Extension (CENPSD-1168)
  - JAR submitted to NRC, July 27, 1999. Informal Questions: Common Cause Treatment and Assumption
- Battery AOT Extension
  - CEOG Questionnaire issued. Draft JAR. Technical Issues for PSASC Resolution

Status of CSS JAR AOT Extension

JAR Issued : March 11, 1998

NRC RAIs issued: June 23, 1998

Response to RAIs: March, 1999

NRC Review: Complete

SER Expected: Complete with exception of ISTS Mark-up

Status of HPSI JAR AOT Extension

JAR Issued :April 6, 1998

NRC RAIs issued: June 23, 1998

Response to RAIs: May, 1999

NRC Review: In Progress

- Restrictions on use to be controlled via CRMP or included in TS
- Longer duration repairs for functional system OK (e.g. Single valve Unavailable).
- HPSI CRMP guidance may be required prior to approval
- Plants with high ICCDP may require additional restrictions
- Questions on Success Criteria

SER Expected : January

Range of SAOT Risk in HPSI Report

TABLE 6.3.2-4
BOUNDING SINGLE AOT (SAOT) RISK FOR PM*

PLANT GROUP	PLANTS	SAOT RISK	COMMENT
SWING HPSIP AVAILABLE	MY, ANO2, MP2, SCE	1.5E-06 TO ~3.2E-06	Entry into LCO ACTION STATEMENT for HPSI Pump repair is expected to be an infrequent occurrence.
ASYMMETRICALLY CONFIGURED SPARE HPSIP	FCS,WSES	<4E-07	very low risk evolution
NO SPARE AVAILABLE	PVNGS, SL1, SL2	1.53E-06 TO 2.73E-06	Long PMs that disable a HPSI subtrain not expected

* Based on proposed AOT

CIV Tech Spec AOT Extension

Scope

- Assess the risk of extending the AOT/CT for maintaining a CIV in the locked open position for up to 7 days
- Develop a joint application report seeking relaxation to the existing AOTs defined in the CIV Technical Specification.
- Provide qualitative recommendation to treat CIV "fail to open" in appropriate system Technical Specification

Risk Assessment Methodology

- Group the various containment penetrations into defined classes (i.e., Class A, B, C, D and E)
- For each class, sub-divide the containment penetrations into generic type of configurations based on CDP/LERP impact due to CIV failure
- For each generic configuration, estimate bounding ICCDP and ICLERP due to the CIV AOT extension
- Compare results with the acceptance criteria for ICCDP and ICLERP (5.0E-7 and 5.0E-8, respectively), based on recommended values of RG 1.177

Summary of Results

- Bounding calculations demonstrate that:
  ICCDP < 5.0E-8
  ICLERP < 9.0E-9 (for non-seismically designed lines)
  < 2.0E-9 (for seismically designed lines)
- Plant risk (i.e., ICCDP & ICLERP) is well below the RG 1.177 acceptance criteria of 5.0E-7 and 5.0E-8, respectively.

Status of CIV AOT Extension

- CIV AOT Extension Joint Application Report submitted to NRC in late July 27, 1999 (CEOG-99-239)
- ISTS Markup to be pursued through ISTSTF
- Technical Review nearing Completion.
- Contractor concerns relating to
  - Assessment of Common Cause. Analyses assume entry into TS with a single non-functional valve. Process not defined for ensuring correct action entered.
  - System maintenance assumptions did not consider valve body removal. Risks would be OK individually but multiple conditions should not be allowed.
  - Confirmation that no action sought "Class E" valves in the closed position (Safety valves that must be open for accident conditions)
  - Issues sent to PSASC and Licensing Subcommittees. Will involve ISTSTF.

Batt./Batt. Charger Tech Spec AOT Extension

Scope

- Assess extending the allowed outage time (AOT) for a DC power source (i.e., battery or battery charger) beyond the current 2 hour limit
- Develop a joint application report seeking relaxation to the existing AOT defined in the Technical Specification for "DC Sources - Operating".

Status of Battery AOT Extension

- Request for Batt./Batt. Charger AOT extension information was transmitted to PSASC members on June 7, 1999.
- All PSASC members with the exception of CC and MPW have responded to information request.
- Evaluated information received to date, estimation of ICCDP is ongoing to determine AOT limit. Initial Assessment
  - Generic Minimum AOT of 8 hrs
  - Minimum time may vary dependent on Battery Design
- Technical issues identified by NRC to IEEE/ISTSTF include (1) charger transient loading capabilities and (2) potential loss of DC bus

Battery AOT Extension

• Submit information request to PSASC members	complete
• Collect and process information	complete
• Develop Draft Battery TS AOT JAR	complete
• Submit JAR to PSASC for review	complete
• Resolve and incorporate comments	in progress
• Submit joint application report to NRC	TBD

Related Issues

- NRC raised concerns with the TSTF regarding changes being proposed for the battery AOT.
  - *Is the capacity of the battery charger(s) adequate for handling transient loading demands for post trip events, given that the battery is out of service?*
  - *Is there an increased potential for a loss of DC bus event with the battery out of service?*
- PSASC members have been requested to provide additional information so that the issue may be resolved.
  - *Confirm that the adequacy of the battery charger capacity was considered and accounted for in the PSA model and summarize the modeling assumptions,*
  - *Specify if the potential for a loss of DC event was considered in the previous analyses, and estimate the risk impact if the potential for loss of DC was not considered.*

Schedule for completion of Battery AOT

- Battery AOT is behind schedule
- A small amount of confirmatory work is required by members to address concerns NRC raised with ISTSTF.
- In some cases model changes and re-analysis may be required

Summary

- CSS SER expected shortly. No open issues noted.
- HPSI SER in preparation. Alternatives in SER may:
  - require plant specific confirmatory assessments to establish current value
  - Commitment and description of CRMP controls to limit extended outages for a non functional HPSI system
- CIV SER will emphasize ability to ensure common cause failures are not active.
  - How should we provide confirmation?
- Battery AOT report needs to address two technical issues prior to release
  - Increase in IEF associated with loss of DC bus
  - Treatment of backup capability of charger

TASK 1115

Global Risk Informed Technical Specifications

Short Term Initiatives

Task 1115

CEOG COMBUSTION ENGINEERING OWNERS GROUP

ABB

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TASK SUMMARY

- Technical support for Mode 4 end state
- Prepare CEOG document eliminating 3.0.3 entry for various loss of function conditions
- PSA support for relaxation of mode restraints

SCE pilot plant and representative plant for generic analyses

CEOG COMBUSTION ENGINEERING OWNERS GROUP

ABB

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MODE 4 END STATE

- PSA validation demonstrating risk of Mode 4 operation is acceptable
  - Mode 4 often lower risk than Mode 5
  - Mode 4 on AFW avoids risk of transitions
  - Draft report being modified to include SCE inputs
  - Draft report modified to address issued raised by NRC reviewer
    - » increased discussion of benefits of Mode 4 AFW operation and risks of SDC entry
    - » added discussion of mode 5 vented and mode 5 unvented operation
    - » Added technical detail on disposition of non-included SD IE events
  - Draft due by mid December
  - Report to be sent to CEOG/RITSTF for review
  - Final report to be submitted to NRC

NM 3.0.3 ENTRY FOR LOSS OF FUNCTION

- Identify TS elements where 3.0.3 action is required in ISTS and define alternative action
- Action based on loss of function with risk informed allowed outage times
- Many conditions bounded by generic assessments
- Plant specific "at power" PSA calcs maybe required for some assessments
- Data request will be prepared by mid December

RELAXATION OF MODE RESTRAINTS

- **Identify conditions where mode restraints should be maintained**
- **Relax T.S. restrictions that prevent entry into higher mode provided risk assessment performed**
- **Simplified generic PSA assessment performed by SCE. Used as basis for RITSTF submittal. Detailed report may not be required.**

Schedule

- End State Draft due for PSASC Review by mid December
- Final Report due by Mid February
- Mode restraints to be submitted via Generic TS Bases
- 3.0.3 Avoidance.
  - » Questionnaire for limited analyses : Mid December
  - » CEOG Summary Document by March 2000

CEOG TASKS TO SUPPORT QUALITY PSAs

Alan Hackerott
Chairman, CEOG-PSASC
December 3, 1999

Scope of CEOG Activities that Support PSA Quality

- PSA quality is supported and improved via a range of PSA infrastructure enhancement and Application Specific activities, including:
- Joint Application Cross Comparisions
  - Cross Comparison of PSA Results, Modeling Assumptions and inputs
  - Development of issue specific PSA standards
  - Development of Good Practices and Applications Guidelines
  - Commitment to PSA Peer Review
  - Proactive program to resolve group issues

CEOG Comparisons

- JAR applications resulted in limited scope component based cross comparisons
- Specific Applications Include
  - ECCS Components (LPSI,HPSI,SIT)
  - CSS
  - Batteries
  - Other Components investigated early in process
    - AFW
    - MSSV
- Comparisons used to identify and resolve basis for plant to plant variability

Cross Comparisons of PSA Assumptions, Models and Results

- A multi-Phase hierarchical comparison effort was initiated in 1995.
  - Phase 1: CDFs,IEFs, relative contributions
  - Phase 2: Component failure rate ranges
  - Phase 3: Common Cause Components
  - Phase 4: Human Factors / dependencies
  - Phase 5: Focused Cut Set Reviews

PSA Standards Development for CEOG

- Standards developed for:
  - ATWS Methodology
  - RCP Seal Failure Frequency (Post IPE)
  - LOCA Frequency Distribution (submitted to industry as strawman; considers LBB)
  - SGTR frequency
  - Selection of Common Cause Components
  - Number of required injection paths

Guidelines

- Configuration Risk Management Program Guidance
- Expert Judgement
- Risk Ranking
- Treatment of Non-PSA HSSCs(*)

Commitment to Overall Quality

- Peer Review Process (All CEOG utilities committed to peer review process)
- Support of ASME Standard

Proactive Programs to Resolve Group Issues

- Issue resolution process
  - program for resolution of CEOG member common PSA issues
- Mechanistic RCP Seal Model

Risk-Informed Technical Specifications

Low Power Shutdown Risk

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Agenda

- Background
- Low Power Shutdown (LPSD) Risk Assessment Methodology
- Major Assumptions
- Low Power vs. Full Power Success Criteria
- LPSD Risk Sensitivities
- Summary

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Background

- LPSD Risk Performed Since 1990
- Started LPSD PRA Models in 1993
- LPSD Risk Used For Outage Risk Planning and Monitoring, RI-IST, RI-TS, and Outage Safety Significance Determinations

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Low Power and Shutdown Risk Assessment Methodology

- WINNUPRA/Safety Monitor
- Full Event Tree/Fault Tree Model
- Only Internal Events Modeled
- Complete System Models
  - Full Power Models used with LPSD enhancements

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LPSD Methodology (con't)

- 41 Low Power/ Shutdown Plant Operating States (POS)
  - Vent size and availability, RCS level, time since shutdown, RCS draining, equipment availability
  - 3 - 5 POS dominate risk profile

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Risk Profile

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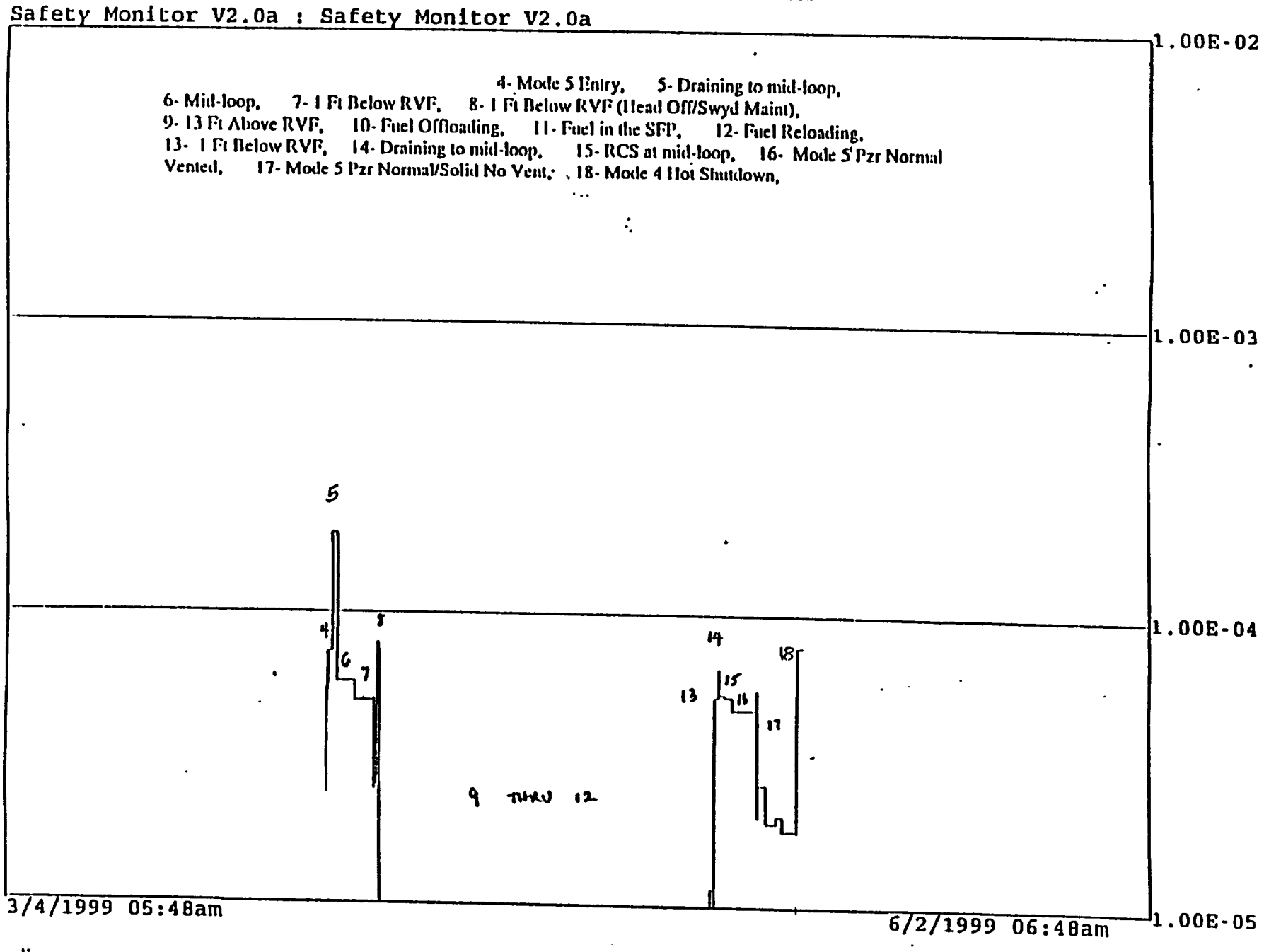
UNIT 3 CYCLE 10 REFUELING OUTAGE



INSTANTANEOUS CORE DAMAGE RISK PROFILE

LPSD Methodology (con't)

- Human Reliability Analysis (HRA) Methods Are The Same As Full Power (i.e. Dr. Swain's THERP method)
  - Mission times based on time to core boiling and core uncovery
  - HRA probabilities are conservative
- System Models And Support System Dependencies Are Essentially The Same As Full Power

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Initiating Events

- Grid-Related Loss of Offsite Power
- Plant-Centered Loss of Offsite Power
- Loss of Shutdown Cooling
  - modeled using fault tree (vs point estimate)
  - includes loss of support system such as CCW, HVAC

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Initiating Events (con't)

- Loss of Inventory (LOI)
  - event frequency based on NSAC data
  - LOI frequency reduced by factor of 10 (judgement) when not in draining or filling operation

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System Alignments

- The SONGS LPSD includes multiple alignments for the following systems:
  - Component Cooling Water
  - Salt Water Cooling
  - Shutdown Cooling
  - Containment Spray
  - High Pressure Safety Injection
  - CVCS

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Major Assumptions

- Core Damage is Defined To Be Core Uncovery
- Large Early Release Not Possible At LPSD
- Gravity Feed Is Not a Success Path (Surge Line Flooding) Unless RPV Head Is Removed
- Containment Spray Pumps Backup The LPSI Pumps For SDC

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Full Power vs. LPSD Success Criteria

	Full Power	LPSD
HPSI	2 of 4 injection lines	1 of 4 injection lines
LPSI (SDC)	2 of 4 injection lines 1 of 2 pumps	1 of 4 injection lines 1 of 4 pumps (incl CS pp)
CS	1 of 2 trains	1 of 2 pumps (SDC backup)
CCW	1 of 2 trains 1 of 3 pumps	same
SWC	1 of 4 pumps 1 of 2 trains	same
AFW	1 of 3 pumps	1 of 2 pumps (turbine drive pump unavailable)
Electrical	1 of 2 trains	same
Core Damage	Core Uncovery	same

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LPSD Risk Sensitivities

- Conservative HRA Leads To Conservative Results
- Loss of Inventory Event Frequency
  - Dominant During Draindown POS
- Initiating Events Contribute Rather Equally For POSs Other Than Draining

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Significant Operator Actions

- Operator Isolates Coolant Diversion Prior To Loss Of SDC
- Operator Initiates Backup SDC Prior To Boiling
- Operator Initiates RCS Make-Up Prior to Core Uncovery
- Operator Initiates DG Cross-tie To Other Unit
- Recovery of Offsite Power

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Summary

- LPSD Risk Analysis Can Give Meaningful, Quality Results Comparable to Full Power Analyses Given:
  - System Success Criteria Are Accurately Captured
  - Operator Recoveries Are Understood
  - Sensitivity to Operator Action Probabilities Are Appreciated
  - Level of Detail of the System Models Is Equivalent To Full Power Models

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Risk Informed Technical Specification Task Force SONGS PRA Presentation

Dennis W. Henneke
SONGS Nuclear Safety Group
10/6/99

SCE Living PRA/Safety Monitor

- ✓ The SONGS 2/3 PRA model is developed and maintained on WINNUPRA, and can be solved on either WINNUPRA or Safety Monitor.
- ✓ Scope of the PRA includes:
  - All modes 1 to 6, refueling and offloaded.
  - External Events for modes 1-4 (Fire/Seismic)
  - Fault Tree Initiating Events for Support systems (e.g., CCW or SDC).

SCE Living PRA/Safety Monitor

- ✓Differences between WINNUPRA and Safety Monitor include:
  - WINNUPRA:
    - Solve individual event trees, sequences etc., or the Safety Monitor top logic model.
    - Software helps in troubleshooting results, viewing solution steps, performing sensitivity, etc.
  - Safety Monitor:
    - Solves whole model (top logic model) each time.
    - Can easily run selected configurations (3-5 min).

SCE Living PRA/Safety Monitor

- ✓Living PRA:
  - PRA is constantly being updated, as new PRA information becomes available or modeling enhancements are performed.
  - Failure Data for major equipment is updated each plant cycle.
  - PRA modeling basis and changes are tracked electronically

Full Power and Transition Models

- The following categories are used for the SONGS 2/3 PRA:
  - Full power: Mode 1
  - Transition: Modes 2, 3, and 4 on AFW
  - Shutdown: Mode 4 on SDC, Modes 5,6 and offloaded.
- Full Power and Transition models include both internal and external events (EEs) .
  - EEs are not used for comparison to shutdown.

Full Power and Transition Models - Continued

- ✓Transition Models are similar to Full Power, with some changes:
  - Pressurizer Safety Lift less likely in modes 2,3 and not possible in mode 4.
  - ATWS Less likely in mode 2 and not possible in modes 3,4.
  - Loss of AFW used instead of Loss of MFW for modes 3, 4 (MFW Not Available for SONGS).
    - AFW TD Pump not available in mode 4 for SONGS
  - Init-LOP increased for modes 3-6, offloaded.

Full Power and Transition Models - Continued

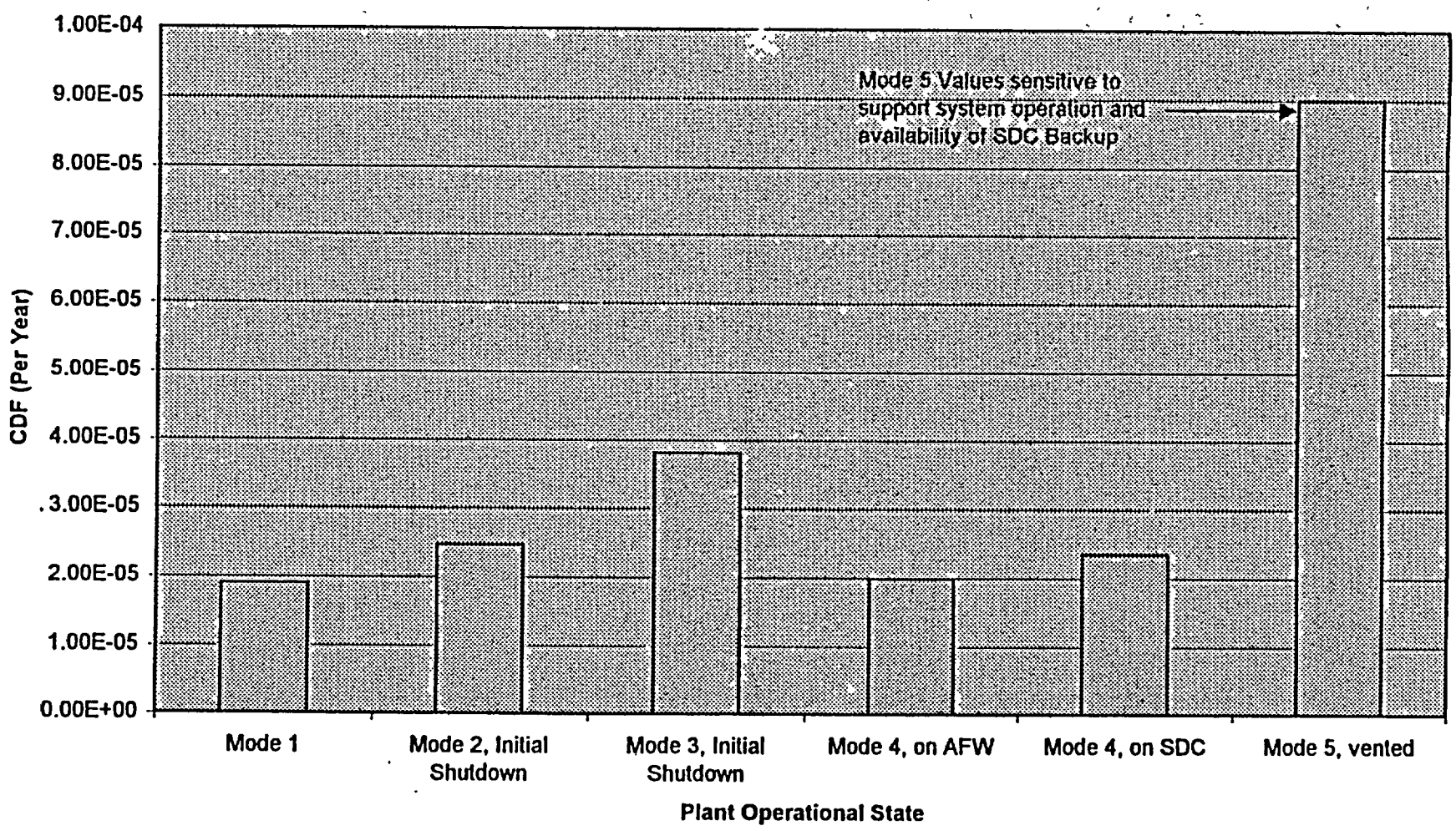
- TT, Rx Trip, etc. set to zero in modes 3/4.
- More time available (2 hours versus 1 hour) for recovery of offsite power and MFW/Condensate.
- LOCA Initiating Events reduced by a factor of 20 for mode 4.
- Loss of MFW increased by 4 in mode 2.
- Other Model adjustments needed for conditional events, such as operator responses, fast bus transfer, or conditional loss of offsite power.

Full Power and Transition Models - Continued

- ✓ Human actions for modes 1-4 are mostly the same, except time related actions.
- ✓ Important IEs change from a typical PRA result in mode 1 to dominated by loss of AFW in mode 3-4, or loss of offsite power.

DRAFT - SONGS
10/4/99

Total CDF, all Initiating Events
SONGS Transition Risk Model
Draft, Rev. 2



Full Power and Transition Models - Continued

- ✓Model Sensitivity:
  - MFW assumed available had little affect on the result, since condensate pumps are already assumed available on all non-LOP sequences.
  - Feed& Bleed/PORV availability will lower results in mode 1-4, but only slightly.
  - SONGS 2/3 Emergency DG Crosstie removal would raise the PRA results for all modes, but the relative risk would remain similar.

Full Power and Transition Models - Continued

✓Model Sensitivity:

- TD AFW Pump being available in mode 4 would lower mode 4 results, with a greater reduction in mode 4 AFW.
- Containment Spray is assumed available for SDC backup. Removal of this results in a factor of 1.5 to 2 for credited modes.

Full Power and Transition Models - Continued:

- ✓Model Sensitivity Conclusions.
  - –Major sensitivities looked at above do not change the general results that mode 4 on AFW has the lowest shutdown risk, and most defense in depth.