

ENCLOSURE

CALVERT CLIFFS NUCLEAR POWER PLANT
EMERGENCY ACTION LEVELS TECHNICAL BASIS DOCUMENT
REVISION 3

9602220363 960215
PDR ADOCK 05000317
F PDR

Baltimore Gas & Electric Company
Docket Nos. 50-317 and 50-318
Independent Spent Fuel Storage Facility Docket No. 72-8
February 15, 1996

ENCLOSURE

CALVERT CLIFFS NUCLEAR POWER PLANT EMERGENCY ACTION LEVELS TECHNICAL BASIS DOCUMENT REVISION 3

SUMMARY

Only the revised pages of the Technical Basis Document are included in this transmittal. New words/information are identified by bold letters and revision bars. Deleted words/information are identified by line-out and revision bars. Typographical and reference corrections are identified by revision bars only.

SPECIFIC REVISION ITEMS

Page	Item
i	<u>Table of Contents:</u> Added "QA4 - Station Blackout While Defueled," page Q:14. Renumbered pages Q:14 through Q:19 to accommodate new page.
A:2	Deleted non applicable step.
G:8	Added new initiating condition, "QA4 - Station Blackout While Defueled."
Q:14	<u>Calvert Cliffs Initiating Condition:</u> Basis for new Initiating Condition QA4 is QA Surveillance Report S-94-3-26. Regulatory Guide 1.101 (NUMARC/NESP-007) includes defueled as a mode. <u>Plant-Specific Information:</u> New basis analysis for creating the new Initiating Condition. <u>EAL:</u> New EAL worded to support analysis of Initiating Condition.
Q:15 through Q:21	Renumbered pages to accommodate new page Q:14.
E:7	Added a cross-reference to the new initiating condition to aid document users.

Continued on the next page.

ENCLOSURE

CALVERT CLIFFS NUCLEAR POWER PLANT EMERGENCY ACTION LEVELS TECHNICAL BASIS DOCUMENT REVISION 3

I:1	<p><u>Plant-Specific Information:</u> Added the statement "Calvert Cliffs EAL is based directly on NUMARC."</p> <p>Removed reference to areas of concern for safe shutdown based on the revised EAL.</p>
I:2	<p><u>Table:</u> Removed the table containing "Areas of Concern for Safe Shutdown." Continuation of revised Plant-Specific Information.</p> <p><u>EAL:</u> Revised EAL to support the revised plant-specific information.</p> <p><u>References:</u> Removed reference to AOPs referring to safe shutdown. Added references supporting new analysis of Initiating Condition.</p>
I:3	<p><u>Plant-Specific Information:</u> Added analysis for determining the magnitude of an Alert level fire. This methodology is with the Unusual Event Initiating Condition.</p> <p><u>EAL:</u> Reworded existing EAL to support the logic addressed in the Plant-Specific Information. Removed reference to explosion. This becomes a separate EAL.</p>

Continued on the next page.

ENCLOSURE

CALVERT CLIFFS NUCLEAR POWER PLANT EMERGENCY ACTION LEVELS TECHNICAL BASIS DOCUMENT REVISION 3

I:4	<p><u>Plant-Specific Information:</u> (Continued from I:3) Continuation of revised Plant-Specific Information.</p> <p><u>EAL 2:</u> New EAL to support the analysis of the Initiating Condition.</p> <p><u>EAL 3:</u> New stand-alone EAL for explosion.</p> <p>Information added to characterize the nature of an explosion. Removed analysis of how fire affects the ability to achieve safe shutdown is determined.</p> <p><u>Table:</u> Corrected reference to 21 Fuel Oil Storage Tank.</p> <p>New analysis identifies how the significance of fire and explosions is determined.</p>
I:5	<p><u>References:</u> Added references supporting new analysis of the Initiating Condition.</p>
O:1	<p>Typographical errors corrected.</p>

TABLE OF CONTENTS

CALVERT CLIFFS NUCLEAR POWER PLANT UNITS 1 & 2

EMERGENCY ACTION LEVELS TECHNICAL BASIS DOCUMENT

REVISION 3

PREPARED:	<u><i>G. C. Rudigier</i></u>	DATE:	<u>1/29/96</u>
	Emergency Planning - G. C. Rudigier		
REVIEWED:	<u><i>J. V. Grooms</i></u>	DATE:	<u>1/29/96</u>
	Plant Operations - J. V. Grooms		
REVIEWED:	<u><i>D. G. Frazier</i></u>	DATE:	<u>1/24/96</u>
	Operations Training - D. G. Frazier		
REVIEWED:	<u><i>G. K. Bailey</i></u>	DATE:	<u>1/25/96</u>
	Chemistry Programs - G. K. Bailey		
REVIEWED:	<u><i>E. H. Roach</i></u>	DATE:	<u>1/24/96</u>
	Radiation Safety - E. H. Roach		
REVIEWED:	<u><i>C. J. Ludlow</i></u>	DATE:	<u>1/24/96</u>
	Design Engineering-Mechanical -C. J. Ludlow		
REVIEWED:	<u><i>R. B. Sydnor</i></u>	DATE:	<u>1/24/96</u>
	Design Engineering-Electrical -R. B. Sydnor		
REVIEWED:	<u><i>S. N. Bailey</i></u>	DATE:	<u>1/24/96</u>
	Nuclear Engineering - S. N. Bailey		
REVIEWED:	<u><i>M. R. Neyman</i></u>	DATE:	<u>1/24/96</u>
	Security - M. R. Neyman		
REVIEWED:	<u><i>J. M. Osborne</i></u>	DATE:	<u>1/24/96</u>
	Licensing - J. M. Osborne		
APPROVED:	<u><i>T. E. Forgette</i></u>	DATE:	<u>1-31-96</u>
	Director-Emergency Planning Unit - T. E. Forgette		
REVIEWED:	<u><i>John Tull</i></u> 96-009	DATE:	<u>1-31-96</u>
	POSRC Meeting No.		
APPROVED:	<u><i>F. E. Kelly</i></u>	DATE:	<u>1/31/96</u>
	Plant General Manager		

Effective Date: with ERPIP 3.0, Revision 18, Change 5

<u>PAGE</u>	<u>REVISION</u>
i	3
ii	1
iii	0
A:1	-
A:2	3
A:3	1
G:1	0
G:2	0
G:3	0
G:4	0
G:5	0
G:6	0
G:7	0
G:8	3
G:9	0
G:10	0
R:1	0
R:2	0
R:3	1
R:4	0
R:5	1
R:6	0
R:7	0
R:8	0
R:9	0
R:10	0
R:11	0
R:12	0
R:13	0
R:14	1
R:15	0
R:16	0
R:17	0
R:18	0
R:19	0
R:20	0
R:21	0
R:22	0
R:23	0
R:24	0
B:1	0
B:2	0
B:3	1
B:4	1
B:5	1
B:6	0
B:7	0

<u>PAGE</u>	<u>REVISION</u>
B:8	0
B:9	0
B:10	0
B:11	0
B:12	0
B:13	0
B:14	0
B:15	0
B:16	0
B:17	0
B:18	0
B:19	0
B:20	0
B:21	0
B:22	0
B:23	0
B:24	1
B:25	0
B:26	0
B:27	0
B:28	0
B:29	0
B:30	0
B:31	0
B:32	0
B:33	0
B:34	1
B:35	1
B:36	0
B:37	0
B:38	0
Q:1	0
Q:2	0
Q:3	0
Q:4	0
Q:5	0
Q:6	0
Q:7	0
Q:8	0
Q:9	0
Q:10	0
Q:11	0
Q:12	0
Q:13	0
Q:14	3
Q:15	3
Q:16	3
Q:17	3
Q:18	3
Q:19	3
Q:20	3
Q:21	3

<u>PAGE</u>	<u>REVISION</u>
E:1	0
E:2	0
E:3	0
E:4	0
E:5	0
E:6	0
E:7	3
E:8	1
E:9	1
E:10	0
E:11	1
E:12	0
E:13	0
E:14	0
E:15	0
E:16	0
T:1	1
T:2	1
T:3	1
T:4	1
I:1	3
I:2	3
I:3	3
I:4	3
I:5	3
N:1	0
N:2	0
N:3	0
N:4	0
O:1	3
O:2	0
O:3	0
O:4	0
O:5	0
O:6	0
O:7	0
O:8	0
O:9	0
O:10	0
O:11	0
O:12	0
O:13	0
O:14	0
O:15	0
O:16	0

TABLE OF CONTENTS

ADMINISTRATIVE CONTROL OF THE EAL TECHNICAL BASIS	A:1
GENERAL NOTES FOR EAL TECHNICAL BASIS	G:1
RADIOACTIVITY RELEASE	
RU1 Unplanned Radioactive Release Exceeding 2 X Tech Spec Limits for AT LEAST 60 Minutes	R:1
RU2 Unexpected Increase in Plant Radiation	R:5
RU3 Potential Degradation of Containment of Dry Stored Spent Fuel	R:7
RA1 Unplanned Radioactive Release Exceeding 200 X Tech Spec Limits for AT LEAST 15 Minutes	R:9
RA2 Damage OR Uncovery of Single Irradiated Fuel Assembly Outside the Reactor Vessel ..	R:13
RA3 Radiation Increases That Impede Safe Plant Operation	R:15
RS1 Off-Site Dose of AT LEAST 0.1 Rem (EDE + CEDE) Or 0.5 Rem CDE Thyroid	R:18
RG1 Off-Site Dose of AT LEAST 1 Rem (EDE + CEDE) Or 5 Rem CDE Thyroid	R:22
FISSION PRODUCT BARRIER DEGRADATION	
BU1 Loss OR Potential Loss of CNTMT Barrier	B:1
BU2 RCS Leakage	B:2
BU3 Fuel Clad Degradation	B:4
BA1 Loss OR Potential Loss of EITHER Fuel Clad Barrier OR RCS Barrier	B:6
BS1 Loss Or Potential Loss of ANY Two Barriers	B:7
BG1 Loss of Two Barriers AND Potential Loss of Third Barrier	B:10
FUEL CLAD BARRIER EALs	B:11
FCB1 Safety Function Status/Functional Recovery	B:12
FCB2 Temperature	B:14
FCB3 Radiation	B:15
FCB4 Reactor Vessel Water Level	B:17
FCB5 SEC Judgement	B:18
RCS BARRIER EALs	B:19
RCB1 Safety Function Status/Functional Recovery	B:20
RCB2 Temperature	B:22
RCB3 Radiation	B:24
RCB4 Coolant Leakage	B:25
RCB5 SEC Judgement	B:27
CONTAINMENT BARRIER EALs	B:28
CNB1 Safety Function Status/Functional Recovery	B:29
CNB2 Temperature	B:30
CNB3 Radiation	B:32
CNB4 Coolant Leakage	B:34
CNB5 Pressure	B:36
CNB6 SEC Judgement	B:38
EQUIPMENT FAILURE	
QU1 Unplanned Loss of Any Function Needed to Maintain Cold Shutdown	Q:1
QU2 Unplanned Loss of Most or All Safety System Annunciators for GREATER THAN 15 Minutes	Q:3
QU3 Unplanned Loss of All On-Site or Off-Site Communications Capabilities	Q:5
QU4 Inability to Reach Required MODE Within Technical Specification Limits	Q:7
QA1 Failure of Automatic Reactor Trip	Q:8
QA2 Inability to Maintain Plant in Cold Shutdown	Q:10
QA3 Unplanned Loss of Safety System Annunciators With Transient In Progress	Q:12
QA4 Station Blackout While Defueled	Q:14
QS1 Failure of BOTH Automatic AND Manual Reactor Trip	Q:4415
QS2 Complete Loss of Function Needed to Achieve or Maintain Hot Shutdown	Q:4516
QS3 Loss of Water Level That Can Uncover Fuel in the Reactor Vessel	Q:4718
QG1 Failure of BOTH Automatic AND Manual Reactor Trip -AND- Extreme Challenge to the Ability to Cool the Core	Q:4920

ADMINISTRATIVE CONTROL OF THE EAL TECHNICAL BASIS

Administrative revisions shall not change the intent of the Basis AND shall not cause a wording difference with ERPIP 3.0, Attachment 1.

IV.B.1.b. Administrative revisions shall be approved by the Director-Emergency Planning.

c. Administrative revisions approved by the Director-Emergency Planning will be distributed in accordance with PR-2-100, Document and Drawing Control.

2. Technical revision.

a. Technical revisions shall be reviewed by:

- (1) Emergency Planning
- (2) Nuclear Operations
- (3) Operations Training
- (4) Chemistry Programs
- (5) Radiation Safety
- (6) Nuclear Engineering
- (7) Design Engineering
- (8) Nuclear Security
- (9) Licensing

b. The Emergency Planning reviewer will collect and reconcile review comments. Reviews will be documented on the Basis review/approval sheet.

c. Technical revisions shall be approved by the Director-Emergency Planning. The Director will consider review comments and their reconciliation.

d. Technical revisions shall be submitted to POSRC and the Plant General Manager in accordance with NS-2-101, Conduct of the Plant Operations and Safety Review Committee/Procedure Review Committee/Qualified Reviewer.

e. Technical revisions approved by the Plant General Manager shall be submitted to the NRC for information in accordance with CCI-154, Preparation of NRC Correspondence. This submittal shall specify that a revision to ERPIP 3.0, Attachment 1, Emergency Action Levels, to implement the Basis document change, will be processed in forty-five (45) days.

f. After action IV.B.2.e. is complete (i.e., the correspondence is mailed) then a revision to ERPIP 3.0, Immediate Actions, Attachment 1, Emergency Action Levels may be initiated in accordance with ERPIP 900, Preparation of Emergency Response Plan and Emergency Response Plan Implementation Procedures. ~~Use the revised Basis document to demonstrate that the effectiveness of the Plan has not been reduced (i.e., that as revised, the EAL scheme continues to meet the guidance addressed in R.G. 1-101, revision 3).~~ The effective date

GENERAL NOTES FOR EAL TECHNICAL BASIS

Table G-3: Comparison of NUMARC Guidelines to BG&E ICs
NUMARC System Multifunction Category

Emergency Class	Generic NUMARC IC	Calvert Cliffs IC
Unusual Event	SU1 - Loss of All Offsite Power to Essential Busses for Greater Than 15 Minutes	EU1 - Loss of Off-Site Power
	SU2 - Inability to Reach Required Shutdown Within Technical Specification Limits	QU4 - Inability to Reach Required MODE Within Technical Specification Limits
	SU3 - Unplanned Loss of All Safety System Annunciators for Greater Than 15 Minutes	QU2 - Unplanned Loss of Most or All Safety System Annunciators for GREATER THAN 15 Minutes
	SU4 - Fuel Clad Degradation	BU3 - Fuel Clad Degradation
	SU5 - RCS Leakage	BU2 - RCS Leakage
	SU6 - Unplanned Loss of All Onsite or Offsite Communications Capabilities	QU3 - Unplanned Loss of All On-Site or Off-Site Communications Capabilities
	SU7 - Unplanned Loss of Required DC Power During Cold Shutdown or Refueling Mode for Greater Than 15 Minutes	EU2 - Loss of Vital 125 Volt DC Power for GREATER THAN 15 Minutes
	Shutdown EAL not currently addressed by NUMARC	QU1 - Unplanned Loss of Any Function Needed to Maintain Cold Shutdown
Alert	SA1 - Loss of All Offsite Power and Loss of All Onsite AC Power During Cold Shutdown or Refueling Mode	EA1 - Station Blackout While on Shutdown Cooling QA4 - Station Blackout While Defueled
	SA2 - Failure of Reactor Protection System Instrumentation to Complete or Initiate an Automatic Reactor Scram Once a Reactor Protection System Setpoint Has Been Exceeded and Manual Scram Was Successful	QA1 - Failure of Automatic Reactor Trip
	SA3 - Inability to Maintain Plant in Cold Shutdown	QA2 - Inability to Maintain Plant in Cold Shutdown
	SA4 - Unplanned Loss of Most or All Safety System Annunciation or Indication in Control Room With Either (1) a Significant Transient in Progress or (2) Compensatory Non-Alarming Indicators not Available	QA3 - Unplanned Loss of Safety System Annunciators With Transient in Progress
	SA5 - AC Power Capability to Essential Busses Reduced to a Single Power Source for Greater Than 15 Minutes Such That Any Additional Single Failure Would Result in Station Blackout	EA2 - Only One AC Power Source Available to Supply 4kV Emergency Buses
Site Emergency	SS1 - Loss of All Offsite Power and Loss of All Onsite AC Power to Essential Busses	ES1 - Station Blackout
	SS2 - Failure of Reactor Protection System Instrumentation to Complete or Initiate an Automatic Reactor Scram Once a Reactor Protection System Setpoint Has Been Exceeded and Manual Scram Was NOT Successful	QS1 - Failure of BOTH Automatic AND Manual Reactor Trip
	SS3 - Loss of All Vital DC Power	EA3 - Loss of 125 Volt DC Power and Reactor Trip ES2 - Loss of All 125 Volt DC Buses
Site Emergency (Continued)	SS4 - Complete Loss of Function Needed to Achieve or Maintain Hot Shutdown	QS2 - Complete Loss of Function Needed to Achieve or Maintain Hot Shutdown
	SS5 - Loss of Water Level That Has or Will Uncover Fuel in the Reactor Vessel	QS3 - Loss of Water Level That Can Uncover Fuel in the Reactor Vessel
	SS6 - Inability to Monitor a Significant Transient in Progress	ES2 - Loss of All 125 Volt DC Buses
General Emergency	SG1 - Prolonged Loss of All Off-Site Power and Prolonged Loss of All On-Site AC Power	EG1 - Prolonged Station Blackout
	SG2 - Failure of the Reactor Protection System and Manual Scram was NOT Successful and There is Indication of an Extreme Challenge to the Ability to Cool the Core	QG1 - Failure of BOTH Automatic AND Manual Reactor Trip -AND- Extreme Challenge to the Ability to Cool the Core

EQUIPMENT FAILURE

Emergency Classification Level: ALERT

Applicable Operational Modes: DEFUELED

Calvert Cliffs Initiating Condition:

QA4 Station Blackout While Defueled

NUMARC Recognition Category: System Malfunction

NUMARC Initiating Condition:

SA1 Loss of All Off-Site Power and Loss of All On-Site AC Power to Essential Busses During Cold Shutdown Or Refueling Mode

Barrier: Not Applicable

NUMARC Generic Basis:

Loss of all AC power compromises all plant safety systems requiring electric power including RHR, ECCS, Containment Heat Removal, Spent Fuel Heat Removal and the Ultimate Heat Sink. When in cold shutdown, refueling, or defueled mode the event can be classified as an Alert because of the significantly reduced decay heat, lower temperature and pressure, increasing the time to restore one of the emergency busses, relative to that specified for the Site Emergency EAL. Escalating to Site <E>mergency, if appropriate, is by <Radioactivity Release or SEC> Judgement ICs. Fifteen minutes was selected as a threshold to exclude transient or momentary power losses.

Plant-Specific Information:

Of concern during defueled conditions is the loss of Spent Fuel Pool cooling. If either Unit has fuel in its reactor vessel then a Site Emergency or Alert will be declared under Initiating Condition ES1 and EA1 respectively for loss of all off-site power and loss of all on-site AC power to essential busses. This Initiating Condition (QA4) applies when both Units are defueled. When defueled, contingency plans are implemented for Spent Fuel Pool cooling malfunction regardless of the reason. Contingency plans are implemented concurrent with the problem recognition to restore power. To exclude declarations because of transients or momentary power losses, the temperature threshold of 155°F was selected. Temperature at this level (design temperature for the system) is a more appropriate indication that the loss of cooling and inability to restore it are an Alert level threat.

Thus, the EAL is written as:

Power to Spent Fuel Cooling Pumps lost AND Spent Fuel Pool temperature increases to greater than 155°F.

Source Documents/References/Calculations:

1. Abnormal Operating Procedures
 - AOP-3B, Abnormal Shutdown Cooling
 - AOP-6F, Spent Fuel Pool Cooling System Malfunctions
2. UFSAR, Chapter 9.4, Spent Fuel Pool Cooling System

EQUIPMENT FAILURE

Emergency Classification Level: SITE EMERGENCY

Applicable Operational Modes: 1, 2

Calvert Cliffs Initiating Condition:

QS1 Failure of BOTH Automatic AND Manual Reactor Trip

NUMARC Recognition Category: System Malfunction

NUMARC Initiating Condition:

SS2 Failure of Reactor Protection System Instrumentation to Complete or Initiate on Automatic Reactor Scram Once a Reactor Protection System Setpoint Has Been Exceeded and Manual Scram Was NOT Successful

Barrier: Not Applicable

NUMARC Generic Basis:

Automatic and manual scrams are not considered successful if action away from the reactor control console was required to scram the reactor.

Under these conditions, the reactor is producing more heat than the maximum decay heat load for which the safety systems are designed. A Site <E>mergency is indicated because conditions exist that lead to imminent loss or potential loss of both fuel clad and RCS. Although this IC may be viewed as redundant to the Fission Product Barrier Degradation IC, its inclusion is necessary to better assure timely recognition and emergency response. Escalation of this event to a General Emergency would be via Fission Product Barrier Degradation or <SEC Judgement> ICs.

Plant-Specific Information:

EOP-0, Post-Trip Immediate Actions, are described under IC QA1, Failure of Automatic Reactor Trip. As stated under QA1, entry into the Alert emergency classification occurs whenever it is determined by the Shift Supervisor that a required automatic reactor trip did not occur, based on the entry conditions into EOP-0. Entry into the Site Emergency is made consistent with EOP-0 procedural requirements and so corresponds to not satisfying the reactivity control criteria of EOP-0. This means that both automatic and manual actions were not effective in bringing the reactor subcritical and that entry into EOP-8, Functional Recovery Procedure, is required.

Thus, the EAL is written as:

EOP-8, Functional Recovery Procedure, is Implemented per EOP-0, Post Trip Immediate Actions, Reactivity Control

Can NOT is used because the ability to meet the final acceptance criteria is the appropriate concern, not whether intermediate acceptance criteria are not being achieved at one point in time.

Source Documents/References/Calculations:

1. Emergency Operating Procedures
 - EOP-0, Post-Trip Immediate Actions
 - EOP-8, Functional Recovery Procedure

EQUIPMENT FAILURE

Emergency Classification Level: SITE EMERGENCY

Applicable Operational Modes: 1, 2, 3, 4

Calvert Cliffs Initiating Condition:

QS2 Complete Loss of Function Needed to Achieve or Maintain Hot Shutdown

NUMARC Recognition Category: System Malfunction

NUMARC Initiating Condition:

SS4 Complete Loss of Function Needed to Achieve or Maintain Hot Shutdown

Barrier: Not Applicable

NUMARC Generic Basis:

This <IC and its associated Generic EAL> address complete loss of functions, including ultimate heat sink and reactivity control, required for hot shutdown with the reactor at pressure and temperature. Under these conditions, there is an actual major failure of a system intended for protection of the public. Thus, declaration of a Site <E>mergency is warranted. Escalation to General Emergency would be via <Radioactivity Release, Fission Product Barrier Degradation, or SEC Judgement> ICs.

Multi-unit stations with shared safety functions should further consider how this IC may affect more than one unit and how this may be a factor in escalating the emergency class.

Plant-Specific Information:

Per Calvert Cliffs Technical Specifications, the following functions are required to be operable during Cold Shutdown and Refueling modes and are necessary to maintain Hot Shutdown (Mode 4) conditions (temperature, pressure, and subcriticality):

- Reactivity Control Systems (TS 3.1)
- Coolant Loops and Coolant Circulation (TS 3.4.1, 3.9.8)
- ECCS Subsystems (TS 3.5.2, 3.5.3)
- Refueling Water Tank (TS 3.5.4)
- Safety Valves (TS 3.4.2)
- Service Water System (TS 3.7.4)
- Overpressure Protection System (TS 3.4.9.3)
- On-Site Power Sources (TS 3.8)
- Monitoring Instrumentation (TS 3.3.3)
- Reactor Coolant System Vents (TS 3.4.13)

AC and DC power systems availability are separately addressed under the Loss of Power Event Category. Thus, these are not addressed under this Initiating Condition. The Overpressure Protection System and Reactor Coolant System Vents are not directly related to core cooling and subcriticality functions. Failures of these systems functions resulting are addressed by Fission Product Barrier Degradation ICs. Loss of Monitoring Instrumentation is not directly related to maintaining subcriticality and heat removal functions, and therefore is not required to be addressed by this IC.

Per AOP-3B, Abnormal Shutdown Cooling Conditions, auxiliary feedwater and atmospheric steam dump capability to at least one SG is necessary to achieve Hot Shutdown conditions under natural circulation conditions. Around the transition from Mode 3 to Mode 4, the Shutdown Cooling System (SDCS) is typically used as the means to remove sensible and decay

EQUIPMENT FAILURE

heat. Once the SDCS is placed in service, the steam generator heat sink capability is no longer necessary. Thus, the EAL reflects that neither the steam generators nor Shutdown Cooling are fully capable of performing heat removal functions. The applicable acceptance criteria for Core and RCS Heat Removal are shown on the Safety Function Status Checks and are fully explained under the basis information for EAL FCB1, Safety Function Status/Functional Recovery.

Per Technical Specification Table 1.1, Operational Modes, the required SDM is K_{eff} less than 0.99 for Mode 4 (Hot Shutdown). The existence of a positive startup rate that could not be eliminated by operation of any reactivity control mechanism corresponds to conditions where a major function intended for the protection of the public has failed and therefore meets the threshold for a Site Emergency classification.

Thus, EAL 1 is written as:

EOP-8, Functional Recovery Procedure, is Implemented AND EITHER of the Following:

- Reactivity Control Acceptance Criteria Can NOT Be Met
- Shutdown Cooling is NOT In Service AND Core and RCS Heat Removal Acceptance Criteria Can NOT Be Met

Can NOT is used because the ability to meet the final acceptance criteria is the appropriate concern, not whether intermediate acceptance criteria are not being achieved at one point in time.

In service means that the SDCS is in the proper configuration for RCS heat removal (SDCS isolation valves open, LPSI pumps operating, etc.) and is considered "operable" as defined in the Calvert Cliffs Technical Specifications Section 1.6.

In order for there to be a path for heat removal between the core and the steam generators or the shutdown cooling system, there must be enough RCS liquid inventory to maintain natural circulation. Recent information from the CE Owners Group indicates that two-phase natural circulation (reflux boiling) works very well and will maintain the RCS between 200 °F and 300 °F. This requires that the RCS water level be below the top of the hot legs. Per AOP-3B, Attachment 14, 50" RVLMS Indication corresponds to the middle of the hot leg and is the 5th RVLMS alarm level. Staying above this level (and below the top of the hot legs at the 71" level) assures that, at a minimum, reflux boiling can be maintained.

Thus, EAL 2 is written as:

Zero (0) Indicated Subcooling Margin Determined Using CET Temperatures AND Valid RVLMS Level Indication of LESS THAN 50 Inches

Source Documents/References/Calculations:

1. Technical Specifications
2. Abnormal Operating Procedures
 - AOP-3B, Abnormal Shutdown Cooling Conditions
3. Emergency Operating Procedures
 - EOP-8, Functional Recovery Procedure
4. Internal Memorandum, J. R. Hill to R. L. Wenderlich, CE Operations Subcommittee Meeting - Trip Report, April 16, 1993

EQUIPMENT FAILURE

Emergency Classification Level: **SITE EMERGENCY**

Applicable Operational Modes: 5, 6

Calvert Cliffs Initiating Condition:

QS3 Loss of Water Level That Can Uncover Fuel in the Reactor Vessel

NUMARC Initiating Condition:

SS5 Loss of Water Level in the Reactor Vessel That Has or Will Uncover Fuel in the Reactor Vessel

Barrier: FUEL CLAD

NUMARC Generic Basis:

Under the conditions specified by this IC, severe core damage can occur and reactor coolant system pressure boundary integrity may not be assured. < For PWRs, this IC covers sequences such as prolonged boiling following loss of decay heat removal.

Thus, declaration of a Site <E>mergency is warranted under the conditions specified by the IC. Escalation to a General Emergency is via <Radioactivity Release IC RG1, Off-Site Dose of AT LEAST 1 REM (EDE+CEDE) Whole Body or 5 REM (CDE) Thyroid>.

Plant-Specific Information:

Sequences that can result in uncover of fuel in the reactor vessel (indirectly by prolonged boiling) include leakage through SG nozzle dams, pipe breaks in the Shutdown Cooling (SDC) System or Chemical & Volume Control System (CVCS), or loss of the SDC function. These leakage sources are outside the reactor vessel and at most could only result in water level decreases to the bottom of the hot leg elevation. This water level decrease would cause loss of SDC suction. In-core instrumentation (ICI) penetrations for Calvert Cliffs are through the vessel head. Thus, these do not have to be considered for this IC.

A review of attachments to AOP-3B, Abnormal Shutdown Cooling Conditions, shows that depending on previous power history and assuming an initial RCS temperature of 140°F, boiling in the core can begin in as little as 7 minutes following loss of SDC during mid-loop operation. AOP-3B also shows that under these conditions, without any operator action, core uncover can begin within about 80 minutes after loss of SDC.

Available methods to restore RCS inventory and to remove core heat include restoring the SDCS, injecting into the RCS from the Refueling Water Tank (RWT) using the HPSI, LPSI, CS or charging pumps, using the steam generators as a heat sink, using the Refueling Pool as a heat sink, aligning a LPSI pump to take suction from the RWT, or even injecting into the RCS using Safety Injection Tanks (SITs). *Given the number of methods to restore inventory, and the amount of time available, it is highly unlikely that this IC will be entered.*

Thus, the EAL is written as:

AOP-3B, Abnormal Shutdown Cooling Conditions, Is Implemented AND ANY of the Following Conditions Exist:

- Alternate Methods for Restoring RCS Inventory Are NOT Effective
- Valid RVLMS Reading Indicating 0% Level
- Valid CET Reading Indicating Superheat Conditions

NOT Effective means that inventory is not being restored based on available operable instrumentation readings such as CETs, RVLMS, Hot Leg Level, or from decreasing level indications from applicable suction sources such as the RWT, containment sump, or SITs.

Valid means that the indication is from instrumentation determined to be operable in accordance with the Technical Specifications or has been verified by other independent methods such as indications displayed on the control panels, reports from plant personnel, or radiological survey results. For example, under conditions where the CETs and the P.VLMS are disconnected to allow reactor vessel head removal, these instrument readings would not be valid.

Source Documents/References/Calculations:

1. Abnormal Operating Procedures
 - AOP-3B, Abnormal Shutdown Cooling Conditions

EQUIPMENT FAILURE

Emergency Classification Level: **GENERAL EMERGENCY**

Applicable Operational Modes: 1

Calvert Cliffs Initiating Condition:

QG1 Failure of BOTH Automatic AND Manual Reactor Trip -AND- Extreme Challenge to the Ability to Cool the Core

NUMARC Recognition Category: System Malfunction

NUMARC Initiating Condition:

SG2 Failure of the Reactor Protection System to Complete an Automatic Scram and Manual Scram was NOT Successful and There is Indication of an Extreme Challenge to the Ability to Cool the Core

Barrier: Not Applicable

NUMARC Generic Basis:

Automatic and manual scrams are not considered successful if action away from the reactor control console is required to scram the reactor.

Under the conditions of this IC and its associated <Generic> EAL, the efforts to bring the reactor subcritical have been unsuccessful and, as a result, the reactor is producing more heat than the maximum decay heat load for which the safety systems were designed. Although there are capabilities away from the reactor control console, such as emergency boration, <> the continuing temperature rise indicates that these capabilities are not effective. This situation could be a precursor for a core melt sequence.

For PWRs, the extreme challenge to the ability to cool the core is intended to mean that the core exit temperatures are at or approaching 1200°F or that the reactor vessel water level is below the top of the active fuel. <>

Another consideration is the inability to initially remove heat during the early stages of this sequence. For PWRs, if emergency feedwater flow is insufficient to remove the amount of heat required by design from at least one steam generator, an extreme challenge should be considered to exist. <>

In the event either of these challenges exist at a time that the reactor has not been brought below the power associated with the safety system design (typically 3% to 5% power), a core melt sequence exists. In this situation, core degradation can occur rapidly. For this reason, the General Emergency declaration is intended to be anticipatory of the fission product barrier matrix declaration to permit maximum offsite intervention time.

Plant-Specific Information:

EOP-0, Post-Trip Immediate Actions, are described under IC QA1, Failure of Automatic Reactor Trip. As stated under QS1, entry into the Site Emergency classification means that both automatic and manual reactor trip were not effective in bringing the reactor subcritical and that functional recovery of reactivity control is required in accordance with EOP-8. Escalation to the General Emergency is indicated whenever Reactor power is not decreasing following actions to bring the reactor subcritical including automatic and manual reactor trip, manually inserting the control rods, tripping the CEDM motor generator sets or performing emergency boration and there are indications of inadequate core cooling.

Thus, the EAL is written as:

EOP-8, **Functional Recovery Procedure**, is Implemented AND Both of the Following:

- Reactivity Control Can NOT Meet Acceptance Criteria AND
- Core and RCS Heat Removal Can NOT Meet Acceptance Criteria

Can NOT is used because the ability to meet the final acceptance criteria is the appropriate concern, not whether intermediate acceptance criteria are not being achieved at any given moment.

Source Documents/References/Calculations:

1. Emergency Operating Procedures
 - EOP-0, Post-Trip Immediate Actions
 - EOP-8, Functional Recovery Procedure

ELECTRICAL

Emergency Classification Level: **ALERT**

Applicable Operational Modes: **5, 6**

Calvert Cliffs Initiating Condition:

EA1 Station Blackout While On Shutdown Cooling

NUMARC Recognition Category: System Malfunction

NUMARC Initiating Condition:

SA1 Loss of All Off-Site Power and Loss of All On-Site AC Power to Essential Busses During Cold Shutdown Or Refueling Mode

Barrier: Not Applicable

NUMARC Generic Basis:

Loss of all AC power compromises all plant safety systems requiring electric power including RHR, ECCS, Containment Heat Removal, Spent Fuel Heat Removal and the Ultimate Heat Sink. When in cold shutdown, refueling, or defueled mode the event can be classified as an Alert because of the significantly reduced decay heat, lower temperature and pressure, increasing the time to restore one of the emergency busses, relative to that specified for the Site Emergency EAL. Escalating to Site <E>mergency, if appropriate, is by <Radioactivity Release or SEC> Judgement ICs. Fifteen minutes was selected as a threshold to exclude transient or momentary power losses.

Plant-Specific Information:

AOP-3B is the procedure entered in modes 5 and 6 for a loss of shutdown cooling regardless of the initiating fault. This procedure is implemented concurrent with problem recognition. Section IX of AOP-3B provides the procedural steps for restoration of electrical power to the 4kV power supplies. These are the safety related buses that provide power to the pumps used for shutdown cooling. This EAL addresses Station Blackout conditions during cold shutdown or refueling. For Station Blackout while defueled, see Initiating Condition QA4, Station Blackout while defueled.

Thus, the EAL is written as:

AOP-3B, Abnormal Shutdown Cooling, is Implemented Due to Loss of 4 kV Power Supplies For GREATER THAN 15 Minutes
--

Source Documents/References/Calculations:

1. Abnormal Operating Procedures
 - AOP-3B, Abnormal Shutdown Cooling

FIRE

Emergency Classification Level: UNUSUAL EVENT

Applicable Operational Modes: ALL

Calvert Cliffs Initiating Condition:

IU1 Fire Within Protected Area Boundary Not Extinguished Within 15 Minutes of Detection

NUMARC Recognition Category: Hazards and Other Conditions Affecting Plant Safety

NUMARC Initiating Condition:

HU2 Fire Within Protected Area Boundary Not Extinguished Within 15 Minutes of Detection

Barrier: Not Applicable

NUMARC Generic Basis:

The purpose of this IC is to address the magnitude and extent of fires that may be potentially significant precursors to damage to safety systems. This excludes such items as fires within administration buildings, waste-basket fires, and other small fires of no safety consequence. This IC applies to buildings and areas contiguous to plant vital areas or other significant buildings or areas. The intent of this IC is not to include buildings (i.e., warehouses) or areas that are not contiguous or immediately adjacent to plant vital areas. Verification of the alarm in this context means those actions taken in the control room to determine that the control room alarm is not spurious.

Escalation to a higher emergency class is by IC <IA1, Fire or Explosion Affecting Safe Shutdown>. <>

Plant-Specific Information:

Calvert Cliffs EAL is based directly on NUMARC.

~~Each Calvert Cliffs unit uses the Abnormal Operating Procedures (AOP) 9A through 9S to address fires within the plant protected and vital areas that are of particular concern because they contain equipment required for safe shutdown. Fire in the Control Room HVAC Room may lead to power being lost to the alternate shutdown panels. Thus, the Control Room HVAC Room (Room 512) has been added to the areas of concern for safe shutdown.~~

FIRE

Areas for Concern for Safe Shutdown

- | | |
|--|---|
| <ul style="list-style-type: none"> • Control Room • Control Room HVAC Room • Cable Spreading Room • Cable Chases • Switchgear Room • ECCS Pump Room • Service Water Pump Room • Component Cooling Pump Room • Main Steam Penetration Room | <ul style="list-style-type: none"> • Electrical Penetration Rooms • Auxiliary Feedwater Pump Room • Charging Pump Rooms • Diesel Generator Rooms • Refueling Water Tank (RWT) 11(21) • Condensate Storage Tank (CST) 12 • Pretreated Water Storage Tank (PWST) 11(21) • Fuel Oil Storage Tank (FOST) 12 |
|--|---|

This list of Safe Shutdown areas is displayed on the EAL Tables to assure that all areas related to Safe Shutdown are considered by the SEC.

Visible smoke is sufficient to conclude that a fire exists. Flames do not have to exist. Odor by itself does not constitute a fire.

A fire is extinguished when the Fire Brigade Leader determines that active combustion has ceased and there is no immediate danger of the fire spreading.

Thus, the EAL is written as:

Fire Within An Area Containing Safe Shutdown Equipment Lasting GREATER THAN 15 minutes..

Fire in/involving any of the below listed areas, that is not extinguished within 15 minutes of Control Room notification or receipt of a 1C24B, Fire System Control Panel, alarm for fire detection and fire suppression system actuation.

- | | |
|--|--|
| <ul style="list-style-type: none"> • Auxiliary Building • Containment • Containment Butler Bldg. • Containment Emergency Air Lock Vestibule • Diesel Generator rooms. • Diesel Generator Bldgs. (0C/1A) • Fire Pump House • Fuel Oil Storage Tanks | <ul style="list-style-type: none"> • Hydrogen Storage Tanks • Intake Structure • ISFSI Protected Area • Main station & service station transformers • North Service Bldg. 12 foot elevation • RWT Rooms • Turbine Building • 13KV Switchgear houses • 13KV Voltage Regulators |
|--|--|

Source Documents/References/Calculations:

1. Abnormal Operating Procedures
 - AOP 9A through 9S, Alternate Safe Shutdown/Control Room Evacuation procedure series
- 1.2: Issue Report IRO-012603, Fire in Room 512..., 10-23-92
2. April 28, 1995 letter, T. E. Forgette to Emergency Planning Unit file 9.5, re: April 14, 1995 fire in Unit 2 Auxiliary Building, five foot elevation, fan room.
3. Issue Report IRO-004-422 (AIT IR199502146), failure to declare Alert in exercise for fire/explosion.
4. EPU file 4.14, EALs; June 30, 1993 letter: "Methodology for Development of Emergency Action Levels", NUMARC/NESP-007, Revision 2, Questions and Answers, June 1993, Hazards and Other Conditions Affecting Plant Safety, question 7, page 22.

FIRE

Emergency Classification Level: **ALERT**

Applicable Operational Modes: **ALL**

Calvert Cliffs Initiating Condition:

IA1 Fire or Explosion Affecting Safe Shutdown

NUMARC Recognition Category: Hazards and Other Conditions Affecting Plant Safety

NUMARC Initiating Condition:

HA2 Fire or Explosion Affecting the Operability of Plant Safety Systems Required to Establish or Maintain Safe Shutdown

Barrier: Not Applicable

NUMARC Generic Basis:

(Site-specific) Areas containing functions and systems required for the safe shutdown of the plant should be specified. (Site-Specific) Safe Shutdown Analysis should be consulted for equipment and plant areas required for the applicable mode. This will make it easier to determine if the fire or explosion is potentially affecting one or more trains of safety systems. Escalation to a higher emergency class, if appropriate, will be based on <Equipment Failure, Electrical, Fission Product Barrier Degradation, Radioactivity Release, or SEC Judgement ICs>. <>

With regard to explosions, only those explosions of sufficient force to damage permanent structures or equipment required for safe operation within the identified plant area should be considered. As used here, an explosion is a rapid, violent, unconfined combustion, or a catastrophic failure of pressurized equipment, that potentially imparts significant energy to near-by structures and materials. The inclusion of a "report of visible damage" should not be interpreted as mandating a lengthy damage assessment before classification. No attempt is made in this <Generic> EAL to assess the actual magnitude of the damage. The occurrence of the explosion with reports of evidence of damage (e.g., deformation, scorching) is sufficient for the declaration. The declaration of an Alert and the activation of the TSC will provide the <SEC> with the resources needed to perform these damage assessments. The <SEC> also needs to consider any security aspects of the explosions, if applicable.

Plant-Specific Information:

Each Calvert Cliffs unit uses the Abnormal Operating Procedures (AOP) 9A through 9S to address fires within the plant protected and vital areas that are of particular concern because they contain equipment required for safe shutdown.

There are two independent clocks for determining the magnitude of a fire based on time. One clock starts when a fire is detected. For practical purposes a fire is detected when the report of the fire is received in the Control Room. Report of a fire may be by Control Room fire alarm or by voice message. A fire alarm refers to 1C24B, Fire System Control Panel, for fire detection and fire suppression system actuation. Fire pump running and trouble alarms by themselves do not constitute a report of a fire. This clock includes: the time it takes to confirm or verify the fire report, plus the response team assembly time, plus the time it takes the responders to establish a fire fighting strategy, plus the time it takes to actually extinguish the fire.

Thus, the EAL 1 is written as:

Fire in an Area of Concern for or Explosion Affecting the Ability to Achieve or Maintain Safe Shutdown that is not extinguished within 30 minutes of its detection.

FIRE

Visible smoke is sufficient to conclude that a fire exists. Flames do not have to exist. Odor by itself does not constitute a fire.

A fire is extinguished when the Fire Brigade Leader determines that active combustion has ceased and there is no immediate danger of the fire spreading.

The other clock for determining the magnitude of a fire is the time it takes to extinguish the fire. This clock begins when the first extinguishing agent is applied to the fire.

Thus, EAL 2 is written as:

Fire in an Area of Concern for Safe Shutdown that is not extinguished within 15 minutes of the first extinguishing agent being applied.

This EAL accounts for situations where the time to validate and respond to the fire is short.

EAL 3 is written as:

Explosion in an Area of Concern for Safe Shutdown.

An explosion is a rapid, violent, unconfined combustion, a catastrophic failure of pressurized equipment, or a violent electric arc, of sufficient force to potentially damage equipment, structures or components.

Determination of whether the fire is affecting ability to achieve or maintain safe shutdown is determined by physical observation, or by Control Room/local control station indications. Observation of damage to systems should be used to discriminate between a major fire and minor fires or fires in areas having a low probability of affecting safe shutdown. For example, this EAL is not expected to be entered for isolated breaker or motor fires. Operability determinations are not expected prior to declaration of this event based EAL.

Fire and/or explosion in the Control Room HVAC Room may lead to power being lost to the alternate shutdown panels. Thus, the Control Room HVAC Room (Room 512) has been added to the areas of concern for safe shutdown. The list of areas of concern for Safe Shutdown are shown below and are prominently displayed on the EAL Table.

Areas of Concern for Safe Shutdown	
<ul style="list-style-type: none">• Control Room• Control Room HVAC Room• Cable Spreading Room• Cable Chases• Switchgear Room• ECCS Pump Room• Service Water Pump Room• Component Cooling Pump Room• Main Steam Penetration Room	<ul style="list-style-type: none">• Electrical Penetration Rooms• Auxiliary Feedwater Pump Room• Charging Pump Rooms• Diesel Generator Rooms• Refueling Water Tank (RWT) 11(21)• Condensate Storage Tank (CST) 12• Pretreated Water Storage Tank (PWST) 11(21)• Fuel Oil Storage Tank (FOST) 21 42
This list of Safe Shutdown areas is displayed on the EAL Tables to assure that all areas related to Safe Shutdown are considered by the SEC.	

The significance of these EALs is not that safety systems have been degraded. What is significant is that a fire of such magnitude that it can not be extinguished in the times specified exists in an area of concern for safe shutdown. Likewise, an explosion is significant because it occurred in an area of concern for safe shutdown, not because it degraded safety systems.

Source Documents/References/Calculations:

1. Abnormal Operating Procedures
 - AOP-9A through 9S, Alternate Safe Shutdown/Control Room Evacuation procedure series
2. Issue Report IRO-012603, Fire in Room 512..., 10-23-92
3. April 28, 1995 letter, T. E. Forgette to Emergency Planning Unit file 9.5, re: April 14, 1995 fire in Unit 2 Auxiliary Building, five foot elevation, fan room.
4. Issue Report IRO-004-422 (AIT IR199502146), failure to declare Alert in exercise for fire/explosion.
5. EPU file 4.14, EALs; June 30, 1993 letter: "Methodology for Development of Emergency Action Levels", NUMARC/NESP-007, Revision 2, Questions and Answers, June 1993; Hazards and Other Conditions Affecting Plant Safety, question 13, page 24.

OTHER HAZARDS

Emergency Classification Level: UNUSUAL EVENT

Applicable Operational Modes: ALL

Calvert Cliffs Initiating Condition:

OU1 SEC Judgement

NUMARC Recognition Category: Hazards and Other Conditions Affecting Plant Safety

NUMARC Initiating Condition:

HU5 Other Conditions Existing Which in the Judgement of the Emergency Director Warrant Declaration of an Unusual Event

Barrier: Not Applicable

NUMARC Generic Basis:

This <Generic> EAL is intended to address unanticipated conditions not addressed explicitly elsewhere but that warrant declaration of an emergency because conditions exist which are believed by the <SEC> to fall under the Unusual Event emergency class.

From a broad perspective, one area that may warrant <SEC> judgement is related to likely or actual breakdown of site specific event mitigating actions. Examples to consider include inadequate emergency response procedures, transient response either unexpected or not understood, failure or unavailability of emergency systems during an accident in excess of that assumed in accident analysis, or insufficient availability of equipment and/or support personnel.

Specific examples of actual events that may require <SEC> judgement for Unusual Event declaration are listed here for consideration. However, this list is by no means all inclusive and is not intended to limit the discretion of the site to provide further examples.

- Aircraft crash on-site
- Train derailment on-site
- Near-site explosion which may adversely affect normal site activities.
- Near-site release of toxic or flammable gas which may adversely affect normal site activities
- Uncontrolled RCS cooldown due to Secondary Depressurization

It is also intended that the <SEC's> judgement not be limited by any list of events as defined here or as augmented by the site. This list is provided solely as examples for consideration and it is recognized that actual events may not always follow a pre-conceived description.

Plant-Specific Information:

Site Emergency Coordinator (SEC) is the title for the emergency director function at Calvert Cliffs. Thus, the EAL is written as:

Any Condition Which in the SEC's Judgement Indicates Potential Degradation in the Level of Safety of the Plant

In this manner, the EAL addresses conditions that fall under the Notification of Unusual Event emergency classification description contained in 14UREG-0654, Appendix 1 that is retained under the NUMARC methodology.