Exelon Generation®

Order No. EA-12-049

RS-14-208

August 28, 2014

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Dresden Nuclear Power Station, Units 2 and 3
Renewed Facility Operating License Nos. DPR-19 and DPR-25
NRC Docket Nos. 50-237 and 50-249

Subject: Third Six-Month Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049)

References:

1. NRC Order Number EA-12-049, " Issuance of Order to Modify Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," dated March 12, 2012
2. NRC Interim Staff Guidance JLD-ISG-2012-01, "Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," Revision 0, dated August 29, 2012
3. NEI 12-06, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide," Revision 0, dated August 2012
4. Exelon Generation Company, LLC's Initial Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049), dated October 25, 2012
5. Exelon Generation Company, LLC Overall Integrated Plan in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049), dated February 28, 2013 (RS-13-020)
6. Exelon Generation Company, LLC First Six-Month Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049), dated August 28, 2013 (RS-13-119)
7. Exelon Generation Company, LLC Second Six-Month Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049), dated February 28, 2014 (RS-14-010)

8. NRC letter to Exelon Generation Company, LLC, Dresden Nuclear Power Station, Units 2 and 3 – Interim Staff Evaluation Relating to Overall Integrated Plan in Response to Order EA-12-049 (Mitigation Strategies) (TAC Nos. MF1046 and MF1047), dated November 22, 2013

On March 12, 2012, the Nuclear Regulatory Commission ("NRC" or "Commission") issued an order (Reference 1) to Exelon Generation Company, LLC (EGC). Reference 1 was immediately effective and directs EGC to develop, implement, and maintain guidance and strategies to maintain or restore core cooling, containment, and spent fuel pool cooling capabilities in the event of a beyond-design-basis external event. Specific requirements are outlined in Attachment 2 of Reference 1.

Reference 1 required submission of an initial status report 60 days following issuance of the final interim staff guidance (Reference 2) and an overall integrated plan pursuant to Section IV, Condition C. Reference 2 endorses industry guidance document NEI 12-06, Revision 0 (Reference 3) with clarifications and exceptions identified in Reference 2. Reference 4 provided the EGC initial status report regarding mitigation strategies. Reference 5 provided the Dresden Nuclear Power Station, Units 2 and 3 overall integrated plan.

Reference 1 requires submission of a status report at six-month intervals following submittal of the overall integrated plan. Reference 3 provides direction regarding the content of the status reports. References 6 and 7 provided the first and second six-month status reports, respectively, pursuant to Section IV, Condition C.2, of Reference 1 for Dresden Station. The purpose of this letter is to provide the third six-month status report pursuant to Section IV, Condition C.2, of Reference 1, that delineates progress made in implementing the requirements of Reference 1. The enclosed report provides an update of milestone accomplishments since the last status report, including any changes to the compliance method, schedule, or need for relief and the basis, if any. The enclosed report also addresses the NRC Interim Staff Evaluation Open and Confirmatory Items contained in Reference 8.

This letter contains no new regulatory commitments. If you have any questions regarding this report, please contact David P. Helker at 610-765-5525.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 28th day of August 2014.

Respectfully submitted,

Glen T. Kaegi
Director - Licensing & Regulatory Affairs
Exelon Generation Company, LLC

Enclosure:
1. Dresden Nuclear Power Station, Units 2 and 3 Third Six-Month Status Report for the Implementation of Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events

cc: Director, Office of Nuclear Reactor Regulation
NRC Regional Administrator - Region III
NRC Senior Resident Inspector – Dresden Nuclear Power Station, Units 2 and 3
NRC Project Manager, NRR – Dresden Nuclear Power Station, Units 2 and 3
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Enclosure

Dresden Nuclear Power Station, Units 2 and 3

Third Six-Month Status Report for the Implementation of Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events

(32 pages)

Enclosure

Dresden's Third Six Month Status Report for the Implementation of Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events

1 Introduction

Dresden Nuclear Power Station (Dresden) developed an Overall Integrated Plan (Reference 1 in Section 8), documenting the diverse and flexible strategies (FLEX), in response to Reference 2. This enclosure provides an update of milestone accomplishments since submittal of the Overall Integrated Plan, including any changes to the compliance method, schedule, or need for relief/relaxation and the basis, if any.

2 Milestone Accomplishments

Modification development started.

3 Milestone Schedule Status

The following provides an update to Attachment 2 of the Overall Integrated Plan. It provides the activity status of each item, and whether the expected completion date has changed. The dates are planning dates subject to change as design and implementation details are developed.

Original Target Completion Date	Activity	Status {Include date changes in this column}	Revised Target Completion Date
	Submit 60 Day Status Report	Complete	
	Submit Overall Integrated Implementation Plan	Complete	
	Contract with National SAFER Response Center	Complete	
	Submit 6 month updates		
August 2013	Update 1	Complete	
February 2014	Update 2	Complete	
August 2014	Update 3	Complete with this submittal	
February 2015	Update 4	Not started	
August 2015	Update 5	Not started	
February 2016	Update 6	Not started	

Original Target Completion Date		Activity	Status {Include date changes in this column}	Revised Target Completion Date
August 2016		Update 7	Not started	
		Submit Completion Report		
Unit 2	Unit 3	Modification Development		
Oct 2014	Sept 2015	• Phase 1 modifications	Started	
Oct 2014	Sept 2015	• Phase 2 modifications	Started	
Oct 2014	Sept 2015	• Phase 3 modifications	Started	
Unit 2	Unit 3	Modification Implementation		
Nov 2015	Nov 2016	• Phase 1 modifications	Note 1	
Nov 2015	Nov 2016	• Phase 2 modifications	Note 1	
Nov 2015	Nov 2016	• Phase 3 modifications	Note 1	
		Procedure development		
Nov 2015		• Strategy procedures	Note 1	
Nov 2015		• Validate Strategy Procedures (NEI 12-06, Sect. 11.4.3)	Note 1	
Nov 2015		• Maintenance procedures	Note 1	
Jul 2015		Staffing analysis	Note 1	
Nov 2015		Storage Plan and construction	Note 1	
Nov 2015		FLEX equipment acquisition	Note 1	
Nov 2015		Training completion	Note 1	
Jul 2015		National SAFER Response Center Operational	(will be a standard date from National SAFER Response Center)	
Nov 2015		Unit 2 Implementation date	Note 1	
Nov 2016		Unit 3 Implementation date	Note 1	

Note(s):

1. Exelon will update the status of ongoing and future milestones in the Integrated Plan for DNPS during a scheduled six (6) month update. This update will include any changes to the milestone schedule as submitted in the February 28, 2014 Integrated Plan update.

4 Changes to Compliance Method

An update call was held with members of the Nuclear Regulatory Commission on May 28, 2014 to review current design concepts. During design development activities occurring since the February 2014 6-Month Status Report the following minor changes to the Compliance Method have been identified. The changes identified below were discussed during the May 28, 2014 update call.

Power for FLEX required loads during non-flood events will be supplied from one pre-staged diesel generator located near the Reactor Building. The pre-staged diesel generator will be housed in a robust structure to provide protection for all events except flood. This diesel generator will be a trailer mounted unit capable of supplying power to all anticipated requirements for both Units at Dresden after the event.

The change in compliance is there is now one diesel generator and it is a pre-staged trailer mounted unit. The remainder of the electrical FLEX strategy remains unaffected.

Flood coping strategy employs a diesel driven portable FLEX pump. Because the flood event is precipitation based there is time to prepare. The pump will be placed on a floating platform inside the Unit 3 Turbine Building Trackway. This location places the pump and platform near a large roll-up door which allows for adequate ventilation and does not impact other flood event preparations. The pump suction source will be the Unit 3 Main Condenser Tube Pull Pit area which will be filled with flood waters entering the Turbine Building. Pump discharge will be routed through temporary hose to a proposed connection on the Fire Protection header located on elevation 545'. Isolation Condenser shell-side makeup can be supplied from the Fire Main through a permanently installed makeup valve. The Fire Main will also be used as a supply header for other hoses to supply makeup needs for RPV makeup and Spent Fuel Pool.

The change in compliance is the portable pump will be located in the Unit 3 Turbine Building and Fire Main piping will be used to transport water from the portable pump to the required loads The electrical strategy during a flood event is unchanged from the February 2014 6-Month Status Update Report.

5 Need for Relief/Relaxation and Basis for the Relief/Relaxation

Dresden Nuclear Power Station expects to comply with the order implementation date and no relief/relaxation is required at this time.

6 Open Items from Overall Integrated Plan and Draft Safety Evaluation

The following tables provide a summary of the open items documented in the Overall Integrated Plan or the Draft Safety Evaluation (SE) and the status of each item.

Section Reference	Overall Integrated Plan Open Item	Status
Sequence of Events (page 5-6)	The times to complete actions in the Events Timeline are based on operating judgment, conceptual designs, and current supporting analyses. The final timeline will be time validated once detailed designs are completed and procedures developed.	Not Started

Section Reference	Overall Integrated Plan Open Item	Status
Sequence of Events (page 5)	Analysis of deviations between Exelon's engineering analyses and the analyses contained in BWROG Document NEDC-33771P, "GEH Evaluation of FLEX Implementation Guidelines and documentation of results on Att. 1B, "NSSS Significant Reference Analysis Deviation Table." Planned to be completed and submitted with August 2013 Six Month Update.	Completed. See August 2013 Update
Sequence of Events (page 8)	Initial evaluations were used to determine the fuel pool timelines. Formal calculations will be performed to validate this information during development of the spent fuel pool cooling strategy detailed design.	Proposed Complete. Engineering Change (EC) 31913, TIME TO BOIL CURVES - OP-DR-104-1001, Revision 2 has been completed. The EC supports the timeline assumptions made using initial evaluations. The associate times are reflected in Attachment 1, Revised Estimated Sequence of Events Timeline.
Deployment Strategy (pages 8-9)	Transportation routes will be developed from the equipment storage area to the FLEX staging areas. An administrative program will be developed to ensure pathways remain clear or compensatory actions will be implemented to ensure all strategies can be deployed during all modes of operation. Identification of storage areas and creation of the administrative program are open items.	See Interim Staff Evaluation Confirmatory Item 3.1.2.2.A response.
Programmatic Controls (pages 9-10)	An administrative program for FLEX to establish responsibilities, and testing & maintenance requirements will be implemented.	Not Started
Spent Fuel Pool Cooling Phase 2 Discussion (page 46)	Complete an evaluation of the spent fuel pool area for steam and condensation.	See Interim Staff Evaluation Confirmatory Item 3.2.2.A response.
Safety Functions Support Phase 2 Discussion (page 57)	Evaluate the habitability conditions for the Main Control Room and develop a strategy to maintain habitability.	See Interim Staff Evaluation Confirmatory Item 3.2.4.6.C response.

Section Reference	Overall Integrated Plan Open Item	Status
Safety Functions Support Phase 2 Discussion (page 57)	Evaluate the habitability conditions for the Auxiliary Electric Equipment Room (AEER) and develop a strategy to maintain habitability.	See Interim Staff Evaluation Confirmatory Item 3.2.4.2.C response.

Item number	Interim Staff Evaluation OPEN Item	Status
3.1.1.1.A	Each section of the Integrated Plan describing storage protection from hazards makes reference to Section 11 rather than to the specific protection requirements described in NEI 12-06 for the applicable hazard; that is Section 6.2.3.1 for floods, Section 7.3.1 for wind, etc. As a result, the specific guidelines for each hazard are not addressed.	Completed. See February 2014 Update
3.1.2.2. B	The Plan is silent regarding loss of normal access to the Ultimate Heat Sink (UHS) due to flood hazard conditions, the need to provide electrical power for sump pumps, and whether or not flood barriers will be utilized.	Completed. See February 2014 Update

Item number	Interim Staff Evaluation OPEN Item	Status
3.2.4.8.A	Updated information provided by the licensee as part of the 6-month update states that they are proposing to install a prestaged generator to supply all FLEX related loads for both units simultaneously for Phase 2 mitigating strategies. This appears to be an alternative approach for satisfying the Mitigating Strategies order. Insufficient information has been provided by the licensee in order to determine whether this provides an equivalent level of protection as would be provided through conformance with NEI 12-06.	Proposed Complete As described in Section 4, Changes to Compliance Method, the conceptual design has changed to utilize a trailer mounted generator unit pre-staged in a robust structure near the Reactor Building. Pre-staging in this manner allows timely implementation of the FLEX strategies by not requiring transport of the generator prior to use. The generator is a portable (trailer mounted) unit that will be connected through the use of temporary cabling. The proposed design meets the requirements of NEI 12-06 Section 3.2.1.3.(7) and Section 3.2.2.(13). Additionally NEI 12-06 Section 3.2.2 states, "It is also acceptable to have a single resource that is sized to support the required functions for multiple units at a site (e.g., a single pump capable of all water supply functions for a dual unit site)." The proposed design utilizes a single generator sized to be capable of powering the required loads of both Units after a FLEX event. The change to the proposed design meets NEI 12-06 requirements and therefore is not an alternative approach.

Item number	Interim Staff Evaluation CONFIRMATORY Item	Status
3.1.1.2.A	A postulated downstream dam failure from a seismic event is still being evaluated.	Completed. See February 2014 Update
3.1.1.2.B	Plans for strategies did not address whether electrical power would be required to move or deploy FLEX equipment (e.g. to open a door from a storage location.)	Not started
3.1.1.3.A	Development of a reference source for obtaining necessary instrument readings in the event of seismic damage to electrical equipment as described in NEI 12-06, Section 5.3.3, consideration 1.	Started
3.1.1.3.B	Use of, or need for ac power to mitigate ground water intrusion was not addressed.	Completed. See February 2014 Update
3.1.1.4.A	Regarding off site resources, detailed plans for local staging areas and transport of FLEX equipment to overcome hazards are to be provided in 6-month update.	Started
3.1.2.A	Impact of persistence of flooding to staging of FLEX equipment not fully addressed.	Started
3.1.2.2.A	Administrative program and procedures for on-site FLEX equipment storage locations and transport routes not yet established.	Started
3.1.2.3.A	Administrative program and procedures related to implementation of mitigation strategies not yet developed.	Started
3.1.4.2.A	Equipment to clear ice and snow from haul pathways is not identified in plan.	Completed. See February 2014 Update
3.1.5.2.A	Procedures to assure equipment can be deployed in a high temperature context have not been developed. Specifically, address high temperature effects on storage locations (e.g. expansion of sheet metal, swollen seals, etc.)	Not started
3.1.5.3.A	Procedures to address high temperature impacts on FLEX equipment not yet developed.	Started

Item number	Interim Staff Evaluation CONFIRMATORY Item	Status
3.2.1.1.A	Need benchmarks to demonstrate Modular Accident Analysis Program (MAAP) 4 is the appropriate code for simulation of ELAP.	Proposed Complete. Information that validates the use of MAAP4 and that provides response to this item is contained in Attachment 4, MAAP Justification for ELAP Analysis Acceptability.
3.2.1.1.B	For MAAP4, collapsed level must remain above Top of Active Fuel and cool down rate must meet technical specifications.	Proposed Complete. Information that validates the use of MAAP4 and that provides response to this item is contained in Attachment 4, MAAP Justification for ELAP Analysis Acceptability. To provide a definitive time frame for worst case action points the Dresden MAAP cases assume no RPV makeup after HPCI is assumed to fail (approximately 2.5 hours after event initiation). The Dresden strategy is to utilize Standby Liquid Control (SBLC) as a high pressure makeup source when the FLEX Generator begins supplying power to safety related electrical busses. MAAP Case 11 (available in ePortal Document title - Dresden FLEX - Overview of MAAP Results - MAAP Analysis DR-MISC-043, Rev. 1.doc) represents the expected plant response to the FLEX strategy most likely to be utilized. Case 11 demonstrates 37.3 hours are available to restore RPV makeup prior to water level dropping below TAF. The Dresden timeline assumes RPV makeup will be initiated prior to that time period.
3.2.1.1.C	MAAP4 use must be consistent with June 2013 position paper.	Proposed Complete. Information that validates the use of MAAP4 and that provides response to this item is contained in Attachment 4, MAAP Justification for ELAP Analysis Acceptability.
3.2.1.1.D	In using MAAP4, the licensee must identify and justify the subset of key modeling parameters cited from Tables 4-1 through 4-6 of the "MAAP4 Application Guidance, Desktop Reference for Using MAAP4 Software, Revision 2" (Electric Power Research Institute Report 1 020236).	Proposed Complete. Information that validates the use of MAAP4 and that provides response to this item is contained in Attachment 4, MAAP Justification for ELAP Analysis Acceptability.
3.2.1.1.E	The specific MAAP4 analysis case that was used to validate the timing of mitigating strategies in the integrated plan must be identified and should be available on the ePortal for NRC staff to view. Alternately, a comparable level of information may be included in the supplemental response.	Proposed Complete. Information that validates the use of MAAP4 and that provides response to this item is contained in Attachment 4, MAAP Justification for ELAP Analysis Acceptability.

Item number	Interim Staff Evaluation CONFIRMATORY Item	Status
3.2.1.3.A	Outstanding Confirmatory Items regarding the use of the MAAP4 analysis may impact the sequence of events timeline. Any changes to the MAAP4 analysis results will need to be reviewed for impact on the sequence of events timeline. The licensee stated that the final timeline will be time validated once detailed designs are completed, procedures are developed, and the results will be provided in a future six (6) month update.	Not started
3.2.1.3.B	Sequence of Events timing for compensatory actions to control temperature rise in the Main Control Room not resolved.	Started
3.2.1.4.A	Detailed engineering analyses to confirm the ability of FLEX pumps to provide required flow and head capacities are not complete.	Started
3.2.1.4.B	Analysis needs to be performed to validate that the plant modifications, selected equipment, and identified mitigating strategy can satisfy the safety function requirements of NEI 12-06. To be provided in a future six (6) month update.	Started

Item number	Interim Staff Evaluation CONFIRMATORY Item	Status
3.2.1.6.A	Whether or not backup compressed air for valve actuation is required, is contingent on the MAAP4 analyses conclusions. The MAAP4 conclusions will determine if containment venting is necessary.	Proposed complete. The Isolation Condenser (IC) removes decay heat with no loss of inventory from the reactor coolant system (although there still may be some leakage from the assumed RPV leakage into the Drywell), and with no addition of heat to the suppression pool. As long as the shell side of the IC is replenished (phase 2) with sufficient water, the IC will remove adequate decay heat to maintain core cooling. MAAP analysis Case 11 (available in ePortal Document title - Dresden FLEX - Overview of MAAP Results - MAAP Analysis DR-MISC-043, Rev. 1.doc) identified drywell pressure would be approximately 20 psig at 2.5 hours from the start of the event, at which time, IC would be re-initiated and HPCI would be assumed lost. Review of the Case 11 MAAP results indicate containment pressure remains below design limits if RPV water remains above TAF and the IC is operating. BWROG document NEDC-33771P, "GEH Evaluation of FLEX Implementation Guidelines" has been compared to the Dresden proposed strategies and Modular Accident Analysis Program (MAAP) results. The results of the BWROG document and Dresden response are consistent. In each case at the end of 24 hours the peak containment values are below their respective design limits with significant margins to the limits. Therefore, containment venting to remove heat from the containment is not required. As such, backup compressed air will not be required.
3.2.2.A	Final analysis of fuel pool area for steam and condensation impacts regarding access is not complete.	Started

Item number	Interim Staff Evaluation CONFIRMATORY Item	Status
3.2.3.A	There are outstanding issues regarding the acceptability of the MAAP4 analysis. The potential for impact of MAAP4 results on the containment heat removal strategy needs to be reviewed.	Proposed complete. Information that validates the use of MAAP4 is contained in Attachment 4, MAAP Justification for ELAP Analysis Acceptability. The Isolation Condenser (IC) removes decay heat with no loss of inventory from the reactor coolant system (although there still may be some leakage from the assumed RPV leakage into the Drywell), and with no addition of heat to the suppression pool. As long as the shell side of the IC is replenished (phase 2) with sufficient water, the IC will remove adequate decay heat to maintain core cooling. MAAP analysis Case 11 (available in ePortal Document title - Dresden FLEX - Overview of MAAP Results - MAAP Analysis DR-MISC-043, Rev. 1.doc) identified drywell pressure would be approximately 20 psig at 2.5 hours from the start of the event, at which time, IC would be re-initiated and HPCI would be assumed lost. Review of the Case 11 MAAP results indicate containment pressure remains below design limits if RPV water remains above TAF and the IC is operating. BWROG document NEDC-33771P, "GEH Evaluation of FLEX Implementation Guidelines" has been compared to the Dresden proposed strategies and Modular Accident Analysis Program (MAAP) results. The results of the BWROG document and Dresden response are consistent. In each case at the end of 24 hours the peak containment values are below their respective design limits with significant margins to the limits. Therefore, containment venting to remove heat from the containment is not required. As such, a specific containment heat removal strategy beyond that identified above will not be required.
3.2.4.2.A	A discussion is needed on the effects of extreme low temperatures (i.e., temperatures below those assumed in the sizing calculation for each battery) on each battery's capability to perform its function for the duration of the ELAP event.	Not started
3.2.4.2.B	Procedure will be developed to address controlling battery room hydrogen concentration.	Not started

Item number	Interim Staff Evaluation CONFIRMATORY Item	Status
3.2.4.2.C	Evaluations to address loss of ventilation in the auxiliary equipment electric room and Battery Rooms are not complete.	Not started
3.2.4.2.D	Insufficient information to address impact on elevated temperatures in areas critical to mitigation strategies. For example, initial temperatures assumed in the analyses is not clear, critical components in pump rooms are not identified, etc. Detailed design information is needed.	Not started
3.2.4.4.A	Provisions for portable lighting for area access not clear. More information required.	Not started
3.2.4.4.B	Confirm upgrades to communication system that resulted from the licensee communications assessment. ADAMS Accession Nos. ML 12306A 199 and ML 13056A 135.	Started
3.2.4.6.A	Surface pyrometer temperature readings are required in the torus area. The licensee needs to address habitability and access to the torus area.	Started
3.2.4.6.B	Final GOTHIC analysis for the HPCI room temperature rise is not complete.	Started
3.2.4.6.C	Habitability of the control room should consider temperature limits of NUMARC 87-00 and MIL-STD-1472C.	Started
3.2.4.8.B	Detailed designs will identify comprehensive load lists to confirm conceptual load assumptions.	Not started
3.2.4.8.C	Insufficient information provided regarding FLEX diesel generators and the plant Class 1 E diesel generators isolation to prevent simultaneously supplying power to the same Class 1 E bus and regarding minimum bus voltages during the use of FLEX generators.	Started

Item number	Interim Staff Evaluation CONFIRMATORY Item	Status
3.2.4.9.A	The licensee stated in its 6-month update that a modification has been proposed to allow transfer of fuel oil from the 2/3 Emergency Diesel Generator main fuel oil storage tank to the area of the proposed FLEX diesel generators. Need to confirm that the modification is installed and supplies sufficient fuel.	Started
3.2.4.9.B	Assessing and maintaining fuel oil quality for FLEX equipment use was not addressed.	Not started
3.2.4.10. A	Final analysis for battery operation with load shed not complete. Need detailed load profile for all mitigating strategies and a detailed discussion of loads that will be shed, how they will be shed, and what are the effects of the shed.	Started
3.4.A	Details not provided to demonstrate the minimum capabilities for offsite resources will be met per NEI 12-06 Section 12.2.	Started

7 Potential Draft Safety Evaluation Impacts

There are no potential impacts to the Draft Safety Evaluation identified at this time.

8 References

The following references support the updates to the Overall Integrated Plan described in this enclosure.

1. Dresden Nuclear Power Station's Overall Integrated Plan in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049)," dated February 28, 2013 (subsequently revised Aug 28, 2013).
2. NRC Order Number EA-12-049, "Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," dated March 12, 2012.
3. Dresden Nuclear Power Station Updated Final Safety Analysis Report, Revision 9
4. Diverse and Flexible Coping Strategies (FLEX) Implementation Guide", NEI 12-06, Revision 0, August 2012

5. Dresden's First Six Month Status Report for the Implementation of Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events, dated August 28, 2013
6. Dresden's Second Six Month Status Report for the Implementation of Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events, dated February 28, 2014
7. Attachment 1 Revised Estimated Sequence of Events Timeline.
8. Attachment 2, Simplified FLEX Makeup Conceptual Design
9. Attachment 3, Simplified FLEX Electrical Conceptual Design
10. Attachment 4, MAAP Justification for ELAP Analysis Acceptability

Attachment 1
Revised Estimated Sequence of Events Timeline

Action item	Elapsed Time	Action	Time Constraint Y/N [1]	Remarks / Applicability
	0	**Event Starts**	NA	Plant @100% power
	0	Reactor scram	NA	Loss of power to Reactor Protection System results in a reactor scram.
1	1 min	Personnel enter DGP 02-03 and DGA 12	N	These actions will provide direction for reactor control and options for loss of AC power.
2	1 min	Isolation Condenser initiated for pressure control (or verified operating if auto initiation occurs)	N	DEOP 100 will direct action based on reactor pressure.
3	2 mins	Attempt to start EDGs upon identification of failure to auto start.	N	Per FLEX event initial conditions the EDGs are not available.
4	3 mins	Attempt to Start IC Makeup Pump for IC Shell side makeup	N	There are no fully qualified makeup sources for shell-side makeup.
5	5 mins	Personnel dispatched to investigate EDG failure to start.	N	Per FLEX event initial conditions the EDGs are not available.
6	5 mins	HPCI initiated for inventory control and reactor pressure control (or verified operating if auto initiation occurs).	N	DEOP 100 will direct this action. HPCI suction will auto swap to the Torus due to CSTs being assumed lost with the FLEX event (not missile protected).
7	10 mins	Attempt to start SBO DG for either Unit	N	Per FLEX event initial conditions the SBO DGs are not available.

[1] Instructions: Provide justification if No or NA is selected in the remark column.
If yes, include technical basis discussion as requires by NEI 12-06, Section 3.2.1.7

Attachment 1
Revised Estimated Sequence of Events Timeline

Action item	Elapsed Time	Action	Time Constraint Y/N [1]	Remarks / Applicability
8	15 mins	Personnel dispatched to investigate SBO DG failure to start.	N	Per FLEX event initial conditions the SBO DGs are not available.
9	15 mins	Perform 125 VDC load shedding per DGA 13	N	This is an immediate action of DGA 13 to prolong battery availability. Must be completed by 30 minutes after event initiation.
10	20 mins	Isolation Condenser secured due to low shell-side water level without a shell-side makeup source.	Y	Per UFSAR, the IC will operate for approximately 20 minutes without shell-side makeup. It is secured when shell-side level is low to prevent possible damage.
11	30 mins	125 and 250 VDC Load Shed Completed (actions identified in DGA 03, DGA 12 and DGA 13)	Y	DGA 12 Step D.13 identifies that load shedding to maintain battery availability must be completed if DC chargers are unavailable.
12	1 hour	Control Room crew has assessed SBO and plant conditions and declares an Extended Loss of AC Power (ELAP) event. • Personnel dispatched to FLEX strategy for supplying make-up water to the Isolation Condenser shell-side from the Unit 3 Suppression Pool. • Personnel dispatched to FLEX strategy for supplying power to the FLEX Makeup Pump and station battery chargers	Y	Time is reasonable approximation based on operating crew assessment of plant conditions

Attachment 1
Revised Estimated Sequence of Events Timeline

Action item	Elapsed Time	Action	Time Constraint Y/N [1]	Remarks / Applicability
13	2 hours	Complete actions for Loss of AEER Ventilation	N	Perform DOA 5750-1 Attachment C Step 6. Actions can be coordinated with personnel obtaining and staging portable generators, fans, etc.
14	2 hours	Establish natural air flow to HPCI room by opening doors.	Y	Preliminary GOTHIC analysis indicates opening doors at 2 hours will result in acceptable room temperature values to support operation of HPCI for at least 6 hours. HPCI room temperature remains below the isolation point during this time. HPCI operation is assumed for approximately 2.5 hours in Phase 1.
15	2 hours	Complete actions for loss of Main Control Room Ventilation.	N	DOA 5750-01 actions.
16	2 hours	Defeat HPCI high temperature and flow isolations	N	Ensure HPCI remains available during the event.
17	2.5 hours	FLEX strategy for supplying power to a Unit 3 FLEX Makeup Pump completed.	Y	Involves running temporary cables and connecting to the selected FLEX Makeup pump.
18	2.5 hours	Unit 3 FLEX pump connected and supplying Isolation Condenser shell-side makeup.	Y	Due to pre-staging of major components, it is reasonable to expect the FLEX pump can be available within this time period.

Attachment 1
Revised Estimated Sequence of Events Timeline

Action item	Elapsed Time	Action	Time Constraint Y/N [1]	Remarks / Applicability
19	2.5 hours	Isolation Condenser initiated for RPV pressure control	Y	Complete prior to loss of HPCI to ensure RPV heat removal mechanism operating prior to MAAP analysis assumed HPCI loss.
20	2.5 hours	HPCI assumed to fail due to suppression pool temperature of ≥140°F	N	HPCI may continue to operate above 140°F but it is not relied upon past this point. Restoration of the Isolation Condenser will replace the need for HPCI in terms of RPV pressure control.
21	3 hours	Personnel dispatched to align power to a FLEX makeup pump from the Unit 2 Suppression Pool and align hoses for supplying make-up water to the Isolation Condenser shell-side.	N	Time is reasonable approximation based on operating crew assessment of plant conditions.
22	6 hours	FLEX strategy for supplying power to 480 VAC busses and associated Motor Control Centers (MCCs) completed.	Y	When the busses are energized, power will be available to supply power to battery chargers and other desired loads such as SBLC and SBGT. Preliminary review indicates the batteries will remain available for at least 6 hours without chargers.
23	6 hours	Isolate both Reactor Recirculation Loops by closing suction and discharge valves	N	Recirc loops are isolated to reduce RPV leakage. The sooner this is accomplished the more reactor inventory is conserved.

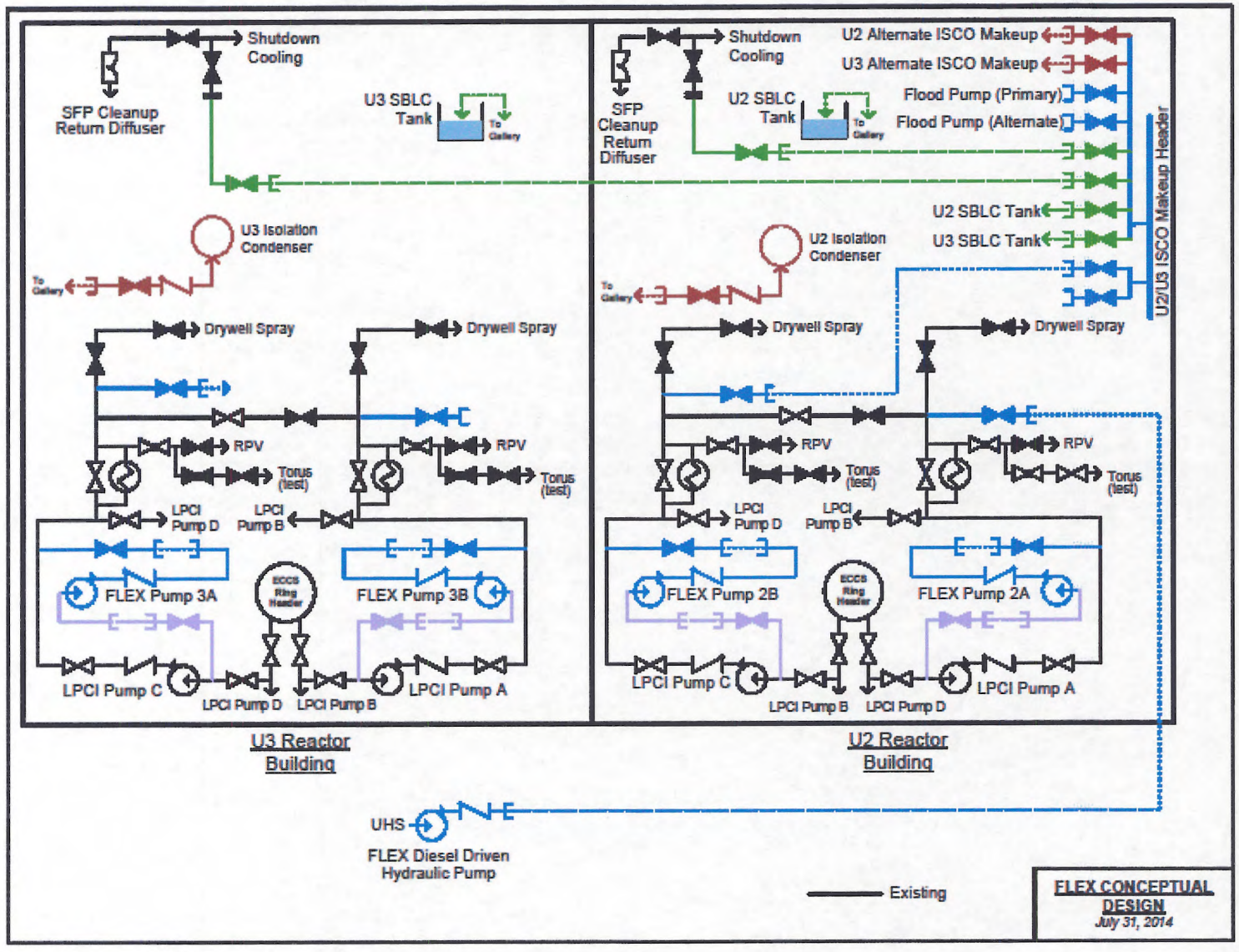
Attachment 1
Revised Estimated Sequence of Events Timeline

Action item	Elapsed Time	Action	Time Constraint Y/N [1]	Remarks / Applicability
24	6 hours	Initiate SBLC as necessary for RPV level control.	N	Per MAAP analysis after Recirculation Loops are isolated and the Isolation Condenser is controlling reactor pressure, RPV leakage will be reduced to approximately 15 gpm at time = 6.0 hours. Makeup from SBLC can be utilized to maintain RPV level above Top of Active Fuel (TAF).
25	6 hours	Personnel dispatched to deploy a submersible pump from the Robust Storage location to provide water from UHS for long-term Suppression Pool makeup.	N	Time is reasonable approximation based on operating crew assessment of plant conditions. Additional site resources will be available 6 hours after event initiation to aid in this effort including personnel to operate equipment such as mobile lifting device to deploy submersible pump in the UHS.
26	7 hours	Unit 2 FLEX pump connected and supplying Isolation Condenser shell-side makeup.	Y	This action must be completed prior to Unit 3 Suppression Pool inventory being reduced below 11 feet.
27	10 hours	Personnel dispatched to establish temporary ventilation to the MCR and AEER (portable fans and associated generators).	N	Further analysis is required to determine if supplemental ventilation is needed.

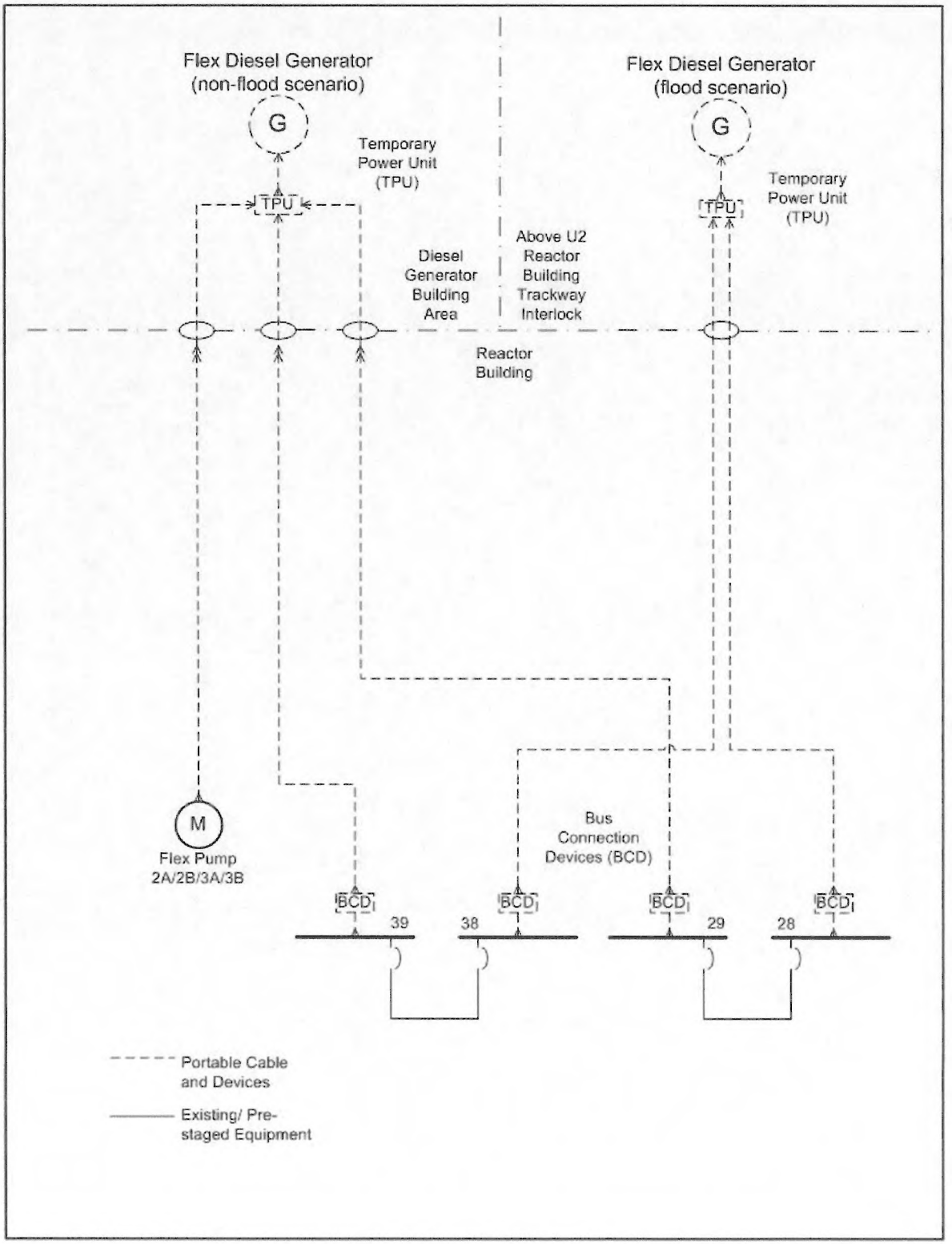
Attachment 1
Revised Estimated Sequence of Events Timeline

Action item	Elapsed Time	Action	Time Constraint Y/N [1]	Remarks / Applicability
28	12 hours	Makeup to the Spent Fuel Pools using FLEX pump strategy is available.	Y	EC 371913, Revision 2,: Time-to-Boil Curves., identifies a time to boil of 9.54 hours, and 110.07 hours to the top of active fuel. Therefore completing the equipment line-up for initiating SFP make-up at 12 hours into the event ensures adequate cooling of the spent fuel is maintained.
29	14 hours	Unit 2 Suppression Pool Makeup available from UHS using portable equipment	Y	Long term makeup water source will be available before the water contained in the Suppression Pools for both Units is exhausted. Makeup from the UHS will not be required before this time.
30	24 hours	Initial equipment from National SAFER Response Center becomes available.	N	NEI 12-06 assumption.
31	24-72 hours	Continue to maintain critical functions of core cooling (via IC and FLEX Pump injection), containment (via hardened vent opening) and SFP cooling (FLEX pump injection to SFP). Utilize initial National SAFER Response Center equipment in spare capacity.	N	None

Attachment 2



Attachment 3



Attachment 4

MAAP JUSTIFICATION FOR ELAP ANALYSIS ACCEPTABILITY

Dresden Nuclear Power Station Response

In response to the letter of October 3, 2013 from Jack Davis (NRR) to Joe Pollock (NEI), the following responses have been developed regarding the use of the Modular Accident Analysis Program (MAAP) for estimating accident progression timing in support of the Overall Integrated Plan for Dresden.

ITEM (NOTE – this item corresponds to NRC Interim Staff Evaluation CONFIRMATORY action item 3.2.1.1.A of the Dresden evaluation)

(1) From the June 2013 position paper, benchmarks must be identified and discussed which demonstrate that MAAP4 is an appropriate code for the simulation of an ELAP event at your facility.

Response to item 1:

Generic response provided by EPRI BWR Roadmap "Technical Basis for Establishing Success Timelines in Extended Loss of AC Power Scenarios in Boiling Water Reactors Using MAAP4," (EPRI Product ID 3002002749).

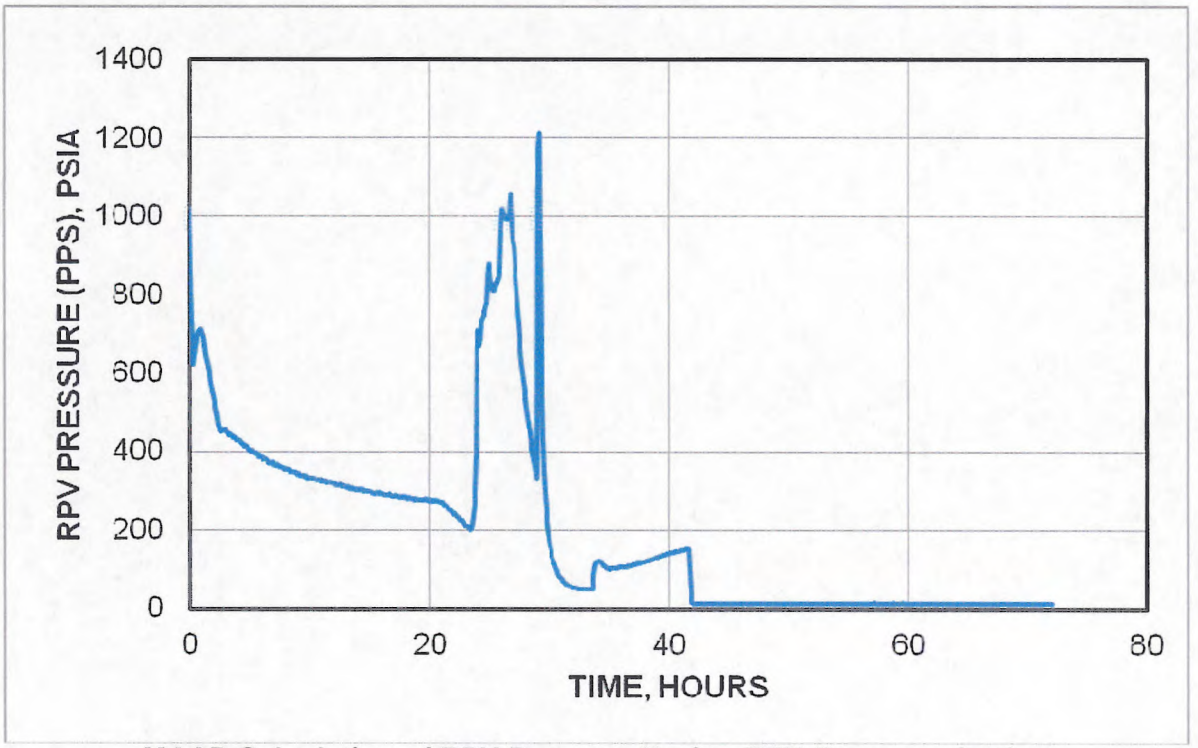
ITEM (NOTE – this item corresponds to NRC Interim Staff Evaluation CONFIRMATORY action item 3.2.1.1.B of the Dresden evaluation)

(2) The collapsed level must remain above Top of Active Fuel (TAF) and the cool down rate must be within technical specification limits.

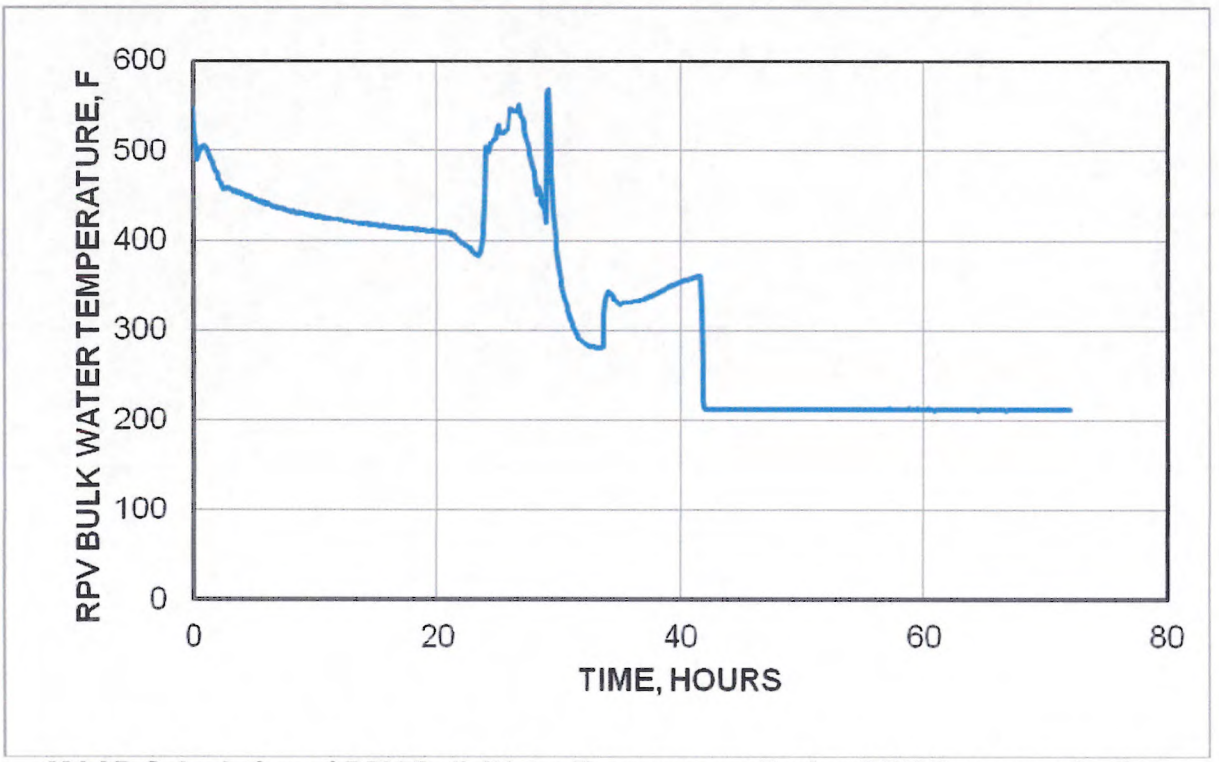
Response to item 2:

Attachment 1A of the updated Dresden Integrated Plan (Aug 2013) indicates that Dresden will utilize the isolation condenser for RPV pressure control which will not exceed the technical specifications limit for RPV cooldown of 100°F/hr. The following plots of the bulk RPV water temperature and RPV pressure from the MAAP analysis confirms this cooldown criteria for the supporting MAAP calculation. Note that the Dresden Integrated Plan does not credit external RPV injection prior to core uncovery in the MAAP analysis. This modeling assumptions leads to unrealistic spikes in RPV pressure and RPV bulk water temperature due to the core being uncovered after approximately 20 hours. It is expected that successful core cooling and prevention of the RPV collapsed water level dropping below TAF would be shown when external RPV injection is included in the calculation. This would avoid these unrealistic assessments after the IC becomes ineffective.

Attachment 4
MAAP JUSTIFICATION FOR ELAP ANALYSIS ACCEPTABILITY



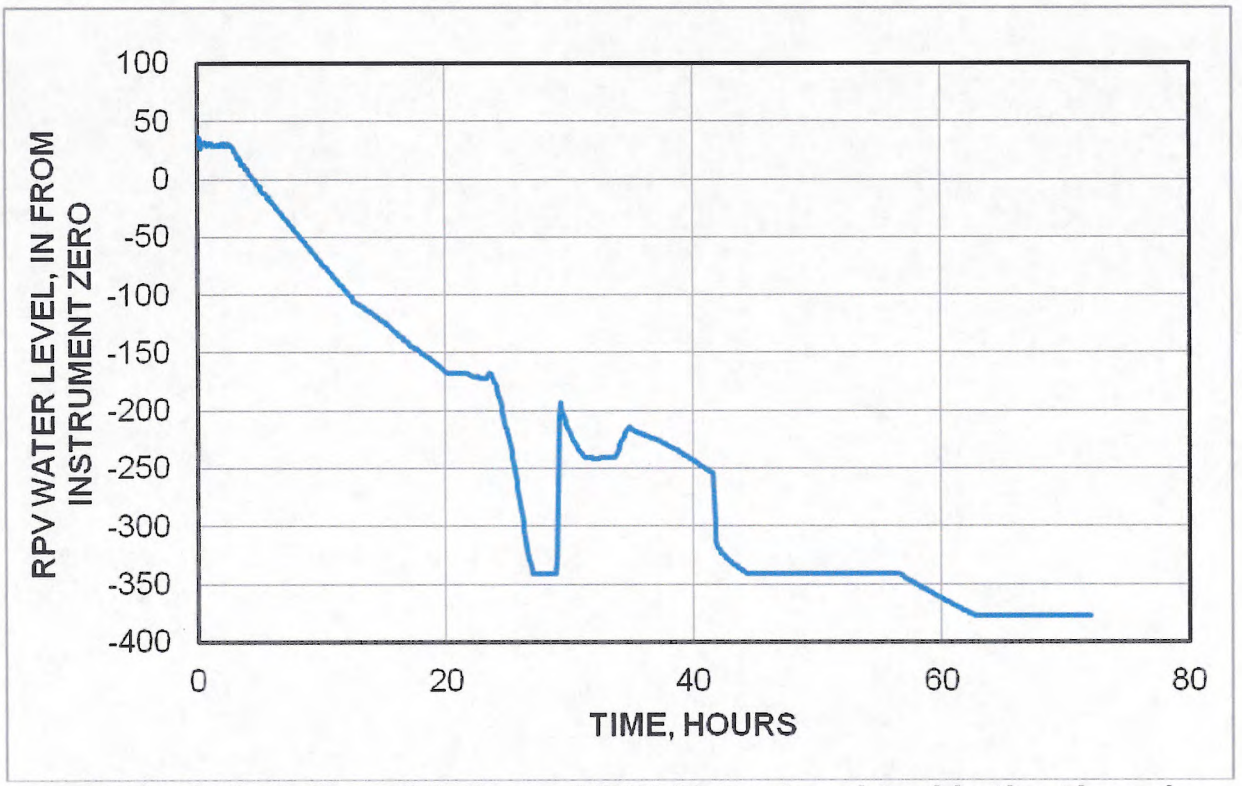
MAAP Calculation of RPV Pressure During RPV Depressurization



MAAP Calculation of RPV Bulk Water Temperature During RPV Depressurization

Attachment 4
MAAP JUSTIFICATION FOR ELAP ANALYSIS ACCEPTABILITY

For the representative MAAP run (Case 9), the collapsed RPV water level inside the shroud drops below TAF and remains below TAF for the duration of the analysis. The plot below shows that the lowest RPV level, calculated by MAAP, was far below instrument zero. Instrument zero is at +503" above vessel zero. TAF is located at -143" relative to instrument zero. The Dresden analysis cites the use of external FLEX pump make-up to the RPV prior to the collapsed RPV water level dropping below TAF which would prevent the core from being uncovered.



MAAP Calculation of Collapsed RPV Water Level Inside the Shroud

ITEM (NOTE – this item corresponds to NRC Interim Staff Evaluation CONFIRMATORY action item 3.2.1.1.C of the Dresden evaluation)

(3) MAAP4 must be used in accordance with Sections 4.1, 4.2, 4.3, 4.4, and 4.5 of the June 2013 position paper.

Response to item 3:

MAAP analysis performed for Dresden was carried out in accordance with Sections 4.1, 4.2, 4.3, 4.4, and 4.5 of the June 2013 position paper, EPRI Technical Report 3002001785, "Use of Modular Accident Analysis Program (MAAP) in Support of Post-Fukushima Applications"..

Attachment 4

MAAP JUSTIFICATION FOR ELAP ANALYSIS ACCEPTABILITY

ITEM (NOTE – this item corresponds to NRC Interim Staff Evaluation CONFIRMATORY action item 3.2.1.1.D of the Dresden evaluation)

(4) In using MAAP4, the licensee must identify and justify the subset of key modeling parameters cited from Tables 4-1 through 4-6 of the "MAAP4 Application Guidance, Desktop Reference for Using MAAP4 Software, Revision 2" (Electric Power Research Institute Report 1020236). This should include response at a plant-specific level regarding specific coding options and parameter choices for key models that would be expected to substantially affect the ELAP analysis performed for that licensee's plant. Although some suggested key phenomena are identified below, other parameters considered important in the simulation of the ELAP event by the vendor / licensee should also be included.

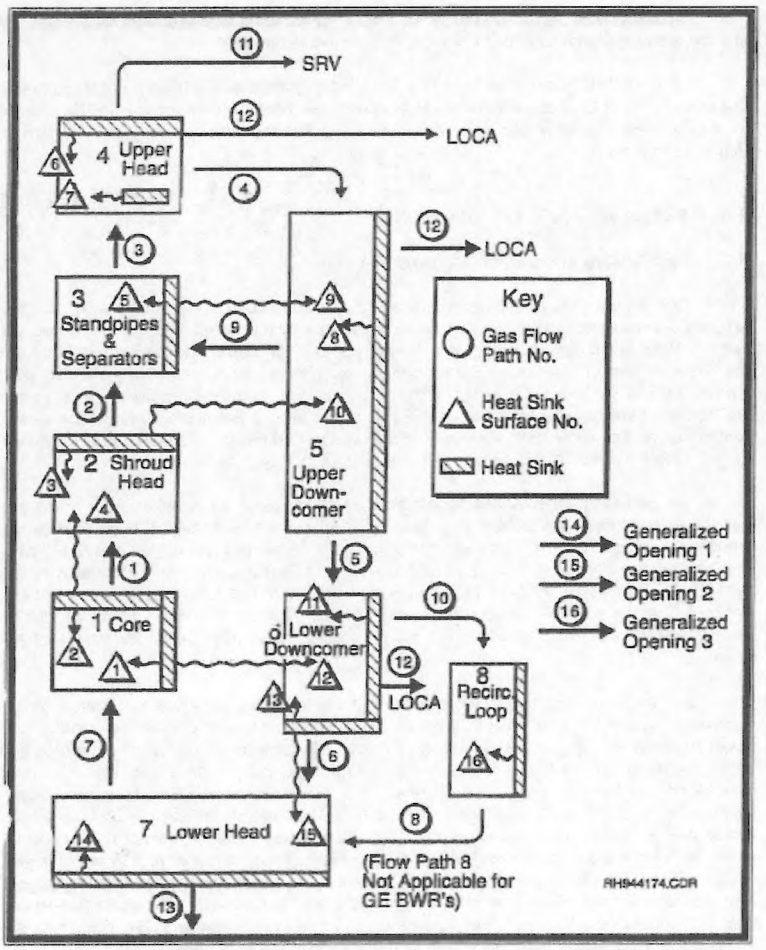
a. Nodalization
b. General two-phase flow modeling
c. Modeling of heat transfer and losses
d. Choked flow
e. Vent line pressure losses
f. Decay heat (fission products / actinides / etc.)

Response to item 4:

a. The reactor vessel nodalization is fixed by the MAAP code and cannot be altered by the user, with the exception of the detailed core nodalization. The Dresden MAAP 4.0.5 parameter file divides the core region into 5 equal volume radial regions and 13 axial regions. The axial nodalization represents 10 equal-sized fueled nodes, 1 unfueled node at the top, and 2 unfueled nodes at the bottom. The figure below, taken from the MAAP Users Manual, illustrates the vessel nodalization scheme.

Attachment 4

MAAP JUSTIFICATION FOR ELAP ANALYSIS ACCEPTABILITY

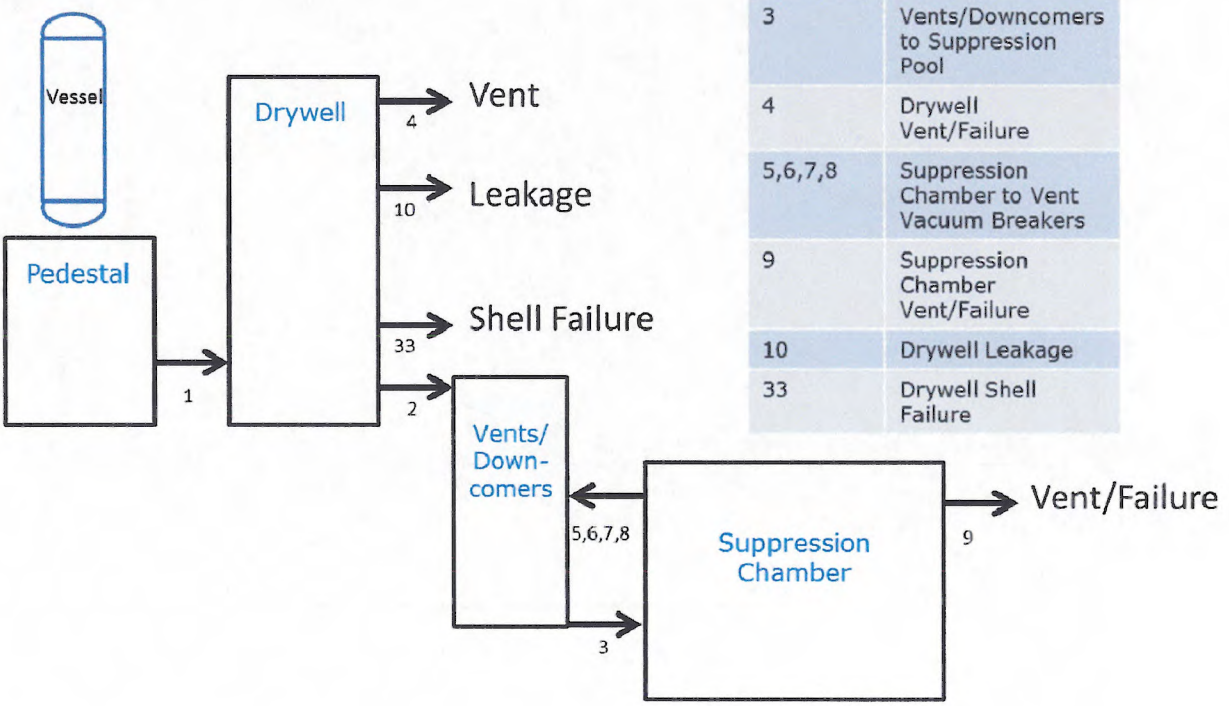


Attachment 4
MAAP JUSTIFICATION FOR ELAP ANALYSIS ACCEPTABILITY

Containment nodalization is defined by the user. The standard nodalization scheme is used in the Dresden MAAP 4.0.5 parameter file and represents the following individual compartments:

1. Reactor pedestal region
2. Drywell
3. Drywell vents to torus
4. Torus (Wetwell)

The figure below illustrates the Dresden containment nodalization along with an identification of containment flow junctions.



Junction	Description
1	Pedestal Door to Drywell
2	Drywell to Vents/Downcomers
3	Vents/Downcomers to Suppression Pool
4	Drywell Vent/Failure
5,6,7,8	Suppression Chamber to Vent Vacuum Breakers
9	Suppression Chamber Vent/Failure
10	Drywell Leakage
33	Drywell Shell Failure

b. General two-phase flow from the reactor vessel is described in the EPRI BWR Roadmap. In the case of the scenario outlined in the integrated plan, flow can exit the RPV via the open SRV(s) and from the assumed recirculation pump seal leakage. Flow from SRV will be single-phase steam and flow from the recirc pump seal or other RPV leakage will be single-phase liquid due to the location of the break low in the RPV with

Attachment 4
MAAP JUSTIFICATION FOR ELAP ANALYSIS ACCEPTABILITY

RPV level continued to be maintain above TAF. Upon exiting the RPV, the seal leakage will flash a portion of the flow to steam based on saturated conditions in the drywell, creating a steam source and a liquid water source to the drywell. As described in the BWR Roadmap (EPRI Product ID 3002002749) there are two parameters that can influence the two-phase level on the RPV. The following table confirms that the parameter values match the recommended values as outlined in the roadmap.

Parameter Name	Value Used in the Dresden MAAP Analysis	EPRI Recommended Value
FCO	1.5248	1.5248
FCHTUR	1.53	1.53

c. Modeling of heat transfer and losses from the RPV are described in the EPRI BWR Roadmap. The parameters that control these processes, as defined in the Roadmap, are provided below with the values selected to represent Dresden.

Parameter Name	Value Used in the Dresden MAAP Analysis	Comment
QC0 – not-thru-insulation heat transfer from RPV during normal operation.	4.2E6 BTU/hr	Plant specific value based on drywell heat removal to coolers during normal operation. Typical values range between 1-2 MW (3.4E6 to 6.8E6 BTU/hr).
FINPLT – number of plates in reflective insulation	8	Plant-specific value
XTINS – average reflective insulation thickness	0.5 ft	Plant-specific value

At the request of the NRC, the following information, as used in the MAAP analysis, is provided.

Parameter Definition	Parameter Name in MAAP	Value Used in the Dresden MAAP Analysis
Power level, MWth	QCR0	2957 MWth
Initial CST water volume, gal	VCST0 (ft^3)	409,971 ft^3
Initial CST water	HCST (enthalpy)	94°F

Attachment 4
MAAP JUSTIFICATION FOR ELAP ANALYSIS ACCEPTABILITY

temperature, F		
Initial suppression pool water mass, lbm	Calculated from input	7,264,000 lbm
Initial suppression pool water level, ft	XWRB0(i), where i is node number for wetwell	14.84 ft
Initial suppression pool water temperature, F	TWRB0(i), where i is node number for wetwell	85°F
Drywell free volume, ft^3	VOLRB(i), where I is node number for drywell	145,786.23 ft^3
Wetwell free volume, ft^3	VOLRB(i) – volume of suppression pool water from initial pool mass	238,375.6 ft^3
Containment vent pressure, psia	Refer to MAAP analysis document	N/A (containment is not vented)
RCIC max flow rate, gpm	WVRCIC	N/A (Dresden does not have RCIC)
Max FLEX pump flow rate, gpm	Refer to MAAP analysis document	500 gpm
Lowest set SRV flow rate, lb/hr	Derived from SRV area, ASRV	540,000 lb/hr
Lowest set SRV pressure, psia	PSETRV	1125.2 psia
Recirc pump seal leakage, gpm	Value that was used to define LOCA area, ALOCA	61 gpm
Total leakage used in the transient, gpm	Value that was used to define LOCA area, ALOCA	61 gpm

d. Choked flow from the SRV and the recirculation pump seal leakage is discussed in the EPRI BWR Roadmap. The parameters identified that impact the flow calculation are listed below with input values identified.

Parameter Name	Value Used in the Dresden MAAP Analysis	EPRI Recommended Value
ASRV – effective flow area for	0.062 ft^2	Plant-specific value

Attachment 4
MAAP JUSTIFICATION FOR ELAP ANALYSIS ACCEPTABILITY

relief valve	(based on rated flow at pressure)	
ALOCA – seal leakage area	9.55E-4 ft^2 (61 gpm at normal conditions)	Plant-specific value
FCDBRK – discharge coefficient for seal leakage	0.75	0.75

e. Venting of the containment was not considered in the Dresden MAAP analysis.

f. Decay heat in MAAP is discussed in the EPRI BWR Roadmap (EPRI Product ID 3002002749). Input parameters used to compute the decay heat are identified in the roadmap and are listed in the following table along with their values used in the Dresden analysis.

Parameter Name	Value Used in the Dresden MAAP Analysis	EPRI Recommended Value
FENRCH – normal fuel enrichment	0.0409	Plant-specific value
EXPO – average exposure	20,000 MW-day/ton	Plant-specific value
FCR – total capture rate of U-238 / total absorption rate	0.324	Plant-specific value
FFAF – total absorption rate / total fission rate	2.37	Plant-specific value
FQFR1 – fraction of fission power due to U-235 and PU-241	0.476	Plant-specific value
FQFR2 – fraction of fission power due to PU-239	0.437	Plant-specific value
FQFR3 – fraction of fission power due to U-238	0.087	Plant-specific value
TIRRAD – average effective irradiation time for entire core	26,280 hours	Plant-specific value

ITEM (NOTE – this item corresponds to NRC Interim Staff Evaluation CONFIRMATORY action item 3.2.1.1.E of the Dresden evaluation)

(5) The specific MAAP4 analysis case that was used to validate the timing of mitigating strategies in the integrated plan must be identified and should be available on the ePortal for NRC staff to view. Alternately, a comparable level of information may be included in the supplemental response. In either case, the analysis should include a plot of the collapsed

Attachment 4
MAAP JUSTIFICATION FOR ELAP ANALYSIS ACCEPTABILITY

vessel level to confirm that TAF is not reached (the elevation of the TAF should be provided) and a plot of the temperature cool down to confirm that the cool down is within tech spec limits.

Response to item 5:

The MAAP analysis performed in support of the Dresden Integrated Plan is documented in calculation DR-MISC-043 Rev. 1 and is available on the ePortal. Case 9 was the specific MAAP run selected to represent the scenario as described in Attachment 1A of the integrated plan.