UK EPR	*UK EPR GDA PROJECT*			
	Title: Resolution Plan for GI-UKEPR-FS05			
	RP unique number:	Revision No.:	Effective Date:	Page No.:
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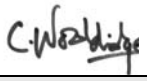
Approved for EDF by: A. PETIT *Name/Initials*  *Date 22/06/2011*	Approved for AREVA by: C. WOOLDRIDGE *Name/Initials*  *Date 23/06/2011*

Resolution Plan Revision History

Rev.	Description of update	Date issued
Rev 0	First revision	23/06/11

1.0 GDA ISSUE

GDA Issue Title	Main Assessment Area	Related Assessment Area
Design Basis Analysis of Essential Support systems	Fault Studies	PSA & Electrical Engineering

GDA Issue	EDF and AREVA to provide a design basis analysis of failures in the essential support systems

2.0 OVERVIEW OF SCOPE OF WORK

SAP FA.2 requires that the process for identifying initiating faults should be systematic, auditable and comprehensive. In UK, any initiating event identified in the PSA should hence be included within (or bounded by) a design basis initiating event unless it is screened out on grounds of low frequency. Therefore, in order to increase confidence that the list of design basis initiating events considered within the PCSR is as comprehensive as possible, RO-UKEPR-40 required EDF and AREVA to reconcile the list of PCC initiating events in the PCSR with the list of PSA initiating events.

In the response to RO-UKEPR-40, an exhaustive review of the PSA initiating events was performed. This response identified additional initiating events associated with failures in the essential support systems that need to be included in the PCC list of initiating events and for which a design basis analysis is required.

The ONR expects EDF and AREVA to perform a design basis analysis of the following initiating events on the essential support systems of the UKEPR:

- Loss of cooling chain faults as identified in the response to RO-UKEPR-40,

- Electrical system faults, and
- HVAC system faults.

Other potential design basis initiating events identified within the response to RO-UKEPR-40 are either covered by other GDA issues or will be addressed through assessment findings as updates to the PCSR.

3.0 GDA ISSUE ACTIONS AND RESOLUTION PLAN DELIVERABLES

3.1 Action GI-UKEPR-FS05.A1

Action I/D	Action Description
GI-UKEPR-FS05-A1	EDF and AREVA to perform a design basis analysis of the following initiating events on the essential support systems of the UKEPR: • Loss of cooling chain faults as identified in NEPR-F DC 584 Rev A • Electrical system faults (as identified from future PSA screening analysis) • HVAC system faults (as identified from future PSA screening analysis)

3.1.1 Planned submissions in response to GI-UKEPR-FS05.A1

3.1.1.1 Description of Scope of Work

In the response to RO-UKEPR-40, EDF and AREVA have identified additional postulated cooling chain failures that need to be treated as design basis initiating events within the PCC analysis. These faults should be subject to a design basis analysis. EDF and AREVA have also identified that postulated failures in the Electrical System and HVAC system will need to be analysed within the PSA. At this stage of the design, a simplified screening analysis will be performed for initiating events related to Electrical system faults and HVAC system faults. Any new initiating bounding events identified must be reviewed for consideration as design basis events. Any new design basis initiating events identified as frequent faults will be subject to a diversity analysis (GI-UKEPR-FS02.A8).

EDF and AREVA will carry out systematic analysis of postulated failures of the cooling chain and of initiating events for electrical systems and HVAC systems identified via the PSA. This analysis will establish the consequences of failures within essential support systems. This will determine whether these potential design basis initiating events are to be included in the exhaustive list of UK EPR design basis faults and treated as such. EDF and AREVA will demonstrate the functional capability of the associated protection systems and that these have an appropriate safety categorisation. Any shortfall in requirements will be subject to an ALARP analysis to identify possible design improvements to reach the appropriate standard.

3.1.1.2 Description of Methodology to be employed

<u>Task 1 – Loss of cooling chain faults</u>

The method described in PCSR Chapter 14 will be applied to the analysis of potential initiating events. This will allow a conservative approach to the assessment of the consequences of these postulated faults. The analysis will be consistent with the rules that apply to deterministic analysis of potential

design basis faults that have been applied to the existing design basis faults.

The analysis will be performed in several stages:

- Functional analysis of the cooling chain and potential failure modes, initiating events. Functional analysis includes identification of initiating events (leakages, blockage of valves, total loss of cooling chain) and their associated frequencies according to updated PSA results.

- Identification of the bounding scenarios and their associated frequencies (need for PSA or DBA analysis will be determined at this stage). Determination of potential frequent initiating events will also be determined at this stage. This will provide the input data for GI-UKEPR-FS02 Action 8).

- Review of potential design changes if needed: feasibility, adequacy of each potential design change with respect to the bounding fault (identification of the ALARP design options), etc.

- Update of fault studies according to previous results: main line of defence (note: for frequent faults identified, the analysis of a diverse line of defence will be dealt with within GI-UKEPR-FS02 Action 8).

- Update of PCSR Chapter 14 – Design Basis Analysis. Potentially impacted sub-chapters are 14.2 to reflect any single failure criteria analysis or justification carried out as part of this work and sub-chapters14.3 through 14.5–Analysis of PCC-2 / PCC-3 and PCC-4 events.

Design changes, if required, will be evaluated and processed in accordance with the UK EPR GDA design change process.

A meeting will be organised with the ONR in September / October (date TBD) to present the results of the functional analysis and bounding scenarios with their associated frequencies, before submission of the dedicated report.

Task 2 – Loss of electrical systems

The method described In PCSR Chapter 14 will be applied to the analysis of potential initiating events. This will allow a conservative approach to the assessment of the consequences of these postulated faults. The analysis will be consistent with the rules that apply to deterministic analysis of potential design basis faults that have been applied to the existing design basis faults.

The PSA identified reliabilities of switchboards will be used to identify the credible equipment failures to analyse. These credible failures will be assessed in order to establish if they are bounded by a loss of safeguard division design basis analysis.

Each postulated equipment failure that is not bounded by the loss of 1 safeguard division will be reviewed to identify transients that are generated by the failure. This will consider the most penalising scenario and the worst aggravating failure for that transient. The mitigation of the transient will be reviewed in order to establish whether the electrical fault has an impact on equipment that will mitigate the fault. In this way, it will be possible to establish whether a new design basis fault has been identified. If a new design basis fault is identified, transient analysis or simplified consequence analyses will be carried out to quantify the impact on the reactor core and any potential radiological

consequences.

The mitigation required for the new PCC will be derived from the transient analysis and appropriate lines of defence justified if they exist or will be introduced via the modification process if required. The modification process will be informed by an ALARP process once feasible design options have been selected.

Any new design basis analysis, transient analysis or ALARP justifications will be incorporated into the PCSR in chapters 14 and 16 where relevant. Any system modifications will be reflected in the relevant PCSR system chapters.

Proposed action plan will be held in different stages:

- Functional analysis of the loss of electrical systems. A number of electrical systems have been identified as bounding systems and failure of each of these systems needs to be analysed.

- Identification of bounding scenarios, including associated frequency (support from PSA group). Bounding scenarios will include typical cases of maintenance at power (and periodic tests).

- Identification of bounding PCC events for each scenario: EDF and AREVA will review the functional analysis to identify bounding PCCs for each initiating event.

- Review of potential design changes, if needed, and their feasibility: assess proposed modifications and adequacy with respect to the identified bounding faults.

Design changes, if required will be evaluated and processed in accordance with the EDF and AREVA required quality assurance design change process.

A meeting will be organised with the ONR in September / October (date TBD) to present the results of the functional analysis and bounding scenarios with their associated frequencies, before submission of the dedicated report.

Task 3 – HVAC Systems

The method applied to the design basis analysis for the loss of heating, ventilation and air conditioning systems faults will be the same approach as that described for Task 2. The deterministic approach described In PCSR Chapter 14 will be applied to the analysis of potential initiating events. This will allow a conservative approach to the assessment of the consequences of these postulated faults. The analysis will be consistent with the rules that apply to deterministic analysis of potential design basis faults that have been applied to the existing design basis faults.

The PSA identified reliabilities of HVAC system components will be used to identify the credible equipment failures to analyse. These credible failures will be assessed in order to establish if they are bounded by the loss of one safeguard division design basis analysis.

Each postulated equipment failure that is not bounded by the loss of 1 safeguard division will be reviewed to identify transients that are generated by that failure. Particular attention will be paid to the

HVAC equipment that supports I&C equipment, electrical switchboards, essential diesel generators and ultimate diesel generators. This process will consider the most penalising scenario and the worst aggravating failure for that transient. Either a new PCC initiating event will be identified or the systems claimed as contributing to a line of defence in mitigation of an existing transient will be reviewed in order to establish whether the HVAC fault has an impact on equipment that will contribute to that line of defence. In this way, it will be possible to establish whether a new design basis fault has been identified. If a new design basis fault is identified, transient analysis or similar analysis will be carried out to quantify the impact on the reactor core and any potential radiological consequences.

The mitigation strategy required for the new PCC will be derived from the transient analysis and appropriate lines of defence justified. Any modification will be informed by an ALARP process once feasible design options have been selected.

Any new design basis analysis, transient analysis or ALARP justifications will be incorporated into the PCSR in chapters 14 and 16 where relevant. Any system modifications will be reflected in the relevant PCSR system chapters.

Proposed action plan will be held in different stages:

- Functional analysis of the loss of HVAC systems to identified bounding failures to be analysed.

- Identification of bounding scenarios, including associated frequency (support from PSA group). Bounding scenarios need to include typical cases of maintenance at power (and periodic tests).

- Identification of bounding PCC events for each scenario: EDF and AREVA will review the functional analysis to identify bounding PCCs for each initiating event

- Review of potential design changes, if needed, and their feasibility: assess proposed modifications and adequacy with respect to the identified bounding faults.

Design changes, if required will be evaluated and processed in accordance with the UK EPR GDA design change process.

A meeting will be organised with the ONR in September / October (date TBD) to present the results of the functional analysis and bounding scenarios with their associated frequencies, before submission of the dedicated report.

3.1.1.3 Deliverable description	**Submission date to ONR/EA**
XXX – Functional analysis for loss of support systems Formal submission setting out the results of the functional analysis. - Meeting – Presentation of functional analysis with loss of cooling chain faults, HVAC and electrical supply - Revision A Functional analysis of failure of essential support systems	 September / October (date TBD) 30/12/2011
XXX – Results of optioneering for loss of support systems Results of optioneering of design change options and conclusion on necessity of design change for loss of cooling chain faults, electrical and HVAC systems faults.	30/12/2011
PCSR chapters for chapters 14 and 16 Potentially impacted PCSR sub-chapters are 14.2 to 14.5, chapter 16.5 and any system chapter potentially identified through the modification process	Advanced copy 28/02/2012 Final submission 01/05/2012
NEPR-F DC 584 Rev A - Consistency between PSA List and PCC List Document NEPR-F DC 584 A will be proposed for update on the basis of the results of the functional analysis and results of optioneering and following the Regulators feedback on these deliverables	28/02/2012

4.0 SUMMARY OF IMPACT ON GDA SUBMISSION DOCUMENTATION

4.1 GDA submission documents impacted by GDA Issue and scheduled to be created (C) or updated (U) within GDA

GDA Submission Documents	C/U	Related GDA Issue Action(s)	Submission Date to ONR/EA
SSER sub-chapters			
Potential update to chapters 14.2 through 14.5 and 16.5			
Chapter 14.2 – Analysis of the Passive Single Failure	U	GI-UKEPR-FS05.A1	Advanced copies 28/02/2012
Chapter 14.3 - Analyses of PCC-2 events	U		
Chapter 14.4 - Analyses of PCC-3 events	U		
Chapter 14.5 - Analyses of PCC-4 events	U		Final submission 01/05/2012
Chapter 16.5 - Adequacy of the UK EPR design regarding functional diversity	U		
GDA reference design documents (SDM in UKEPR-I-002)			
None			
Other GDA submission supporting documents			
XXX – Functional analysis for loss of support systems	C	GI-UKEPR-FS05.A1	31/12/2011
XXX – Results of optioneering for loss of support systems	C		31/12/2011
NEPR-F DC 584 – Rev B – Consistency between PSA List and PCC List	U		28/02/2012

5.0 JUSTIFICATION OF ADEQUACY

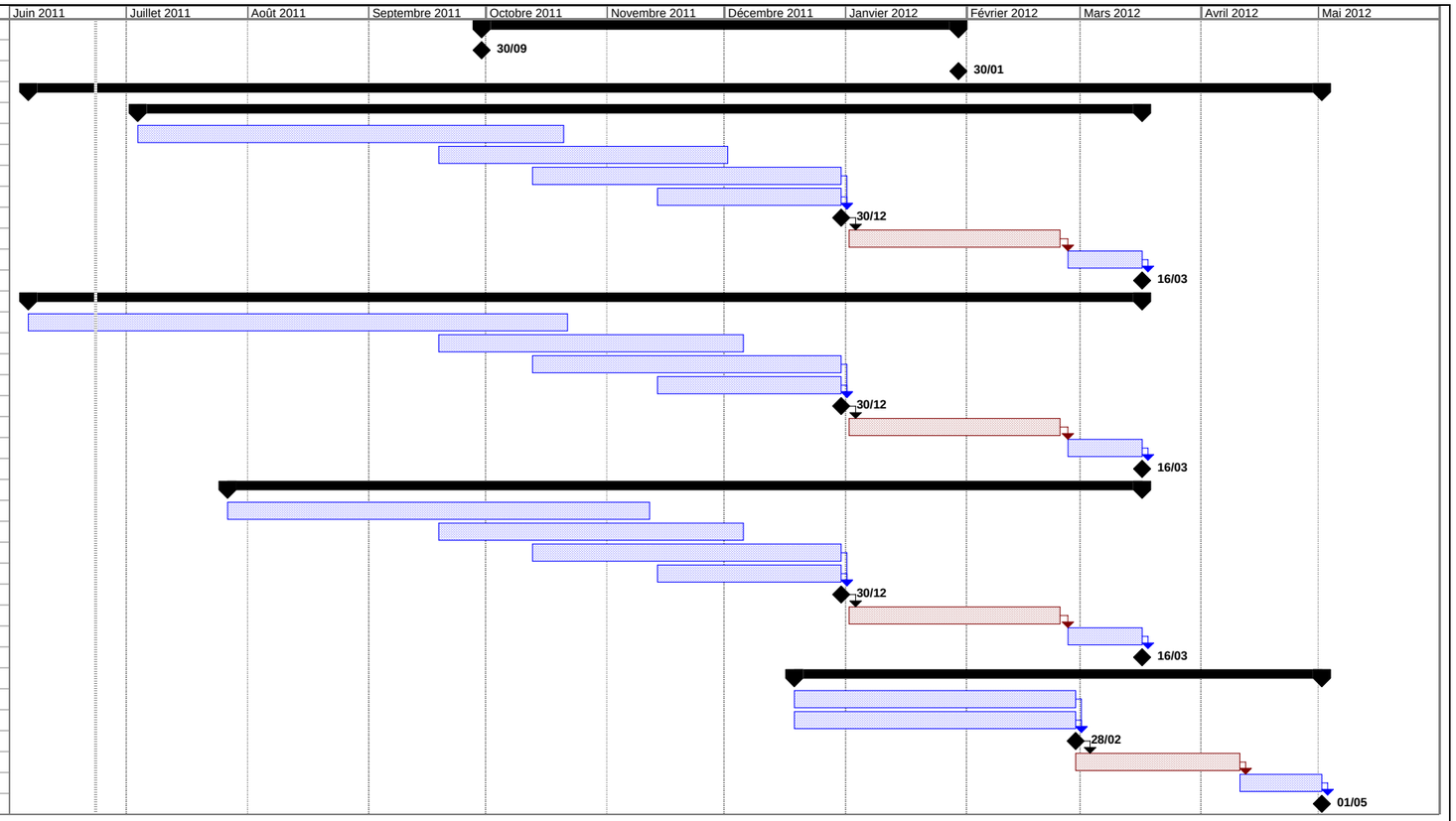
Postulated failures of the cooling chain, of electrical supplies and of HVAC systems will be analysed in accordance with the EDF and AREVA rules for the analysis of design basis initiating events. The identification of the consequences of these postulated failures will therefore allow a systematic and exhaustive approach to the inclusion or otherwise of these failures as design basis faults. The analysis of postulated failures, informed by the identification of initiating events from the PSA, will confirm whether they are to be included within the design basis or not.

Potential solutions and mitigation strategies will be identified where a new design basis fault is confirmed through analysis. The process for the choice of potential design solutions will include assessment of the benefits of particular solutions and whether the risk of radiological release resulting from new design basis fault and any associated mitigating actions is as low as reasonably practicable.

6.0 TIMETABLE AND MILESTONE PROGRAMME LEADING TO THE DELIVERABLES

The schedule is attached to this resolution plan.

N°	Nom de la tâche	Durée	Début	Fin	Prédécesseurs	Noms ressources
1	**Meetings**	**86 jours**	**Ven 30/09/11**	**Lun 30/01/12**		
2	Meeting 1 - Functional analysis and bounding scenarios	0 jour	Ven 30/09/11	Ven 30/09/11		
3	Meeting 2 - if necessary - feedback on deliverables	0 jour	Lun 30/01/12	Lun 30/01/12		
4	**Action 1 - Analysis of support systems**	**237 jours?**	**Lun 06/06/11**	**Mar 01/05/12**		
5	**Task 1 - Cooling Chain**	**185 jours**	**Lun 04/07/11**	**Ven 16/03/12**		
6	Functional analysis of cooling chain	79 jours	Lun 04/07/11	Jeu 20/10/11		
7	Frequencies analysis and bounding scenarios	54 jours	Lun 19/09/11	Jeu 01/12/11		
8	ALARP analysis	57 jours	Jeu 13/10/11	Ven 30/12/11		
9	Report - functional analyses	35 jours	Lun 14/11/11	Ven 30/12/11		
10	Transmission to ONR	0 jour	Ven 30/12/11	Ven 30/12/11	9;8	
11	ONR review	40 jours	Lun 02/01/12	Ven 24/02/12	10	
12	Update following ONR comments (including reviews)	15 jours	Lun 27/02/12	Ven 16/03/12	11	
13	Submission of revised report	0 jour	Ven 16/03/12	Ven 16/03/12	12	
14	**Task 2 - Electrical Systems**	**205 jours?**	**Lun 06/06/11**	**Ven 16/03/12**		
15	Functional analysis of electrical systems	100 jours	Lun 06/06/11	Ven 21/10/11		
16	Frequencies analysis and bounding PCCs	56 jours	Lun 19/09/11	Lun 05/12/11		
17	ALARP analysis	57 jours?	Jeu 13/10/11	Ven 30/12/11		
18	Report - functional analyses	35 jours	Lun 14/11/11	Ven 30/12/11		
19	Transmission to ONR	0 jour	Ven 30/12/11	Ven 30/12/11	18;17	
20	ONR review	40 jours	Lun 02/01/12	Ven 24/02/12	19	
21	Update following ONR comments (including reviews)	15 jours	Lun 27/02/12	Ven 16/03/12	20	
22	Submission of revised report	0 jour	Ven 16/03/12	Ven 16/03/12	21	
23	**Task 3 - HVAC Systems**	**168 jours?**	**Mer 27/07/11**	**Ven 16/03/12**		
24	Functional analysis of HVAC systems	78 jours	Mer 27/07/11	Ven 11/11/11		
25	Frequencies analysis and bounding PCCs	56 jours	Lun 19/09/11	Lun 05/12/11		
26	ALARP analysis	57 jours?	Jeu 13/10/11	Ven 30/12/11		
27	Report - functional analyses	35 jours	Lun 14/11/11	Ven 30/12/11		
28	Transmission to ONR	0 jour	Ven 30/12/11	Ven 30/12/11	27;26	
29	ONR review	40 jours	Lun 02/01/12	Ven 24/02/12	28	
30	Update following ONR comments (including reviews)	15 jours	Lun 27/02/12	Ven 16/03/12	29	
31	Submission of revised report	0 jour	Ven 16/03/12	Ven 16/03/12	30	
32	**Task 4 - Documentation Update**	**97 jours**	**Lun 19/12/11**	**Mar 01/05/12**		
33	Draft PCSR Chapters	52 jours	Lun 19/12/11	Mar 28/02/12		
34	Update of NEPR-F DC 584 A -	52 jours	Lun 19/12/11	Mar 28/02/12		
35	Transmission to ONR	0 jour	Mar 28/02/12	Mar 28/02/12	33;34	
36	ONR review	30 jours	Mer 29/02/12	Mar 10/04/12	35	
37	Update following ONR comments (including reviews)	15 jours	Mer 11/04/12	Mar 01/05/12	36	
38	Submission of revised report	0 jour	Mar 01/05/12	Mar 01/05/12	37	



Projet : GI-FS03_V1
Date : Jeu 23/06/11

Tâche
Fractionnement
Avancement
Jalon
Récapitulative
Récapitulatif du projet
Tâches externes
Jalons externes
Échéance