UK EPR	UK EPR GDA PROJECT			
	Title: Resolution Plan for GI-UKEPR-FS02			
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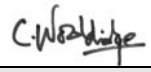
Approved for EDF by: A. PETIT *Name/Initials*  *Date* *29/06/2011*	Approved for AREVA by: C. WOOLDRIDGE *Name/Initials*  *Date* *29/06/2011*

Resolution Plan Revision History

Rev.	Description of update	Date issued
Rev 0	First revision	29/06/2011

1.0 GDA ISSUE

GDA Issue Title	Main Assessment Area	Related Assessment Area
DIVERSITY FOR FREQUENT FAULTS	Fault Studies	PSA, C&I, Human Factors

GDA Issue	Demonstration of functional diversity for frequent faults

2.0 OVERVIEW OF SCOPE OF WORK

In the UK, fault sequences with a frequency greater than 1×10^{-7} per year are considered to be within the design basis. Given realistic limits for estimates for common mode failure, it follows that for faults more frequent than about 1×10^{-3} per year two diverse safety systems need to be provided for each safety function to ensure that the sequence frequency target for design basis events of 1×10^{-7} per year is met. RO-UKEPR-41 required a demonstration that for all design basis faults more frequent than 1×10^{-3} per year a diverse safety system, qualified to an appropriate standard, is provided for each safety function.

Report NEPR-F DC 592 Rev A has demonstrated adequate diversity for each safety function to meet the requirements of this regulatory observation for most of the frequent faults. However, there are a number of very specific cases were further evidence is required by ONR. These specific cases are outlined in this GDA issue (see action description below).

3.0 GDA ISSUE ACTIONS AND RESOLUTION PLAN DELIVERABLES

3.1 Action GI-UKEPR-FS02.A1, A3 and A4

Action I/D	Action Description
GI-UKEPR-FS02.A1	Implement the proposed modification to provide a diverse high hot leg pressure trip signal on an appropriately diverse protection system for a loss of normal feedwater fault with failure of the reactor protection system to trip. EDF and AREVA have identified that a modification is required to provide a reactor trip signal on high hot leg pressure on a non-TXS based protection system. This is to protect against a loss of normal feedwater fault with failure of the TXS based reactor protection system to trip the reactor. The design for the proposed modification will need to complete the six-stage modification process for inclusion within the consolidated PCSR. With agreement from the Regulator this action may be completed by alternative means.
GI-UKEPR-FS02.A3	Implement the proposed modification to provide a diverse low RCP speed trip signal on an appropriately diverse protection system for a reduction in flow fault with failure of the reactor protection system to trip. EDF and AREVA have identified that a modification is required to provide a reactor trip signal on low RCP speed on a non-TXS based protection system. This is to protect against a flow reduction fault with failure of the TXS based reactor protection system to trip the reactor. The design for the proposed modification will need to complete the six stage modification process for inclusion in the consolidated PCSR. With agreement from the Regulator this action may be completed by alternative means.
GI-UKEPR-FS02.A4	Implement the proposed modification to provide diverse high axial offset and high neutron flux trips on an appropriately diverse protection system for a RCCA bank withdrawal fault with failure of the reactor protection system to trip. EDF and AREVA have identified that two extra reactor trip signals need to be added to a non-TXS based protection system. The extra trip signals are a high axial offset trip and a high neutron flux trip. These changes are to protect against a RCCA bank withdrawal fault with failure of the TXS based reactor protection system to trip the reactor. The design for the proposed modification will need to complete the six-stage modification process for inclusion in the consolidated PCSR. With agreement from the Regulator this action may be completed by alternative means.

3.1.1 Planned submissions in response to GI-UKEPR- FS02. A1, A3 and A4

3.1.1.1 Description of Scope of Work

The proposed modification identifying the additional reactor trip signals in the SAS to ensure functional diversity is presented in Change Management Form #23 (CMF023). Stage 1 of the modification (description and rationale for the change) was submitted in January 2011. In order to complete the six-step process, Stage 2 of the modification (Impact analysis) will be submitted.

3.1.1.2 Description of Methodology to be employed

Stage 2 of the GDA Design Change process identified in UKEPR-I-003 – Design change procedure shall be applied to CMF 023.

An impact analysis of the modification will be performed on the GDA submission documentation.

The Impact on the PCSR has already been identified and PCSR chapters have been updated accordingly in the March 2011 submission.

3.1.1.3 Deliverable description	**Submission date to HSE/EA**
CMF 023 – Stage 2	30/06/2011
Impact analysis for CMF 23 (SSER, L2/L3 documents and SDMs impact)	

3.2 Action GI-UKEPR-FS02.A2

Action I/D	Action Description
GI-UKEPR-FS02.A2	Provide improved protection for the excessive increase in secondary steam flow fault with failure of the reactor to trip due to either mechanical failure of the rods to insert or failure of the reactor protection system. In NEPR-F DC 592, analysis is presented for the case of excessive increase in secondary steam flow with failure of the reactor to trip. The analysis demonstrates that for such transients, the fault continues for a considerable period and that the variation in DNB is significant. This is true for both the mechanical failure of the rods to insert and the failure of the TXS-based reactor protection system: - In the case of the mechanical failure to insert, the position has been made worst by the recent design change to increase the partial cooldown rate for SBLOCA faults which has resulted in a relaxation of the SG pressure drop trip set point which now means that low SG level is the most effective trip parameter for these faults. - In the case of mechanical failure of the rods to insert, EDF and AREVA will justify why it is not ALARP to provide an additional trip signal or tighten the protection set points for this fault. - In the case of TXS failure, EDF and AREVA will perform an ALARP study to explore the feasibility of providing an extra trip parameter on a non-TXS based diverse protection system. Any design modifications identified as necessary will need to complete the six-stage modification process for inclusion in the consolidated PCSR. With agreement from the Regulator this action may be completed by alternative means.

3.2.1 Deliverables already submitted to HSE/EA in response to GI-UKEPR-FS02.A2

	Date of submission
Full Response to TQ 1432 – Comments on Report NEPR-F DC 592 Rev A. The results corresponding to the transient analysis performed using a 3D core modelling are presented the TQ response	05/05/2011

3.2.2 Planned submissions in response to GI-UKEPR- FS02. A2

3.2.2.1 Description of Scope of Work

In NEPR-F DC 592, analysis is presented for the case of excessive increase in secondary steam flow with failure of the reactor to trip. The analysis demonstrates that for such transients, the fault continues for a considerable period and that the variation in DNB is significant. This is true for both the mechanical failure of the rods to insert and the failure of the TXS-based reactor protection system. In the case of the mechanical failure to insert, the recent design change to increase the partial cooldown rate for SBLOCA faults has resulted in a relaxation of the SG pressure drop trip set point which now means that low SG level is the most effective trip parameter for these faults.

In the case of mechanical failure of the rods to insert, EDF and AREVA will justify why it is not ALARP to provide an additional trip signal or tighten the protection set points for this fault. In the case of TXS failure, EDF and AREVA will perform an ALARP study to explore the feasibility of providing an extra trip parameter on a non-TXS based diverse protection system.

Should any design modifications be identified as necessary, they will need to complete the six-stage modification process for inclusion in the consolidated PCSR.

3.2.2.2 Description of Methodology to be employed

Task 1: ATWS 3D calculation in case of excessive increase in steam flow to demonstrate that margins are sufficient to meet the safety criteria (task already performed and transmitted through response to TQ 1432 - Item 6).

Task 2: Sensitivity studies on axial offset, radial power distribution and moderator effect will be performed for the 3D ATWS in addition to the computation provided in Task 1.

Task 3: An ALARP analysis regarding the feasibility to decrease the time to reach a diversified reactor trip in case of excessive increase in steam flow will be produced.

Task 4: PCSR Update.

Update of the PCSR Sub-chapter and documentation to add this demonstration to the functional diversity analysis.

Task 5: Design changes

If design changes are identified as the ALARP solution during resolution of the GDA Issue action, they will be processed according to UKEPR-I-003 – Design Change Process.

Schedule to be defined according to results of Task 3.

3.2.2.3 Deliverable description	**Submission date to HSE/EA**
PEPR-F- XXX - ATWS excessive increase in steam flow – Sensitivity studies Sensitivity analyses on axial offset and radial power distribution for the ATWS excessive increase in steam flow	31/10/2011
NEPR-F DC 592 A – Functional Diversity for Frequent Faults – Quantified Analyses Addition of ALARP justification of the design	30/12/2011
PCSR Sub-chapter 16.5 – Adequacy of UK EPR Design Regarding Functional Diversity Update of PCSR sub chapter to include demonstration of the functional diversity analysis	Advanced copy 28/02/2012 Final 01/05/2012

3.3 Action GI-UKEPR-FS02.A5

Action I/D	Action Description
GI-UKEPR-FS02.A5	Demonstrate the provision of diverse protection against rod misplacement faults including one or more dropped rods. No analysis of these faults is presented within NEPR-F DC 592 and yet these faults will be very difficult to detect should there be a failure of the TXS-based reactor protection system. For this reason, EDF and AREVA are to provide explicit transient analysis using design basis analysis techniques for these faults to demonstrate that the diverse protection systems are functionally capable of maintaining adequate margin to departure from nucleate boiling. A modification to include the provision of a negative-rate flux trip signal on a non TXS-based protection system is to be considered as a possible ALARP measure. The design of any proposed modification will need to complete the six-stage modification process for inclusion within the consolidated PCSR. With agreement from the Regulator this action may be completed by alternative means.

3.3.1 Deliverables already submitted to HSE/EA in response to GI-UKEPR-FS02.A5

	Date of submission
Full Response to TQ 1432 – Comments on Report NEPR-F DC 592 Rev A. The long term aspect study for the following situation: Rod Drop of three RCCAs with ATWS due to the total failure of TXS platform is presented in the TQ 1432 response	05/05/2011

3.3.2 Planned submissions in response to GI-UKEPR- FS02.A5

3.3.2.1 Description of Scope of Work

The analyses for these faults are not presented in NEPR-F DC 592 and yet these faults will be difficult to detect should there be a failure of the TXS-based reactor protection system. For this reason, EDF and AREVA are to provide explicit transient analysis using design basis analysis techniques for these faults to demonstrate that the diverse protection systems are functionally capable of maintaining adequate margin to departure from nucleate boiling.

An analysis was provided through the response to TQ 1432 presenting a case of 3 dropped rods with failure of the TXS system.

In addition, analysis studies justifying that the selected rod drop pattern is the bounding case will

be required. ONR would also like assurance that the rods that are predicted to enter DNB will not exceed the cladding temperature constraints during the transient and will therefore retain their structural integrity.

The design of any proposed modification will need to complete the six-stage modification process for inclusion within the consolidated PCSR.

3.3.2.2 Description of Methodology to be employed

Task 1: Sensitivity study

Analysis justifying that the selected rod drop pattern (presented in the response to TQ 1432) is the bounding case will be performed. The complementary study will also include assurance that the rods that are predicted to enter DNB will not exceed the cladding temperature constraints during the transient and will therefore retain their structural integrity.

Justification of the case presented to HSE in May 2011 will be given.

Schedule: 15/10/2011

Task 2 : Documentation update

Update of the PCSR Sub-chapter and documentation to add these additional analysis.

Task 3: Design changes

If design changes are identified, they will be processed according to UKEPR-I-003 – Design Change Process.

Schedule to be defined according to results of Task 1.

3.3.2.3 Deliverable description

	Submission date to HSE/EA
pepcf XX.XXXX - UK EPR GDA – TQ 1432 - ATWS by loss of TXS – RCCA misalignment up to Rod drop Document will present rod drop analysis and appropriate sensitivity studies.	15/11/2011
NEPR-F DC 592 A – Functional Diversity for Frequent Faults – Quantified Analyses Update of document to include rod drop analysis (TQ 1432 and complements)	31/12/2011

PCSR Sub-chapter 16.5 – Adequacy of UK EPR Design Regarding Functional Diversity	Advanced copy
Update of document to include rod drop analysis (TQ 1432 and complements)	28/02/2012
	Final
	01/05/2012

3.4 Action GI-UKEPR-FS02.A6

Action I/D	Action Description
GI-UKEPR-FS02.A6	Demonstrate the provision of diverse protection against loss of CVCS following a normal reactor trip and xenon decay including demonstration of diversity to operator action. After every reactor trip from full power there is an eventual decay in the level of xenon poisoning within the reactor core. The resultant swing in reactivity needs to be compensated for through increasing the boron concentration in the reactor to ensure an adequate shutdown margin. While the emergency boration system (EBS) and the incontainment refuelling water storage tank (IRWST) provide two diverse sources of borated water, should the operator fail to ensure adequate shutdown margin using the Chemical and Volume Control System (CVCS), both these systems are also dependent upon operator action for actuation. Although timescales are long (many hours), this implies a combined human reliability of 1 x 10-7 per demand to meet the design basis target. For this reason, EDF and AREVA are to provide an ALARP study into the feasibility of automatically actuating the CVCS system to inject borated water after every reactor trip and for the EBS to be automatically actuated following failure of the CVCS. Alternatively, EDF and AREVA may wish to provide a consequence analysis of what would happen should the operator fail to ensure adequate shutdown margin. With agreement from the Regulator this action may be completed by alternative means.

3.4.1 Deliverables already submitted to HSE/EA in response to GI-UKEPR-FS02.A6

	Date of submission
Part Response to TQ 1432 – Comments on Report NEPR-F DC 592 Rev A - Item 1) presents the claim made by AREVA/EDF and provides the safety advantages and disadvantages for automatic EBS actuation after failure of CVCS.	17/02/2011

3.4.2 Planned submissions in response to GI-UKEPR- FS02.A6

3.4.2.1 Description of Scope of Work

After every reactor trip from full power there is an eventual decay in the level of xenon poisoning within the reactor core. The resultant swing in reactivity needs to be compensated for through increasing the boron concentration in the reactor to ensure an adequate shutdown margin. Should failure of the CVCS occur, two diverse sources of borated water are provided by the extra boration system (EBS) and the in-containment refuelling water storage tank (IRWST).

Reliance is placed on operator action to initiate both these systems manually. ONR is requesting AREVA and EDF to provide an ALARP study regarding feasibility of automatically actuating the EBS system to inject borated water after every reactor trip.

3.4.2.2 Description of Methodology to be employed

Task 1: Identification of all potential design options coping with the loss of CVCS after normal reactor trip.

The solution identified by the ONR in the GDA issue action text will be analysed first: automatic EBS actuation after RT. Other potential design options will be discussed internally between A/E through a dedicated meeting.

Task 2: Review of advantages/disadvantages for all design options proposed. This shall include (as mentioned in the full response to TQ 1432):

- Identification of the need (benefits for PSA, for instance)
- Safety advantages (Automatic safety class 1 boration ensures long-term sub-criticality, etc …)
- Safety disadvantages (SGTR management, structural integrity concerns etc…)
- Operational advantages / disadvantages (systematic boration at high boron concentration), impact on outage / planning / availability of the plant

Step 3: Conclusion of the ALARP aspect of the design regarding long-term subcriticality according to ALARP principles given PCSR Chapter 17 – Compliance with ALARP principle.

Step 4: Based on the conclusions of the ALARP analysis in Step 3, a design change will be proposed if needed.

3.4.2.3 Deliverable description	Submission date to HSE/EA
Diverse protection against loss of CVCS – ALARP justification of the design This document will present the review of safety and operational advantages/disadvantages of all potential solution and conclude on ALARP design.	22/07/2011
Update of PCSR Chapter 17 - Compliance with ALARP principle Addition of conclusions regarding ALARP analysis of design options coping with loss of CVCS after RT.	Advanced copy 30/11/2011 Final 13/01/2012

3.5 Action GI-UKEPR-FS02.A7

Action I/D	Action Description
GI-UKEPR-FS02.A7	Demonstrate the provision of diverse protection against a homogenous boron dilution fault occurring in shutdown conditions with failure of the reactor protection system. No analysis of this fault is presented within NEPR-F DC 592 and yet such a fault would be very difficult to detect should there be a failure of the TXS-based reactor protection system. For this reason, EDF and AREVA are to provide explicit transient analysis using design basis analysis techniques for this fault to demonstrate that the diverse protection systems are functionally capable of maintaining adequate margin to departure from nucleate boiling. A modification to include the provision of a boron dilution block signal and an EBS actuation signal on a non TXS-based protection system (actuated by low doubling time and/or high source-range flux level) is to be considered as a possible ALARP measure. The design of any proposed modification will need to complete the six-stage modification process for inclusion within the consolidated PCSR. With agreement from the Regulator this action may be completed by alternative means.

3.5.1 Planned submissions in response to GI-UKEPR- FS02.A7

3.5.1.1 Description of Scope of Work

EDF and AREVA shall demonstrate that the UK EPR is adequately protected against the sequence combining a homogeneous boron dilution from the CVCS in shutdown states and the loss of reactor protection system (or TXS).

An ALARP analysis will be performed to investigate potential modifications to ensure that the diverse protection systems are functionally capable of maintaining adequate margin to departure from nucleate boiling.

EDF and AREVA will respond to HSE's queries on the supplied safety case and provide further evidence, if required. EDF and AREVA will update the PCSR accordingly with the agreed safety case.

3.5.1.2 Description of Methodology to be employed

<u>Task 1: ALARP analysis</u>

All signals that can be credited in a non TXS platform to prevent homogeneous boron dilution from the CVCS in shutdown states with the loss of reactor protection system (or TXS) will be identified.

This functional analysis will also identify the corresponding level of qualification for each signal.

Based on the safety rules defining whether a signal can be credited in the functional diversity safety analysis, A/E will define how to characterize and detect a homogeneous CVCS dilution (at power or in shutdown states) and automatic or manual actions to be triggered after the dilution detection.

All potential means of detection shall be analysed and potential design changes shall be reviewed against the ALARP principle: review of safety and operational advantages/disadvantages.

A meeting will be organised with HSE to present the progress in October 2011.

A document presenting the result of optioneering will be issued in November 2011.

Task 2: Safety demonstration update

According to the ALARP analysis performed in Task 1, the safety demonstration will be performed according to the rules and methodology outlined in PCSR Chapter 16 – Risk Reduction and Severe Accident analyses.

The PCSR chapter (chapter 16.5 – Adequacy of the UK EPR design regarding functional diversity) will be updated accordingly.

Schedule: End of December 2011.

Task 3: Design changes

If design changes are identified as the ALARP solution during resolution of the GDA Issue action, they will be processed according to UKEPR-I-003 – Design Change Process.

Schedule to be defined according to results of Task 1.

3.5.1.3 Deliverable description

	Submission date to HSE/EA
PEPC-F.11.XX – Diverse protection against homogeneous dilution – ALARP justification of the design	30/11/2011
ALARP analysis of all potential means of detection and protection against homogeneous boron dilution faults from CVCS with loss of TXS	
NEPR-F DC 580 D – Functional Diversity for Frequent Faults	31/01/2012
Revision of the document to include analysis of functional diversity for homogeneous boron dilution faults from CVCS with failure of the TXS	

PCSR Sub-chapter 16.5 - Adequacy of the UK EPR design regarding functional diversity.	Advanced copy 28/02/2012
Update to include above analysis	Final 01/05/2012

3.6 Action GI-UKEPR-FS02.A8

Action I/D	Action Description
GI-UKEPR-FS02.A8	Demonstrate the provision of diverse protection for the frequent faults involving the loss of essential support systems (e.g. loss of cooling chain, electrical, HVAC). EDF and AREVA are to provide a demonstration of diversity for frequent faults involving loss of essential support systems including loss of cooling chain, electrical and HVAC systems. EDF and AREVA are to demonstrate that any diverse systems claimed are appropriately categorised. In the case of loss of grid with failure of the TXS-based protection system, the feasibility of automatically actuating the station-blackout diesel generators (SBO DGs) on a non-TXS based protection system will need to be considered as a possible ALARP measure. Any design changes identified from the review will need to complete the six-stage modification process for inclusion within the consolidated PCSR. With agreement from the Regulator this action may be completed by alternative means.

3.6.1 Planned submissions in response to GI-UKEPR- FS02.A8

3.6.1.1 Description of Scope of Work

EDF and AREVA are to demonstrate that a diverse mean of achieving controlled state is available for all frequent faults involving the loss of essential support system and that structures, systems and components are appropriately categorised. Any design changes required because of any reclassifications should be incorporated within the generic UKEPR safety case.

This demonstration will be performed for all frequent faults that will be identified through resolution to GI-UKEPR-FS05 (Loss of essential support systems).

The case of LOOP with failure of TXS will be accorded particular attention in order to assess appropriately the need of potential automatic actuation of Ultimate Diesel Generators (UDGs).

3.6.1.2 Description of Methodology to be employed

Task 1: The analysis for resolution of this GDA Issue action will demonstrate that diversity is ensured to reach the controlled state with appropriate safety classification. The design basis analysis in response to GI-UKEPR-FS05 will identify any loss of essential support system that is to be included in the EPR design basis. Part of the design Basis analysis will be to assign a probability to the failure that is an initiating event to a design basis accident (PCC), enabling identification of new frequent faults if such faults exist. Analyses shall demonstrate that such frequent faults are manageable using available and appropriately classified means. Analyses rules will be those established for the diversity

transient analyses (RO-UKEPR-41). This process will cover the case of the RCP thermal barrier if the essential support system design basis work identifies a leak at the thermal barrier to be a frequent fault.

If shortfalls are identified an ALARP analysis may be presented considering the impact on SSC classification change.

Task 2: For the initiating event of Loss of off-site power (LOOP) with coincident failure of the TXS I&C platform, the following actions will be performed

- a. Functional analysis for the transient. The latest UDG manual actuation start time delay will be defined. This delay will be compared to HF analysis of UDG manual actuation that has been performed.
- b. If inadequate safety margins are identified in a), a feasibility study of automatic actuation of UDGs will be performed
- c. Based on the previous analysis detailed in a and b above, an ALARP analysis will be developed.

Task 3: PCSR update

The PCSR chapters presenting the approach to diversity (Chapter 16.5) and Fault Schedule (14.7) will be updated according to the above analyses.

3.6.1.3 Deliverable description

	Submission date to HSE/EA
Diverse protection against frequent essential support system faults – ALARP justification of the design (RCP thermal barrier and automatic UDG actuation)	20/01/2012
NEPR-F DC 580 – Functional Diversity for Frequent Faults Update of supporting document to include Functional diversity for frequent faults on support systems	31/01/2012
PCSR Sub-chapter 16.5 - Adequacy of the UK EPR design regarding functional diversity. Update of PCSR chapter 16.5 to include additional elements from NEPR-F DC 580 revision B and C	Advanced copy 28/02/2012 Final 01/05/2012

PCSR Sub-Chapter 14.7 - Fault and protection schedule.

Update of PCSR chapter 14.7 to include additional diversity analysis .

Advanced copy 28/02/2012

Final 01/05/2012

3.7 Action GI-UKEPR-FS02.A9

Action I/D	Action Description
GI-UKEPR-FS02.A9	Demonstrate that there exists a diverse means of achieving the safe shutdown state from the controlled state for frequent faults. EDF and AREVA are to demonstrate that diverse means of achieving a safe shutdown state from the controlled state exist for all frequent faults and that all structures, systems and components are appropriately categorised. Any design changes required because of any reclassifications will need to complete the six-stage modification process for inclusion in the consolidated PCSR. With agreement from the Regulator this action may be completed by alternative means.

3.7.1 Planned submissions in response to GI-UKEPR- FS02.A9

3.7.1.1 Description of Scope of Work

EDF and AREVA are to demonstrate that a diverse means of achieving a safe shutdown state from the controlled state exist for all frequent faults and that all structures, systems and components are appropriately categorised. Any design changes required because of any reclassifications should be incorporated within the generic UKEPR safety case.

This demonstration will be performed for all frequent faults already identified in GDA and potential additional frequent faults identified through resolution to GI-UKEPR-FS-05 (Loss of support systems).

3.7.1.2 Description of Methodology to be employed

Step 1: The analysis for resolution of this GDA Issue action will demonstrate that diversity is ensured to reach the safe shutdown state with appropriate safety classification.

Each frequent fault (identified in the list from RO-UKEPR-40 response) will be analysed. For each fault, one will analyse, having in mind that the controlled state has been reached, diverse means to reach the safe shutdown state (or at a minimum a final state). Typically, for each Potential Initiating Event (PIE), after controlled state has been reach, one will analyse the consequences of losing separately, one of the following main system feature:

- Loss of boration means to ensure long-term sub-criticality:
    - RCV[CVCS] which is non-safety classified for post-accident boration
    - RBS [EBS] which is supposed to be lost as a consequence of diversity analysis

- Or, loss of cooling means to RHR conditions:
    - GCTc [MSB] which is non-safety classified for post-accident
    - VDA [MSRT] which is supposed to be lost as a consequence of diversity analysis
- Or, loss of depressurizing means to RHR conditions:
    - RCV [CVCS] spray which is non-safety classified for post-accident
    - PSV which is supposed to be lost as a consequence of diversity analysis

This analysis will credit if required the bleed and feed procedure, or will use appropriate safety classified means.

If shortfalls are identified an ALARP analysis shall be performed to assess the impact of a potential SSC classification modification.

Step 2: The analysis is similar to the one performed for step 1 after analysis of the loss of support systems performed in GI-UKEPR-FS05. For each frequent fault identified in the resolution to GI-UKEPR-FS-05, an analysis will be performed to ensure that appropriate diversified means of reaching the safe shutdown state are available.

Step 3: PCSR update

The PCSR chapters presenting the approach to diversity (Chapter 16.5) and Fault Schedule (14.7) will be updated according to the above analyses.

3.7.1.3 Deliverable description

	Submission date to HSE/EA
NEPR-F DC 580 C – Functional Diversity for Frequent Faults A first update of the Functional diversity for frequent faults document is scheduled to include diversity until safe shutdown state for all frequent faults already identified in GDA	22/07/2011
NEPR-F DC 580 D – Functional Diversity for Frequent Faults A second update of the Functional diversity for frequent faults document is scheduled to include diversity until safe shutdown state for additional frequent faults identified through resolution of GI-UKEPR-FS-05.	31/01/2012
PCSR Sub-chapter 16.5 - Adequacy of the UK EPR design regarding functional diversity. Update of PCSR chapter 16.5 to include additional elements from NEPR-F DC 580 revision B and C	Advanced copy 28/02/2012 Final 01/05/2012

PCSR Sub-Chapter 14.7 - Fault and protection schedule.

Update of PCSR chapter 14.7 to include additional diversity analysis until safe shutdown state is reached.

Advanced copy 28/02/2012

Final 19/06/2012

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 HSE/EA
SSER sub-chapters PCSR Chapter 17 – Compliance with ALARP principle Draft PCSR chapter	**U**	GI-UKEPR-FS02.A6	Advanced copy 30/11/2011 Final 13/01/2012
PCSR Sub-chapter 16.5 - Adequacy of the UK EPR design regarding functional diversity. Draft PCSR chapter	**U**	GI-UKEPR-FS02.A2, A5, A8 and A9	Advanced copy 28/02/2012 Final 01/05/2012
PCSR Sub-Chapter 14.7 - Fault and protection schedule. Draft PCSR chapter	**U**	GI-UKEPR-FS02.A8 and A9	Advanced copy 28/02/2012 Final 19/06/2012
GDA reference design documents (SDM in UKEPR-I-002) None			
Other GDA submission supporting documents Diverse protection against loss of CVCS – ALARP justification of the design	**C**	GI-UKEPR-FS02.A6	22/07/2011
PEPR-F- XXX - ATWS excessive increase in steam flow – Sensitivity studies Sensitivity analyses on axial offset and radial power distribution for the ATWS excessive increase in steam flow	**C**	GI-UKEPR-FS02.A2	31/10/2011
pepcf XX.XX - UK EPR GDA – ATWS by loss of TXS – Uncontrolled RCCA bank withdrawal at power and RCCA misalignment up to Rod drop Document will present rod drop analysis and justifications from task1.	**C**	GI-UKEPR-FS02.A5	15/11/2011

NEPR-F DC 580 C/D – Functional Diversity for Frequent Faults (2 successive updates)	**U**	GI-UKEPR-FS02.A7, A8 and A9	22/07/2011 31/01/2012
NEPR-F DC 592 A – Functional Diversity for Frequent Faults – Quantified Analyses Addition of ALARP justification of the design	**U**	GI-UKEPR-FS02.A2 and A5	30/12/2011
PEPC-F.11.XX – Diverse protection against homogeneous dilution – ALARP justification of the design	**C**	GI-UKEPR-FS02.A7	30/11/2011
CMF 023 – Stage 2 Impact analysis for CMF 23 (SSER, L2/L3 documents and SDMs impact)	**C**	GI-UKEPR-FS02.A1, A3 and A4	30/06/2011
Diverse protection against frequent essential support system faults – ALARP justification of the design (RCP thermal barrier and automatic UDG actuation)	**C**	GI-UKEPR-FS02.A8	20/01/2012

5.0 JUSTIFICATION OF ADEQUACY

The analyses proposed to solve these GDA Issue actions are based on:

- systematic review of all potential failure modes to ensure that all initiating events are covered by the analysis,
- Full ALARP analyses including evaluation of safety and operational advantages and disadvantages.

If required, design changes will be processed according to appropriate QA processes (I-003 – Design Change Process). All supporting documentation impacted by the resolution of the GDA Issue actions will be identified and documents will be updated according to appropriate QA processes (both entities usual QA processes as well as GDA specific requirements such as co-applicant review).

The GDA documentation (supporting documents and PCSR) will be updated to reflect the GDA Issue Actions resolution.

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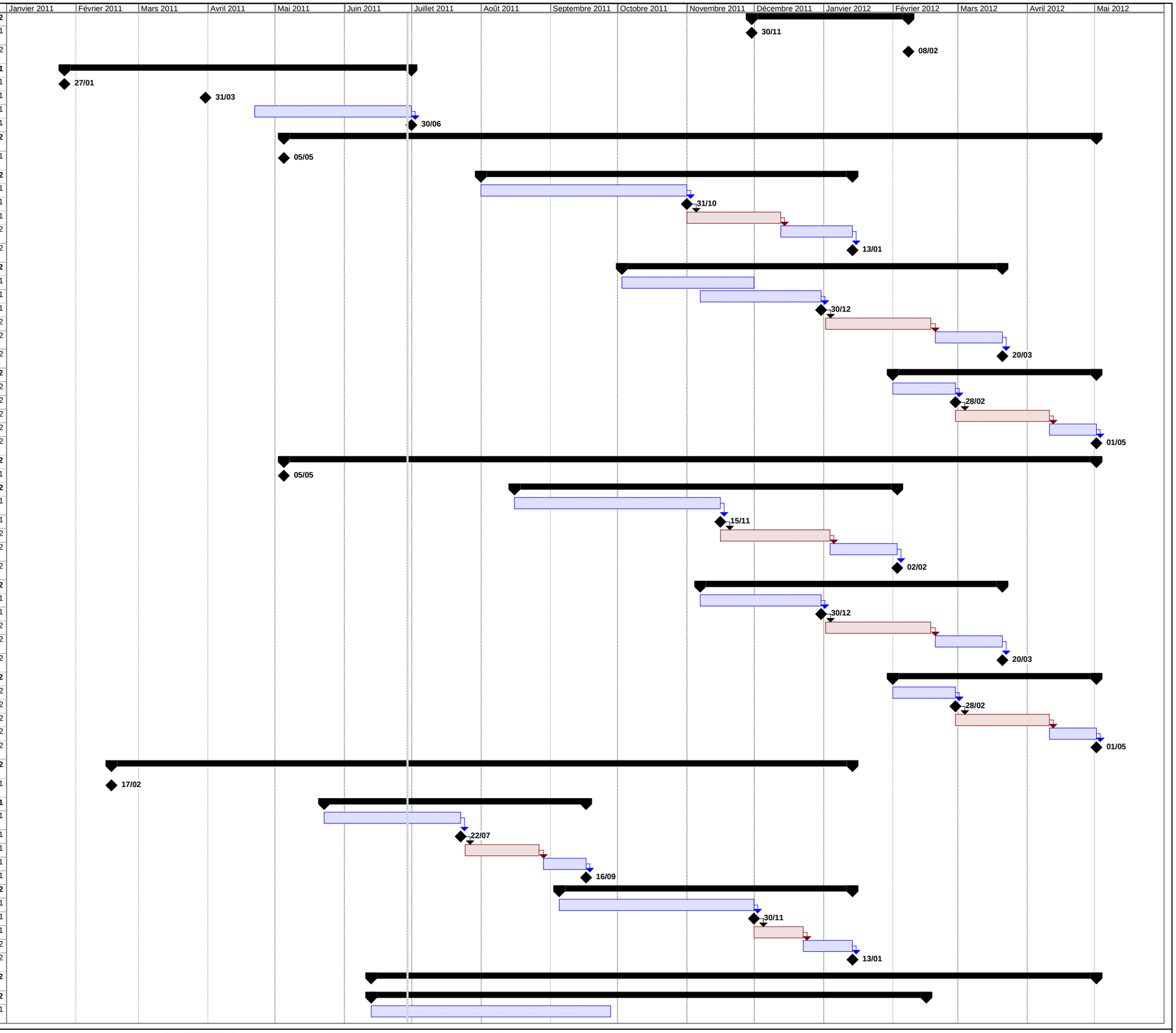
6.0 TIMETABLE AND MILESTONE PROGRAMME LEADING TO THE DELIVERABLES

Schedule is attached to this resolution plan.

N°		Nom de la tâche	Durée	Début	Fin
1		**Meetings**	**50 jours**	**Mer 30/11/11**	**Mer 08/02/12**
2		Meeting 1 - if necessary - progress meeting on deliverables	0 jour	Mer 30/11/11	Mer 30/11/11
3		Meeting 2 - if necessary - progress meeting on deliverables	0 jour	Mer 08/02/12	Mer 08/02/12
4		**Actions 1,3,4 - CMF 23**	**111 jours**	**Jeu 27/01/11**	**Jeu 30/06/11**
5		Submission of Stage 1 CMF	0 jour	Jeu 27/01/11	Jeu 27/01/11
6		Submission of updated PCSR	0 jour	Jeu 31/03/11	Jeu 31/03/11
7		Impact Analysis	50 jours	Ven 22/04/11	Jeu 30/06/11
8		Submission of Stage 2	0 jour	Jeu 30/06/11	Jeu 30/06/11
9		**Action 2 - Increase in secondary steam flow**	**259 jours?**	**Jeu 05/05/11**	**Mar 01/05/12**
10		Submission of Full response to TQ 1432	0 jour	Jeu 05/05/11	Jeu 05/05/11
11		**Task 1 - Sensitivity study**	**120 jours**	**Lun 01/08/11**	**Ven 13/01/12**
12		Study and report preparation	66 jours	Lun 01/08/11	Lun 31/10/11
13		Submission of revised analysis	0 jour	Lun 31/10/11	Lun 31/10/11
14		ONR Review	30 jours	Mar 01/11/11	Lun 12/12/11
15		Documentation update following ONR Review if needed	24 jours	Mar 13/12/11	Ven 13/01/12
16		Transmission of updated document	0 jour	Ven 13/01/12	Ven 13/01/12
17		**Task 2 - ALARP Analysis**	**122 jours?**	**Lun 03/10/11**	**Mar 20/03/12**
18		ALARP Analysis	43 jours?	Lun 03/10/11	Mer 30/11/11
19		Revision of NEPR-F DC 592	40 jours?	Lun 07/11/11	Ven 30/12/11
20		Submission of revised analysis	0 jour	Ven 30/12/11	Ven 30/12/11
21		ONR Review	35 jours	Lun 02/01/12	Ven 17/02/12
22		Documentation update following ONR Review if needed	22 jours?	Lun 20/02/12	Mar 20/03/12
23		Transmission of updated document	0 jour	Mar 20/03/12	Mar 20/03/12
24		**Task 3 - PCSR Update**	**65 jours**	**Mer 01/02/12**	**Mar 01/05/12**
25		Draft PCSR chapter	20 jours	Mer 01/02/12	Mar 28/02/12
26		Transmission to ONR	0 jour	Mar 28/02/12	Mar 28/02/12
27		ONR review	30 jours	Mer 29/02/12	Mar 10/04/12
28		Update following ONR comments	15 jours	Mer 11/04/12	Mar 01/05/12
29		Submission of final PCSR chapters	0 jour	Mar 01/05/12	Mar 01/05/12
30		**Actions 5 - Rod Drop**	**259 jours?**	**Jeu 05/05/11**	**Mar 01/05/12**
31		Submission of Full response to TQ 1432	0 jour	Jeu 05/05/11	Jeu 05/05/11
32		**Task 1 - Sensitivity study**	**123 jours?**	**Mar 16/08/11**	**Jeu 02/02/12**
33		Complementary analysis and justification	66 jours?	Mar 16/08/11	Mar 15/11/11
34		Submission of revised analysis	0 jour	Mar 15/11/11	Mar 15/11/11
35		ONR Review	35 jours	Mer 16/11/11	Mar 03/01/12
36		Documentation update following ONR Review if needed	22 jours?	Mer 04/01/12	Jeu 02/02/12
37		Transmission of updated document	0 jour	Jeu 02/02/12	Jeu 02/02/12
38		**Task 2 - documentation update**	**97 jours?**	**Lun 07/11/11**	**Mar 20/03/12**
39		Revision of NEPR-F DC 592	40 jours?	Lun 07/11/11	Ven 30/12/11
40		Submission of revised analysis	0 jour	Ven 30/12/11	Ven 30/12/11
41		ONR Review	35 jours	Lun 02/01/12	Ven 17/02/12
42		Documentation update following ONR Review if needed	22 jours?	Lun 20/02/12	Mar 20/03/12
43		Transmission of updated document	0 jour	Mar 20/03/12	Mar 20/03/12
44		**Task 3 - PCSR Update**	**65 jours**	**Mer 01/02/12**	**Mar 01/05/12**
45		Draft PCSR chapter	20 jours	Mer 01/02/12	Mar 28/02/12
46		Transmission to ONR	0 jour	Mar 28/02/12	Mar 28/02/12
47		ONR review	30 jours	Mer 29/02/12	Mar 10/04/12
48		Update following ONR comments	15 jours	Mer 11/04/12	Mar 01/05/12
49		Submission of final PCSR chapters	0 jour	Mar 01/05/12	Mar 01/05/12
50		**Action 6 - Protection against loss of CVCS**	**237 jours**	**Jeu 17/02/11**	**Ven 13/01/12**
51		Submission of Full response to TQ 1432	0 jour	Jeu 17/02/11	Jeu 17/02/11
52		**Task 1 - ALARP Analysis**	**85 jours**	**Lun 23/05/11**	**Ven 16/09/11**
53		ALARP analysis of options and Report	45 jours	Lun 23/05/11	Ven 22/07/11
54		Report - transmission to HSE	0 jour	Ven 22/07/11	Ven 22/07/11
55		ONR review	25 jours	Lun 25/07/11	Ven 26/08/11
56		Update following ONR comments	15 jours	Lun 29/08/11	Ven 16/09/11
57		Submission of revised report	0 jour	Ven 16/09/11	Ven 16/09/11
58		**Task 2 - PCSR update**	**95 jours**	**Lun 05/09/11**	**Ven 13/01/12**
59		Draft PCSR chapter	63 jours	Lun 05/09/11	Mer 30/11/11
60		Transmission to ONR	0 jour	Mer 30/11/11	Mer 30/11/11
61		ONR review	16 jours	Jeu 01/12/11	Jeu 22/12/11
62		Update following ONR comments	16 jours	Ven 23/12/11	Ven 13/01/12
63		Submission of final PCSR chapters	0 jour	Ven 13/01/12	Ven 13/01/12
64		**Action 7 - Homogeneous boron dilution with loss of TXS**	**232 jours?**	**Lun 13/06/11**	**Mar 01/05/12**
65		**Task 1 - ALARP analysis**	**178 jours?**	**Lun 13/06/11**	**Mer 15/02/12**
66		Analysis of options - ALARP conclusion	77 jours?	Lun 13/06/11	Mar 27/09/11



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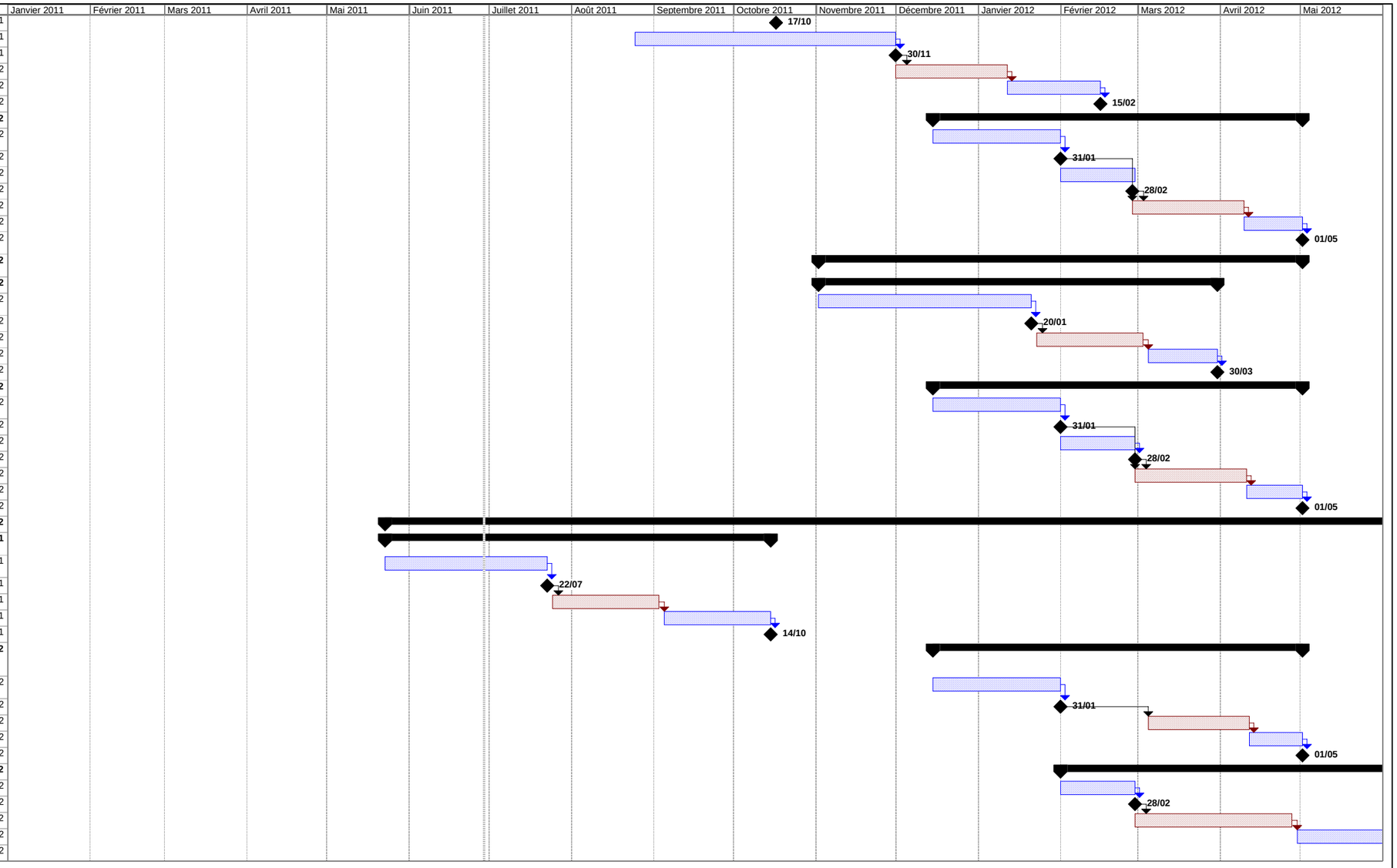
Tâche | Avancement | Récapitulative | Tâches externes | Échéance
Fractionnement | Jalon | Récapitulatif du projet | Jalons externes

N°	Nom de la tâche	Durée	Début	Fin
67	Meeting on proposed analysis	0 jour	Lun 17/10/11	Lun 17/10/11
68	Report on ALARP conclusions	70 jours	Jeu 25/08/11	Mer 30/11/11
69	Transmission to ONR	0 jour	Mer 30/11/11	Mer 30/11/11
70	ONR review	30 jours	Jeu 01/12/11	Mer 11/01/12
71	Update following ONR comments	25 jours	Jeu 12/01/12	Mer 15/02/12
72	Submission of final document	0 jour	Mer 15/02/12	Mer 15/02/12
73	**Task 2 - documentation update**	**99 jours?**	**Jeu 15/12/11**	**Mar 01/05/12**
74	Update of document NEPR-F DC 580	34 jours?	Jeu 15/12/11	Mar 31/01/12
75	Submission of revised analysis	0 jour	Mar 31/01/12	Mar 31/01/12
76	Draft PCSR chapter	20 jours	Mer 01/02/12	Mar 28/02/12
77	Transmission to ONR	0 jour	Mar 28/02/12	Mar 28/02/12
78	ONR review	30 jours	Mar 28/02/12	Lun 09/04/12
79	Update following ONR comments	16 jours	Mar 10/04/12	Mar 01/05/12
80	Submission of final PCSR chapters	0 jour	Mar 01/05/12	Mar 01/05/12
81	**Action 8 - Diversity for support systems frequent faults**	**130 jours?**	**Mer 02/11/11**	**Mar 01/05/12**
82	**Task 1 - ALARP Analysis**	**108 jours?**	**Mer 02/11/11**	**Ven 30/03/12**
83	Diversity analysis for frequent faults identified in FS05	58 jours?	Mer 02/11/11	Ven 20/01/12
84	Transmission to ONR	0 jour	Ven 20/01/12	Ven 20/01/12
85	ONR review	30 jours	Lun 23/01/12	Ven 02/03/12
86	Update following ONR comments	20 jours	Lun 05/03/12	Ven 30/03/12
87	Submission of final document	0 jour	Ven 30/03/12	Ven 30/03/12
88	**Task 2 - Documentation update**	**99 jours?**	**Jeu 15/12/11**	**Mar 01/05/12**
89	Update of document NEPR-F DC 580	34 jours?	Jeu 15/12/11	Mar 31/01/12
90	Submission of revised analysis	0 jour	Mar 31/01/12	Mar 31/01/12
91	Draft PCSR chapter	20 jours	Mer 01/02/12	Mar 28/02/12
92	Transmission to ONR	0 jour	Mar 28/02/12	Mar 28/02/12
93	ONR review	30 jours	Mer 29/02/12	Mar 10/04/12
94	Update following ONR comments	15 jours	Mer 11/04/12	Mar 01/05/12
95	Submission of final documentation	0 jour	Mar 01/05/12	Mar 01/05/12
96	**Action 9 - Diversity for safe state**	**282 jours**	**Lun 23/05/11**	**Mar 19/06/12**
97	**Task 1 - Analysis for identified frequent faults**	**105 jours**	**Lun 23/05/11**	**Ven 14/10/11**
98	Analysis of diversity for safe shutdown state and update of	45 jours	Lun 23/05/11	Ven 22/07/11
99	Transmission to ONR	0 jour	Ven 22/07/11	Ven 22/07/11
100	ONR review	30 jours	Lun 25/07/11	Ven 02/09/11
101	Update following ONR comments	30 jours	Lun 05/09/11	Ven 14/10/11
102	Submission of final document	0 jour	Ven 14/10/11	Ven 14/10/11
103	**Task 2 - Analysis for identified frequent faults following FS05**	**99 jours**	**Jeu 15/12/11**	**Mar 01/05/12**
104	Analysis of diversity for safe shutdown state and update of	34 jours	Jeu 15/12/11	Mar 31/01/12
105	Submission of revised analysis	0 jour	Mar 31/01/12	Mar 31/01/12
106	ONR review	28 jours	Lun 05/03/12	Mer 11/04/12
107	Update following ONR comments	14 jours	Jeu 12/04/12	Mar 01/05/12
108	Submission of final documentation	0 jour	Mar 01/05/12	Mar 01/05/12
109	**Task 3 - Documentation update**	**100 jours**	**Mer 01/02/12**	**Mar 19/06/12**
110	Draft PCSR chapter	20 jours	Mer 01/02/12	Mar 28/02/12
111	Transmission to ONR	0 jour	Mar 28/02/12	Mar 28/02/12
112	ONR review	43 jours	Mer 29/02/12	Ven 27/04/12
113	Update following ONR comments	37 jours	Lun 30/04/12	Mar 19/06/12
114	Submission of final documentation	0 jour	Mar 19/06/12	Mar 19/06/12



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