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	Title: Resolution Plan for GI-UKEPR-SI01			
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Name/Initials  *Date 28/06/2011*	*Name/Initials*  *Date 28/06/2011*

Resolution Plan Revision History

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

1.0 GDA ISSUE

GDA Issue Title	Main Assessment Area	Related Assessment Area
Avoidance of Fracture - Margins Based on Size of Crack-Like Defects	**Structural Integrity**	

GDA Issue	**Demonstration of defect tolerance and the absence of planar defects in the High Integrity Components (HICs) which requires integration of qualified non-destructive examinations during manufacture and analyses for limiting sizes of crack-like defects using conservative material fracture toughness properties.**

2.0 OVERVIEW OF SCOPE OF WORK

A list of High Integrity Components (HIC) where the likelihood of gross failure is claimed to be so low it can be discounted were identified through the EDF and AREVA response to RO-UKEPR-19.

RO-UKEPR-20 applies Principles EMC 1 to 3 and Paragraphs 243 to 253 of the SAPs to these components and an approach has been adopted to demonstrate that HIC components will enter service with either no crack-like defects or else ensuring that defects are sufficiently small for there to be a substantial margin to the limiting defect size. This is achieved by :

Limiting Defect Size Analyses: Calculation of critical defect sizes of the most sensitive areas of the HIC components is performed using fast fracture analysis to determine bounding end of life limiting defect sizes. Qualification defect sizes for Non Destructive Testing (NDT) are determined from the limiting defect sizes which are smaller by a margin, (Defect Size Margin (DSM) of 2). This analysis takes into account normal and fault loading conditions. Initiation fracture toughness is used as the basis for analysis of frequent loading conditions and for fracture analyses of infrequent fault or hazard loading conditions the results using initiation fracture toughness are supplemented with results using fracture toughness based on limited amounts of stable tearing. The analysis has focussed on the main welds of the HIC components.

Qualification of Manufacturing Examinations: Qualified manufacturing NDT inspections are defined to demonstrate their capability of reliably detecting defects of structural concern with high confidence. The qualification defect size must be less that the limiting defect size. This analysis has focussed on defining NDT techniques (notably UT) for qualification which are capable of detecting crack like defects of structural concern with high reliability and other plausible defects with reasonable reliability. A prototype application has been developed and submitted for assessment in GDA to demonstrate the principles of the qualification process based on the recommendations of the European Network for Inspection and Qualification (ENIQ).

Demonstration of Fracture Toughness: In all cases, toughness values used in analyses should be appropriate lower bound values (SAPs para 278). Work undertaken in response to RO-UKEPR-20 has been to define lower bound toughness values of the HIC component materials for Fracture mechanics analysis (FMA) and to develop the principles of fracture toughness tests during manufacture.

Although EDF and AREVA have submitted all the planned reports on avoidance of fracture for the HIC components, information submitted towards the end of Step 4 has only been subject to a high level assessment by ONR. A more detailed assessment of the FMA is therefore considered necessary by ONR and further information of some NDT methods is required. EDF and AREVA are asked to provide:

- Further evidence that the NDT methods proposed are likely to be capable of detecting defects smaller by some margin than the calculated limiting defect sizes (e.g. a target margin of 2). This evidence must include confirmation that the design of components facilitates an adequate inspection.
- Provide adequate responses to any questions arising from assessment by ND of documents whether submitted during GDA Step 4 but not reviewed in detail at that time or submitted as part of this GDA Issue

3.0 GDA ISSUE ACTIONS AND RESOLUTION PLAN DELIVERABLES

3.1 Action GI-UKEPR-SI01.A1

Action I/D	Action Description
GI-UKEPR-SI01.A1	Support assessment of the fracture analysis approach by providing adequate responses to any questions arising from assessment by ONR of documents submitted during GDA Step 4 but not reviewed in detail at that time. A number of fracture assessment reports arrived later in the Step 4 assessment timeframe than had been originally planned. As a result ONR has been unable to undertake a full assessment of all the fracture assessment reports within the timescales allowed for GDA Step 4, but has undertaken a high level review of the reports where a full assesmsent was not possible in order to gain confidence in the approach. This GDA Issue Action has been created to support the full assessment of the reports not yet fully assessed. EDF and AREVA should: • Provide adequate responses to questions arising from the ONR assessment of reports relating to this subject submitted during GDA Step 4 but not yet fully assessed. With agreement from the Regulator this action may be completed by alternative means.

3.1.1 Deliverables already submitted to ONR/EA in response to GI-UKEPR-SI01.A1

The deliverables submitted in GDA Step 4 which have not yet been reviewed in detail by ONR are understood to be the following:

	Date of submission
PEERF 10-1525/A Critical Defect Sizes in the RPV Cover Head Weld *This report describes the Fracture Mechanics Analysis and evaluates the critical defect sizes in the RPV Head weld*	28/10/2010
PEER-F 10.1871/A Critical defect sizes in the RPV outlet set-on weld. *This report describes the Fracture Mechanics Analysis and evaluates the critical defect sizes in the RPV Outlet set-on weld*	23/12/2010

PEER-F 10.2068/A Critical defect sizes in the RPV outlet DMW — 23/12/2010

This report describes the Fracture Mechanics Analysis and evaluates the critical defect sizes in the RPV Outlet Dissimilar Metal Weld

PEEG-F 10.1395/B critical defect sizes in the SG Tube sheet welded connection (tube sheet to primary & secondary) — 23/12/2010

This report describes the Fracture Mechanics Analysis and evaluates the critical defect sizes in the Steam Generator tubesheet primary and secondary weld connections

PEER-F 10.2038/B RCP casing of EPR fast fracture analysis — 31/03/2011

This report describes the Fracture Mechanics Analysis and evaluates the critical defect sizes in large weld repairs of the austenitic Reactor Coolant Pump Casing

PEEM-F 11.0567/A Fracture toughness properties of repair welds in cast pump casing — 31/03/2011

This report evaluates the tearing resistance properties of the weld metal deposit of repair welds to the stainless steel Reactor Coolant Pump casing

PEER-F 10.1674/A RCP Flywheel mechanical and fracture analysis — 02/12/2010

This report describes the Fracture Mechanics Analysis and evaluates the critical defect sizes in the Reactor Coolant Pump Flywheel

PEER-F 101936/A Specific modified RSE-M approach consistent with R6 rules to compare with the RSE-M approach — 22/12/2010

This methodology report describes a modified RSE-M approach consistent with R6 rules which was implemented on the most sensitive zone of each High Integrity Component to evaluate and compare the critical defect sizes calculated by each approach.

PEER-F 10.2069/B Critical defect sizes using modified RSE-M approach with R6 rules — 07/01/2011

This report describes the Fracture Mechanics Analysis and evaluates the critical defect sizes of the most sensitive component zones using the modified RSEM approach consistent with R6 rules

PEER-F 10.1989/A Summary of the FMA approaches in RSE-M Appendix 5.4 — 17/12/2010

This report provides an overview of the Fracture Mechanics Approaches in RSEM Appendix 5.4 and describes both the development and validation of these RSEM approaches.

3.1.2 Planned submissions in response to GI-UKEPR-SI01.A1

3.1.2.1 Description of Scope of Work

AREVA & EDF will provide responses to any questions which are raised by ONR through their continued (post Step 4) assessment of the Fracture Mechanics Analysis supporting the Avoidance of Fracture safety case for the UK EPR.

The ONR assessment will focus on the FMA cases for the following component welds :

- RPV Closure head joint and outlet set on weld
- RPV Outlet dissimilar metal weld
- SG tube sheet welded connection (primary and secondary)
- RCP Casing repair weld
- RCP Flywheel
- Selected zones where modified RSEM has been applied

and on the following parameters :

- FMA approaches used to calculate critical defect sizes and results of the above component welds
- Transient definitions of the RPV outlet set on weld
- Residual stresses and material characteristics of the RCP casing repair welds
- Questions resulting from review of the DMW
- Over-speed case for the RCP flywheel

3.1.2.2 Description of Methodology to be employed

Task 1 - ONR assessment and responses to questions

ONR are expected to complete their assessment of the EDF & AREVA reports and will raise questions as their assessment progresses.

As ONR have already performed a high level review which has not raised any concerns, this response plan assumes that questions will be of a clarification nature and will not involve re-calculation work.

On this basis it is assumed ONR will complete their assessment of the FMA within the indicative timescale of 31 August 2011 except the transient definitions of the RPV outlet set on weld which will be completed by the indicative timescale of 30 September 2011.

Questions which are raised by ONR will be clarified by EDF and AREVA then acknowledged with a committed response date to provide the following:

a) Response to the question

b) Potential draft PCSR updates of subchapter sections impacted by the response

c) Potential Supporting Documents impacted by the response

On the basis that questions will be for clarification and no major concerns are raised, the date for transmittal of all planned EDF and AREVA responses is 15 November 2011

Task 2 – Update of PCSR and Supporting Documents (if necessary)

Any draft updates of PCSR sub-chapter sections and updates of identified Supporting Documents impacted by the responses to questions will be transmitted to ONR for review.

The transmittal date for transmittal of the draft PCSR update, if required, is 31 January 2012.

If updates to PCSR sub-chapter sections are necessary they will be finalised taking into account ONR feedback on the previously submitted draft versions.

Transmittal date for final PCSR updates, if required is 29 February 2012

The transmittal date of updates to supporting documents, if required, is 31 January 2012

Task 3 – Convergence Meetings

Two convergence meetings will be held to obtain ONR assessment feedback on EDF & AREVA responses to questions as well as potential draft PCSR and supporting document updates which may be provided. The status of the GDA Issue will be reviewed and agreed as well as agreeing any remaining steps to complete and close the action.

Date of preliminary Convergence Meeting 29 November 2011

Date of final Convergence Meeting 09 February 2012

3.1.2.3 Deliverable description

	Submission date to ONR/EA
Update of the PCSR (if required)	Draft 31/01/2012 Final 29/02/2012
Update of Supporting Documents (if required)	31/01/2012

3.2 Action GI-UKEPR-SI01.A2

Action I/D	Action Description
GI-UKEPR-SI01.A2	Provide an improved definition and evidence of capability of manufacturing inspection techniques for the austenitic and dissimilar metal welds. Provide more detail of the NDT methods proposed for certain components and provide additional evidence that these are likely to be capable of detecting defects smaller by some margin than the calculated limiting defect sizes (e.g. a target margin of 2). This evidence must include confirmation that the design of components facilitates an adequate inspection. A high level review of the latest proposals from EDF and AREVA has identified gaps in the evidence required. Although two alternative ultrasonic inspection techniques are proposed, EDF and AREVA should provide the following information for at least one of these options: • Evidence that the ultrasonic beams selected are able to detect defects of structural concern including those in the planes of the weld fusion faces over their full extent; • Evidence that the design is such that there are no significant restrictions to inspection from features such as counterbores, changes of section thickness, tapered or curved surfaces, error of form etc; • Evidence that, when fully developed, the ultrasonic detection and characterisation procedures are likely to have adequate capability for the expected sizes of the defects to be qualified. • Adequate responses to questions arising from ONR assessment of documents relating to this subject whether submitted already or as a result of the Resolution Plan for this Action. With agreement from the Regulator this action may be completed by alternative means.

3.2.1 Deliverables already submitted to ONR/EA in response to GI-UKEPR-SI01.A2

The following information has been submitted in GDA Step 4 but not yet reviewed in detail by ONR

	Date of submission
PEEM-F 11.0505A UK EPR Ultrasonic examination of MCL homogeneous and dissimilar metal welds *This report provided in response to TQ1457 (Capability of manufacturing NDT proposed for austenitic and dissimilar metal welds) describes the techniques and capability of ultrasonic examinations proposed for the homogeneous welds of the Main Coolant Lines (MCL) and the Dissimilar Metal Welds (DMW) of the UK EPR. The report examines the weld coverage ability of each technique and its ability to overcome geometrical pipe constraints in the proximity of the weld.*	04/04/2011

3.2.2 Planned submissions in response to GI-UKEPR-SI01.A2

3.2.2.1 Description of Scope of Work

In response to this action EDF & AREVA intend to build on the Step 4 response provided in report PEEM-F 11.0505A sent with TQ1457 which is undergoing further ONR assessment.

EDF and AREVA response to this action will consist of two reports :

Report PEEM-F 11.0505 “UK EPR Ultrasonic examination of MCL homogeneous and dissimilar metal welds” will be updated to include a more detailed analysis of the UT NDT proposals for the current MCL design to meet the UT objective (i.e. to demonstrate 100% UT coverage of the weld and capability to detect defects of structural concern including planar defects parallel to the fusion faces).. The update to report PEEM-F 11.0505A will focus on two weld cases :

a) Welded joint between the MCL and RCP Casing
b) Worst case homogeneous weld to bend of the MCL

The following additional information will be provided in the update to PEEM-F 11.0505A:

- more comprehensive coverage diagrams for each weld to demonstrate UT capability including: beam angles, probe distances and estimated angles of incidence.

- further justification of the tolerance of geometrical defects including, counter bore, error of form, proximity of bends as well as impacts of diameter changes at the welded joints of pipework to main components where no offset is provided.

- details of the procedures and controls to demonstrate that they are adequate for the qualified detection of defects of structural concern. This includes details of how the tolerance levels

are respected.

In this report EDF & AREVA will distinguish between weld access for manufacturing NDT which can be performed from both the outer and inner pipe surfaces and PSI/ISI inspections which are performed from the outer pipe surface. The inspection objective however in both cases will be to demonstrate 100% UT coverage of the weld and capability to detect defects of structural concern including planar defects parallel to the fusion faces.

A second report PEER-F DC 60A Design Basis - Main Coolant Pipe weld connections describes the basis for the design of the EPR primary circuit and particularly the homogeneous welds of the MCL and their local design features which may impact UT manufacturing inspections and PSI/ISI. The following information will be presented in this design basis report:

- interface data from the main components (SG, RCP, RPV)
- input data from the Orbital GTAW Narrow Gap welding procedure and weld inspectability
- input data from the design of MCL to Pressure and Temperature
- constraints from layout
- constraints from the assembly phase, in particular on-site erection, taking into account manufacturing tolerances and on-site adaptations

3.2.2.2 Description of Methodology to be employed

Task 1 – Production of Reports and ONR assessment

EDF & AREVA will update the design description of report PEEM-F 11.0505A to examine the access and UT capability for manufacturing as well as PSI/ISI

Transmittal date of this report is 07 September 2011

EDF & AREVA will produce report PEER-F DC 60A describing the basic design of the EPR primary circuit and particularly the homogeneous welds of the MCL and the local design features which may impact UT manufacturing inspections and PSI/ISI.

Transmittal date of the report is 07 September 2011

ONR are expected to complete their assessment of the Step 4 deliverables related to this action as well as the two new Issue action deliverables within the indicative timescale of 25 November 2011

Any questions which are raised by ONR during their assessment will be clarified by EDF and AREVA then acknowledged with a committed response date to provide the following:

a) Response to the question

b) Potential draft PCSR updates of subchapter sections impacted by the response

c) Potential Supporting Documents impacted by the response

On the basis that questions will be for clarification and no major concerns are raised, the date for transmittal of all planned EDF and AREVA responses is 23 December 2011

Task 2 – Update of PCSR and Supporting Documents

The following PCSR sub-chapter is potentially to be updated :

- Draft PCSR sub-chapter 5.4.3

Transmittal date of the draft PCSR update, if required, is 31 January 2012

Updates to PCSR sub-chapter sections will be finalised taking into account ONR feedback on the previously submitted draft versions.

Transmittal date for final PCSR update, if required, is 29 February 2012

The following supporting document is potentially to be updated

- PEER-F 102070/B Demonstration of integrity of High Integrity Components

Transmittal date of this update, if required, is 31 January 2012

Task 3 – Convergence Meetings

Two technical meetings and two convergence meetings will be held to obtain ONR assessment feedback on EDF and AREVA reports as well as responses to questions and the draft PCSR and supporting document updates which may have been provided. The status of the GDA Issue will be reviewed and agreed as well as any necessary steps to complete and close the action.

Date of first Technical meeting 12 October 2011

Date of second Technical Meeting 29 November 2011

Date of preliminary Convergence Meeting 10 January 2012

Date of final Convergence Meeting 9 February 2012

3.2.2.3 Deliverable description	**Submission date to ONR/EA**
PEEM-F 11.0505 UK EPR Ultrasonic examination of MCL homogeneous and dissimilar metal welds *This report describes two UT examination techniques and their capability to meet the inspection objective to detect defects of structural concern anywhere in the weld including near vertical defects parallel to the fusion faces of the welds. The report will distinguish between weld access for manufacturing NDT which can be performed from both the outer and inner pipe surfaces and PSI/ISI inspections which are performed from the outer pipe surface to meet the inspection objective.*	07/09/2011
.	
PEER-F DC 60A Design Basis - Main Coolant Line weld connections *This report describes the basic design of the EPR primary circuit and particularly the homogeneous welds of the MCL and their local design features which may impact UT manufacturing inspections and PSI/ISI.*	07/09/2011
PEER-F 102070 Demonstration of integrity of High Integrity Components (if required) *This report describes the overall Avoidance of Fracture integrity case for the main welds of HIC components*	31/01/2012
PCSR Sub-chapter 5.4. section 5.4.3 (if required) *This PCSR subchapter section describes the design and safety features of the MCL.*	Draft 31/01/2012 Final 29/02/2012

3.3 Action GI-UKEPR-SI01.A3

Action I/D	Action Description
GI-UKEPR-SI01.A3	Provide additional evidence of capability for the main steam line welds. Provide more detail of the NDT methods proposed for certain components and provide additional evidence that these are likely to be capable of detecting defects smaller by some margin than the calculated limiting defect sizes (e.g. a target margin of 2). This evidence must include confirmation that the design of components facilitates an adequate inspection. A high level review of the latest proposals from EDF and AREVA has identified gaps in the evidence required and as a result EDF and AREVA should provide: • Confirmation that the weld preparation angles are such that near-specular reflection is achievable over the full height of all welds. • Evidence confirming that the effects of any potentially significant restrictions to inspection (tapered or curved surfaces, counterbores, error of form etc) are acceptable; • Evidence that, when fully developed, the ultrasonic detection and characterisation procedures are likely to have adequate capability for the expected sizes (4-5mm) of the defects to be qualified. • Adequate responses to questions arising from ONR assessment of documents relating to this subject whether submitted already or as a result of the Resolution Plan for this Action. With agreement from the Regulator this action may be completed by alternative means.

3.3.1 Deliverables already submitted to ONR/EA in response to GI-UKEPR-SI01.A3

The following information has been submitted in GDA Step 4 but not yet reviewed in detail by ONR

	Date of submission
PEEM-F 10.1134/D UK EPR – Manufacturing Non Destructive Testing to be Qualified *This report describes the NDT techniques which will be deployed for the manufacturing examinations of the main welds of HIC components. It describes the UT technique and its capability to detect defects of structural concern in the ferritic welds of the Main Steam Lines (MSL).*	21/12/2010

3.3.2 Planned submissions in response to GI-UKEPR-SI01.A3

3.3.2.1 Description of Scope of Work

EDF and AREVA will provide evidence that the UT techniques to be implemented for the qualified manufacturing inspection of the high integrity MSL welds are capable of achieving near-specular reflection over the full height of all welds to detect defects of structural concern.

The EDF and AREVA response will consist of two reports.

The first report PEEM-F 11.0959 UK EPR Ultrasonic examination of MSL welds will be an analysis of the access and capability of the proposed UT examinations to detect defects of concern at the manufacturing and PSI/ISI stages and will include:

- Description of local MSL design features
- Description of the UT technique proposed
- Detailed coverage diagrams of each MSL weld using the proposed technique including beam angles and incidence angles to demonstrate that near specular reflection is achievable over the full height of all welds and taking into account local design features of the pipework
- Further justification of the tolerance of geometrical defects including, counter bore, error of form, proximity of bends as well as impacts of diameter changes at the welded joints
- Details of the procedures and controls to demonstrate that they are adequate for the qualified detection of defects of structural concern. This includes details of how the tolerance levels are respected.

In this report EDF & AREVA will distinguish between weld access for manufacturing NDT which can be performed from both the outer and inner pipe surfaces and PSI/ISI inspections which are performed from the outer pipe surface. The inspection objective however in both cases will be to demonstrate that the UT techniques are capable of achieving near-specular reflection over the full height of all welds to detect defects of structural concern.

The second report will include detailed modelling using CIVA software to demonstrate that defects of structural concern (4-5mm) can be detected using the UT techniques proposed. In particular this analysis shall focus on two bounding MSL cases to demonstrate the capability of the proposed UT techniques to detect defects which are both normal and up to 10° off-normal incidence to the beam angle. This modelling work will build on evidence already submitted to ONR in report PEEM-F 10.1134/D of sensitivity studies calibrated on a 2mm side drilled hole to demonstrate that the proposed UT techniques are capable of detecting 4mm defects. The analysis will focus on two cases :

a) MSSV weld (4mm defect in 23mm weld thickness)

b) Isolation valve weld (5mm defect in 60mm weld thickness which would cover the required detection of 5mm defect in 38mm weld thickness)

3.3.2.2 Description of Methodology to be employed

Task 1 – Production of Reports and ONR Assessment

EDF and AREVA will gather available manufacturing and inspection data to produce a report PEEM-F 11.0959 UK EPR Ultrasonic examination of MSL welds

Transmittal date of report 29 July 2011

A second report describing the modelling analysis using CIVA software to demonstrate the capability of the proposed UT examination techniques to detect defects of structural concern (4-5mm)

Transmittal date of report is 07 October 2011

ONR are expected to complete their assessment of the Step 4 deliverables related to this action as well as the two new Issue action deliverables within an indicative timescale of 25 November 2011

Any questions which are raised by ONR will be clarified by EDF and AREVA with ONR then acknowledged with a committed response date to provide the following:

a) Response to the question

b) Potential draft PCSR updates of subchapter sections impacted by the response

c) Potential Supporting Documents impacted by the response

On the basis that questions will be for clarification and no major concerns are raised, the date for transmittal of all planned EDF and AREVA responses is 23 December 2011

Task 2 – Update of PCSR and Supporting Documents

The following PCSR sub-chapter is potentially to be updated :

- Draft PCSR sub-chapter 10.3.7

Transmittal date of the draft PCSR update, if required, is 31 January 2012

Updates to PCSR sub-chapter sections will be finalised taking into account ONR feedback on the previously submitted draft versions.

Transmittal date for final PCSR update, if required, is 29 February 2012

The following supporting documents is potentially to be updated

- PEER-F 102070/B Demonstration of integrity of High Integrity Components

Transmittal date of this update, if required, is 31 January 2012

Task 3 – Convergence Meeting

A technical meeting and two convergence meetings will be held to obtain ONR assessment feedback on EDF and AREVA reports as well as any responses to questions and draft PCSR and supporting document updates which have been provided. The status of the GDA Issue will be reviewed and agreed as well as any necessary steps to complete and close the action.

Date of Technical Meeting 29 November 2011

Date of preliminary Convergence Meeting 10 January 2012

Date of final Convergence Meeting 9 February 2012

3.3.2.3 Deliverable description	**Submission date to ONR/EA**
PEEM-F 11.0959 UK EPR Ultrasonic examination of MSL welds	29/07/2011
This report describes the access and capability of the UT techniques proposed for the MSL manufacturing weld inspections and PSI/ISI to demonstrate that near specular reflection can be achieved across the height of all welds to detect defects of structural concern.	
Modelling of the bounding qualification examination defect size in the MSL welds using CIVA software	07/10/2011
This report describes the modelling analysis to examine the capability of the proposed UT examinations to detect defects of 4 and 5mm in 23mm thick and 60mm thick MSL weld respectively.	

PEER-F 102070 Demonstration of integrity of High Integrity Components	31/01/2012
This report describes the overall Avoidance of Fracture integrity case for the main welds of HIC components	
PCSR Sub-chapter 10.3. section 10.3.7	Draft 31/01/2012
This section of the PCSR describes the design and safety features of the MSL	Final 29/02/2012

3.4 Action GI-UKEPR-SI01.A4

Action I/D	Action Description
GI-UKEPR-SI01.A4	Provide an improved definition of techniques and evidence of capability for inspection of repair welds in RCP casings. Provide more detail of the NDT methods proposed for certain components and provide additional evidence that these are likely to be capable of detecting defects smaller by some margin than the calculated limiting defect sizes (e.g. a target margin of 2). This evidence must include confirmation that the design of components facilitates an adequate inspection. A high level review of the latest proposals from EDF and AREVA has identified gaps in the evidence required. Activities by EDF and AREVA should comprise: • Submission of the detailed results from the inspection trials on the mock-up. • Evidence that, in addition to minimising the risk of any welding defects, the design of excavations for weld repairs will also take account of the need for NDT and particularly the need to ensure that the ultrasonic beams selected can achieve favourable angles of incidence on the fusion faces. • Adequate responses to questions arising from ONR assessment of documents relating to this subject whether submitted already or as a result of the Resolution Plan for this Action. With agreement from the Regulator this action may be completed by alternative means.

3.4.1 Deliverables already submitted to ONR/EA in response to GI-UKEPR-SI01.A4

The following information has been submitted in GDA Step 4 but not yet reviewed in detail by ONR

	Date of submission
PEEM-F 10.2218A Proposition for NDT examination of major repair welds in the RCP casing *This report describes the tests and analyses the results of an NDT test programme on a full scale mock up of a Reactor Coolant Pump casing using radiography and ultrasonic techniques to detect implanted defects. It makes recommended proposals for manufacturing NDT of any large weld repairs of the RCP casing of the UK EPR*.	23/12/2010

3.4.2 Planned submissions in response to GI-UKEPR-SI01.A4

3.4.2.1 Description of Scope of Work

Firstly EDF and AREVA are to provide detailed results of NDT examinations using radiography and ultrasonic techniques performed as part of a test programme on a full scale mock-up of RCP Casing.

Secondly EDF and AREVA shall clarify whether there are specific requirements (RCC-M code or manufacturing specifications, procedures or guidelines) to ensure that large casing repair excavation profiles are prepared to enable UT to achieve favourable angles of incidence on the fusion faces. This analysis will entail a review of current design and manufacturing requirements and recommendations to be made to update procedures, to ensure large casing repairs are adequately prepared for UT inspection.

3.4.2.2 Description of Methodology to be employed

Task 1 – Production of Reports and ONR Assessment

Firstly EDF and AREVA will provide the NDT test report of the series of tests performed recently on a full scale representative mock-up of a cast austenitic RCP casing. These tests were performed to investigate the capability of radiographic and ultrasonic techniques to detect, characterize and size defects in large weld repairs.

The report describes:

- Mock up repairs and their defects
- NDT techniques and methods
- Data acquisition and processing
- Summary of results
- Appendices – test reports

Transmittal date of report 12 July 2011

Secondly EDF and AREVA will update report PEEM-F 10.2218A to include a review of current design and manufacturing requirements (RCC-M code or manufacturing specifications, procedures or guidelines) and recommendations to be made to update procedures, to ensure large casing repairs are adequately prepared for UT inspection and particularly ensuring ultrasonic beam angles achieve favourable angles of incidence on the fusion faces.

Transmittal date of report 15 September 2011

ONR are expected to complete their assessment of the Step 4 deliverables related to this action as well as the two new Issue action deliverables within the indicative timescale of 14 October 2011

Any questions which are raised by ONR will be clarified by EDF and AREVA with ONR then acknowledged with a committed response date to provide the following:

a) Response to the question

b) Potential draft PCSR updates of subchapter sections impacted by the response

c) Potential Supporting Documents impacted by the response

On the basis that questions will be for clarification and no major concerns are raised, the target date for transmittal of all planned EDF and AREVA responses is 10 November 2011

Task 2 – Update of Supporting Documents

The following supporting documents is potentially to be updated

- PEER-F 102070/B Demonstration of integrity of High Integrity Components

Transmittal date of this update, if required, is 31 January 2012

Task 3 – Convergence Meeting

A convergence meeting will be held to obtain ONR assessment feedback on the test report and any responses to questions. The status of the GDA Issue will be reviewed and agreed as well as any necessary steps to complete and close the action.

Date of Convergence Meeting 29 November 2011

3.4.2.3 Deliverable description	**Submission date to ONR/EA**
EFFQM 10.17210 UK EPR Pump Casing Test Report (processes, application and summary of results) *This test report describes the programme of tests performed on an RCP casing mockup using radiography and ultrasonic techniques to detect implanted defects in large weld repairs. It provides the NDT test results.*	12/07/2011
PEEM-F 10.2218 Proposition for NDT examination of major repair welds in the RCP casing *This report provides an analysis of the NDT test results using radiography and ultrasonic techniques on a representative mockup of an RCP casing with weld repairs and proposals for manufacturing NDT of any large weld repairs of the RCP casing of the UK EPR. It will be updated with a review of the current design and manufacturing requirements and recommendations to be made to update procedures, to ensure large casing repairs are adequately prepared for UT inspection*	15/09/2011
PEER-F 102070 Demonstration of integrity of High Integrity Components *This report describes the overall Avoidance of Fracture integrity case for the main welds of HIC components*	31/01/2012

3.5 Action GI-UKEPR-SI01.A5

Action I/D	Action Description
GI-UKEPR-SI01.A5	Provide evidence justifying the manufacturing inspections of the RCP flywheel and the principles of ISI. Provide more detail of the NDT methods proposed for certain components and provide additional evidence that these are likely to be capable of detecting defects smaller by some margin than the calculated limiting defect sizes (e.g. a target margin of 2). This evidence must include confirmation that the design of components facilitates an adequate inspection. A high level review of the latest proposals from EDF and AREVA has identified gaps in the evidence required. Activities by EDF and AREVA should comprise: • Justification of the maximum overspeed used to derive the limiting defect size and an analysis of potential in-service initiation or growth. • Evidence that the manufacturing inspections adequately cover all plausible defects of concern: e.g. this should include evidence that ultrasonic inspection from the outer curved surface of the plates is not required, that the inspection holes do not require inspection during manufacture, and that the ultrasonic and penetrant inspections have the required capability. • Justification of any ISI proposed in comparison with that required by US NRC Reg. Guide 1.14. • Adequate responses to questions arising from ONR assessment of documents relating to this subject whether submitted already or as a result of the Resolution Plan for this Action. With agreement from the Regulator this action may be completed by alternative means.

3.5.1 Deliverables already submitted to ONR/EA in response to GI-UKEPR-SI01.A5

The following information has been submitted in GDA Step 4 but not yet reviewed in detail by ONR

	Date of submission
PEEO-F 10.0715A Non destructive tests performed on the Reactor Coolant Pump flywheel during manufacturing	02/12/2010

This report describes the manufacturing NDT applied to the RCP Flywheel

3.5.2 Planned submissions in response to GI-UKEPR-SI01.A5

3.5.2.1 Description of Scope of Work

EDF and AREVA will update two reports to provide further evidence in justifying the manufacturing inspections of the RCP flywheel:

The first report PEER-F 10.1674/A “RCP Flywheel mechanical and fracture analysis” will be updated with justification of the maximum overspeed of 125% used to derive the limiting defect size. The integrity of RCP flywheel against fast fracture has been demonstrated taking into account centrifugal forces corresponding to an overspeed of 1.25 of the flywheel according to US NRC Reg Guide 1.14. This “design” overspeed is greater than any overspeed generated in accidental conditions and is considered for the Fracture Mechanics Analysis.

Based on Flamanville 3 loading files, the update of report PEER-F 10.1674/A will also include an analysis with a scoping calculation of the life fatigue crack growth for a defect occurring in the flywheel.

The second report PEEO-F 10.0715A ”Non destructive tests performed on the Reactor Coolant Pump flywheel during manufacturing” will be updated to provide clarification of the enhanced RCCM criteria applied to NDT of the flywheel and evidence that the manufacturing inspections adequately cover all plausible defects of concern. The flywheel material, its form and the manufacturing process have an impact on the types of plausible defect and the ND controls which are performed. The report will include evidence that :

- ultrasonic inspection from the outer curved surface of the plates is not required,
- inspection holes do not require inspection during manufacture,
- ultrasonic and penetrant inspections have the required capability.

Finally EDF and AREVA will produce a new report to describe the principles of the PSI/ISI of the RCP flywheel and compare and justify differences with the requirements of US NRC Reg. Guide 1.14 .

3.5.2.2 Description of Methodology to be employed

Task 1 – Production of Reports and ONR Assessment

Report PEER-F 10.1674/A will be updated to provide further justification on the overspeed value considered for the Fracture Mechanics Analysis and will also include an estimation of the life fatigue crack growth for a defect occurring in the flywheel.

Transmittal date of this report is 30 August 2011

Report PEEO-F 10.0715A will be updated to explain the enhanced requirements for the UT controls and justification as to why these controls are adequately capable of controlling all plausible defects of concern. .

Transmittal date of this report is 30 August 2011

Finally EDF and AREVA will provide a report to explain the principles of in-service monitoring and controls performed on the flywheel and to justify differences with requirements of US NRC Reg Guide 1.14.

Transmittal date of this report is 30 August 2011

ONR are expected to complete their assessment of the Step 4 deliverables related to this action as well as the three new Issue action deliverables within the indicative timescale of 30 September 2010

Any questions which are raised by ONR will be clarified by EDF and AREVA with ONR then acknowledged with a committed response date to provide the following:

a) Response to the question
b) Potential draft PCSR updates of subchapter sections impacted by the response
c) Potential Supporting Documents impacted by the response

On the basis that questions will be for clarification and no major concerns are raised, the date for transmittal of all planned EDF and AREVA responses is 28 October 2011

Task 2 – Update of PCSR and Supporting Documents

The following PCSR sub-chapter is potentially to be updated :

- Draft PCSR sub-chapter 5.4.1

Transmittal date of the draft PCSR update, if required, is 24 November 2011

Updates to PCSR sub-chapter sections will be finalised taking into account ONR feedback on the previously submitted draft version.

Transmittal date for final PCSR update, if required, is 23 December 2011

The following supporting document is potentially to be updated

- PEER-F 102070/B Demonstration of integrity of High Integrity Components

Transmittal date of this update, if required, is 31 January 2012

Task 3 – Convergence Meeting

A convergence meeting will be held to obtain ONR assessment feedback on the EDF & AREVA reports as well as responses to any further questions and draft PCSR and supporting document updates which have been provided. The status of the GDA Issue will be reviewed and agreed as well as any necessary steps to complete and close the action.

Date of Convergence Meeting 29 November 2011

3.5.2.3 Deliverable description	**Submission date to ONR/EA**
PEER-F 10.1674 RCP Flywheel mechanical and fracture analysis	30/08/2011
The update of this report describes the Fracture Mechanics Analysis and critical defect evaluation of the Reactor Coolant pump flywheel. It provides justification of the maximum overspeed used in the analysis to determine the critical defect size and the estimated fatigue crack growth of the flywheel	
PEEO-F 10.0715 Non destructive tests performed on the Reactor Coolant Pump flywheel during manufacturing	30/08/2011
The update of this report describes the manufacturing NDT applied to the RCP Flywheel and justifies the capability of the NDT controls to adequately detect plausible defects of concern and why certain NDT controls of some flywheel surfaces are not required.	

ECEMA111847 Principles for the RCP flywheel ISI	30/08/2011
This report describes the principles of ISI applied to the Reactor Coolant pump flywheel and justifies differences with the requirements of US NRC Reg Guide 1.14	
PEER-F 102070 Demonstration of integrity of High Integrity Components	31/01/2012
This report describes the overall Avoidance of Fracture integrity case for the main welds of HIC components	
PCSR Sub-chapter 5.4. section 5.4.1	Draft 24/11/2011
This section of the PCSR describes the design and safety features of the RCP	Final 23/12/2011

3.6 Action GI-UKEPR-SI01.A6

Action I/D	Action Description
GI-UKEPR-SI01.A6	Provide additional evidence to support the technical justification of the prototype application. Provide more detail of the NDT methods proposed for certain components and provide additional evidence that these are likely to be capable of detecting defects smaller by some margin than the calculated limiting defect sizes (e.g. a target margin of 2). This evidence must include confirmation that the design of components facilitates an adequate inspection. EDF and AREVA should provide: • An explanation of how the defects proposed in the test piece will take into account the 'worst case defects' and will be sufficient to test the weaknesses identified in the inspection procedure. • An explanation of how the effects of the cladding (e.g. anisotropy, uneven interface with parent material) on the inspection capability will be taken into account, • Quantification of the maximum surface profile variations (error of form) on the surfaces of the weld and cladding and justification of its acceptability. • Clarification of how surface profile variations (error of form) are controlled and checked. • Clarification of the capability likely to be achieved using the flow charts for defect characterisation. • Adequate responses to questions arising from ONR assessment of documents relating to this subject whether submitted already or as a result of the Resolution Plan for this Action. With agreement from the Regulator this action may be completed by alternative means.

3.6.1 Deliverables already submitted to ONR/EA in response to GI-UKEPR-SI01.A6

The following information has been submitted in GDA Step 4 but not yet reviewed in detail by ONR

	Date of submission
PEEM-F 102217/A Technical Justification for UT examination of prototype application *This report describes the principles of Technical Justification for the qualified NDT inspection of the pressuriser butt weld prototype application. This report presents the arguments and some evidence to show that the proposed inspection meet the requirements of the Inspection Specification. It describes the physical reasoning, modelling work, experimental trials and experience feedback to support both process and operator qualification.*	23/12/2010
COUSUK-NPR0200A Inspection Procedure - UT testing of PZR upper shell / upper head *This report describes the Inspection Procedure for pulse-echo UT examination of the pressuriser butt weld prototype application*	23/12/2010
COUSUK-NPR0201A Inspection Procedure – UT testing of PZR butt welds Tandem method *This report describes the Inspection Procedure for tandem UT examination of the pressuriser butt weld prototype application*	23/12/2010

3.6.2 Planned submissions in response to GI-UKEPR-SI01.A6

3.6.2.1 Description of Scope of Work

EDF and AREVA are to provide additional evidence to support the NDT technical justification of the prototype application. Additional clarification will be provided in an update to report PEEM-F 102217/A Technical Justification for UT examination of prototype application to explain the level of evidence required to support a full Technical Justification. In particular EDF and AREVA will consider how to take into account:

- Selection and treatment of worst case defects and particularly those related to the test pieces to adequately test any weaknesses identified in the inspection procedure:

For each influential parameter described in Section 3.3 (influential parameters due to the defects)

of PEEM-F 102217/A, information will be provided to explain how worst case defects are selected and the justification to include them in test pieces.

- Effects of the cladding (e.g. anisotropy, uneven interface with parent material) and its impact on the inspection capability:

Further details will be provided in Section 3.2 (influential parameters due to the component presence of cladding) on the treatment of cladding features which effect inspection and on further work in terms of modelling and practical trails which will need to be performed to determine their impact.

- Maximum surface profile variations (error of form) on the surfaces of the weld and cladding and justification of its acceptability.

- Control and verification of surface profile variations (error of form).

Surface profile variation requirements will be quantified and described in Section 3.1(influential parameters surface preparation) of the report together with the control and verification methods which are applied.

- Application of flowcharts for defect characterisation and clarification on their capability

The flowchart is a robust method developed by the CEN and used through European Standards to characterise whether defects are planar or non planar. The report will be updated to explain the background of flowchart development and how and why they are used as part of the inspection defect characterisation.

3.6.2.2 Description of Methodology to be employed

Task 1 – Production of a Report and ONR Assessment

EDF and AREVA will update PEEM-F 102217/A Technical Justification for UT examination of prototype application to describe:

- how worst case defects are selected to be included in test pieces,
- treatment of cladding features and outline details of modelling and test programmes to examine their impact,
- surface profile variation requirements and associated control and verification methods
- background to flowchart development and justification for their use as part of inspection defect characterisation

Transmittal date of report 12 October 2011

ONR are expected to complete their assessment of the Step 4 deliverables related to this action as well as the new Issue action deliverable within the indicative timescale of 14 November 2011

Any questions which are raised by ONR will be clarified by EDF and AREVA with ONR then acknowledged with a committed response date to provide the following:

a) Response to the question asked

b) Potential draft PCSR updates of subchapter sections impacted by the response

c) Potential Supporting Documents impacted by the response

On the basis that questions will be for clarification and no major concerns are raised, the date for transmittal of all planned EDF and AREVA responses is 16 December 2011

Task 2 – Update of PCSR and Supporting Documents

The following supporting document is potentially to be updated

- PEER-F 102070/B Demonstration of integrity of High Integrity Components

Transmittal date of this update, if required, is 31 January 2012

Task 3 – Convergence Meeting

A convergence meeting will be held to obtain ONR assessment feedback on EDF and AREVA reports as well as any responses to questions and draft PCSR and supporting document updates which have been provided. The status of the GDA Issue will be reviewed and agreed as well as any necessary steps to complete and close the action.

Date of Convergence Meeting 10 January 2012

3.6.2.3 Deliverable description	**Submission date to ONR/EA**
PEEM-F 102217 Technical Justification for UT examination of prototype application	12/10/2011
The update of this report will include further explanation on how worst case defects are selected to be included in test pieces, treatment of cladding features and outline details of modelling and test programmes to examine their impact, surface profile variation requirements and associated control and verification methods, background to flowchart development and justification for their use as part of inspection defect characterisation.	
PEER-F 102070 Demonstration of integrity of High Integrity Components	31/01/2012
This report describes the overall Avoidance of Fracture integrity case for the main welds of HIC components	

3.7 Action GI-UKEPR-SI01.A7

Action I/D	Action Description
GI-UKEPR-SI01.A7	Provide additional evidence to confirm design and accessibility for in-service inspection (ISI). Provide more detail of the NDT methods proposed for certain components and provide additional evidence that these are likely to be capable of detecting defects smaller by some margin than the calculated limiting defect sizes (e.g. a target margin of 2). This evidence must include confirmation that the design of components facilitates an adequate inspection. EDF and AREVA should provide: • A systematic review of the locations proposed for ISI to confirm that, as well as being physically accessible, the design of all the HIC pipework welds facilitates inspections likely to have the required capability and that there are no undue restrictions from any local design features such as counterbores or tapered surfaces. • Adequate responses to questions arising from ONR assessment of documents relating to this subject whether submitted already or as a result of the Resolution Plan for this Action. With agreement from the Regulator this action may be completed by alternative means.

3.7.1 Deliverables already submitted to ONR/EA in response to GI-UKEPR-SI01.A7

The following information has been submitted in GDA Step 4 but not yet reviewed in detail by ONR

	Date of submission
Response to TQ1456	04/04/2011

Description of the capability of proposed UT techniques to access the homogeneous welds of the Main Coolant Lines and Dissimilar Metal Welds for in-service inspection and reference to report PEEM-F 11.0505A for further details

3.7.2 Planned submissions in response to GI-UKEPR-SI01.A7

3.7.2.1 Description of Scope of Work

EDF and AREVA are to provide additional evidence to confirm that the as-built weld inspection locations of HIC pipework are accessible and that UT techniques for in-service inspection have the required capability to detect defects in 100% of the weld including vertical defects in the plane of the fusion faces from the outside pipe surface whilst overcoming pipe geometry restrictions

EDF and AREVA have provided details on the MCL and DMW through TQ1456 and report PEEM-F 11.0505A provided with TQ1457 and are awaiting ONR to complete their assessment.

EDF and AREVA will provide evidence to confirm design and accessibility for in-service inspections from the outside surfaces of the HIC pipework to meet the inspection objectives in the following reports:

a) The update of report PEEM-F 11.0505 UK EPR Ultrasonic examination of MCL homogeneous and dissimilar metal welds which will be provided in response to Action 2 of this GDA Issue describes two UT examination techniques and their capability to control 100% of the weld including planar defects parallel to the weld fusion faces for in-service inspection from the outside pipe surface.

b) EDF & AREVA will produce report PEER-F DC 60A for Action 2 of this GDA Issue describing the basic design of the EPR primary circuit and particularly the homogeneous welds of the MCL and the local design features which may impact UT manufacturing inspections and PSI/ISI.

c) The report PEEM-F 11.0959/A UK EPR Ultrasonic examination of MSL welds which is being prepared in response to Action 3 of this GDA Issue describes the UT examination techniques for the MSL and their capability of achieving near-specular reflection over the full height of all welds to detect defects of structural concern for in-service inspection from the outside pipe surface.

3.7.2.2 Description of Methodology to be employed

Task 1 – Production of Reports and ONR Assessment

The update of report PEEM-F 11.0505 UK EPR Ultrasonic examination of MCL homogeneous and dissimilar metal welds will examine the access and UT capability for PSI/ISI as well as manufacturing controls. This report is prepared as part of GI-UKEPR-SI01.A2 and will be transmitted to ONR 07/09/2011.

EDF & AREVA will produce report PEER-F DC 60A describing the basic design of the EPR primary circuit and particularly the homogeneous welds of the MCL and the local design features which may impact UT manufacturing inspections and PSI/ISI. This report is prepared as part of GI-UKEPR-SI01.A2 and will be transmitted to ONR 07/09/2011

Report PEEM-F 11.0959/A UK EPR Ultrasonic examination of MSL welds will be based on the Flamanville 3 MSL In-service accessibility analysis. This report is prepared as part of GI-UKEPR-SI01.A3 and will be transmitted to ONR 29/07/2011.

ONR are expected to complete their assessment of the Step 4 deliverables related to this action as well as the three new Issue action deliverables within the indicative timescale of 25 November 2011

Any questions which are raised by ONR will be clarified by EDF and AREVA with ONR then acknowledged with a committed response date to provide the following:

a) Response to the question asked

b) Potential draft PCSR updates of subchapter sections impacted by the response

c) Potential Supporting Documents impacted by the response

On the basis that questions will be for clarification and no major concerns are raised the date for transmittal of all planned EDF and AREVA responses is 23 December 2011

Task 2 – Update of PCSR

The following PCSR sub-chapters are potentially to be updated :

- Draft PCSR sub-chapter 5.2.5
- Draft PCSR sub-chapter 10.3.6

Transmittal date of these updates, if required, is 31 January 2012

Updates to PCSR sub-chapter sections will be finalised taking into account ONR feedback on the previously submitted draft versions.

Transmittal date for final PCSR updates, if required, is 29 February 2012

Task 3 – Convergence Meetings

A technical meeting and two convergence meetings will be held to obtain ONR assessment feedback on EDF and AREVA report as well as responses to questions and the draft PCSR and supporting document updates which will have been provided. The status of the GDA Issue will be reviewed and agreed as well as any necessary steps to complete and close the action.

Date of Technical Meeting 29 November 2011

Date of preliminary Convergence Meeting 10 January 2012

Date of final Convergence Meeting 9 February 2012

3.7.2.3 Deliverable description	**Submission date to ONR/EA**
PEEM-F 11.0505 UK EPR Ultrasonic examination of MCL homogeneous and dissimilar metal welds *This report describes two UT examination techniques and their capability to meet the inspection objective to detect defects of structural concern anywhere in the weld including near vertical defects parallel to the fusion faces of the welds. The report will distinguish between weld access for manufacturing NDT which can be performed from both the outer and inner pipe surfaces and PSI/ISI inspections which are performed from the outer pipe surface to meet the inspection objective.*	07/09/2011
PEER-F DC 60A Design Basis - Main Coolant Line weld connections *This report describes the basic design of the EPR primary circuit and particularly the homogeneous welds of the MCL and their local design features which may impact UT manufacturing inspections and PSI/ISI.*	07/09/2011
PEEM-F 11.0959/A UK EPR Ultrasonic examination of MSL welds *This report describes the access and capability of the UT techniques proposed for the MSL manufacturing weld inspections and PSI/ISI to demonstrate that near specular reflection can be achieved across the height of all welds to detect defects of structural concern.*	29/07/2011
PCSR Sub-chapter 5.2 section 5.2.5 *This section of the PCSR describes the access to the React Coolant System for in-service inspection*	Draft 31/01/2012 Final 29/02/2012
PCSR Sub-chapter 10.3. section 10.3.6 *This section of the PCSR describes the access to the Main Steam Line for periodic tests and maintenance*	Draft 31/01/2012 Final 29/02/2012

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 HSE/EA
SSER sub-chapters			
PCSR sub-chapter 5.4.3	U	GI-UKEPR-SI02.A2	Draft 31/01/2012 Final 29/02/2012
PCSR sub-chapter 10.3.7	U	GI-UKEPR-SI02.A3	Draft 31/01/2012 Final 29/02/2012
PCSR sub-chapter 5.4.1	U	GI-UKEPR-SI02.A5	Draft 24/11/2011 Final 23/12/2011
PCSR sub-chapter 5.2.5	U	GI-UKEPR-SI02.A7	Draft 31/01/2012 Final 29/02/2012
PCSR sub-chapter 10.3.6	U	GI-UKEPR-SI02.A7	Draft 31/01/2012 Final 29/02/2012

Other GDA submission supporting documents

PEER-F 102070 Demonstration of integrity of High Integrity Components	U	GI-UKEPR-SI02.A2 GI-UKEPR-SI02.A3 GI-UKEPR-SI02.A4 GI-UKEPR-SI02.A5 GI-UKEPR-SI02.A6	31/01/2012
PEER-F DC 60A Design Basis- Main Coolant Line weld connections	C	GI-UKEPR-SI02.A2 GI-UKEPR-SI02.A7	07/09/2011
PEEM-F 11.0505 UK EPR Ultrasonic examination of MCL homogeneous and dissimilar metal welds	U	GI-UKEPR-SI02.A2 GI-UKEPR-SI02.A7	07/09/2011
PEEM-F 11.0959 UK EPR Ultrasonic examination of MSL welds	C	GI-UKEPR-SI02.A3 GI-UKEPR-SI02.A7	29/07/2011
Modelling of MSL weld defects	C	GI-UKEPR-SI02.A3	07/10/2011
EFFQM 10.17210 UK EPR Pump Casing Test Report (processes, application and summary of results)	C	GI-UKEPR-SI02.A4	12/07/2011
PEEM-F 10.2218 Proposition for NDT examination of major repair welds in the RCP casing	U	GI-UKEPR-SI02.A4	15/09/2011

PEER-F 10.1674 RCP Flywheel mechanical and fracture analysis	U	GI-UKEPR-SI02.A5	30/08/2011
PEEO-F 10.0715 Non destructive tests performed on the Reactor Coolant Pump flywheel during manufacturing	U	GI-UKEPR-SI02.A5	30/08/2011
ECEMA111847 Principles for the RCP flywheel ISI	C	GI-UKEPR-SI02.A5	30/08/2011
PEEM-F 102217 Technical Justification for UT examination of prototype application	U	GI-UKEPR-SI02.A6	12/10/2011

5.0 JUSTIFICATION OF ADEQUACY

The analyses proposed to resolve these GDA Issue actions draw on the extensive FMA & NDT experience within AREVA and EDF for the design, manufacture of EPR components and operating of the French reactor fleet.

For Action 1, a process has been established to support ONR to complete their FMA assessment. Although the questions have not yet been asked, the overall scope is defined.

For action 2 EDF and AREVA will select the two most challenging welds to perform UT examination and provide more comprehensive UT coverage diagrams of the welds to show how geometrical constraints are overcome, justification of the UT tolerance of geometrical constraints and details of UT procedures and controls which will need to be developed to ensure the inspection objective of 100% weld coverage and capability to detect defects of structural concern including planar defects parallel to the fusion faces can be met.

Furthermore the basis for the design of the EPR primary circuit and particularly the homogeneous welds of the MCL and their local design features which may impact UT manufacturing inspections and PSI/ISI will be described.

For Action 3 EDF and AREVA will examine and demonstrate the capability of UT examination of the Main Steam Lines to perform near specular reflection over the full height of each weld to detect defects of structural concern. The analysis will focus on comprehensive UT coverage diagrams of each weld to show how geometrical constraints are overcome as well as quantifying the UT tolerance of these geometrical constraints. Modelling work will also be performed to provide evidence that the proposed UT examinations are capable of detecting defects as small as 4-5mm.

For Action 4, practical NDT trials have been undertaken to examine the capability of UT and RT to detect defects in a representative mock-up of the RCP casing with weld repairs. The trials were successful and this experience has enhanced our understanding of the capability of UT on thick walled cast austenitic components. Detailed results of this test programme will be provided as evidence to support the choice of NDT techniques retained for the qualified examination of large weld repairs in the RCP casing. A review of current design and manufacturing requirements will also be performed and recommendations made to ensure that large casing repair excavation profiles are prepared to enable UT to achieve favourable angles of incidence on the fusion faces.

For Action 5, additional RCP flywheel analysis will be undertaken to support the FMA case involving justification of overspeed loads and a fatigue scoping calculation. Clarification will also be provided to explain the enhanced manufacturing NDT requirements and why they are

adequately capable of controlling all plausible defects of concern. Furthermore evidence that ultrasonic inspection of the outer curved surface of the flywheel plates is not required and that the inspection holes of the flywheels do not require inspection during manufacture will be provided.

Finally the principles of ISI for the flywheel and differences from US NRC Reg Guide 1.14 requirements will be explained.

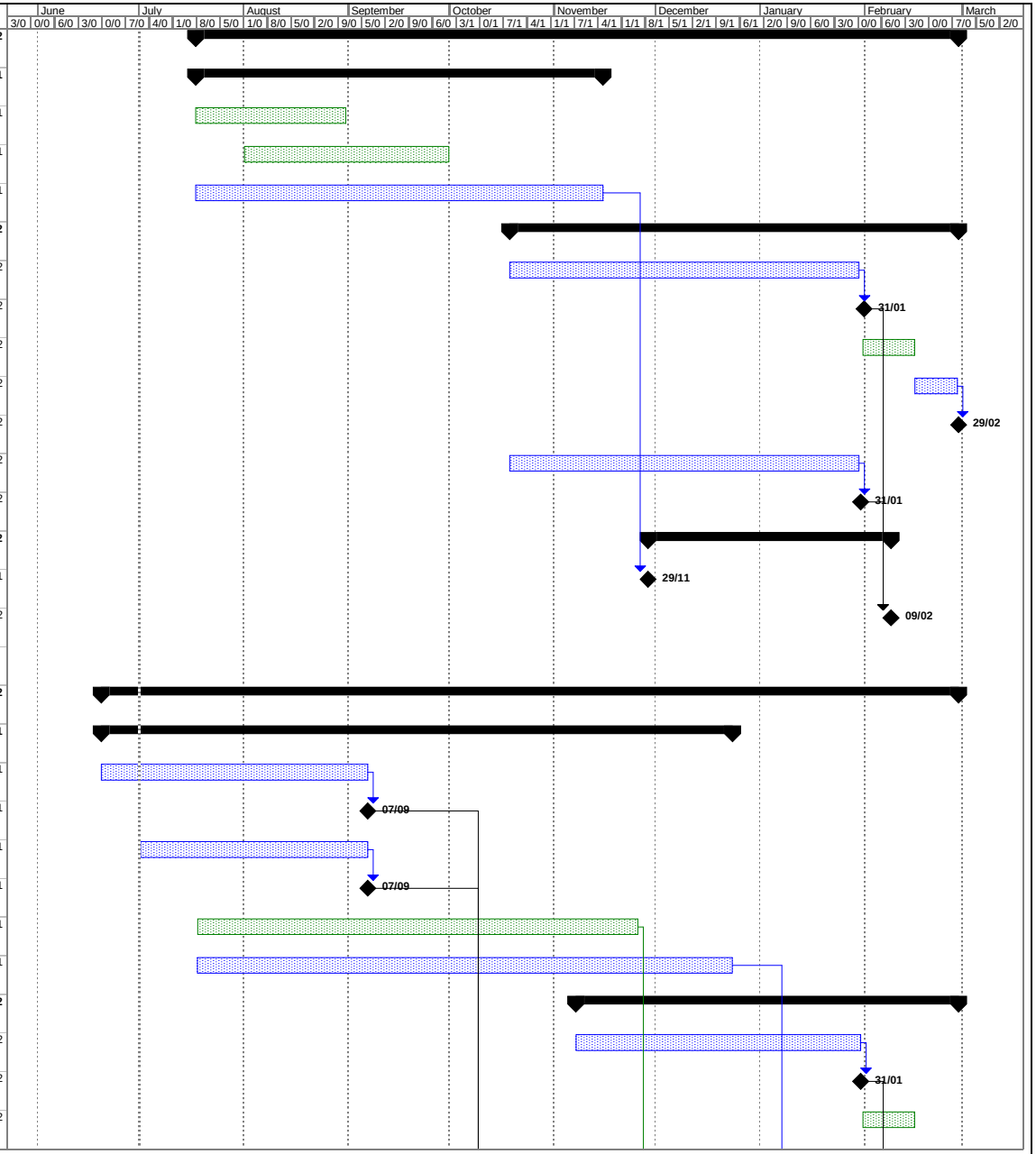
For Action 6, additional evidence to support the NDT Technical Justification of the prototype application will be provided to demonstrate the principles and understanding of a qualification process which will be deployed during detailed design. In particular EDF and AREVA will provide further explanation on how worst case defects are selected to be included in test pieces, treatment of cladding features and outline details of modelling and test programmes to examine their impact, surface profile variation requirements and associated control and verification methods, background to flowchart development and justification for their use as part of inspection defect characterisation.

For Action 7 EDF and AREVA will analyse the access and capability of UT techniques on the MCL/ DMW to meet the inspection objective, (100% weld coverage and capability to detect defects of structural concern including planar defects parallel to the fusion faces), and the MSL inspection objective (*achieve near specular reflection across the height of all welds to detect defects of structural concern)* from the outside surface of the pipes whilst overcoming pipe geometry restrictions for in-service inspection.

PCSR and supporting documentation impacted by the resolution of the GDA Issue actions will be identified and documents will be updated according to appropriate QA processes.

6.0 TIMETABLE AND MILESTONE PROGRAMME LEADING TO THE DELIVERABLES

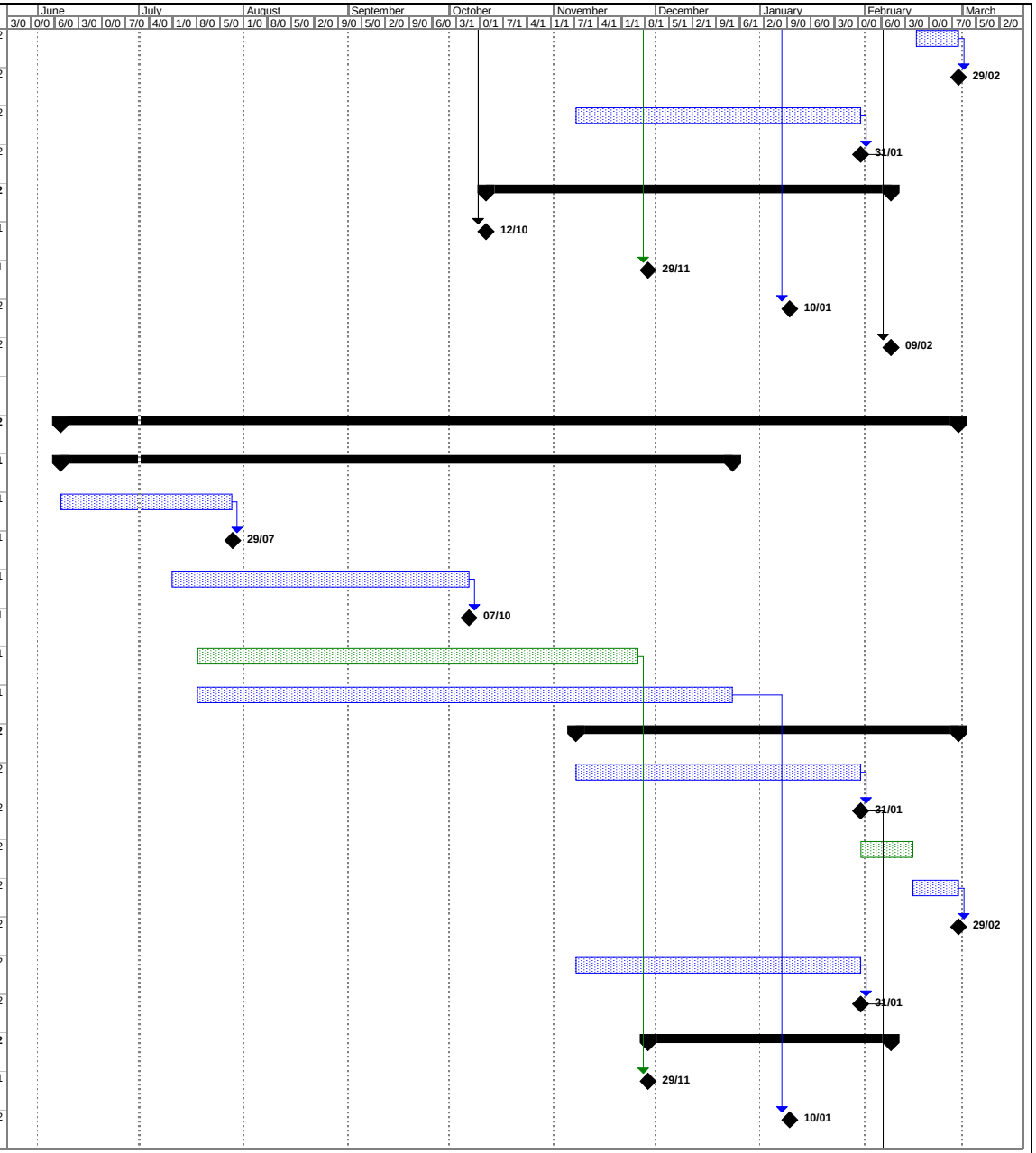
ID	Task Name	Duration	Start	Finish
1	**Issue SI01 Action 1 Fracture Mechanics Analysis**	**185,14 days**	**Mon 18/07/11**	**Wed 29/02/12**
2	**Task 1 ONR Assessment of Step 4 deliverables**	**99 days**	**Mon 18/07/11**	**Tue 15/11/11**
3	ONR Assessment of FMA Action deliverables	37 days	Mon 18/07/11	Wed 31/08/11
4	ONR Assessment of Transient Definition	51 days	Mon 01/08/11	Fri 30/09/11
5	RP responses to ONR Queries	99 days	Mon 18/07/11	Tue 15/11/11
6	**Task 2 Update of PCSR & Supporting Documents**	**108,57 days**	**Wed 19/10/11**	**Wed 29/02/12**
7	Preparation of draft PCSR sections, if required	84 days	Wed 19/10/11	Mon 30/01/12
8	Submission of draft PCSR to ONR	0 days	Tue 31/01/12	Tue 31/01/12
9	ONR Assessment of draft PCSR	13 days	Tue 31/01/12	Wed 15/02/12
10	Preparation of final PCSR update integrating ONR comments	10 days	Thu 16/02/12	Tue 28/02/12
11	Submission to ONR	0 days	Wed 29/02/12	Wed 29/02/12
12	Preparation of updates to supporting documents	84 days	Wed 19/10/11	Mon 30/01/12
13	Transmission of supporting documents to ONR, if required	0 days	Tue 31/01/12	Tue 31/01/12
14	**Task 3 Convergence meetings**	**59,43 days**	**Tue 29/11/11**	**Thu 09/02/12**
15	Preliminary Convergence meeting	0 days	Tue 29/11/11	Tue 29/11/11
16	Final Convergence meeting	0 days	Thu 09/02/12	Thu 09/02/12
17				
18	**Issue SI01 Action 2 Non Destructive testing of MCL & DMW**	**208 days**	**Mon 20/06/11**	**Wed 29/02/12**
19	**Task 1 Production of reports & ONR Assessment**	**154,14 days**	**Mon 20/06/11**	**Fri 23/12/11**
20	Preparation of MCL weld connection design basis report PEER-F DC 60A	65 days	Mon 20/06/11	Tue 06/09/11
21	Submission of report to ONR	0 days	Wed 07/09/11	Wed 07/09/11
22	Update MCL UT capability report PEEM-F 11.0505A	54 days	Fri 01/07/11	Tue 06/09/11
23	Submission of report to ONR	0 days	Wed 07/09/11	Wed 07/09/11
24	ONR assessment of deliverables	108 days	Mon 18/07/11	Fri 25/11/11
25	RP response to ONR queries	131 days	Mon 18/07/11	Fri 23/12/11
26	**Task 2 Update of PCSR & Supporting Documents**	**93,14 days**	**Mon 07/11/11**	**Wed 29/02/12**
27	Preparation of draft update to PCSR Sub-chapter 5.4 section 3	69 days	Mon 07/11/11	Mon 30/01/12
28	Transmission to ONR	0 days	Tue 31/01/12	Tue 31/01/12
29	ONR Assessment	13 days	Tue 31/01/12	Wed 15/02/12



Project: RP Schedule GI-UKEPR- SI01
Date: Fri 01/07/11

Task | Progress | Summary | External Tasks | Deadline
Split | Milestone | Project Summary | External Milestone

ID	Task Name	Duration	Start	Finish
30	Update following resolution of ONR comments	10 days	Thu 16/02/12	Tue 28/02/12
31	Submission of updated PCSR Sub-chapter	0 days	Wed 29/02/12	Wed 29/02/12
32	Preparation of updates to supporting document PEER-F 102070, if required	69 days	Mon 07/11/11	Mon 30/01/12
33	Transmission of supporting document - PEER-F 102070, if required	0 days	Tue 31/01/12	Tue 31/01/12
34	**Task 3 Convergence Meetings**	**98,29 days**	**Wed 12/10/11**	**Thu 09/02/12**
35	Technical Meeting	0 days	Wed 12/10/11	Wed 12/10/11
36	Technical Meeting	0 days	Tue 29/11/11	Tue 29/11/11
37	Preliminary Convergence Meeting	0 days	Tue 10/01/12	Tue 10/01/12
38	Final Convergence Meeting	0 days	Thu 09/02/12	Thu 09/02/12
39				
40	**Issue SI01 Action 3 Non Destructive testing of MSL**	**217,14 days**	**Wed 08/06/11**	**Wed 29/02/12**
41	**Task 1 Production of reports & ONR Assessment**	**163,29 days**	**Wed 08/06/11**	**Fri 23/12/11**
42	Preparation of MSL UT capability report PEEM-F 11.0959	42 days	Wed 08/06/11	Thu 28/07/11
43	Submission of report to ONR	0 days	Fri 29/07/11	Fri 29/07/11
44	Preparation of MSL weld defect modelling Report	73 days	Mon 11/07/11	Thu 06/10/11
45	Submission of report to ONR	0 days	Fri 07/10/11	Fri 07/10/11
46	ONR assessment of deliverables	108 days	Mon 18/07/11	Fri 25/11/11
47	RP response to ONR queries	131 days	Mon 18/07/11	Fri 23/12/11
48	**Task 2 Update of PCSR & Supporting Documents**	**93,14 days**	**Mon 07/11/11**	**Wed 29/02/12**
49	Preparation of draft update to PCSR Sub-chapter 10.3 section 7	69 days	Mon 07/11/11	Mon 30/01/12
50	Transmission to ONR	0 days	Tue 31/01/12	Tue 31/01/12
51	ONR Assessment	13 days	Tue 31/01/12	Wed 15/02/12
52	Update following resolution of ONR comments	11 days	Wed 15/02/12	Tue 28/02/12
53	Submission of updated PCSR Sub-chapter	0 days	Wed 29/02/12	Wed 29/02/12
54	Preparation of updates to supporting document PEER-F 102070, if required	69 days	Mon 07/11/11	Mon 30/01/12
55	Transmission of supporting document - PEER-F 102070, if required	0 days	Tue 31/01/12	Tue 31/01/12
56	**Task 3 Convergence Meetings**	**59,43 days**	**Tue 29/11/11**	**Thu 09/02/12**
57	Technical Meeting	0 days	Tue 29/11/11	Tue 29/11/11
58	Preliminary Convergence Meeting	0 days	Tue 10/01/12	Tue 10/01/12



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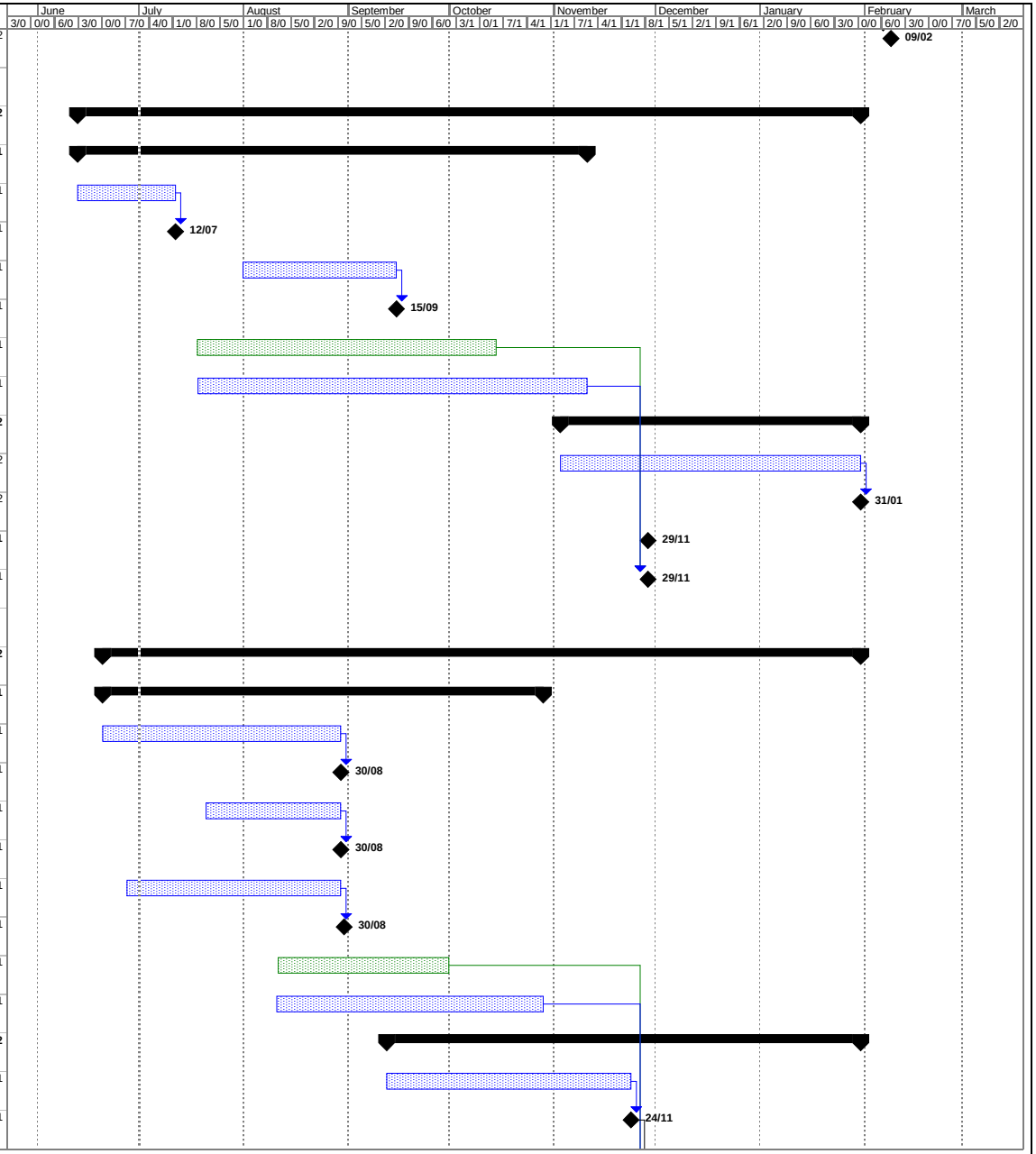
ID	Task Name	Duration	Start	Finish
59	Final Convergence Meeting	0 days	Thu 09/02/12	Thu 09/02/12
60				
61	**Issue SI01 Action 4 Non Destructive testing of RCP Repair welds**	**189,71 days**	**Mon 13/06/11**	**Tue 31/01/12**
62	**Task 1 Production of reports & ONR Assessment**	**124,43 days**	**Mon 13/06/11**	**Thu 10/11/11**
63	Preparation of RCP NDT Test report EFFQM 10.17210	24 days	Mon 13/06/11	Tue 12/07/11
64	Submission of report to ONR	0 days	Tue 12/07/11	Tue 12/07/11
65	Update of RCP NDT Report PEEM-F 10.2218	38 days	Mon 01/08/11	Thu 15/09/11
66	Submission of report to ONR	0 days	Thu 15/09/11	Thu 15/09/11
67	ONR assessment of deliverables	74 days	Mon 18/07/11	Fri 14/10/11
68	RP response to ONR queries	95 days	Mon 18/07/11	Thu 10/11/11
69	**Task 2 Update of PCSR & Supporting Documents**	**72,14 days**	**Thu 03/11/11**	**Tue 31/01/12**
70	Preparation of updates to supporting document PEER-F 102070, if required	72 days	Thu 03/11/11	Mon 30/01/12
71	Transmission of supporting document - PEER-F 102070, if required	0 days	Tue 31/01/12	Tue 31/01/12
72	**Task 3 Convergence Meetings**	**0 days**	**Tue 29/11/11**	**Tue 29/11/11**
73	Convergence Meeting	0 days	Tue 29/11/11	Tue 29/11/11
74				
75	**Issue SI01 Action 5 FMA & NDT of RCP flywheel**	**183,86 days**	**Mon 20/06/11**	**Tue 31/01/12**
76	**Task 1 Production of reports & ONR Assessment**	**108,29 days**	**Mon 20/06/11**	**Fri 28/10/11**
77	Update of RCP flywheel FMA report PEER-F 10.1674	58 days	Mon 20/06/11	Mon 29/08/11
78	Submission of report to ONR	0 days	Tue 30/08/11	Tue 30/08/11
79	Update of RCP flywheel NDT report PEEO-F 10.0715	32 days	Thu 21/07/11	Mon 29/08/11
80	Submission of report to ONR	0 days	Tue 30/08/11	Tue 30/08/11
81	Preparation of RCP flywheel ISI principles report ECEMA111847	52 days	Mon 27/06/11	Mon 29/08/11
82	Submission of report to ONR	0 days	Tue 30/08/11	Tue 30/08/11
83	ONR assessment of deliverables	42 days	Thu 11/08/11	Fri 30/09/11
84	RP response to ONR queries	65 days	Thu 11/08/11	Fri 28/10/11
85	**Task 2 Update of PCSR & Supporting Documents**	**115 days**	**Mon 12/09/11**	**Tue 31/01/12**
86	Preparation of draft update to PCSR Sub-chapter 5.4 section 1	60 days	Mon 12/09/11	Wed 23/11/11
87	Transmission to ONR	0 days	Thu 24/11/11	Thu 24/11/11



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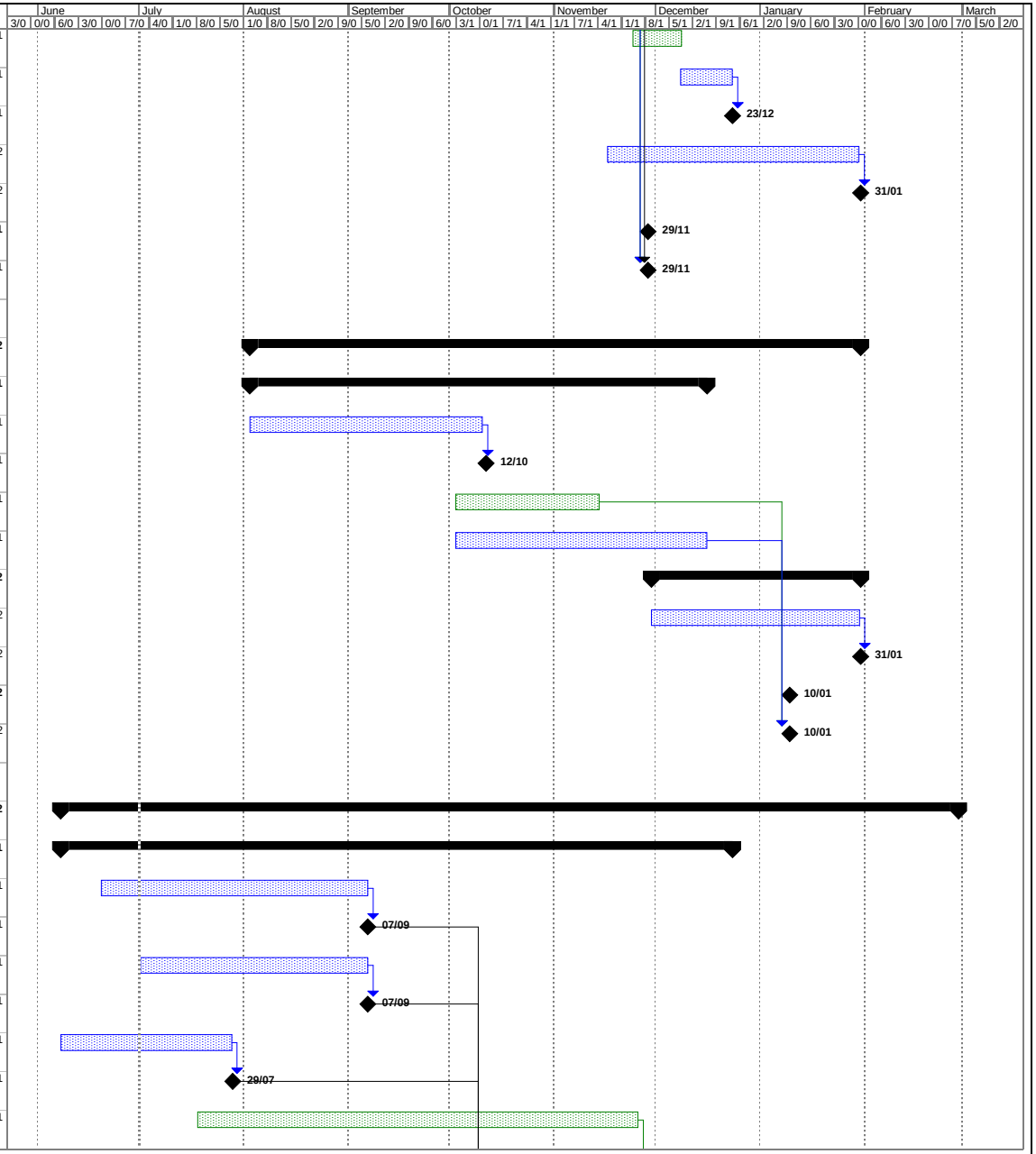
ID	Task Name	Duration	Start	Finish
88	ONR Assessment	12 days	Thu 24/11/11	Thu 08/12/11
89	Update following resolution of ONR comments	13 days	Thu 08/12/11	Fri 23/12/11
90	Submission of updated PCSR Sub-chapter	0 days	Fri 23/12/11	Fri 23/12/11
91	Preparation of updates to supporting document PEER-F 102070, if required	60 days	Thu 17/11/11	Mon 30/01/12
92	Transmission of supporting document - PEER-F 102070, if required	0 days	Tue 31/01/12	Tue 31/01/12
93	**Task 3 Convergence Meetings**	**0 days**	**Tue 29/11/11**	**Tue 29/11/11**
94	Convergence Meeting	0 days	Tue 29/11/11	Tue 29/11/11
95				
96	**Issue SI01 Action 6 Prototype Application NDT technical Justification**	**147,43 days**	**Wed 03/08/11**	**Tue 31/01/12**
97	**Task 1 Production of reports & ONR Assessment**	**111,14 days**	**Wed 03/08/11**	**Fri 16/12/11**
98	Update of NDT Technical Justification report PEEM-F 10.2217	56 days	Wed 03/08/11	Tue 11/10/11
99	Submission of report to ONR	0 days	Wed 12/10/11	Wed 12/10/11
100	ONR assessment of deliverables	35 days	Mon 03/10/11	Mon 14/11/11
101	RP response to ONR queries	62 days	Mon 03/10/11	Fri 16/12/11
102	**Task 2 Update of PCSR & Supporting Documents**	**50,29 days**	**Wed 30/11/11**	**Tue 31/01/12**
103	Preparation of updates to supporting document PEER-F 102070, if required	50 days	Wed 30/11/11	Mon 30/01/12
104	Transmission of supporting document - PEER-F 102070, if required	0 days	Tue 31/01/12	Tue 31/01/12
105	**Task 3 Convergence Meetings**	**0 days**	**Tue 10/01/12**	**Tue 10/01/12**
106	Convergence Meeting	0 days	Tue 10/01/12	Tue 10/01/12
107				
108	**Issue SI01 Action 7 Non Destructive testing of MCL & DMW**	**217,14 days**	**Wed 08/06/11**	**Wed 29/02/12**
109	**Task 1 Production of reports & ONR Assessment**	**163,29 days**	**Wed 08/06/11**	**Fri 23/12/11**
110	Preparation of MCL weld connection design basis report PEER-F DC 60A	65 days	Mon 20/06/11	Tue 06/09/11
111	Submission of report to ONR	0 days	Wed 07/09/11	Wed 07/09/11
112	Update MCL UT capability report PEEM-F 11.0505A	54 days	Fri 01/07/11	Tue 06/09/11
113	Submission of report to ONR	0 days	Wed 07/09/11	Wed 07/09/11
114	Preparation of MSL UT capability report PEEM-F 11.0959	42 days	Wed 08/06/11	Thu 28/07/11
115	Submission of report to ONR	0 days	Fri 29/07/11	Fri 29/07/11
116	ONR assessment of deliverables	108 days	Mon 18/07/11	Fri 25/11/11



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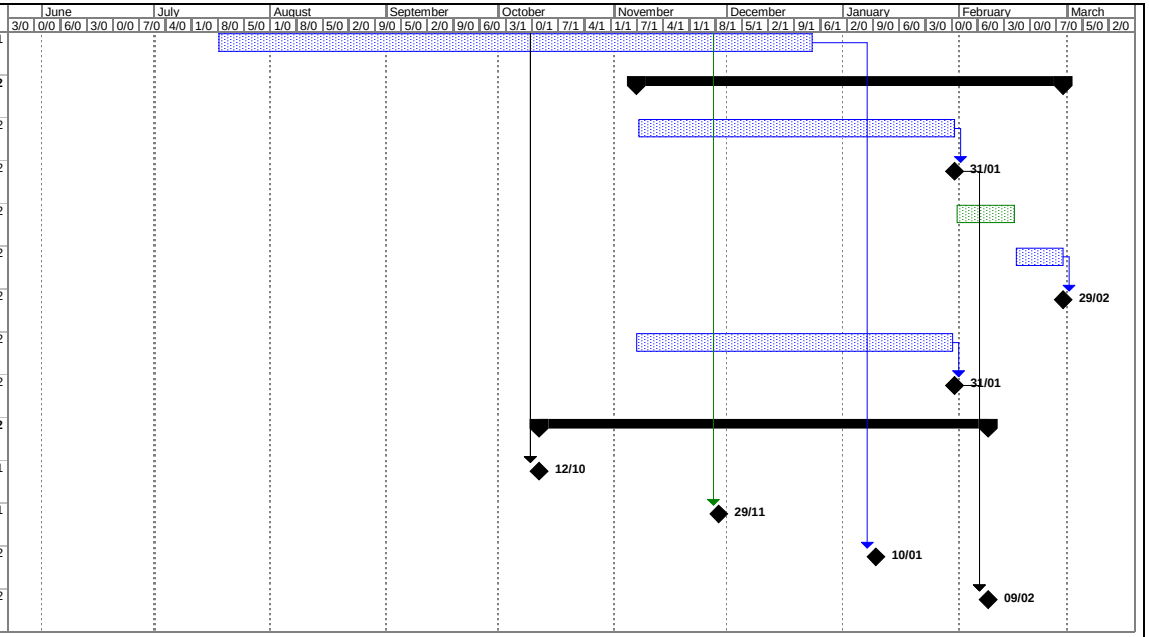
ID	Task Name	Duration	Start	Finish
117	RP response to ONR queries	131 days	Mon 18/07/11	Fri 23/12/11
118	**Task 2 Update of PCSR & Supporting Documents**	**93,71 days**	**Mon 07/11/11**	**Wed 29/02/12**
119	Preparation of draft update to PCSR Sub-chapter 5.4 section 3	69 days	Mon 07/11/11	Mon 30/01/12
120	Transmission to ONR	0 days	Tue 31/01/12	Tue 31/01/12
121	ONR Assessment	13 days	Tue 31/01/12	Wed 15/02/12
122	Update following resolution of ONR comments	10 days	Thu 16/02/12	Tue 28/02/12
123	Submission of updated PCSR Sub-chapter	0 days	Wed 29/02/12	Wed 29/02/12
124	Preparation of updates to supporting document PEER-F 102070, if required	69 days	Mon 07/11/11	Mon 30/01/12
125	Transmission of supporting document - PEER-F 102070, if required	0 days	Tue 31/01/12	Tue 31/01/12
126	**Task 3 Convergence Meetings**	**98,29 days**	**Wed 12/10/11**	**Thu 09/02/12**
127	Technical Meeting	0 days	Wed 12/10/11	Wed 12/10/11
128	Technical Meeting	0 days	Tue 29/11/11	Tue 29/11/11
129	Preliminary Convergence Meeting	0 days	Tue 10/01/12	Tue 10/01/12
130	Final Convergence Meeting	0 days	Thu 09/02/12	Thu 09/02/12



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