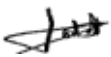



<b>UK EPR</b>	<b>UK EPR GDA PROJECT</b>			
	Title: Resolution Plan for GI-UKEPR-CC03			
	RP unique number: <b>GI-UKEPR-CC03-RP</b>	Revision No.: 0	Effective Date: 12/12/2011	Page No.: 1 of 21
Approved for EDF by: A. PETIT  Name/Initials  Date 12/12/2011		Approved for AREVA by: G. CRAIG  Name/Initials  Date 12/12/2011		

### Resolution Plan Revision History

Rev.	Description of update	Date issued
0	First Issuance	12/12/2011

#### 1.0 GDA ISSUE

GDA Issue Title	Main Assessment Area	Related Assessment Area
Consider and Action Plans to address the Lessons Learnt from the Fukushima Event	Cross Cutting	All

<b>GDA Issue</b>	EDF and AREVA are required to demonstrate how they will be taking account of the lessons learnt from the unprecedented events at Fukushima, including those lessons and recommendations that are identified in the HM Chief Inspector's interim and final reports.
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#### 2.0 OVERVIEW OF SCOPE OF WORK

Following the events at the Fukushima Daiichi NPP in Japan, EDF/AREVA have initiated an internal review of the response of the UK EPR to extreme natural events. The aim is to demonstrate the resilience of the plant to beyond design basis hazards considered, and to identify reasonably practicable improvements to the design, and to accident management procedures, to improve plant robustness to hypothetical events involving extended unavailability of AC electric power and/or ultimate heat sink, whatever the cause.

GDA Issue GI-UKEPR-CC-03 requests that EDF/AREVA provide the results of this internal resilience analysis, and provide plans for implementing lessons learned. It further requests that any design or procedural changes are included in an update of the UK EPR SSER and UK EPR design reference documentation. The GDA Issue also requests that a written response is provided to those

<b>UK EPR</b>	<b>UK EPR GDA PROJECT</b>			
	Title: Resolution Plan for GI-UKEPR-CC03			
	GI unique number: <b>GI-UKEPR-CC03-RP</b>	Revision No.: 0	Effective Date: 12/12/2011	Page No.: 2 of 21

recommendations in the HM Chief Inspector Nuclear Installations' interim and final reports on the Fukushima events which are applicable to the GDA of UK EPR.

The deliverables planned in this Resolution Plan will present results of the safety reviews of the EPR design performed by EDF/AREVA following the Fukushima events, including design and construction measures considered for implementation in the light of lessons learned.

<b>UK EPR</b>	<b>UK EPR GDA PROJECT</b>			
	Title: Resolution Plan for GI-UKEPR-CC03			
	GI unique number: <b>GI-UKEPR-CC03-RP</b>	Revision No.: 0	Effective Date: 12/12/2011	Page No.: 3 of 21

### 3.0 GDA ISSUE ACTIONS AND RESOLUTION PLAN DELIVERABLES

#### 3.1 Action GI-UKEPR-CC03.A1

Action I/D	Action Description
<b>GI-UKEPR-CC03.A1</b>	<p>EDF and AREVA to address the lessons learnt from their internal review following the Fukushima event relevant to GDA for the UK EPR.</p> <p>Evidence we expect to see provided to address this action includes:</p> <ol style="list-style-type: none"> <li>1. Internal review summary report</li> <li>2. A plan for the necessary actions arising from the internal review report</li> <li>3. Modification of the following, as appropriate: <ol style="list-style-type: none"> <li>a. Design Reference and SSERs</li> <li>b. Submission Master List documentation (Levels 1-3), including amendments to submission level 2 design information such as SDMs in accordance with GDA Issue GI-UKEPR-CC.02</li> <li>c. Resolution Plans in response to other relevant GDA Issues</li> </ol> </li> <li>4. Confirmation that any design changes resulting from these reviews for inclusion into GDA will be managed in accordance with the UK EPR GDA Project Procedure UKEPR-I-003.</li> </ol> <p>With agreement from the Regulator this action may be completed by alternative means.</p>

#### 3.1.1 Planned submissions in response to GI-UKEPR-CC03.A1

##### 3.1.1.1 Description of Scope of Work

A preliminary review of the lessons learned from the Fukushima event was carried out by AREVA/EDF. This review has indicated a number of key areas where additional design and procedural measures could in principle improve the ability of the UK EPR to withstand extreme natural events which could impact on availability of electrical supplies and cooling systems. Assessments are in progress of the practicability of making plant improvements in these areas. Results of these studies will be presented in a series of reports as described below. It is considered that submission of these reports will provide a comprehensive response to Action GI-UKEPR-CC03.A1.

Potential changes identified as enhancements will be subjected to a resilience assessment process where appropriate, i.e., a qualitative As Low As Reasonably Practicable (ALARP) assessment, on the basis of engineering judgments. Best Available Techniques (BAT) assessment for environmental aspects will be undertaken where appropriate to evaluate the proposed enhancements. Design changes (if any) resulting from the tasks defined herein will be managed in accordance with the UK EPR GDA Project Procedure UKEPR-I-003.

<b>UK EPR</b>	<b>UK EPR GDA PROJECT</b>			
	Title: Resolution Plan for GI-UKEPR-CC03			
	GI unique number: <b>GI-UKEPR-CC03-RP</b>	Revision No.: 0	Effective Date: 12/12/2011	Page No.: 4 of 21

### 3.1.1.2 Description of Methodology to be employed

A safety evaluation of the UK EPR following the Fukushima events was launched in accordance with the WENRA specification published on 21 April 2011: the objective was to review the UK EPR reference design, to identify margins, analyse robustness for natural events beyond the current design basis including cliff-edge effects, and define additional reasonably practicable measures that could be applied in the design and operation of the UK EPR to further improve robustness.

The analysis examined the behaviour of the plant in situations involving successive failures, up to extreme situations such as the total loss of AC power or loss of the ultimate heat sink and combinations of the two. The scope of analysis included:

- a robustness analysis of the current reference design with respect to seismic and external flooding events that are beyond the design basis, with consideration given to extreme weather conditions;
- a robustness analysis addressing total loss of AC power and/or loss of the ultimate heat sink situations (noting that loss of heat sink is bounded by the loss of AC power case), for both the reactor building and the spent fuel pool, considering situations beyond those considered in the current reference design;
- a stress analysis for the reactor in the case of severe accidents.

The analysis aimed to identify, as part of the post Fukushima robustness analysis, and for beyond design situations, any additional reasonably practicable measures that could be implemented to achieve the plant safety objectives. The outcome of the investigations will be presented in a series of dedicated reports as outlined below.

#### **Task 1 of GI-UKEPR-CC03.A1 – Summary Report of Lessons Learned for UK EPR**

A summary report will be issued presenting the results of the EPR robustness analysis described above. The report will identify design and construction measures that are being considered for implementation in the light of lessons learned.

The summary report may result in updates to the Safety, Security and Environmental Report (SSER) submission documents for the UK EPR. Such updates, if required, will be implemented following completion of the detailed design assessments performed under Tasks 2-4 of this GDA issue action (see below).

#### **Task 2 of GI-UKEPR-CC03.A1 – Robustness Analysis of the UK EPR Against Seismic and Flooding Events with Consideration Given to Extreme Weather Conditions**

This task will involve a detailed review of the robustness of the design of the UK EPR against beyond design basis seismic and flooding events with consideration given to extreme weather conditions, in order to identify the need, if any, to implement additional reasonably practicable improvements.

<b>UK EPR</b>	<b>UK EPR GDA PROJECT</b>			
	Title: Resolution Plan for GI-UKEPR-CC03			
	GI unique number: <b>GI-UKEPR-CC03-RP</b>	Revision No.: 0	Effective Date: 12/12/2011	Page No.: 5 of 21

Two sub-tasks will be performed, as follows:

Task 2.1: Design Against Seismic Events:

A report will be issued with the following scope:

- Review of design against seismic events confirming robustness against beyond design basis conditions including:
  - Seismic resistance of the safety classified structures,
  - Classification of equipment,
  - Seismic resistance of the flood protection of structures.

Robustness of fuel pool. Reports on the Fukushima event (not yet substantiated) suggest that one or more of the spent fuel pools on the site may have been partially drained of cooling water. A review of the risk of UK EPR fuel pool drainage due to failure of penetrations and coolant suction lines is being carried out under GDA Issue GI-UKEPR-FS-03. The study will be extended to cover potential beyond design basis conditions. Depending on the outcomes of this review, reasonably practicable measures may be identified to reduce the risk of fuel pool drainage.

Task 2.2: Design Against Flooding Events with Consideration Given to Extreme Weather Conditions:

A report will be issued with the following scope:

- Review of UK EPR design against external flooding and robustness in beyond design basis conditions, covering in particular:
  - Protection of openings to buildings housing safety classified equipment:
    - For the doors which are the main potential route for water to enter the protected area,
    - For the flood protection partitioning,
    - For the structures and devices protecting the SBO diesel generators and 12h batteries.
  - Resistance of equipment in the pumping station to flooding.
  - Means of avoiding consequential hazards and events that could result from external flooding.
- Review of UK EPR design against extreme weather conditions to confirm robustness.

Two dedicated reports will be issued presenting the outcome of the robustness review for seismic and flooding events with consideration given to extreme weather conditions. Potential reasonably practicable measures for improving the design of systems, structures and components will be identified.

Implementation of the conclusions of these reports may require an update to the SSER for the UK EPR. Implementation of updates to the SSER is discussed further under GI-UKEPR-CC03.A2 Task 2.

<b>UK EPR</b>	<b>UK EPR GDA PROJECT</b>			
	Title: Resolution Plan for GI-UKEPR-CC03			
	GI unique number: <b>GI-UKEPR-CC03-RP</b>	Revision No.: 0	Effective Date: 12/12/2011	Page No.: 6 of 21

### Task 3 of GI-UKEPR-CC03.A1 – Robustness of Power Sources / Long Term Cooling

The Fukushima event involved extended loss of on-site and off-site AC power sources resulting in failure of essential cooling systems: depletion of batteries eventually caused a loss of all essential power sources needed for plant control and operation of safety equipment. In particular, ability of operators to restore control of the NPPs was impeded by lack of access to supplies of fresh water for cooling the reactors and the fuel pools and a means of delivering the cooling water.

Disruption of local communications to site impeded access to the site for delivery of temporary generators and fuel supplies.

EDF/AREVA will consider what measures could be implemented to improve the resilience of the UK EPR to extended loss of off-site and/or on-site power sources in situations where site access could be restricted due to disruption of local communications. This will cover the assessment of the robustness of the EPR to a complete loss of AC and DC power sources.

Measures considered will include:

- Improved procedures for utilisation of fuel stocks to extend the operating period of emergency and backup diesel generators for conditions where fuel deliveries to site are impeded
- Measures to secure and extend the availability of battery backed uninterruptible power supplies in the event of extended loss of emergency and back-up diesel generators, to provide guaranteed power for essential I&C, ventilation systems and control room functions, including:
  - Consideration of possible extension of battery lifetime
  - Consideration of use of portable generators to recharge batteries.
- Measures to provide additional seismically secure means of cooling of the reactor and spent fuel pool appropriate to the level of defence in depth required. The aim is to provide cooling for the reactor and the fuel pool for a sufficiently long period of time to allow the operators to restore normal cooling systems or bring in coolant from off-site sources, while avoiding fuel damage or significant releases of radioactivity to the environment.

In particular, the aim is to avoid the fuel from becoming uncovered in the spent fuel pool: The radiological protection function and cooling of fuel assemblies in the spent fuel pool is ensured by there being a sufficient level of water (i.e. water in the pool plays a role in confinement). EDF/AREVA are re-assessing the robustness of the design in order to identify any additional reasonably practicable measures that might be needed, in the light of experience from the Fukushima event, to ensure, in all cases, that make-up water can be provided to the fuel pool to avoid the fuel from becoming uncovered.

The review will cover all different situations including handling of a fuel assembly.

Other measures to improve robustness of the UK EPR Fuel Pool in order to reduce the risk of over-pressurisation in the Fuel Building:

- EDF/AREVA will re-assess the adequacy of planned measures to mitigate the build-up of combustible gases and steam in the Fuel Building, in the light of experience from the Fukushima event. The assessment will cover the risk of hydrogen generation in the Fuel Pool and the risk of pressure increases in the building induced by the production of steam. Potential reasonably practicable measures to mitigate risk will be presented.

<b>UK EPR</b>	<b>UK EPR GDA PROJECT</b>			
	Title: Resolution Plan for GI-UKEPR-CC03			
	GI unique number: <b>GI-UKEPR-CC03-RP</b>	Revision No.: 0	Effective Date: 12/12/2011	Page No.: 7 of 21

A report will be produced presenting the outcome of the review of the robustness of the UK EPR power sources and long term cooling and potential reasonably practicable measures for improvements.

Implementation of the conclusions of this report may require an update to the SSER for the UK EPR. Implementation of updates to the SSER is discussed further under GI-UKEPR-CC03.A2 Task 2.

#### **Task 4 of GI-UKEPR-CC03.A1 – Management of Severe Accidents**

The design of the UK EPR is such that the risk of a severe accident situation i.e. core melt, is extremely low.

In the context of the analysis of the events that took place at Fukushima and of the specifications for the safety evaluation, the progression of a severe accident in the extreme situation of a simultaneous loss of all AC electrical power and/or ultimate heat sink (noting that loss of heat sink is bounded by the loss of AC power case) is being reviewed. The review will identify additional provisions that could be implemented to improve robustness.

The review will include:

- The means of limiting the pressure increase in the containment, by opening depressurisation valves on the primary circuit (supported by 12 hour batteries) to prevent high pressure core melt and potential loss of containment.
- Control of Combustible Gases: In the Fukushima event, plant damage occurred due to hydrogen explosions following failure of equipment designed to reduce explosion risk. EDF/AREVA will re-assess the adequacy of planned measures to mitigate risk of hydrogen explosion, and identify additional reasonably practicable measures that might be implemented.
- Control and instrumentation: The Fukushima events involved widespread failure of essential support systems, including control and instrumentation, lighting, ventilation, and communication systems. AREVA/EDF will re-assess the adequacy of the plant control and instrumentation and communication systems for severe accident conditions, including qualification of equipment used in these extreme situations, and will identify potential reasonably practicable measures for improvements.

A report will be produced, presenting the outcome of the review, identifying any potential reasonably practicable measures for improvements.

Implementation of the conclusions of this report may require an update to the SSER for the UK EPR. Implementation of updates to the SSER is discussed further under GI-UKEPR-CC03.A2 Task 2.

Any potential design changes resulting from Tasks 2 to 4 will be managed in accordance with the UK EPR GDA Project Procedure UKEPR-I-003. The programme associated with these tasks takes into account the potential need for EDF/AREVA to issue CMFs through to at least Stage 2 including a description of the design change and consideration of potential updates to impacted supporting documents, as deemed reasonably practicable, to facilitate the assessment of changes.

<b>UK EPR</b>	<b>UK EPR GDA PROJECT</b>			
	Title: Resolution Plan for GI-UKEPR-CC03			
	GI unique number: <b>GI-UKEPR-CC03-RP</b>	Revision No.: 0	Effective Date: 12/12/2011	Page No.: 8 of 21

### 3.1.1.3 Deliverable description

**Submission date to ONR/EA**

Task 1 of GI-UKEPR-CC03.A1 – Summary Report of Lessons Learned for UK EPR

16/12/2011

*This report will present results of the safety reviews of the EPR performed following the Fukushima event, the aim of which is to make an initial identification of design and construction measures that could be considered for implementation in the light of lessons learned. This deliverable responds to Action A1.1 of GI-UKEPR-CC03.*

Task 2 of GI-UKEPR-CC03.A1 – Robustness Analysis of the UK EPR Against Seismic and Flooding Events with Consideration Given to Extreme Weather Conditions

- Task 2.1 – Design Against Seismic Events

30/03/2012

*This document will review the robustness of the EPR against beyond design basis seismic events and potential reasonably practicable measures for improvements. This deliverable responds to Actions A1.2-A1.4 of GI-UKEPR-CC03.*

- Task 2.2 – Design Against Flooding Events with Consideration Given to Extreme Weather Conditions

13/04/2012

*This document will review the robustness of the EPR against beyond design basis flooding events with consideration given to extreme weather conditions and potential reasonably practicable measures for improvements. This deliverable responds to Actions A1.2-A1.4 of GI-UKEPR-CC03.*

Task 3 of GI-UKEPR-CC03.A1 – Robustness of Power Sources / Long Term Cooling

13/04/2012

*This document will review the robustness of the UK EPR power sources and cooling of the reactor and the fuel pool, along with potential reasonably practicable measures for improvements. This deliverable responds to Actions A1.2-A1.4 of GI-UKEPR-CC03.*

Task 4 of GI-UKEPR-CC03.A1 – Management of Severe Accidents

20/04/2012

*This document will describe design measures in place in the event of a postulated severe accident scenario. The adequacy of important plant systems and equipment during extreme situations will be reviewed. Potential reasonably practicable measures for improvements will be proposed if necessary. This deliverable responds to Actions A1.2-A1.4 of GI-UKEPR-CC03.*



<b>UK EPR</b>	<b>UK EPR GDA PROJECT</b>			
	Title: Resolution Plan for GI-UKEPR-CC03			
	GI unique number: <b>GI-UKEPR-CC03-RP</b>	Revision No.: 0	Effective Date: 12/12/2011	Page No.: 9 of 21

### 3.2 Action GI-UKEPR-CC03.A2

Action I/D	Action Description
<b>GI-UKEPR-CC03.A2</b>	<p>EDF and AREVA to address the lessons learnt that are relevant to GDA for UK EPR from HM Chief Inspector Nuclear Installations' interim and final reports.</p> <p>Evidence we expect to see provided to address this action includes:</p> <ol style="list-style-type: none"> <li>1) A Plan to address the relevant actions arising from HM Chief Inspector's interim and final reports.</li> <li>2) Modification of the following, as appropriate: <ol style="list-style-type: none"> <li>a. Design Reference and SSERs</li> <li>b. Submission Master List documentation (Levels 1-3), including amendments to submission level 2 design information such as SDMs in accordance with GDA Issue GI-UKEPR-CC.02</li> <li>c. Resolution Plans in response to other relevant GDA Issues</li> </ol> </li> <li>3) Confirmation that any design changes resulting from these reviews for inclusion into GDA will be managed in accordance with the UK EPR GDA Project Procedure UKEPR-I-003.</li> </ol> <p>With agreement from the Regulator this action may be completed by alternative means.</p>

#### 3.2.1 Planned submissions in response to GI-UKEPR-CC03.A2

##### 3.2.1.1 Description of Scope of Work

The ONR final report on lessons learned from the Fukushima event contains 38 recommendations, a number of which involve actions placed on the UK Nuclear Industry. The following recommendations are considered relevant to GDA of the UK EPR:

It should be noted that some of the ONR recommendations are considered to be most applicable to either the site location and/or the management arrangements of the plant operator (IR-10, IR-11, IR-12, IR-13, IR-14, IR-17 and IR-24). However, the generic aspects of the recommendations identified below will also be considered as part of this resolution plan.

**Recommendation IR-4: Both the UK nuclear industry and ONR should consider ways of enhancing the drive to ensure more open, transparent and trusted communications, and relationships, with the public and other stakeholders.**

<b>UK EPR</b>	<b>UK EPR GDA PROJECT</b>			
	Title: Resolution Plan for GI-UKEPR-CC03			
	GI unique number: <b>GI-UKEPR-CC03-RP</b>	Revision No.: 0	Effective Date: 12/12/2011	Page No.: 10 of 21

**Recommendation IR-8:** The UK nuclear industry should review the dependency of nuclear safety on off-site infrastructure in extreme conditions, and consider whether enhancements are necessary to sites' self sufficiency given the reliability of the grid under such extreme circumstances.

**Recommendation IR-9:** Once further relevant information becomes available, the nuclear industry should review what lessons can be learnt from the comparison of the events at the Fukushima-1 (Fukushima Dai-ichi) and Fukushima-2 (Fukushima Dai-2) sites.

**Recommendation IR-10:** The UK nuclear industry should initiate a review of flooding studies, including from tsunamis, in light of the Japanese experience, to confirm the design basis and margins for flooding at UK nuclear sites, and whether there is a need to improve further site-specific flood risk assessments as part of the periodic safety review programme, and for any new reactors. This should include sea-level protection.

**Recommendation IR-11:** The UK nuclear industry should ensure that safety cases for new sites for multiple reactors adequately demonstrate the capability for dealing with multiple serious concurrent events induced by extreme off-site hazards.

**Recommendation IR-12:** The UK nuclear industry should ensure the adequacy of any new spent fuel strategies compared with the expectations in the Safety Assessment Principles of passive safety and good engineering practice.

**Recommendation IR-13:** The UK nuclear industry should review the plant and site layouts of existing plants and any proposed new designs to ensure that safety systems and their essential supplies and controls have adequate robustness against severe flooding and other extreme external events.

**Recommendation IR-14:** The UK nuclear industry should ensure that the design of new spent fuel ponds close to reactors minimises the need for bottom penetrations and lines that are prone to siphoning faults. Any that are necessary should be as robust to faults as are the ponds themselves.

**Recommendation IR-15:** Once detailed information becomes available on the performance of concrete, other structures and equipment, the UK nuclear industry should consider any implications for improved understanding of the relevant design and analyses.

**Recommendation IR-16:** When considering the recommendations in this report the UK nuclear industry should consider them in the light of all extreme hazards, particularly for plant layout and design of safety related plant.

<b>UK EPR</b>	<b>UK EPR GDA PROJECT</b>			
	Title: Resolution Plan for GI-UKEPR-CC03			
	GI unique number: <b>GI-UKEPR-CC03-RP</b>	Revision No.: 0	Effective Date: 12/12/2011	Page No.: 11 of 21

**Recommendation IR-17:** The UK nuclear industry should undertake further work with the National Grid to establish the robustness and potential unavailability of off-site electrical supplies under severe hazard conditions.

**Recommendation IR-18:** The UK nuclear industry should review any need for the provision of additional, diverse means of providing robust sufficiently long term independent electrical supplies on sites, reflecting the loss of availability of off-site electrical supplies under severe conditions.

**Recommendation IR-19:** The UK nuclear industry should review the need for, and if required, the ability to provide longer-term coolant supplies to nuclear sites in the UK in the event of severe off-site disruption, considering whether further on-site supplies or greater off-site capability is needed. This relates to both carbon dioxide and fresh water supplies, and for existing and proposed new plants.

**Recommendation IR-20:** The nuclear industry should review site contingency plans for pond water make up under severe accident conditions to see whether they can and should be enhanced given the experience at Fukushima.

**Recommendation IR-21:** The UK nuclear industry should review the ventilation and venting routes for nuclear facilities where significant concentrations of combustible gases may be flowing or accumulating to determine whether more should be done to protect them.

**Recommendation IR-22:** The UK nuclear industry should review the provision of on-site emergency control, instrumentation and communications in light of the circumstances of the Fukushima accident including long timescales, wide spread on and off-site disruption, and the environment on-site associated with a severe accident.

**Recommendation IR-24:** The UK nuclear industry should review existing severe accident contingency arrangements and training, giving particular consideration to the physical, organisational, behavioural, emotional and cultural aspects for workers having to take actions on-site, especially over long periods. This should take account of the impact of using contractors for some aspects on-site such as maintenance and their possible response.

**Recommendation IR-25:** The UK nuclear industry should review, and if necessary extend, analysis of accident sequences for long term severe accidents. This should identify appropriate repair and recovery strategies to the point at which a stable state is achieved, identifying any enhanced requirements for central stocks of equipment and logistical support.

**Recommendation IR-26:** A response to the various recommendations in the interim report should be made available within one month of it being published. These should include appropriate plans for addressing the recommendations. Any responses provided will be compiled on the ONR website.

<b>UK EPR</b>	<b>UK EPR GDA PROJECT</b>			
	Title: Resolution Plan for GI-UKEPR-CC03			
	GI unique number: <b>GI-UKEPR-CC03-RP</b>	Revision No.: 0	Effective Date: 12/12/2011	Page No.: 12 of 21

**Recommendation FR-2:** The UK nuclear industry should ensure that structures, systems and components needed for managing and controlling actions in response to an accident, including plant control rooms, onsite emergency control centres and offsite emergency centres, are adequately protected against hazards that could affect several simultaneously.

**Recommendation FR-3:** Structures, systems and components needed for managing and controlling actions in response to an accident, including plant control rooms, onsite emergency control centres and offsite emergency centres, should be capable of operating adequately in the conditions, and for the duration, for which they could be needed, including possible severe accident conditions.

**Recommendation FR-4:** The nuclear industry should ensure that adequate Level 2 Probabilistic Safety Analyses (PSA) are provided for all nuclear facilities that could have accidents with significant offsite consequences and use the results to inform further consideration of severe accident management measures. The PSAs should consider a full range of external events including “beyond design basis” events and extended mission times.

**Recommendation FR-6:** The nuclear industry with others should review available techniques for estimating radioactive source terms and undertake research to test the practicability of providing real-time information on the basic characteristics of radioactive releases to the environment to the responsible off-site authorities, taking account of the range of conditions that may exist on and off the site

**Recommendation FR-11:** The UK nuclear industry should continue to promote sustained high levels of safety culture amongst all its employees, making use of the National Skills Academy for Nuclear and other schemes that promote “nuclear professionalism”.

**Recommendation FR-12:** Reports on the progress that has been made in responding to the recommendations in this report should be made available to ONR by June 2012. These should include the status of the plans, together with details of improvements that have been implemented by that time.

Many of the above recommendations will be responded to by the reports issued under Action GI-UKEPR-CC03.A1 (see below). AREVA/EDF will provide a review report responding to the complete set of relevant recommendations.

<b>UK EPR</b>	<b>UK EPR GDA PROJECT</b>			
	Title: Resolution Plan for GI-UKEPR-CC03			
	GI unique number: <b>GI-UKEPR-CC03-RP</b>	Revision No.: 0	Effective Date: 12/12/2011	Page No.: 13 of 21

### 3.2.1.2 Recommendations not considered relevant to GDA

The following recommendations of the ONR report applicable to the Nuclear Industry are deemed not to be relevant to GDA of the UK EPR, for the reasons stated:

**Recommendation IR-23: The UK nuclear industry, in conjunction with other organisations as necessary, should review the robustness of necessary off-site communications for severe accidents involving widespread disruption.**

*Establishment of off-site communications for severe accident situations is covered by the Emergency Planning arrangements for an individual NPP which are dependent on the site location and the management arrangements of the plant operator. This issue cannot be addressed as part of a Generic Design Assessment.*

**Recommendation FR-1: All nuclear site licensees should give appropriate and consistent priority to completing Periodic Safety Reviews (PSR) to the required standards and timescales, and to implementing identified reasonably practicable plant improvements.**

*This recommendation is only applicable to operators of existing UK nuclear facilities.*

### 3.2.1.3 Description of Methodology to be employed

#### Task 1 of GI-UKEPR-CC03.A2 – Response Report to Recommendations from HM Chief Inspector of Nuclear Installations’ Report on the Fukushima Event

Based on the applicability of the generic aspects of the ONR recommendations to the UK EPR as identified in 3.2.1.1, EDF and AREVA will provide a summary report which effectively responds to these ONR recommendations. This report will present how the design of the UK EPR considers and/or accounts for the items listed below.

**Recommendation IR-4:** The efforts made by EDF/AREVA to provide open and public access to GDA design information for the UK EPR will be summarized

**Recommendation IR-8:** The robustness of UK EPR design against natural events, including robustness of on-site power supplies and water supply infrastructures, will be addressed by GI-UKEPR-CC03.A1 Tasks 2-4. The task responses will be summarised.

**Recommendation IR-9:** EDF/AREVA will provide a commentary on the differences between the behaviour of the Fukushima Daiichi and Fukushima Daiini NPPs. Lessons learned for the UK EPR design, if any, will be stated.

**Recommendation IR-14:** Will be addressed by GI-UKEPR-CC03.A1 Task 2.1. The task response will be summarised.

**Recommendation IR-15:** Will be addressed by GI-UKEPR-CC03.A1 Task 2 (including reference to analytical studies reported in GDA). The task response will be summarised.

**Recommendation IR-16:** Will be addressed by GI-UKEPR-CC03.A1 Tasks 2-4. The task responses will be summarised.

<b>UK EPR</b>	<b>UK EPR GDA PROJECT</b>			
	Title: Resolution Plan for GI-UKEPR-CC03			
	GI unique number: <b>GI-UKEPR-CC03-RP</b>	Revision No.: 0	Effective Date: 12/12/2011	Page No.: 14 of 21

**Recommendation IR-18:** Will be addressed by GI-UKEPR-CC03.A1 Task 3. The task response will be summarised.

**Recommendation IR-19:** Will be addressed by GI-UKEPR-CC03.A1 Task 3. The task response will be summarised.

**Recommendation IR-20:** Will be addressed by GI-UKEPR-CC03.A1 Tasks 3 and 4. The task responses will be summarised.

**Recommendation IR-21:** Will be addressed by GI-UKEPR-CC03.A1 Task 4. The task response will be summarised.

**Recommendation IR-22:** Will be addressed by GI-UKEPR-CC03.A1 Tasks 4. The task response will be summarised.

**Recommendation IR-25:** Will be addressed by GI-UKEPR-CC03.A1 Tasks 3-4. The task responses will be summarised.

**Recommendation IR-26:** Was responded to by letter ND(NII) EPR 00879N dated 17th June 2011.

**Recommendation FR-2:** Will be addressed by GI-UKEPR-CC03.A1 Task 2. The task response will be summarised.

**Recommendation FR-3:** Will be addressed by GI-UKEPR-CC03.A1 Tasks 3-4. The task responses will be summarised.

**Recommendation FR-4:** The UK EPR Level 2 Probabilistic Safety Analyses (PSA) will be referenced and its adequacy checked.

**Recommendation FR-6:** The status of available technology for monitoring of radioactive source terms will be reviewed to consider the practicability of providing real-time information on radioactive releases to the environment to UK off-site authorities in the future operation of UK EPRs.

**Recommendation FR-11:** The continuing efforts and initiatives being taken by EDF/AREVA to develop a strong safety culture within their organisations, and achieved a highly skilled and professional workforce, will be summarised.

**Recommendation FR-12:** Will be responded by the issue of the review report.

It should be noted that some of the ONR recommendations are considered to be most applicable to either the site location and/or the management arrangements of the plant operator. However, the generic aspects of the recommendations identified below will also be considered as part of this resolution plan.

**Recommendation IR-10:** Evaluation of site flooding risk, including protection against tsunami and phenomena leading to sea level rise at coastal sites, is site dependent and cannot be performed as part of a Generic Design Assessment. However, GI-UKEPR-CC03.A1 Task 2.1 will include an explanation of how external flooding risk is addressed in the UK EPR design in order to meet deterministic and probabilistic safety targets.

<b>UK EPR</b>	<b>UK EPR GDA PROJECT</b>			
	Title: Resolution Plan for GI-UKEPR-CC03			
	GI unique number: <b>GI-UKEPR-CC03-RP</b>	Revision No.: 0	Effective Date: 12/12/2011	Page No.: 15 of 21

**Recommendation IR-11:** GDA of UK EPR has considered the safety of a unit in isolation. However, GI-UKEPR-CC03.A2 Task 1 will consider the general principles applicable to the UK EPR design such as it being designed as a standalone unit and not reliant on adjacent units in the seismic and flooding events with consideration given to extreme weather conditions. The potential implications of constructing multiple units on a single site will be considered during the site licensing phase.

**Recommendation IR-12:** Detailed assessment of robustness of spent fuel storage against extreme natural events cannot be performed in GDA, as storage strategies are to be decided by plant operators. However GI-UKEPR-CC03.A1 Tasks 2.1 and 2.2 will include a review of the principles that could be applied to the design of spent fuel pool to ensure robustness against within- and beyond- design basis external hazards considered in link with Fukushima events.

**Recommendation IR-13:** Evaluation of the impact of site layout on risk due to seismic and flooding events with consideration given to extreme weather conditions is site dependent and cannot be performed in GDA. However, GI-UKEPR-CC03.A1 Task 2.1 will present the principles which apply to plant layout to ensure robustness of the design against within- and beyond- design basis seismic and flooding events (with consideration given to extreme weather conditions).

**Recommendation IR-17:** Details of grid connections to individual NPPs are negotiated between the plant operator and the National Grid Company and cannot be assessed in detail in GDA. However the UK EPR design considers a wide range of grid faults which have been taken into account in the design and will be presented in GI-UKEPR-CC03.A1 Task 3.

**Recommendation IR-24:** Development of procedures for normal and emergency operation of the UK EPR, training of plant personnel and the use of contractors on-site is the responsibility of the plant operator and is largely outside the scope of GDA. However, the UK EPR design is based upon the consideration of years of operational feedback which has been used to develop highly effective severe accident management systems and to provide a basis for developing management guidelines. This will be summarized in response to GI-UKEPR-CC03.A2 Task 1.

## **Task 2 of GI-UKEPR-CC03.A2 – Update to SSER Submission Documentation**

The conclusions of the reports from GI-UKEPR-CC03.A1 and the summary report associated with GI-UKEPR-CC03.A2 might require updates to the relevant UK EPR SSER documentation (comprising the PCSR, PCER and CSA and key supporting references where appropriate). Required updates to the PCER will include updated BAT assessments if needed. This takes into account the need for EDF and AREVA to identify potentially impacted submission documentation early in the assessment process.

<b>UK EPR</b>	<b>UK EPR GDA PROJECT</b>			
	Title: Resolution Plan for GI-UKEPR-CC03			
	GI unique number: <b>GI-UKEPR-CC03-RP</b>	Revision No.: 0	Effective Date: 12/12/2011	Page No.: 16 of 21

#### 3.2.1.4 Deliverable description

#### Submission date to ONR/EA

Task 1 of GI-UKEPR-CC03.A2 – Response Report to Recommendations from HM Chief Inspector of Nuclear Installations’ Report on the Fukushima Event

27/07/2012

*This document provides an overall summary as to how the design of the UK EPR considers and/or accounts for the applicable recommendations from the HM Chief Inspector of Nuclear Installations’ Report. This deliverable responds to Action A2.1 of GI-UKEPR-CC03.A2.*

Task 2 of GI-UKEPR-CC03.A2 – Update to Relevant SSER Submission Documentation

27/07/2012

*This task will identify (as necessary) changes to the relevant UK EPR SSER documentation (i.e., PCSR, PCER and CSA and key supporting references where appropriate). This deliverable responds to Action A2.2 of GI-UKEPR-CC03.A2.*

Advance

version

16/11/2012

Final version



<b>UK EPR</b>	<b>UK EPR GDA PROJECT</b>			
	Title: Resolution Plan for GI-UKEPR-CC03			
	GI unique number: <b>GI-UKEPR-CC03-RP</b>	Revision No.: 0	Effective Date: 12/12/2011	Page No.: 17 of 21

#### 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

<b>GDA Submissions Documents</b>	<b>C/U</b>	<b>Related GDA Issue Action(s)</b>	<b>Submission Date to ONR/EA</b>
<b>SSER sub-chapters</b> Update to Relevant SSER Submission Documentation	U	GI-UKEPR-CC03.A2 (Task 2)	27/07/2012 Advance version 16/11/2012 Final version
<b>GDA reference design documents (SDM in UKEPR-I-002)</b> Impacted documents (if any) still to be identified	TBD	TBD	TBD

<b>UK EPR</b>	<b>UK EPR GDA PROJECT</b>			
	Title: Resolution Plan for GI-UKEPR-CC03			
	GI unique number: <b>GI-UKEPR-CC03-RP</b>	Revision No.: 0	Effective Date: 12/12/2011	Page No.: 18 of 21

<b>Other GDA submission supporting documents</b>			
Summary Report of Lessons Learned for UK EPR	C	GI-UKEPR-CC03.A1 (Task 1)	16/12/2011
Robustness Analysis of the UK EPR Against Seismic and Flooding Events with Consideration Given to Extreme Weather Conditions <ul style="list-style-type: none"> <li>• Design Against Seismic Events</li> <li>• Design Against Flooding Events with Consideration Given to Extreme Weather Conditions</li> </ul>	C	GI-UKEPR-CC03.A1 (Task 2.1)	30/03/2012
	C	GI-UKEPR-CC03.A1 (Task 2.2)	13/04/2012
Robustness of Power Sources / Long Term Cooling	C	GI-UKEPR-CC03.A1 (Task 3)	13/04/2012
Management of Severe Accidents	C	GI-UKEPR-CC03.A1 (Task 4)	20/04/2012
Response Report to Recommendations from HM Chief Inspector of Nuclear Installations' Report on the Fukushima Event	C	GI-UKEPR-CC03.A2 (Task 1)	27/07/2012

<b>UK EPR</b>	<b>UK EPR GDA PROJECT</b>			
	Title: Resolution Plan for GI-UKEPR-CC03			
	GI unique number: <b>GI-UKEPR-CC03-RP</b>	Revision No.: 0	Effective Date: 12/12/2011	Page No.: 19 of 21

#### **4.2 GDA submission documents impacted by GDA Issue and scheduled to be updated post GDA**

Changes identified as enhancements will be subjected to a resilience assessment process where appropriate, i.e., a qualitative As Low As Reasonably Practicable (ALARP) assessment, on the basis of engineering judgments. Best Available Techniques (BAT) assessment for environmental aspects will be undertaken where appropriate to evaluate the proposed enhancements. Design changes (if any) resulting from the analyses carried out in response to this GDA Issue will be managed in accordance with the UK EPR GDA Project Procedure UKEPR-I-003, i.e. a CMF will be opened for any identified change and an impact analysis on GDA Level 1, 2 and Level 3 documents performed to identify GDA documents impacted by the design change.

In some cases documents impacted by a CMF may not be able to be updated during GDA due to the changes being identified too late in the GDA process. In such cases, document packages for open design changes will be created according to the UK EPR GDA design change process and handed over into the ONR and EA permissioning process for Nuclear Site Licensing (c.f. GDA Issue GI-UKEPR-CC02 Action 2).

#### **5.0 JUSTIFICATION OF ADEQUACY**

The deliverables submitted in response to these issue actions will provide a comprehensive response to the GDA Issue GI-UKEPR-CC03. The conclusions contained in these deliverables will provide confidence in the UK EPR design and that following the Fukushima events, EDF/AREVA have applied rigorous steps to consider design and construction measures for implementation, where appropriate, based on these lessons learned.

Note that the actions of GI-UKEPR-CC03 and the associated deliverables described herein contribute to the substantiation of the following relevant SAP for the UK EPR:

<b>Engineering principles: external and internal hazards</b>	<b>'Cliff-edge' effects</b>	<b>EHA.7</b>
A small change in DBA parameters should not lead to a disproportionate increase in radiological consequences.		

Justifications for each task associated with the actions of this GI-UKEPR-CC03 are explained in the paragraphs to follow.

The response provided through **GI-UKEPR-CC03.A1 Task 1** will present the results of a EPR robustness analysis which will identify design and construction measures considered for implementation in the light of lessons learned from Fukushima.

The response provided through **GI-UKEPR-CC03.A1 Task 2** will present a detailed review of the UK EPR robustness against beyond design basis seismic and flooding events with consideration given to extreme weather conditions. Through this response reasonably practicable improvements, if determined necessary, will be identified for implementation into the UK EPR design.

<b>UK EPR</b>	<b>UK EPR GDA PROJECT</b>			
	Title: Resolution Plan for GI-UKEPR-CC03			
	GI unique number: <b>GI-UKEPR-CC03-RP</b>	Revision No.: 0	Effective Date: 12/12/2011	Page No.: 20 of 21

The response provided through **GI-UKEPR-CC03.A1 Task 3** will present a detailed review of the robustness of the UK EPR power sources and long term cooling in situations where site access could be restricted. Through this response reasonably practicable improvements, if determined necessary, will be identified for implementation into the UK EPR design.

The response provided through **GI-UKEPR-CC03.A1 Task 4** will present a detailed review of the management of severe accidents through the consideration of the adequacy of various measures and equipment relied upon in the event of a severe accident. Through this response reasonably practicable improvements, if determined necessary, will be identified for implementation into the UK EPR design.

The tasks of GI-UKEPR-CC03.A1 will be used to formulate a consolidated response to the HM Chief Inspector Nuclear Installations' report on the Fukushima event through the issue of the **GI-UKEPR-CC03.A2 Task 1** summary report. The justification which will be included in this response will clearly identify how the design of the UK EPR considers and/or has accounted for HM Chief Inspector recommendations.

Resolution of this GDA issue will identify reasonably practicable changes to equipment design to reduce and mitigate the considered scenarios and will in particular identify and eliminate cliff-edge effects. Identified changes to the design (if any) will be implemented through the UK EPR design change process developed for GDA.

<b>UK EPR</b>	<b>UK EPR GDA PROJECT</b>			
	Title: Resolution Plan for GI-UKEPR-CC01			
	GI unique number: <b>GI-UKEPR-CC01-RP</b>	Revision No.: 0	Effective Date: 12/12/2011	Page No.: 21 of 21

## 6.0 TIMETABLE AND MILESTONE PROGRAMME LEADING TO THE DELIVERABLES

Included as an attachment to this resolution plan, please consult the GI-UKEPR-CC03 resolution plan schedule.

ID	Task Name	Duration	Start	Finish	2011		Qtr 3, 2011			Qtr 4, 2011			Qtr 1, 2012			Qtr 2, 2012			Qtr 3, 2012			Qtr 4, 2012			Qtr 1,
					May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
1	<b>Action 1 of GI-UKEPR-CC03</b>	<b>298 days</b>	<b>Wed Aug 24, '11</b>	<b>Fri Oct 12, '12</b>																					
2	<b>Task 1 - Summary Report of Lessons Learned for UK EPR</b>	<b>83 days</b>	<b>Wed Aug 24, '11</b>	<b>Fri Dec 16, '11</b>																					
3	Report and Analysis Preparation	83 days	Wed Aug 24, '11	Fri Dec 16, '11																					
4	Issuance to ONR/EA/OCNS	0 days	Fri Dec 16, '11	Fri Dec 16, '11																					
5	<b>Task 2 - Robustness Analysis of the UK EPR for Beyond Design Basis Events</b>	<b>195 days</b>	<b>Mon Jan 9, '12</b>	<b>Fri Oct 5, '12</b>																					
6	<b>Task 2.1 - Seismic Events</b>	<b>185 days</b>	<b>Mon Jan 9, '12</b>	<b>Fri Sep 21, '12</b>																					
7	Report and Analysis Preparation	60 days	Mon Jan 9, '12	Fri Mar 30, '12																					
8	Issuance to ONR/EA/OCNS	0 days	Fri Mar 30, '12	Fri Mar 30, '12																					
9	ONR/EA/OCNS Assessment and Convergence with EDF/AREVA	65 days	Mon Apr 2, '12	Fri Jun 29, '12																					
10	Update of Report and Analysis (if applicable)	50 days	Mon Jul 2, '12	Fri Sep 7, '12																					
11	Issuance of Updated Documentation (if applicable)	0 days	Fri Sep 7, '12	Fri Sep 7, '12																					
12	<b>Identification of Design Changes</b>	<b>145 days</b>	<b>Mon Mar 5, '12</b>	<b>Fri Sep 21, '12</b>																					
13	Stage 1 CMF(s) preparation	20 days	Mon Mar 5, '12	Fri Mar 30, '12																					
14	Issuance to ONR/EA/OCNS	0 days	Fri Mar 30, '12	Fri Mar 30, '12																					
15	ONR/EA/OCNS Assessment of CMF(s)	20 days	Mon Apr 2, '12	Fri Apr 27, '12																					
16	Stage 2 CMF(s) preparation	30 days	Mon Apr 2, '12	Fri May 11, '12																					
17	Issuance to ONR/EA/OCNS	0 days	Fri May 11, '12	Fri May 11, '12																					
18	ONR/EA/OCNS Assessment of CMF(s)	35 days	Mon May 14, '12	Fri Jun 29, '12																					
19	Update of Impacted Documents (where appropriate)	60 days	Mon Jul 2, '12	Fri Sep 21, '12																					
20	<b>Task 2.2 - Flooding Events</b>	<b>195 days</b>	<b>Mon Jan 9, '12</b>	<b>Fri Oct 5, '12</b>																					
21	Report and Analysis Preparation	70 days	Mon Jan 9, '12	Fri Apr 13, '12																					
22	Issuance to ONR/EA/OCNS	0 days	Fri Apr 13, '12	Fri Apr 13, '12																					
23	ONR/EA/OCNS Assessment and Convergence with EDF/AREVA	65 days	Mon Apr 16, '12	Fri Jul 13, '12																					
24	Update of Report and Analysis (if applicable)	40 days	Mon Jul 16, '12	Fri Sep 7, '12																					
25	Issuance of Updated Documentation (if applicable)	0 days	Fri Sep 7, '12	Fri Sep 7, '12																					
26	<b>Identification of Design Changes</b>	<b>145 days</b>	<b>Mon Mar 19, '12</b>	<b>Fri Oct 5, '12</b>																					
27	Stage 1 CMF(s) preparation	20 days	Mon Mar 19, '12	Fri Apr 13, '12																					
28	Issuance to ONR/EA/OCNS	0 days	Fri Apr 13, '12	Fri Apr 13, '12																					
29	ONR/EA/OCNS Assessment of CMF(s)	20 days	Mon Apr 16, '12	Fri May 11, '12																					
30	Stage 2 CMF(s) preparation	30 days	Mon Apr 16, '12	Fri May 25, '12																					
31	Issuance to ONR/EA/OCNS	0 days	Fri May 25, '12	Fri May 25, '12																					
32	ONR/EA/OCNS Assessment of CMF(s)	35 days	Mon May 28, '12	Fri Jul 13, '12																					
33	Update of Impacted Documents (where appropriate)	60 days	Mon Jul 16, '12	Fri Oct 5, '12																					
34	<b>Task 3 - Robustness of Power Sources / Long Term Cooling</b>	<b>190 days</b>	<b>Mon Jan 16, '12</b>	<b>Fri Oct 5, '12</b>																					
35	Report and Analysis Preparation	65 days	Mon Jan 16, '12	Fri Apr 13, '12																					
36	Issuance to ONR/EA/OCNS	0 days	Fri Apr 13, '12	Fri Apr 13, '12																					
37	ONR/EA/OCNS Assessment and Convergence with EDF/AREVA	65 days	Mon Apr 16, '12	Fri Jul 13, '12																					
38	Update of Report and Analysis (if applicable)	45 days	Mon Jul 16, '12	Fri Sep 14, '12																					
39	Issuance of Updated Documentation (if applicable)	0 days	Fri Sep 14, '12	Fri Sep 14, '12																					
40	<b>Identification of Design Changes</b>	<b>150 days</b>	<b>Mon Mar 12, '12</b>	<b>Fri Oct 5, '12</b>																					
41	Stage 1 CMF(s) preparation	25 days	Mon Mar 12, '12	Fri Apr 13, '12																					
42	Issuance to ONR/EA/OCNS	0 days	Fri Apr 13, '12	Fri Apr 13, '12																					
43	ONR/EA/OCNS Assessment of CMF(s)	20 days	Mon Apr 16, '12	Fri May 11, '12																					
44	Stage 2 CMF(s) preparation	30 days	Mon Apr 16, '12	Fri May 25, '12																					
45	Issuance to ONR/EA/OCNS	0 days	Fri May 25, '12	Fri May 25, '12																					
46	ONR/EA/OCNS Assessment of CMF(s)	35 days	Mon May 28, '12	Fri Jul 13, '12																					
47	Update of Impacted Documents (where appropriate)	60 days	Mon Jul 16, '12	Fri Oct 5, '12																					
48	<b>Task 4 - Management of Severe Accidents</b>	<b>190 days</b>	<b>Mon Jan 23, '12</b>	<b>Fri Oct 12, '12</b>																					
49	Report and Analysis Preparation	65 days	Mon Jan 23, '12	Fri Apr 20, '12																					

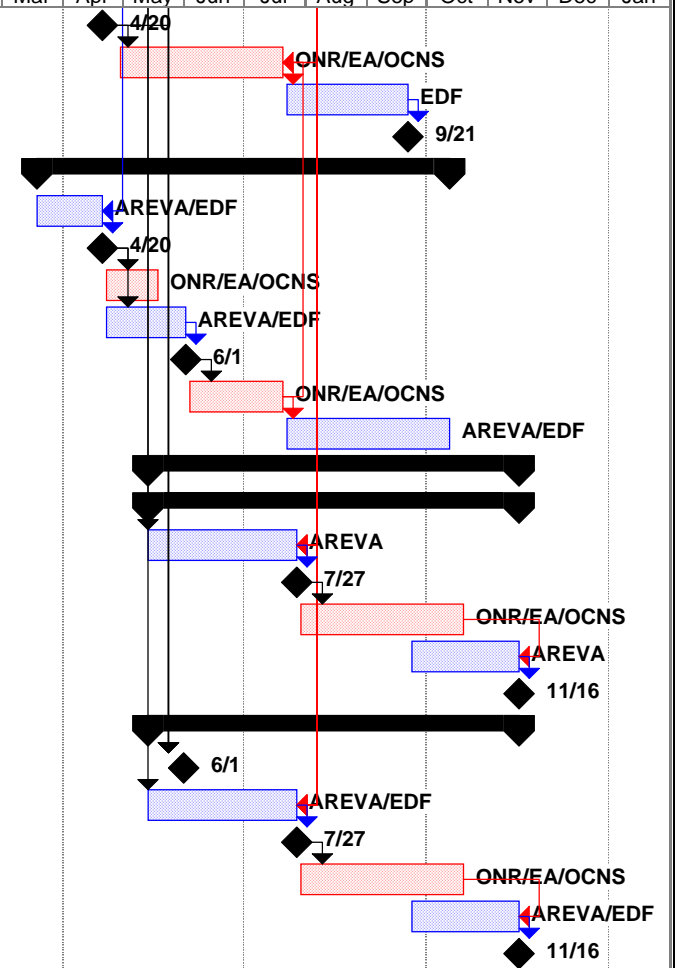
Project: GI-UKEPR-CC03 Schedule  
Date: Mon Dec 12, '11

Task: Progress: Summary: External Tasks: Deadline:

Split: Milestone: Project Summary: External Milestone:

Page 1

ID	Task Name	Duration	Start	Finish	2011		Qtr 3, 2011			Qtr 4, 2011			Qtr 1, 2012			Qtr 2, 2012			Qtr 3, 2012			Qtr 4, 2012			Qtr 1,	
					May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	
50	Issuance to ONR/EA/OCNS	0 days	Fri Apr 20, '12	Fri Apr 20, '12																						
51	ONR/EA/OCNS Assessment and Convergence with EDF/AREVA	60 days	Mon Apr 30, '12	Fri Jul 20, '12																						
52	Update of Report and Analysis (if applicable)	45 days	Mon Jul 23, '12	Fri Sep 21, '12																						
53	Issuance of Updated Documentation (if applicable)	0 days	Fri Sep 21, '12	Fri Sep 21, '12																						
54	<b>Identification of Design Changes</b>	<b>150 days</b>	<b>Mon Mar 19, '12</b>	<b>Fri Oct 12, '12</b>																						
55	Stage 1 CMF(s) preparation	25 days	Mon Mar 19, '12	Fri Apr 20, '12																						
56	Issuance to ONR/EA/OCNS	0 days	Fri Apr 20, '12	Fri Apr 20, '12																						
57	ONR/EA/OCNS Assessment of CMF(s)	20 days	Mon Apr 23, '12	Fri May 18, '12																						
58	Stage 2 CMF(s) preparation	30 days	Mon Apr 23, '12	Fri Jun 1, '12																						
59	Issuance to ONR/EA/OCNS	0 days	Fri Jun 1, '12	Fri Jun 1, '12																						
60	ONR/EA/OCNS Assessment of CMF(s)	35 days	Mon Jun 4, '12	Fri Jul 20, '12																						
61	Update of Impacted Documents (where appropriate)	60 days	Mon Jul 23, '12	Fri Oct 12, '12																						
62	<b>Action 2 of GI-UKEPR-CC03</b>	<b>135 days</b>	<b>Mon May 14, '12</b>	<b>Fri Nov 16, '12</b>																						
63	<b>Task 1 - Response to HM Chief Inspector Report</b>	<b>135 days</b>	<b>Mon May 14, '12</b>	<b>Fri Nov 16, '12</b>																						
64	Report Preparation	55 days	Mon May 14, '12	Fri Jul 27, '12																						
65	Issuance to ONR/EA/OCNS	0 days	Fri Jul 27, '12	Fri Jul 27, '12																						
66	ONR/EA/OCNS Assessment and Convergence with EDF/AREVA	60 days	Mon Jul 30, '12	Fri Oct 19, '12																						
67	Update of Report (if applicable)	40 days	Mon Sep 24, '12	Fri Nov 16, '12																						
68	Issuance of Updated Documentation (if applicable)	0 days	Fri Nov 16, '12	Fri Nov 16, '12																						
69	<b>Task 2 - PCSR/PCER/CSA Updates</b>	<b>135 days</b>	<b>Mon May 14, '12</b>	<b>Fri Nov 16, '12</b>																						
70	Identification of Potentially Impacted Documentation (Letter)	0 days	Fri Jun 1, '12	Fri Jun 1, '12																						
71	PCSR/PCER/CSA Preparation (Advance Version)	55 days	Mon May 14, '12	Fri Jul 27, '12																						
72	Issuance to ONR/EA/OCNS	0 days	Fri Jul 27, '12	Fri Jul 27, '12																						
73	ONR/EA/OCNS Assessment and Convergence with EDF/AREVA	60 days	Mon Jul 30, '12	Fri Oct 19, '12																						
74	Update of PCSR/PCER/CSA (if applicable)	40 days	Mon Sep 24, '12	Fri Nov 16, '12																						
75	Issuance of Updated Documentation	0 days	Fri Nov 16, '12	Fri Nov 16, '12																						



Project: GI-UKEPR-CC03 Schedule  
Date: Mon Dec 12, '11

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