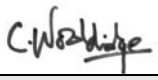
Approved for EDF by: A. PETIT		Approved for AREVA by: C. WOOLDRIDGE	
Name/Initials 	*Date 05/07/2011*	*Name/Initials* 	*Date 05/07/2011*

Resolution Plan Revision History

Rev.	Description of update	Date issued
Revision 0	First Issue	30/06/2011
Revision 1	Update with ONR comments	05/07/2011

1.0 GDA ISSUE

GDA Issue Title	Main Assessment Area	Related Assessment Area
Identification and substantiation of human based safety claims	Human Factors	PSA Internal Hazards Fault Studies

GDA Issue	Inadequate substantiation of human based safety claims and omission of a consolidated Human Factors safety case for the UK EPR

2.0 OVERVIEW OF SCOPE OF WORK

2.1 Background

At the end of GDA Step 3 ONR raised Regulatory Observation (RO) 38 specifying that the *"current PCSR for the UK EPR does not present the safety case for Human Factors in a recognisable UK structure".* The corresponding RO Action (ROA) required that *"The Requesting Party is required to submit documentation that clearly defines the role of human actions on the UK EPR (i.e. the safety 'claims') and justifies those actions via human factors analysis (i.e. the 'arguments' and 'evidence')"*.

In addition, during the GDA Step 4 assessment ONR issued further ROs relating to the consideration of maintenance human errors (RO 71), misdiagnosis potential (RO 79) and violation potential (RO 80). ONR considered that these collective ROs reflect a substantial and significant gap in the safety justification for HF on the UK EPR.

In response to the ROAs relating to these ROs, EDF / AREVA has proposed a 'forward action plan'. Four example analyses were submitted to ND for assessment during GDA Step 4 to give confidence in the method statements that will be used during the Nuclear Site Licence to substantiate Human Based Safety Claims. However, ONR has considered that the Human Based Safety claims have to be substantiated during the GDA phase. Therefore, ONR judges that a substantial and significant gap in the UK EPR safety case for GDA (PCSR) remains, and it is on this basis that ONR recommend that the ROs be consolidated into a GDA Issue.

2.2 Scope of the work

The work to resolve the GDA issue is to identify and substantiate the human based safety claims according to TAG T/AST/063 on HRA, Paragraph 4.2: that states "Where safety important human actions are required and their need is justified, the feasibility and reliability of the actions should be demonstrated qualitatively using task analysis".

The work is the consolidation and complement of the documentation provided during the GDA step 4 assessment. Given the scope of Action 1 of GI-UKEPR-HF01, EDF / AREVA have chosen to structure the associated response activities into four (4) discrete sub-actions to ensure that a thorough work programme can be established. The following actions and sub actions will be completed to establish a consolidated Human Factors Safety Case:

- GI-UKEPR-HF01.A1 – Substantiate the UK EPR human based safety claims
    - GI-UKEPR-HF01.A1.1 – Substantiate the Type A and B human failure events
    - GI-UKEPR-HF01.A1.2 – Substantiate the Type C human failure events
    - GI-UKEPR-HF01.A1.3 – Provide holistic arguments for key elements of the proposed UK EPR operation
    - GI-UKEPR-HF01.A1.4 – Provide analytical evidence on how the design of the UK EPR prevents and mitigates violation potential
- GI-UKEPR-HF01.A2 – Provide a consolidated HF safety case and PCSR update for the UK EPR

The sub actions of GI-UKEPR-HF01.A1 and action GI-UKEPR-HF01.A2 are developed below.

In order to provide ONR with visibility and confidence in the GDA Issue resolution and the completion of this scope of work, regular Progress Meetings will be held throughout 2011 to discuss the evolution of the Resolution Plan and to collect ONR feedback at an early stage. Formal feedback will be sought from ONR for EDF/AREVA submissions provided prior to these progress meetings. In particular, Task Analysis will be provided on a regular basis. Suggested meeting dates at this stage are late September 2011, mid-December 2011, late February 2012 and end of May 2012.

3.0 GDA ISSUE ACTIONS AND RESOLUTION PLAN DELIVERABLES

3.1 Action GI-UKEPR-HF01.A1

Action I/D	Action Description
GI-UKEPR-HF01.A1	Substantiate the UK EPR human based safety claims. It is the expectation of ONR that all human based safety claims are considered along with supporting holistic arguments for key elements of the proposed UK EPR design and operation. It will be necessary to complete the identification of UK EPR human based safety claims. Human based safety claims may also result from safety analysis undertaken in related technical areas; principally Internal Hazards and Fault Studies. It will not be sufficient to only consider claims currently modelled in the PSA. All identified actions should be sentenced; however it will not be necessary to fully analyse in detail all individual claims. Our expectation is that the substantiation is both targeted and proportionate; recognising the human contribution to overall risk. Sentencing may employ an initial risk based screening of actions, but consideration should also be given to task complexity and novelty, and to UK EPR specific issues. In particular the response should include: • Substantiation of the Type A and B human failure events (HFEs). - Submit a methodology for the substantiation of Type A and Type B. - Complete the identification of Type A HFEs. - Substantiate the identified Type A HFEs on the basis of system contribution to overall risk, and proportionate contribution of human error to system unavailability. The selection of actions and sample size should be substantiated. - Substantiate the identified Type B HFEs and justify any sampling of actions. • Substantiate the Type C HFEs. - Advise ONR of any amendments to the methodology for the substantiation of Type C HFEs and highlight how it accommodates violation potential. - Identify additional human based safety claims arising from safety analysis undertaken in response to GDA Issues in related technical areas. - Provide targeted and proportionate substantiation of identified human actions. The sample size and type should be justified. • Provide holistic arguments for key elements of the proposed UK EPR operation. - Provide arguments and evidence to support the claim that the State Orientated Approach and Automatic Diagnosis reduces misdiagnosis potential

	- Provide arguments and evidence relating to situations with failed Automatic Diagnosis; and - Consider whether other holistic arguments / evidence are required to support the safety case for Human Factors. • Provide analytical evidence on how the design of the UK EPR prevents and mitigates violation potential. - Submit a methodology for the substantiation of Type A and Type B HFEs that accommodates consideration of violation potential; - Provide additional evidence on how the UK EPR design prevents / mitigates violation potential. With agreement from the Regulator this action may be completed by alternative means.

As noted above,, EDF / AREVA have chosen to structure the associated response activities for GI-UKEPR-HF01.A1 into four (4) discrete sub-actions to ensure that a thorough work programme can be established. This structure is outlined below and the associated response approach for each sub-action is described in Section 3.2 to 3.5:

GI-UKEPR-HF01.A1.1 will address the following items from Action 1 (See Section 3.2):

- Substantiation of the Type A and B human failure events (HFEs).
  - Submit a methodology for the substantiation of Type A and Type B.
  - Complete the identification of Type A HFEs.
  - Substantiate the identified Type A HFEs on the basis of system contribution to overall risk, and proportionate contribution of human error to system unavailability. The selection of actions and sample size should be substantiated.
  - Substantiate the identified Type B HFEs and justify any sampling of actions.

GI-UKEPR-HF01.A1.2 will address the following items from Action 1 (See Section 3.3):

- Substantiate the Type C HFEs.
  - Advise ONR of any amendments to the methodology for the substantiation of Type C HFEs and highlight how it accommodates violation potential.
  - Identify additional human based safety claims arising from safety analysis undertaken in response to GDA Issues in related technical areas.
  - Provide targeted and proportionate substantiation of identified human actions. The sample size and type should be justified.

GI-UKEPR-HF01.A1.3 will address the following items from Action 1 (See Section 3.4):

- Provide holistic arguments for key elements of the proposed UK EPR operation.
  - Provide arguments and evidence to support the claim that the State Orientated Approach and Automatic Diagnosis reduces misdiagnosis potential
  - Provide arguments and evidence relating to situations with failed Automatic Diagnosis; and
  - Consider whether other holistic arguments / evidence are required to support the safety case for Human Factors.

GI-UKEPR-HF01.A1.4 will address the following items from Action 1 (See Section 3.5):

- Provide analytical evidence on how the design of the UK EPR prevents and mitigates violation potential.
  - Submit a methodology for the substantiation of Type A and Type B HFEs that accommodates consideration of violation potential;
  - Provide additional evidence on how the UK EPR design prevents / mitigates violation potential.

3.2 Action GI-UKEPR-HF01.A1.1

Action I/D	Action Description
GI-UKEPR-HF01.A1.1	Substantiate the Type A and B human failure events - Submit a methodology for the substantiation of Type A and Type B - Complete the identification of Type A HFEs - Substantiate the identified Type A HFEs on the basis of system contribution to overall risk, and proportionate contribution of human error to system unavailability. The selection of actions and sample size should be substantiated. - Substantiate the identified Type B HFEs and justify any sampling of actions.

3.2.1 Deliverables already submitted to HSE/EA in response to GI-UKEPR-HF01.A1.1

	Date of submission
ECEF102051, Revision A, - UK EPR: EDF AREVA Task analysis method statement for Pre-fault Human Errors and Human Errors performed on systems and equipment not modelled in PSA	Submitted as part of the Consolidated PCSR submission 31/3/2011
EPR00847N : Update of the Methodology for the Analysis of Type A Human Based Safety Claims	18/04/11

3.2.2 Planned submissions in response to GI-UKEPR- HF01.A1.1

3.2.2.1 Description of Scope of Work

The work consists of the identification and the substantiation of the Type A/B Human Based Safety Claims (HBSCs) in a manner consistent with the GDA stage and with the implementation of a risk proportionate approach.

Type A HBSCs are pre-fault human actions occurring during normal operation that degrade mitigation system availability. Type B HBSCs are pre-fault human actions leading to an initiating event.

To address this action the following tasks will be implemented:

- Submit a methodology for the substantiation of Type A and Type B human failure events;

- Identify the Type A and Type B human failure events arising from maintenance, testing and calibration tasks that are performed on systems modelled in the PSA;
- Substantiate the identified Type A human failure events;
- Substantiate the identified Type B human failure events;
- Complete the identification of pre-fault human failure events not modelled in the PSA.

Tasks and methodologies are detailed in subsection 3.1.2.2

At present it is not possible to fully determine the volume of work to substantiate the Type A and B HBSCs. This will be determined through the early phase of this work as the HBSCs are identified. This will be discussed with ONR at the earliest opportunity.

3.2.2.2 Description of Methodology to be employed

Task 1 to GI-UKEPR-HF01.A1.1 - Submit a methodology for the substantiation of Type A and Type B human failure events (HFEs)

A method for the analysis of pre-fault errors Type A/B errors was provided to ONR as part of the EPR GDA via Annex 1 of letter in reference [1]. This method was updated in Appendix 1 of letter in reference [2] to take into account HSE comments made in letter EPR70258R. This pre-fault method statement is now contained in reference [3], March 2011.

An example of the application of a Type A task analysis, applied to the Extra Boration System [2], was provided in GDA under letter in reference [2]

It became evident during this pre-fault analysis that there was an inconsistency between with the level of design information available at this stage and the level of detail required to apply the pre-fault method statement. The analysis was very detailed, to a level not appropriate for this stage of the EPR design.

As such, the approach for Type A analysis for GDA is being amended to incorporate an iterative step for the generic design stage as presented in reference [4].

The detailed methodology will be provided as a deliverable of the plan. A summary of this methodology is provided in Appendix 1.

The main differences between the previous and the amended methodology regarding the identification and the substantiation of the Type A human failure events are the following:

- The use of the EPRI Predictive Maintenance Basis to identify tasks.
- The use of a Human HAZOP study to undertake the error and violation analysis.
- Consideration of a hierarchy of controls in relation to errors and violations.

Task 2 to GI-UKEPR-HF01.A1.1 – Identify the Type A and Type B human failure events arising from

maintenance, testing and calibration tasks that are performed on systems modelled in the PSA;

The HFEs related to misalignment of manual valves are already modelled in the 2011 PSA. The motor operated and solenoid valves are not modelled in the 2011 PSA, as they are automatically realigned on safety demand and their misalignment is indicated by alarms in the Main Control Room. These design features will be confirmed.

Completion of the identification of Type A and B HFEs will be carried-out by following the amended methodology developed and submitted in Task 1, to identify the HFEs arising from maintenance, testing and calibration tasks.

These HFEs will be identified by a screening process that uses the PSA (Revision 2011) and aims to:

- Conduct risk-based screening using PSA to identify the safety significant systems and equipment and their failure modes.
- Identify the associated critical tasks that could render safety significant systems and equipment unable to perform their safety function.

The PSA will be screened to identify safety significant systems and equipment and associated failure modes, using the following screening criteria: a Risk Increase Factor of greater than 2 or a Fussell Vesely value of greater than 5 x 10-3 that are justified within the methodology. This will identify all equipment on which a medium or higher claim is made. The tasks identified for this equipment will be screened to identify those that are critical and for which the consequence of error could lead to the failure modes identified in the PSA. Other screening factors will include the nature of the task (e.g. invasive) and the potential for common mode failures.

The errors that could lead to the identified failure modes will be identified using the Human HAZard and OPerability (HAZOP) study method. This will provide a structured and systematic method of analysing the tasks. Each task will be presented and a list of guide words for error types and violations will be considered. Where potential errors or violations are identified, the associated consequences (failure modes) will be recorded along with the Performance Shaping Factors that influence task reliability.

Task 3 to GI-UKEPR-HF01.A1.1 - Substantiate the identified Type A human failure events (HFEs)

The Type A HFEs identified in task 2 will be substantiated following the methodology provided in Appendix 1.

The error analysis will use the Human HAZOP study format to identify potential errors and violations. The hierarchy of control measures associated with each error/violation will also be considered. The existing controls will be recorded and where appropriate recommendations will be made for further controls. Although a very detailed ALARP assessment is not proposed, ALARP considerations will be applied to ensure that there has not been foreclosure of options at this stage of the design.

The volume of work to substantiate the Type A HBSCs will be determined once the HBSCs have been identified as part of Task 2. This will then allow a staggered schedule of work with associated intermediate deliverables to be established.

Task 4 to GI-UKEPR-HF01.A1.1 - Substantiate the identified Type B human failure events

In the frame of the GDA step 4 assessment, the list of human failure events associated with initiating faults identified in the PSA was provided [5] and it was confirmed in reference [6] that this list is exhaustive relating to the current stage of the PSA scope.

EDF/AREVA will provide explanations and justifications in order to substantiate these 5 human failure events, consisting of errors leading to homogeneous dilution and uncontrolled level drop during shutdown state and failures to respond to an initial fault that does not of itself immediately lead to an initiating event (related to fire or flood).

These type B HFEs will be substantiated based on:

- a justification of the frequency of the initiating events based on the use of operational experience and international data;
- evidence to support the adequacy of the operational experience process used to date;
- consideration of the learning that has been applied to existing plants and carried-forward to the EPR design in order to prevent the occurrence of these events.

The consideration of those Type B errors will include consideration of error mechanisms. Consideration will also be given as to how the design is judged to be ALARP to a level commensurate with the level of design detail available.

In addition any Type B HFEs identified in Task 2 as arising from maintenance, testing and calibration tasks will be substantiated following the methodology provided in Appendix A, provided that there is information available to sufficiently inform the analysis.

As noted under Task 3, the schedule to substantiate the Type A/B HBSCs will be established once the identification of the claims has been completed.

Task 5 to GI-UKEPR-HF01.A1.1 - Complete the identification of pre-fault human failure events not modelled in the PSA

The scope of this task is to identify additional pre-fault human based safety claims arising from the deterministic safety analysis undertaken in response to GDA issues in related technical areas.

- **Dropped loads and fuel handling**

Dropped loads and fuel handling are identified as the two key areas for consideration of equipment where failures could lead to a significant release. The work performed for the resolution of Internal Hazards GDA issue GI-UKEPR-IH01 will provide an assessment of potential dropped loads that could result in nuclear significant consequences.

Potentially some human based safety claims are related to this work and the aim of this task is to identify them. The following steps will be performed:

- Provision of the information on lifting/handling operations required to identify the HBSCs

A document produced in the frame of Task 1 of the GDA Issue GI-UKEPR-IH01.A1 will present the following elements for the UK EPR, using information based upon the Flamanville 3 reference design, when the relevant

information for the UK EPR does not yet exist:

- A description of classification principles for lifting devices,
- A description of RS1/RS2 lifting devices & load path routes;
- A review of operating feedback experience;
- A presentation of acceptance criteria for load drop events in terms of frequency vs. radiological consequences;
- An identification of the existing prevention measures (design, administrative ...) planned for UK EPR.

This document will provide information on lifting/handling operations that will be considered to identify the HBSCs.

- Development of a risk analysis methodology to identify the HBSCs

A risk analysis methodology will be elaborated to identify the critical Human Based Safety Claims (HBSCs). The main streams of this methodology will be to identify elementary actions for the whole process of handling operations and to perform associated Failure Modes and Effects Analysis. This methodology will allow the identification of critical tasks.

The main principles of the risk analysis methodology will be submitted to the ONR and discussed at a level 4 meeting, as an intermediate deliverable.

- Identification of the Human Based Safety Claims

Task 2 of the GDA Issue GI-UKEPR-IH01.A1 will determine the consequences of the representative dropped loads previously identified as being risk significant.

The risk analysis methodology will be implemented for each of these representative high risk lifting/handling operations .

This implementation will be based on the current level of knowledge of the UK EPR generic design. To cope with the lack of procedures at this stage, all the available information from the GDA Issue GI-UKEPR-IH01.A1 as well as input of SMEs will be used

As a result, a list of Human Based Safety Claims will be provided. Consideration that the design is ALARP will be achieved via SME consideration of existing prevention measures together with any further necessary prevention/protection measures that are identified in Task 2 of GI_UKEPR-IH01.A1.

In the licensing phase, the risk analysis methodology will be re-implemented, based on the detailed design and procedures to confirm and/or complete the list Human Based Safety Claims that will be substantiated following the proportionate approach presented in the method statement in reference [7].

- **Deterministic claims arising from other GDA issues in related technical areas: the heterogeneous dilution case**

The pre-fault HBSCs for the heterogeneous dilution are under identification by the fault studies topic (GI-UKEPR-FS-01). If any HBSCs are required by these studies then they will be substantiated using the appropriate task analysis method statement.

3.2.2.3 Deliverable description	**Submission date to HSE/EA**
D1.1 Human Factors method statement generic design related for type A/B Human failure events	01/07/11
D1.2 Intermediate deliverable: Schedule of risk significant equipment grouped into generic equipment types.	05/08/11
D1.3 Identification of task associated with type A/B human failure events, modelled in the PSA	14/10/11
D1.4 Task Analysis (Human HAZOP) Programme for type A/B human failure events modelled in the PSA	31/10/11
D1.5 Substantiation of identified type A human failure events modelled in the PSA	30/05/12
D1.5 Intermediate submissions of substantiation of type A HFEs according to D1.4	30/01/12
D1.6 Confirmation of design features relating to misalignment of automated valves	30/12/11
D1.7 Substantiation of identified type B human failures events	29/03/12
D1.8 Intermediate deliverable: Main principles of the Risk analysis methodology and template	22/09/11
D1.9 Dropped loads and fuel handling: Risk analysis methodology for the identification of the Human Based Safety Claims	30/11/11
D1.10 Dropped loads and fuel handling: Identification of the Human Based Safety Claims	08/06/12
D1.10 Intermediate Identification of Dropped loads and fuel handling HBSCs	30/03/12
D1.11 Heterogeneous dilution: Substantiation of the human based safety claims	30/12/11
PCSR 18.1 UKEPR0002-181-I06 (Draft)	31/05/12
PCSR 18.1 UKEPR0002-181-I06 (Final Issue)	14/09/12

3.3 Action GI-UKEPR-HF01.A1.2

Action I/D	Action Description
GI-UKEPR-HF01.A1.2	Substantiate the Type C Human Failure Events - Advise ONR of any amendments to the methodology for the substantiation of Type C HFEs and highlight how it accommodates violation potential. - Identify additional human based safety claims arising from safety analysis undertaken in response to GDA issues in related technical areas - Provide targeted and proportionate substantiation of identified human actions. The sample size and type should be justified

3.3.1 Planned submissions in response to GI-UKEPR-HF01.A1.2

3.3.1.1 Description of Scope of Work

The work consists of the identification and the substantiation of Type C Human Based Safety Claims (HBSCs) in a manner consistent with a GDA stage and with the implementation of a risk proportionate approach. The Type C HBSCs are post initiator claims on operator actions.

To address this action the following tasks will be implemented:

- Advise ND of any amendments to the methodology for the substantiation of Type C human failure events;
- Update the identification of Type C human based safety claims based upon the revised 2011 PSA
- Identify additional human based safety claims arising from safety analysis undertaken in response to GDA Issues in related technical areas;
- Provide targeted and proportionate substantiation of identified human actions.

3.3.1.2 Description of Methodology to be employed

Task 1 to GI-UKEPR-HF01.A1.2 - Advise of any amendments to the methodology for the substantiation of Type C human failure events (HFEs)

The Type C method statement was provided to ONR [9] under letter EPR00586N.

Amendments to the methodology are as follow:

- Based on the initial scenario discussions and review, the majority of medium risk claims will be treated as

medium-complex risk claims, which is considered to be a conservative approach;

- The medium risk will be grouped on similar post-fault actions or similar initiating events. The grouping will be justified within the relevant task analysis document which sentences and substantiates these type C human based safety claims

- The method statement makes provision for the use of the simulator, where the HF analyst deems it appropriate and of benefit to the analysis process in order to substantiate individual claims. This task analysis process will draw benefit from the use of the simulator where it is appropriate, in accordance with the method statement for Type C analysis. The justification for the use or otherwise of the simulator will be contained in the task analysis. As the benefit of using the simulator will become evident as the initial task analysis results are produces, it is not considered timely to pronounce at this stage on the use or otherwise of the simulator for each individual claim. At present, it is not possible to use the simulator for shutdown state (State D, E and F) scenarios, severe accident OSSA scenarios and NCSS scenarios as there is currently no modelling of these scenarios in the simulator.

Task 2 to GI-UKEPR-HF01.A1.2 - Update the identification of Type C human based safety claims to the revised 2011 PSA

The list of Type C probabilistic HBSCs was provided during step 4 GDA assessment on the basis of the 2009 PSA revision. This list was updated in consistent with the PSA revision 2011.

The main difference between the list derived from the 2009 PSA revision and the 2011 PSA revision is the presence of operator actions to be performed using Non Computerised Safety System through a dedicated panel and HMI. HBSCs associated with the NCSS have been identified in the current Level 2 PSA. These claims will be analysed as part of the GDA in a manner that is consistent with the level of design detail that is available at this stage of the NCSS development.

The HRA notebook [5] presents a description of the actions modelled in the PSA. The risk base approach categorises operator claims as high, medium or low, as presented in the method statement in reference[9]. The identification process is performed by applying risk ranking criteria (Risk Increase Factor and Fussell-Vesely) to the risk of both Core Damage Frequency (CDF) and Large Release Frequency (LRF).

The post fault errors identified as low claims (152 post fault operator claims) do not contribute significantly to the increase of CDF or LRF risk based on these criteria and are sentenced within the HRA notebook [6] which provides, for each action, the representative initiating event, time available for the action inferred from support studies, task location and stress level.

As a result, the number of risk significant post-faults errors is 8 High and 28 Medium, which will be analysed according to the method statement for post fault methodology [9] taking into account the amendments described in Task 1.

The identification and categorisation of Type C claims will be presented in a dedicated deliverable for the GDA issue.

Task 3 to GI-UKEPR-HF01.A1.2 - Identify additional human based safety claims arising from safety analysis undertaken in response to GDA Issues in related technical areas;

The technical areas where potential additional human based safety claims are to be identified are the following:

- Steam Generator Tube Rupture Substantiation

The Steam Generator Tube Rupture (SGTR) case is generated in the Fault Studies topic (GI-UKEPR-FS04.A2). The HBSCs will be identified by the fault studies topic as part of the GI-UKEPR-FS04 GDA issue.

- Internal flooding substantiation

The internal flooding safety case is generated in the Internal Hazards topic (PGI-UKEPR-IH03). Human factor actions that are considered necessary in the internal flooding case to mitigate flood source with respect to the integrity of divisional separation, will be identified. When identified, the HBSCs will, where appropriate, be grouped (for example an operator action on the same valve in the 4 Divisions) and the grouping justified.

Task 4 to GI-UKEPR-HF01.A1.2 - Provide targeted and proportionate substantiation of identified human actions

The steps described in Tasks 2 and 3, will lead to the identification of HBSCs. The feasibility of these actions is substantiated through the application of the task analysis process To cover the sources of HSBCs in turn:

- Probabilistic Type C Human Based Safety Claims

The work of substantiation has begun during the GDA step 4 assessment and 3 substantiated claims were submitted to the ONR in references [9] and [8], with the analysis of a 4th claim currently in progress.

The analysis of actuating the secondary cooldown (OP_FSCD_30MIN), concludes that the claimed operation response is not feasible within the claimed timescale. The main causes are due to the conservatism of the original definition of the claim and to simulation issues regarding the sub cooling margin. In a timescale consistent with the licensing phase, a new simulator observation will be carried out for this claimed operator response to ensure that the expected response time is met when the claim has been fully defined and the simulation of the sub-cooled margin has been optimised.

Although the analysis of the claim for establishing the cross connections to feed EFWS (OP_FEED_TK) concludes the feasibility of the claimed operator action, ONR raised issues regarding this example. These issues will be analysed and, where relevant to the GDA, taken into account in the final report substantiating the type C claims.

The analysis of start-up of SB0 (OP_SB0DG2H) concludes that the claim is feasible. The comments raised by the ONR regarding this example will be taken into account and, where relevant to the GDA, addressed in the final report.

The issues and the follow-up actions required for these examples are discussed in report reference [9].

The task will be completed by reporting appropriate Task Analysis for post-faults errors (8 high and 28 Medium HBSCs). An initial deliverable will be the schedule of the analyses to be undertaken and when they will be provided to the ONR for assessment. The Task Analyses will then be provided as a set of further intermediate deliverables.

- HBSCs Arising from Safety Analysis undertaken in Response to GDA Issues in Related Technical Areas

The proposed schedule for the 2 deliverables “Substantiation of steam generator tube rupture human based safety claims” and “Substantiation of internal flooding human based safety claims” reflect the dependency with the related GDA issues.

The identified claims for SGTR and internal flooding will be considered of high risk significance in a conservative approach and analysed following the method statement for post-fault HSBCs [9].

3.3.1.3 Deliverable description	**Submission date to HSE/EA**
D2.1 Identification and categorisation of PSA 2011 Type C claims	01/08/11
D2.2 Schedule of intermediate Type C task analyses	15/07/11
D2.3 Substantiation of steam generator tube rupture human based safety claims This date is consistent with the deliverable identified in the external resolution plan GI-UKEPR-FS04.A2, to provide detailed human factors justification of the actions claimed in the design basis safety case for the PCC-3 fault.	14/10/11
D2.4 Substantiation of internal flooding human based safety claims This date is dependent upon the internal hazards deliverable identified in Task 2 of external resolution plan GI-UKEPR-IH03.01, identification of the mitigation measures for the bounding cases	13/03/12
D2.5 Substantiation of PSA Type C claims	30/05/12
D2.5 Intermediate submissions of substantiation of type A HFEs according to D2.2	15/11/11
PCSR 18.1 UKEPR0002-181-I06 (Draft)	31/05/12
PCSR 18.1 UKEPR0002-181-I06 (Final Issue)	14/09/12

3.4 Action GI-UKEPR-HF01.A1.3

Action I/D	Action Description
GI-UKEPR-HF01.A1.3	Provide holistic arguments for key elements of the proposed UK EPR operation - Provide arguments and evidence to support the claim that the State Oriented Approach and Automatic Diagnosis reduces the misdiagnosis potential: - Provide arguments and evidence relating to situations with failed Automatic Diagnosis; and - Consider whether other holistic arguments/evidence are required to support the safety case for Human Factors

3.4.1 Planned submissions in response to GI-UKEPR-HF01.A1.3

3.4.1.1 Description of Scope of Work

The holistic claims are considered as high level claims that overarch lower level claims. These holistic claims are embedded in the high level principles for the design of the UK EPR operation.

To address this action the following tasks will be implemented:

- Provide arguments and evidence to support the claim that the State Orientated Approach and Automatic Diagnosis reduce the likelihood of misdiagnosis and increase the resilience against misdiagnosis;
- Provide arguments and evidence relating to situations with failed Automatic Diagnosis;
- Consider whether other holistic arguments / evidence are required to support the safety case for Human Factors.

3.4.1.2 Description of Methodology to be employed

Task 1 to GI-UKEPR-HF01.A1.3 - Provide arguments and evidence to support the claim that the State Orientated Approach and Automatic Diagnosis reduce the likelihood of misdiagnosis and increase the resilience against misdiagnosis

The 3 claims relating to misdiagnosis are identified:

- The State Oriented Approach reduces the likelihood of misdiagnosis and should misdiagnosis occur, will improve and support detection and recovery
- The Automatic Diagnosis approach reduce the likelihood of misdiagnosis and should misdiagnosis occur, will improve and support detection and recovery

- The Strategy Operator, Shift Supervisor and Safety Engineer roles provide an error prevention, detection and recovery contribution.

These 3 claims will be substantiated by holistic arguments, holistic evidence and analytical evidence provided in the task analysis work implemented for Type C claims. The work will take account of comments provided by the ONR in letter EPR70305N. When relevant, the results from the Flamanville 3 trials or earlier design studies will be used.

Task 2 to GI-UKEPR-HF01.A1.3 - Provide arguments and evidence relating to situations with failed Automatic Diagnosis

The case of Automatic Diagnosis failure will be considered as part of Task 1 to GI-UKEPR-HF01.A1.3.

Task 3 to GI-UKEPR-HF01.A1.3 - Consider whether other holistic arguments / evidence are required to support the safety case for Human Factors

At present one other claim relating to PICS to SICS transfer has been identified. The claim relating to PICS to SICS transfer will be substantiated by holistic arguments to demonstrate that transfer from PICS to SICS and operation from SICS are feasible, and thereby support an ALARP position for this stage in the design. A high level assessment of the feasibility of SICS actions will be performed on a very limited sample of high risk and medium risk complex HBSCs**.**

Other claims will be considered and if relevant they will be substantiated.

3.4.1.3 Deliverable description	**Submission date to HSE/EA**
D3.1 Holistic arguments to support claims relating to misdiagnosis in emergency operations	29/03/12
D3.2 Holistic evidence to support claims relating to misdiagnosis in emergency operations	30/04/12
D3.3 Holistic arguments to support claims relating to PICS to SICS transfer	09/03/12
D3.4 Holistic evidence to support claims relating to PICS to SICS transfer	30/04/12
PCSR 18.1 UKEPR0002-181-I06 (Draft)	31/05/12
PCSR 18.1 UKEPR0002-181-I06 (Final Issue)	14/09/12

3.5 Action GI-UKEPR-HF01.A1.4

Action I/D	Action Description
GI-UKEPR-HF01.A1.4	Provide analytical evidence on how the design of the UK EPR prevents and mitigates violation potential - Submit a methodology for the substantiation of Type A and Type B HFEs that accommodates consideration of violation potential - Provide additional evidence on how the UK EPR design prevents/mitigates violation potential

3.5.1 Planned submissions in response to GI-UKEPR-HF01.A1.4

3.5.1.1 Description of Scope of Work

Violations have been defined by the Human Factors in Reliability Group (1995) as “any deliberate deviations from the rules, procedures, instructions and regulations drawn up for the safe operation and maintenance of a plant or equipment.”

To address this action, the following tasks will be implemented:

- Submit a methodology for the substantiation of pre-fault and post-fault human failure events that accommodates consideration of violation potential;
- Provide additional evidence on how the UK EPR design prevents / mitigates violation potential.

3.5.1.2 Description of Methodology to be employed

Task 1 to GI-UKEPR-HF01.A1.4 - Submit a methodology for the substantiation pre-fault and post fault human failure events that accommodates consideration of violation potential

Regarding pre-fault the amended method statement for Type A/B errors (Appendix 1) explains how the potential for violations will be considered when addressing action A1.1. The detailed task analysis methodology for Type A/B will be provided as a deliverable of the plan as part of action A1.1. This will encompass general violation motivators and induced behaviours.

With regard to post-fault violations, the method statement for Type C errors [9] explains how the potential for violation will be considered (i.e. as part of the resolution of action A1.2). Furthermore, the task analyses already completed for Type C errors provide examples and evidence of the application of the method.

Task 2 to GI-UKEPR-HF01.A1.4 - Provide additional evidence on how the UK EPR design prevents / mitigates violation potential

Evidence that UK EPR prevents and mitigates violation potential will be provided through the task analysis process that will be implemented for pre-fault and post-fault claims, following the respective method statements.

The consequences of violations are the same as those for genuine errors; the difference between an error and a violation is the motivation of the individual performing the task. At the GDA stage in the system life cycle, there is insufficient information available about the pre-fault tasks to identify the motivation for committing violations. However, consideration of violations during the analysis can be undertaken by including the word violation as a guideword, in the potential error taxonomy used to conduct the analysis.

For the post-fault claims, analyses of the required procedural response (in instances when this information is available) are used to identify the potential motivation for violations. For example, the analysis identifies potential violations by identifying competing / contradictory goals that the operators may be faced with when implementing a required response (the consequence of these violations is equivalent to an error of omission: the operator fails to complete a required action) and also by identifying where the required procedural response introduces the opportunity for the operator to pre-empt a required action (the consequences of these violations is equivalent to an error of commission: the operator conducts an action too soon). The knowledge of the Subject Matter Experts, as elicited at the workshops, is used to identify potential motivations that could lead the operator to undertaking a course of action that is in violation of the required procedural response. These workshops will be led by a SQEP HF practitioner.

3.5.1.3 Deliverable description

	Submission date to HSE/EA
D1.1 Human Factors method statement generic design related for Type A/B Human failure events	30/06/11
D1.5 Substantiation of identified type A human failure events modelled in the PSA	30/05/12
D2.5 Substantiation of PSA Type C claims	30/05/12
PCSR 18.1 UKEPR0002-181-I06 (Draft)	30/05/12
PCSR 18.1 UKEPR0002-181-I06 (Final Issue)	14/09/12

3.6 Action GI-UKEPR-HF01.A2

Action I/D	Action Description
GI-UKEPR-HF01.A2	Provide a consolidated HF safety case and PCSR update for the UK EPR. EDF and AREVA should provide an updated PCSR submission that presents the overall HF safety case for the UK EPR. This should include and integrate the various submissions stemming from work undertaken during GDA and that related to action GI-UKEPR-HF01.A1. With agreement from the Regulator this action may be completed by alternative means.

3.6.1 Planned submissions in response to GI-UKEPR-HF01.A2

3.6.1.1 Description of Scope of Work

At the end of GDA Step 3 HSE raised Regulatory Observation (RO) RO-UKEPR-038 specifying that the *"current PCSR for the UK EPR does not present the safety case for Human Factors in a recognisable UK structure"*. The corresponding RO Action (ROA) required that *"The Requesting Party is required to submit documentation that clearly defines the role of human actions on the UK EPR (i.e. the safety 'claims') and justifies those actions via human factors analysis (i.e. the 'arguments' and 'evidence')*".

SAP SC.4 states that *"A safety case should be accurate, objective and demonstrably complete for its intended purpose"*. Additionally TAG T/AST/058 on HFI includes an Appendix that provides details of ND's broad expectations for the HF consideration at the PCSR stage.

To address this action, an update of relevant sections of the PCSR will be submitted.

3.6.1.2 Description of Methodology to be employed

Task 1 to GI-UKEPR-HF01.A2 - Provide a consolidated HF safety case and PCSR update for the UK EPR

A consolidated HF safety will be provided as part of the PCSR 2012 submission. This updated PCSR submission will present the overall HF safety case for the UK EPR. This will include and integrate the various submissions stemming from work undertaken during GDA and that related to action GI-UKEPR-HF01.A1

ONR feedback on the March 2011 PCSR Chapter 18 structure will be taken into account, and intermediate draft structure of the PCSR chapter 18 will be submitted to allow ONR assessment at an early stage.

3.6.1.3 Deliverable description	**Submission date to HSE/EA**
D4.1 Intermediate deliverable: PCSR 18.1 UKEPR0002-181-I06 agreement of structure	*30/12/11*
D4.1 PCSR 18.1 UKEPR0002-181-I06 (Draft)	31/05/12
D4.1 PCSR 18.1 UKEPR0002-181-06 (Final Issue)	14/09/12

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			
D4.1 Intermediate deliverable: PCSR 18.1 UKEPR0002-181-I06 agreement of structure	C	*GI-UKEPR-HF01.A2*	*30/12/11*
D4.2 PCSR 18.1 UKEPR0002-181-I06 (Draft)	U	GI-UKEPR-HF01.A2	31/05/12
D4.3 PCSR 18.1 UKEPR00002-181-06 (Final Issue)	C	GI-UKEPR-HF01.A2	14/09/12
GDA reference design documents (SDM in UKEPR-I-002)	N/A	N/A	
None			
Other GDA submission supporting documents			
D1.1 Human Factors method statement generic design related for type A/B Human failure events	C	GI-UKEPR-HF01.A1.1	01/07/11
D1.2 Intermediate deliverable: Schedule of risk significant equipment grouped into generic equipment types	*C*	*GI-UKEPR-HF01.A1.1*	*05/08/11*
D1.3 Identification of task associated with type A/B human failure events modelled in the PSA	C	GI-UKEPR-HF01.A1.1	14/10/11
D1.4 Task Analysis (Human HAZOP) Programme for type A/B human failure events modelled in the PSA	*C*	*GI-UKEPR-HF01.A1.1*	*31/10/11*
D1.5 Intermediate submissions of substantiation of type A HFEs according to D1.4	C	GI-UKEPR-HF01.A1.1	30/01/12
D1.5 Substantiation of identified type A human failure events modelled in the PSA	C	GI-UKEPR-HF01.A1.1	30/05/12
D1.6 Confirmation of design features relating to misalignment of automated valves	C	GI-UKEPR-HF01.A1.1	30/12/11
D1.7 Substantiation of identified type B human failures events	C	GI-UKEPR-HF01.A1.1	29/03/12

D1.8 Dropped loads and fuel handling Intermediate deliverable: Main principles of the Risk analysis methodology and template	*C*	*GI-UKEPR-HF01.A1.1*	*22/09/11*
D1.9 Dropped loads and fuel handling: Risk analysis methodology for the identification of the Human Based Safety Claims	C	GI-UKEPR-HF01.A1.1	30/11/11
D1.10 Intermediate Identification of Dropped loads and fuel handling HBSCs	C	GI-UKEPR-HF01.A1.	30/03/12
D1.10 Dropped loads and fuel handling: Identification of the Human Based Safety Claims	C	GI-UKEPR-HF01.A1.1	08/06/12
D1.11 Heterogeneous dilution: Substantiation of the human based safety claims	C	GI-UKEPR-HF01.A1.1	30/12/11
D2.1 Identification and categorisation of PSA 2011 type C claims	C	GI-UKEPR-HF01.A1.2	01/08/11
D2.2 Schedule of intermediate Type C task analyses	*C*	*GI-UKEPR-HF01.A1.2*	*15/07/11*
D2.3 Substantiation of steam generator tube rupture human based safety claims	C	GI-UKEPR-HF01.A1.2	14/10/11
D2.5 Intermediate submissions of substantiation of PSA Type C claims according to D2.2	C	GI-UKEPR-HF01.A1.2	15/11/11
D2.4 Substantiation of internal flooding human based safety claims	C	GI-UKEPR-HF01.A1.2	13/03/12
D2.5 Substantiation of PSA Type C claims	C	GI-UKEPR-HF01.A1.2	30/05/12
D3.1 Holistic arguments to support claims relating to misdiagnosis in emergency operations	C	GI-UKEPR-HF01.A1.3	29/03/12
D3.2 Holistic evidence to support claims relating to misdiagnosis in emergency operations	C	GI-UKEPR-HF01.A1.3	30/04/12
D3.3 Holistic arguments to support claims relating to PICS to SICS transfer	C	GI-UKEPR-HF01.A1.3	09/03/12
D3.4 Holistic evidence to support claims relating to PICS to SICS transfer	C	GI-UKEPR-HF01.A1.3	30/04/12

Note that items in italics are not GDA submission supporting documents, but intermediate deliverables in order to gather in the same section all deliverables to ONR in the framework of the Resolution Plan

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

None

5.0 JUSTIFICATION OF ADEQUACY

The GDA Issues has two main parts that are reflected as the two actions. The first action is to provide an adequate substantiation of the Human Based Safety Claims (HBSCs) that are made with the UKEPR safety justification. The second action is to provide a consolidated Human Factors Safety case for the UKEPR.

The first stage of the first action is to ensure that the HBSCs have been identified. The HBSCs are considered to fall into 4 broad categories:

- the HBSCs modelled in the PSA.
- the HBSCS related to systems that are not modelled in the PSA
- the HBSCs that are made in the deterministic safety analysis undertaken in related technical areas (principally Internal Hazards and Fault studies)
- Holistic claims that support the HF safety case (e.g. that use of the State Orientated approach provides resilience against mis-diagnosis).

When the HBSC has been identified, then the substantiation can be performed. This will be performed by the appropriate type of analysis as detailed in the relevant methodology.

For the HBSCs that are modelled in the PSA, these are split into pre-fault (Type A/B) and post-fault claims (Type C). Identification of these two types of HBSCs is performed separately.

The steps in indentifying the pre-fault errors are identified in Appendix 1. This provides a methodology for identifying the pre-fault tasks arising from maintenance, testing and calibration activities on risk significant equipment, that could lead to the failure modes that are considered in the PSA. The claim is that the equipment will be designed and constructed so that the likelihood of human failure events (HFEs) occurring during these tasks, that could affect the ability of this equipment to operate correctly, is ALARP. Whether these HFEs are Type A or Type B is dependent on the failure mode that results. These claims will be substantiated by performing a Human HAZOP study format to identify the features that are (or should be) implemented into the design to make it robust against such pre-fault errors.

The identification of tasks in this study will be performed using generic PWR information. This is justified because it is too early in the design of the UKEPR for specific information to be available. The information is restricted to maintenance, calibration and testing activities. In relation to pre-fault errors that could arise from other activities, it should be noted that

- Failures to perform manual valve alignments correctly are explicitly modelled in the PSA
- Failures of automatic valve alignments are alarmed in the main control room. This will be confirmed as part of the Resolution Plan
- Five specific Type B high risk HFEs have been identified based on Operating Experience and the risk reduced to ALARP. These HBSCs will be substantiated.
- It is too early in the design process to have specific information available on UKEPR operating procedures and processes.
- Maintenance, Calibration and Testing are potentially intrusive activities that can lead to risk significant failure modes.

The post-fault errors are explicitly modelled in the PSA. The substantiation of the HBSCs is performed on a risk proportionate basis based on the risk analysis performed using the PSA results. The substantiation of the claims is performed using Task Analysis as defined in the appropriate method statement. The Simulator will be used where appropriate as described in more detail within section 3.2.2.2.

The current PSA does not provide a complete model of the Station. In particular there are some systems that are not modelled in PSA that can lead to significant risk. Cranes (leading to Dropped Loads) and Fuel Handling equipment have been specifically identified as such equipment. These systems have been identified based on operational experience and also based on studies performed for other plants. It is judged that these are the 'non-PSA' systems that can have risk significant HBSCS. Studies will be performed to identify the HBSCs associated with these equipments and these will be substantiated using the appropriate methodologies.

High risk deterministic HBSCs that are already identified will be substantiated. The UKEPR safety justification has been extensively examined through GDA and it is considered that any deterministic HBSCs that are high risk will have been identified. The deterministic claims will be identified and substantiated based on the information available at the GDA stage of the design. Where detailed information is not yet available then consideration will be given to using information from other EPR designs where it is relevant and appropriate.

Other deterministic claims that are in an early stage of identification will be substantiated during the site licensing phase using a systematic approach. The purpose of the resolution plan for these HBSCs is to define the process for their identification and determination of how to implement a risk proportionate approach (definition of a risk analysis methodology).

Generic claims that can support the whole HF safety case will be identified and substantiated to the extent possible at the GDA stage of design. The claims that have already been identified relate to use of the 'State Oriented Approach' and 'Automatic Diagnosis' together with the overall concept of operations. These claims will be substantiated through argument and evidence based on Operational Experience. The overall safety case will be considered for other holistic arguments that will be presented to a level appropriate for GDA.

The GDA design will also be considered to ensure that it is ALARP with respect to minimising the incentive to Violations. Evidence to support the arguments supporting this claim will be obtained by ensuring that the work outlined above in relation to substantiation of HBSCs considers the potential for violation and how the incentives and dis-incentives for violation behaviour can be built into the generic design.

The PCSR will be revised to provide a consolidated HF safety case for the UK EPR, in a recognisable UK safety case structure (i.e. claims-argument-evidence). This will incorporate the results of the work described in this Resolution Plan to identify and substantiate the HBSCs, and to develop holistic arguments for key aspects of the UK EPR operations.

6.0 REFERENCES

Ref [1] EDF/AREVA GDA Task Analysis Method Statement – Claim 2: Pre-Fault Human Errors. Sent under letter EPR00591N. 05/10/10

Ref [2] EDF/AREVA GDA Task Analysis: Example Pre-Fault Analysis. EPR00661N: Technical Report, 16474/TR/0005. EPR00661N. 22/11/10

Ref [3] EDF AREVA GDA Task analysis method statement for Pre-fault Human Errors and Human Errors performed on systems and equipment not modelled in PSA. ECEF102051, Revision A. Submitted as part of the Consolidated PCSR submission 31/03/2011

Ref [4] Update of the Methodology for the Analysis of Type A Human Based Safety Claims. Sent under letter EPR00847N. 18/04/11

Ref [5] Human reliability analysis notebook of the UK EPR probabilistic safety assessment. NEPS-F DC 191. Sent under letter EPR00328N. 19/03/10

Ref [6] Full response to TQ751. Completeness of HFEs associated with initiating faults. 20/05/10

Ref [7] EDF/AREVA Task analysis method statement-claim 3 - Human Errors performed on systems and equipment not modelled in the PSA. Sent under letter EPR00591N. 05/10/10

Ref [8] EDF/AREVA GDA Task Analysis Post Fault Example 3, [OP_FEED_TK]. Technical Report, 16474-TR-0006 December 2010. Sent under letter EPR00698N. 15/12/10

Ref [9] EDF/AREVA GDA Task Analysis Method Statement & Analysis of Two Example Operator Claims. Technical Report, 16474/TR/0003. Sent under letter EPR00586N. 30/09/10

7.0 TIMETABLE AND MILESTONE PROGRAMME LEADING TO THE DELIVERABLES

The timetable and milestone programme is appended at the end of this Resolution Plan.

APPENDIX 1 TASK ANALYSIS METHOD STATEMENT: ANALYSIS OF PRE-INITIATOR HUMAN ERRORS

This method statement provides a task analysis methodology appropriate for proportionate assessment of pre-initiator human errors (Type A) and violations that could impact on safety significant equipment and the ability of that equipment to fulfil a safety related function. It also provides a method for the identification of any Type B errors and violations associated with preventative maintenance activities. The following steps will be followed:

Step 1: Conduct risk based screening of systems and equipment using the PSA.

The PSA will be screened using the following screening criteria: a Risk Increase Factor of greater than 2 or a Fussell Vesely value of greater than 5 x 10-3. This will identify all equipment on which a medium or higher claim is made. These equipment items and their associated failure modes shall form the scope for the subsequent assessments.

Step 2: Identify Legacy and Non-legacy equipment.

The risk significant equipment identified at Step 1 will be divided into two groups “Legacy” and “Non-legacy”. This demarcation is required because there will be differences in the level of information available for these two groups. Legacy equipment is defined as equipment for which there is substantive information and experience within EDF / AREVA. Non-legacy equipment is defined as equipment that is of a new design, or equipment of an existing design for which there is not substantive information or experience within EDF AREVA.

Step 3: Grouping of Equipment by Generic Type

The identified equipment will be grouped together into generic types. This will facilitate the identification of preventative maintenance, test and calibration tasks in the next step. A technical meeting will be held with SMEs to verify the groupings. For legacy items the grouping of equipment will take account of the existing EDF maintenance databases and procedures along with guidance from SMEs. For non-legacy items there may be limited information, so this activity may rely heavily on SME opinion and current industry standard information along with analogy to the legacy information.

Step 4: Identification of Maintenance, testing and calibration tasks.

The Institute of Nuclear Power Operations (INPO) has issued guidance on the processes which may be employed by member utilities to maintain high levels of safe and reliable operation of equipment within their plants. A methodology for the practical implementation of these Preventative Maintenance (PM) objectives has been established by the Electrical Power Research Institute (EPRI), which has provided information for a PM Basis. The PM Basis includes a “Template Page” for each component which shows PM tasks and frequencies and which provides a technically defensible PM program. As part of a desk based exercise, these PM programmes will be used to identify the preventative maintenance, testing and calibration tasks required for the generic legacy and non-legacy equipment types identified in Step 3. This will ensure identification of a comprehensive and valid set of PM tasks for each equipment type. In the event that novel non-legacy equipment types are identified, tasks will be identified based on analogy to the legacy equipment, as well as from SME input.

Step 5: Task Screening

A proportionate, risk based approach will be taken to the task analysis. For each generic equipment type, the preventative maintenance, test and calibration tasks identified in Step 4 will be screened to identify those where the consequence of error/violation could result in the failure modes identified in Step 1. The screening activity will be a qualitative desk top exercise. A detailed procedure for conducting the screening will be issued prior to

commencement of the activity. However, in addition to the failure modes, the following criteria are likely to be used to screen the tasks:

- Nature of the task (e.g. invasive);
- Potential for common mode errors;

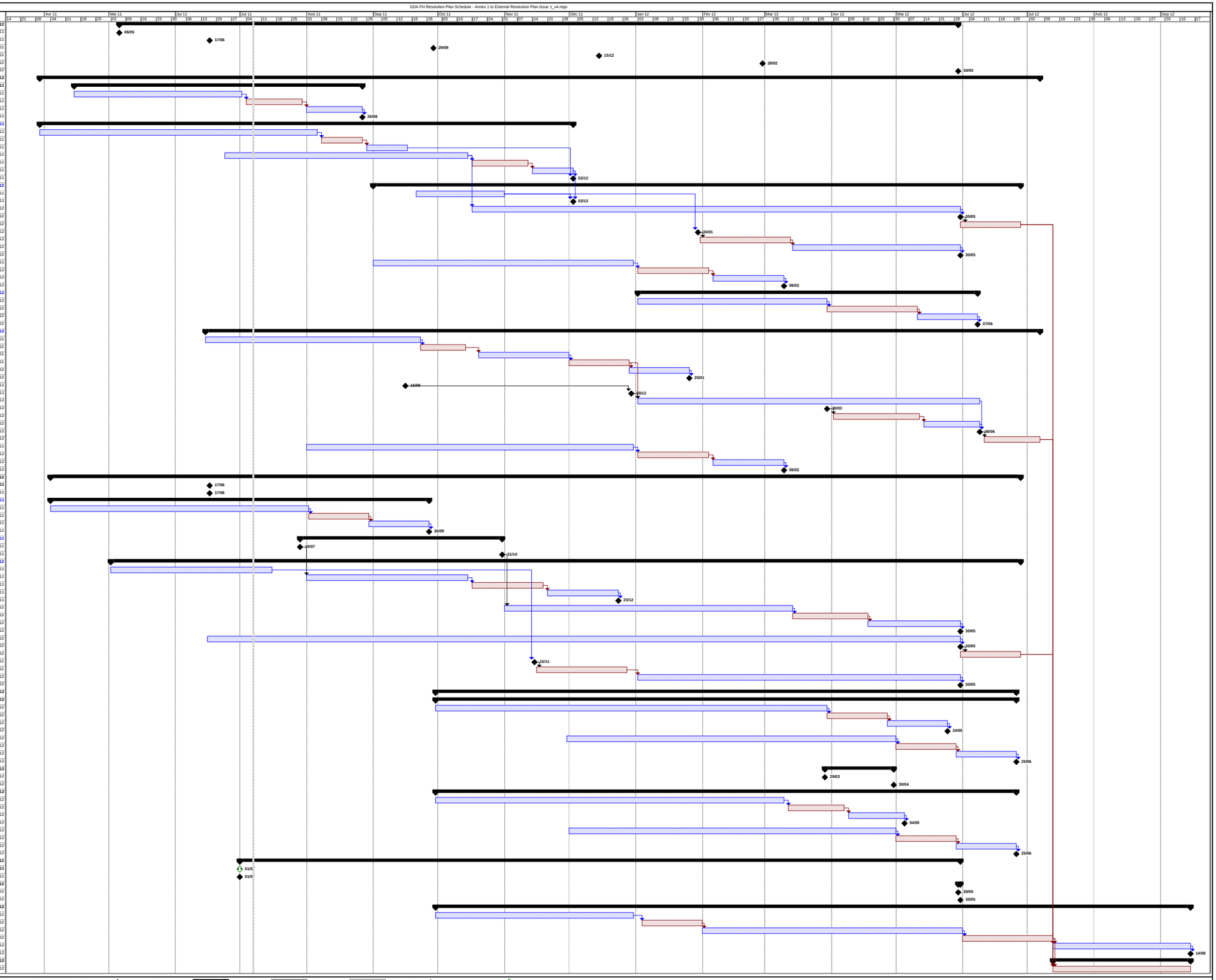
Step 6: Analysis of Critical Tasks

The critical tasks identified from the Step 5 screening exercise will be subjected to an error analysis. The error analysis will use the Human HAZard and OPerability (HAZOP) study format. This will provide a structured and systematic way of analysing the tasks. Each task will be presented and a list of guide words for error types and violations will be considered (a detailed procedure including the guidewords will be issued prior to the study). Where errors or violations are identified the consequences will be recorded along with the Performance Shaping Factors (PSFs) that influence task reliability. Type B errors associated with preventative maintenance, testing and calibration will also be identified by considering the consequences associated with an error or violation for each task. As part of the Human HAZOP a hierarchy of control measures associated with each task will be considered. The existing controls will be recorded and where appropriate recommendations will be made for further controls. The hierarchy of controls to be applied has been derived from those in the Nuclear Installations Inspectorate Safety Assessment Principles and is as follows:

- Is the design inherently safe, having eliminated the opportunity for error/violation?
- Does the design prevent the error/violation (i.e. passive safety measures)?
- Does the design control the escalation of the events following the error/violation (engineered safety measures)?
- What operational controls and procedures could improve safety (administrative safety measures)?
- Does the design mitigate the impact of the error/violation/PSFs (mitigation safety measures)?

The use of the Human HAZOP and the application of a hierarchy of controls will enable substantiation of the existing controls, as well as identification of any further requirements required to ensure the equipment design is resilient to Type A or B errors and violations.

N°	Task Name	Durée	Début	Fin
1	**Progress Meetings HSE/EA - EDF/AREVA**	**278 jours**	**Ven 06/05/11**	**Mer 30/05/12**
2	Progress Meeting 1	0 jour	Ven 06/05/11	Ven 06/05/11
3	Progress Meeting 2	0 jour	Ven 17/06/11	Ven 17/06/11
4	Progress Meeting 3	0 jour	Jeu 29/09/11	Jeu 29/09/11
5	Progress Meeting 4	0 jour	Jeu 15/12/11	Jeu 15/12/11
6	Progress Meeting 5	0 jour	Mar 28/02/12	Mar 28/02/12
7	Progress Meeting 6	0 jour	Mer 30/05/12	Mer 30/05/12
8	**HF1.A1.1 - Substantiate the type A and B human failure events**	**333 jours?**	**Mer 30/03/11**	**Ven 06/07/12**
9	**Task 1 to HF.A.1.1 - Submit a methodology for the substantiatior**	**96 jours**	**Ven 15/04/11**	**Ven 26/08/11**
10	D1.1.Human Factors method statement generic design related h	2,8 mois	Ven 15/04/11	Ven 01/07/11
11	D1.1.ONR review	20 jours	Lun 04/07/11	Ven 29/07/11
12	D1.1.Update following ONR comments	20 jours	Lun 01/08/11	Ven 26/08/11
13	D1.1. Submission of revised report	0 jour	Ven 26/08/11	Ven 26/08/11
14	**Task 2 to HF.A.1.1 - Identify the Type A and Type B human failur**	**178 jours**	**Mer 30/03/11**	**Ven 02/12/11**
15	D1.2. Schedule of risk significant equipment grouping	93 jours	Mer 30/03/11	Ven 05/08/11
16	D1.2.ONR review	15 jours	Lun 08/08/11	Ven 26/08/11
17	D1.2.Update following ONR comments	15 jours	Lun 29/08/11	Ven 16/09/11
18	D1.3.Identification of task associated with type A/B human failure	4,05 mois	Ven 24/06/11	Ven 14/10/11
19	D1.3.ONR review	20 jours	Lun 17/10/11	Ven 11/11/11
20	D1.3.Update following ONR comments	15 jours	Lun 14/11/11	Ven 02/12/11
21	D1.3.Submission of revised report	0 jour	Ven 02/12/11	Ven 02/12/11
22	**Task 3 to HF.A.1.1 - Substantiate the identified Type A human fa**	**215 jours?**	**Jeu 01/09/11**	**Mer 27/06/12**
23	D1.4.Task Analysis (Human HAZOP) Programme for type A/B h	1,45 mois	Mer 21/09/11	Lun 31/10/11
24	D1.4Task Analysis (Human HAZOP) Programme update	0 jour	Ven 02/12/11	Ven 02/12/11
25	D1.5.Substantiation of identified type A/B human failure events	8,15 mois	Lun 17/10/11	Mer 30/05/12
26	D1.5.Submission of the last TA according to D1.4	0 jour	Mer 30/05/12	Mer 30/05/12
27	D1.5.Final ONR review	20 jours	Jeu 31/05/12	Mer 27/06/12
28	D1.5.Submission of TA according to D1.4	0 jour	Lun 30/01/12	Lun 30/01/12
29	D1.5.ONR review	30 jours	Mar 31/01/12	Lun 12/03/12
30	D1.5.Update and complete following ONR comments	56 jours?	Mer 14/03/12	Mer 30/05/12
31	D1.5. Submission of revised report(s)	0 jour	Mer 30/05/12	Mer 30/05/12
32	D1.6.Confirmation of design features relating to misalignment of	4,35 mois	Jeu 01/09/11	Ven 30/12/11
33	D1.6.ONR review	25 jours	Lun 02/01/12	Ven 03/02/12
34	D1.6.Update and complete following ONR comments	25 jours	Lun 06/02/12	Ven 09/03/12
35	D1.6. Submission of revised report	0 jour	Ven 09/03/12	Ven 09/03/12
36	**Task 4 to HF.A.1.1 - Substantiate the identified Type B human fa**	**114 jours**	**Lun 02/01/12**	**Jeu 07/06/12**
37	D1.7.Substantiation of identified type B human failures events m	3,2 mois	Lun 02/01/12	Jeu 29/03/12
38	D1.7.ONR review	30 jours	Ven 30/03/12	Jeu 10/05/12
39	D1.7.Update following ONR comments	20 jours	Ven 11/05/12	Jeu 07/06/12
40	D1.7. Submission of revised report	0 jour	Jeu 07/06/12	Jeu 07/06/12
41	**Task 5 to HF.A.1.1 - Complete the identification of pre-fault hum**	**278 jours**	**Mer 15/06/11**	**Ven 06/07/12**
42	D1.8.Dropped loads/fuel handling: Main principles of Risk analys	3,6 mois	Mer 15/06/11	Jeu 22/09/11
43	D1.8.ONR review	15 jours	Ven 23/09/11	Jeu 13/10/11
44	D1.9.Risk analysis methodology for the identification of the HBS	30 jours	Jeu 20/10/11	Mer 30/11/11
45	D1.9.ONR review	20 jours	Jeu 01/12/11	Mer 28/12/11
46	D1.9.Update and complete following ONR comments	20 jours	Jeu 29/12/11	Mer 25/01/12
47	D1.9. Submission of revised report	0 jour	Mer 25/01/12	Mer 25/01/12
48	IH01-Summary of Design Basis & Principles - Report	0 jour	Ven 16/09/11	Ven 16/09/11
49	IH01-Dropped Loads Safety Case – Summary report and suppo	0 jour	Ven 30/12/11	Ven 30/12/11
50	D1.10.Dropped loads and fuel handling: Identification of the Hun	5,75 mois	Lun 02/01/12	Ven 08/06/12
51	D1.10.Dropped loads/fuel handling-Intermediate submission	0 jour	Ven 30/03/12	Ven 30/03/12
52	D1.10.ONR review	30 jours	Lun 02/04/12	Ven 11/05/12
53	D1.10.Update and complete following ONR comments	20 jours	Lun 14/05/12	Ven 08/06/12
54	D1.10. Submission of revised report	0 jour	Ven 08/06/12	Ven 08/06/12
55	D1.10.Final ONR review	20 jours	Lun 11/06/12	Ven 06/07/12
56	D1.11.Heterogeneous dilution : Substantiation of the heterogene	5,5 mois	Lun 01/08/11	Ven 30/12/11
57	D1.11.ONR review	25 jours	Lun 02/01/12	Ven 03/02/12
58	D1.11.Update following ONR comments	25 jours	Lun 06/02/12	Ven 09/03/12
59	D1.11. Submission of revised report	0 jour	Ven 09/03/12	Ven 09/03/12
60	**HF1.A1.2 - Substantiate the typeC human failure events that are perti**	**323 jours?**	**Lun 04/04/11**	**Mer 27/06/12**
61	**Task 1 to HF.A.1.2 -Advise of any amendments to the methodolo**	**0 jour**	**Ven 17/06/11**	**Ven 17/06/11**
62	RP HF01	0 jour	Ven 17/06/11	Ven 17/06/11
63	**Task 2 to HF.A.1.2 -Update the identification of Type C human be**	**126 jours**	**Lun 04/04/11**	**Lun 26/09/11**
64	D2.1.Identification and categorisation of PSA 2011 Type C claim	86 jours	Lun 04/04/11	Lun 01/08/11
65	D2.1.ONR review	20 jours	Mar 02/08/11	Lun 29/08/11
66	D2.1.Update following ONR comments	20 jours	Mar 30/08/11	Lun 26/09/11
67	D2.1. Submission of revised report	0 jour	Lun 26/09/11	Lun 26/09/11
68	**Task 3 to HF.A.1.2 -Identify additional human based safety claim**	**66 jours**	**Ven 29/07/11**	**Lun 31/10/11**
69	FS04-Steam Generator Tube Rupture Human Based Safety Cla	0 jour	Ven 29/07/11	Ven 29/07/11
70	IH03 - Internal flooding Human based Safety claims identificatior	0 jour	Lun 31/10/11	Lun 31/10/11
71	**Task 4 to HF.A.1.2 -Provide targeted and proportionate substant**	**303 jours?**	**Lun 02/05/11**	**Mer 27/06/12**
72	D2.2.Schedule of intermediate Type C task analyses	55 jours	Lun 02/05/11	Ven 15/07/11
73	D2.3.Substantiation of steam generator tube rupture human bas	55 jours	Lun 01/08/11	Ven 14/10/11
74	D2.3.ONR review	25 jours	Lun 17/10/11	Ven 18/11/11
75	D2.3.Update following ONR comments	25 jours	Lun 21/11/11	Ven 23/12/11
76	D2.3. Submission of revised report	0 jour	Ven 23/12/11	Ven 23/12/11
77	D2.4.Substantiation of internal flooding human based safety clai	96 jours	Mar 01/11/11	Mar 13/03/12
78	D2.4.ONR review	25 jours	Mer 14/03/12	Mar 17/04/12
79	D2.4.Update following ONR comments	31 jours	Mer 18/04/12	Mer 30/05/12
80	D2.4. Submission of revised report	0 jour	Mer 30/05/12	Mer 30/05/12
81	D2.5.Substantiation of PSA Type C claims	250 jours	Jeu 16/06/11	Mer 30/05/12
82	D2.5.Submission on the last TA according to D2.2	0 jour	Mer 30/05/12	Mer 30/05/12
83	D2.5.Final ONR review	20 jours	Jeu 31/05/12	Mer 27/06/12
84	D2.5. Submission of TA according to D.2.2	0 jour	Mar 15/11/11	Mar 15/11/11
85	D2.5.ONR review	30 jours	Mer 16/11/11	Mar 27/12/11
86	D2.5.Update and complete following ONR comments	108 jours?	Lun 02/01/12	Mer 30/05/12
87	D2.5. Submission of revised report(s)	0 jour	Mer 30/05/12	Mer 30/05/12
88	**HF1-A1.3 - Provide holistic arguments for key elements of the propos**	**192 jours?**	**Ven 30/09/11**	**Lun 25/06/12**
89	**Task 1 to HF.A.1.3 -Provide arguments and evidence to support t**	**192 jours?**	**Ven 30/09/11**	**Lun 25/06/12**
90	D3.1. Misdiagnosis in emergency operations - Holistic argument	130 jours	Ven 30/09/11	Jeu 29/03/12
91	D3.1.ONR review	20 jours	Ven 30/03/12	Jeu 26/04/12
92	D3.1.Update following ONR comments	20 jours	Ven 27/04/12	Jeu 24/05/12
93	D3.1. Submission of revised report	0 jour	Jeu 24/05/12	Jeu 24/05/12
94	D3.2. Misdiagnosis in emergency operations - Holistic evidence	109 jours?	Mer 30/11/11	Lun 30/04/12
95	D3.2.ONR review	20 jours	Mar 01/05/12	Lun 28/05/12
96	D3.2.Update following ONR comments	20 jours	Mar 29/05/12	Lun 25/06/12
97	D3.2. Submission of revised report	0 jour	Lun 25/06/12	Lun 25/06/12
98	**Task 2 to HF.A.1.3 -Provide arguments and evidence relating to t**	**22 jours**	**Jeu 29/03/12**	**Lun 30/04/12**
99	Contribution to D3.1	0 jour	Jeu 29/03/12	Jeu 29/03/12
100	Contribution to D3.2	0 jour	Lun 30/04/12	Lun 30/04/12
101	**Task 3 to HF.A.1.3 -Consider whether other holistic arguments /**	**192 jours?**	**Ven 30/09/11**	**Lun 25/06/12**
102	D3.3. PICS to SICS transfer - Holistic arguments	116 jours	Ven 30/09/11	Ven 09/03/12
103	D3.3.ONR review	20 jours	Lun 12/03/12	Ven 06/04/12
104	D3.3.Update following ONR comments	20 jours	Lun 09/04/12	Ven 04/05/12
105	D3.3. Submission of revised report	0 jour	Ven 04/05/12	Ven 04/05/12
106	D3.4. PICS to SICS transfer - Holistic evidence	108 jours?	Jeu 01/12/11	Lun 30/04/12
107	D3.4.ONR review	20 jours	Mar 01/05/12	Lun 28/05/12
108	D3.4.Update following ONR comments	20 jours	Mar 29/05/12	Lun 25/06/12
109	D3.4. Submission of revised report	0 jour	Lun 25/06/12	Lun 25/06/12
110	**HF1-A1.4 - Provide analytical evidence on how the design of the UK E**	**239 jours**	**Ven 01/07/11**	**Mer 30/05/12**
111	**Task 1 to HF.A.1.4 -Submit a methodology for the substantiation**	**0 jour**	**Ven 01/07/11**	**Ven 01/07/11**
112	D1.1.Human Factors method statement generic design related h	0 mois	Ven 01/07/11	Ven 01/07/11
113	**Task 2 to HF.A.1.4 -Provide additional evidence on how the UK E**	**1 jour**	**Mer 30/05/12**	**Mer 30/05/12**
114	D1.5.Substantiation of identified type A human failure events	0 mois	Mer 30/05/12	Mer 30/05/12
115	D2.5.Substantiation of PSA Type C claims	0 jour	Mer 30/05/12	Mer 30/05/12
116	**HF1-A2 - Provide a consolidated HF safety case and PCSR update fo**	**251 jours?**	**Ven 30/09/11**	**Ven 14/09/12**
117	D4.1.Intermediate deliverable: Structure PCSR 18.1 UKEPR0002-18	66 jours?	Ven 30/09/11	Ven 30/12/11
118	D4.1.ONR review	20 jours	Mer 04/01/12	Mar 31/01/12
119	D4.1.PCSR 18.1 UKEPR0002-181-I06 (Draft)	87 jours?	Mer 01/02/12	Jeu 31/05/12
120	D4.1.ONR review	30 jours	Ven 01/06/12	Jeu 12/07/12
121	D4.1.PCSR 18.1 UKEPR0002-181-06 (Final Issue)	46 jours	Ven 13/07/12	Ven 14/09/12
122	D4.1.Submission of final PCSR 18.1 UKEPR0002-181-06	0 jour	Ven 14/09/12	Ven 14/09/12
123	**Update of ONR HF Report**	**46 jours**	**Ven 13/07/12**	**Ven 14/09/12**
124	Update of ONR HF Report	46 jours	Ven 13/07/12	Ven 14/09/12



Project: Template - GDAI Resolution P
Date: Jeu 07/07/11

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