1ST INTERIM REVIEW

OF THE

GENERIC DESIGN ASSESSMENT

OUTSTANDING ISSUES

CLIENT: WILKINSON ENVIRONMENTAL

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1ST INTERIM REVIEW
GENERIC DESIGN ASSESSMENT OF THE PROPOSED GENERATION III NUCLEAR POWER PLANTS
UNITED KINGDOM'S NEW-BUILD NUCLEAR PROGRAMME

SUMMARY

The Generic Design Assessment (GDA), also referred to as *pre-licensing*, aims to assess the generic safety, security and environmental aspects of new designs of nuclear power plants (NPPs). Underway since early 2008, the GDA originally considered four different Generation III NPP designs but, apart from the AREVA European Pressurized Reactor (EPR),[1] all other Generation III NPP designs, notably the Westinghouse AP1000, have been suspended or completely withdrawn from the GDA process.

This 1st Interim Stage Review sets out the outstanding design and technical concerns, the *GDA Issues*, that have yet to be resolved by the Office for Nuclear Regulation (ONR) and the *Requesting Party*, AREVA-EdF as these relate to the EPR NPP that has now completed the final Step 4 stage of the GDA process. At completion of Step 4 in December 2011, the EPR design was awarded an *Interim Design Acceptance Compliance* (I-DAC).

OUTSTANDING GDA ISSUES

At this time, there are 30 outstanding GDA Issues relating to unresolved concerns across a number of sectors of the pre-construction nuclear safety case (PCSR) which has to be completed before the ONR will proceed to issued a Final DAC (F-DAC) – the outstanding GDA Issues are identified in TABLE 2. Effectively, even if given planning consent, major site preparation and construction works, particularly to the nuclear island, cannot proceed in the absence of F-DAC and to do so AREVA-EdF would undertake such works at *'developer's risk'*, meaning that any non-compliant features that affect nuclear safety may be subject to removal at the ONR's discretion. At the time of issue of the I-DAC, the projected timescales for satisfactory resolution of all outstanding GDA Issues was, by the latest, November 2012 in advance of the civil engineering works start date of January 2013 for the first two UK EPR NPPs at Hinkley Point.

The outstanding GDA Issues range from resilience to internal hazards, adequacy of the structural integrity of the built-structures including the all-important primary containments of the nuclear island, doubts about the hardware backup of the centralised instrumentation and control systems, human factors and so on. Although limited to 31 in number, the majority of the individual GDA Issues are a composite made up of a number of often quite involved tasks to be undertaken, the outcomes of which have to be further substantiated and finally incorporated into the all-important PCSR – even a relatively straightforward GDA Issue, such as giving account of dropped loads within the nuclear island structures, is projected to require 5 months to completion, after which it has to be assessed and approved by the ONR.

Of the single outstanding GDA Issue that has been resolved to date, although the ONR *'closed'* the GDA Issue it found it necessary to impose two caveats in the form of *Assessment Findings* (AFs) that, in themselves, require resolution before the construction would be permitted to proceed beyond a certain stage at the Hinkley Point new build site. *Assessment Findings* have also been issued at the Step 4 review stage with, for example, in the review of the structural integrity of the reactor pressure circuit (RPC), a total of 41 AF topics being *milestoned* for final assessment well into the construction and commissioning stages of the EPR new build programme, that is well past the granting of the F-DAC. Whereas it might be reasonably argued that certain AFs can only be resolved at particular points in the construction programme (ie where in situ welding of the RPC is required), it is considered that about one-quarter of the AFs raised under the structural integrity example should have not bypassed but remained within the sphere of the GDA process.

Deferring resolution of nuclear safety topics via the AF bypass route could introduce a degree of compromise particularly if, at the post-design and manufacture milestone, the AF reveals a shortfall in the nuclear safety function that cannot be readily resolved practicably by, for example, a design change in an already manufactured or installed component and, as a result, relaxation of a particular safety function, target or similar. This, it may be argued, was a germane weakness of the Finnish nuclear safety regulator's (STUK) approach to its licensing of the first EPR at Olkiluoto, whereby forward milestones in the construction programme could not be met on timescale and/or technical design aspects resulting in huge cost and completion date overruns and, some would argue, at compromise of the NPP's forward nuclear safety. There may also arise organisational difficulties in dovetailing so many deferred AFs into the construction/commissioning programme overall, particularly if the Requesting Party is experiencing resourcing shortfalls to match an increasingly detailed workload as the new-build project simultaneously advances on several technical fronts.

Meeting the technical demands and, particularly, the timescales for resolving the GDA Issues has clearly presented difficulties to AREVA-EdF. Several key GDA civil engineering and structural integrity GDA Issues are running late and the rate of responding to the ONR's milestone programme has fallen badly behind, with about one-third of GDA Issues documentation failing to be submitted on time – in March-April 2012 about 75 of a total of 200 submissions required at that date had failed to be delivered within the target timescales. Indeed, the ONR has been openly critical of AREVA-EdF, noting that GDA Issues assessments and deliverables *"have been late or do not provide the quality of information or depth of*

[1] The EPR is a four-loop PWR (Pressurized Water Reactor) with electric output of 1600 MW and thermal power of 4300 MW. The reactor operating pressure is 155 bar.

evidence that we expected" adding that *"it is unlikely that the GDA Issues will be closed-out on the timescales indicated in the resolution plans"*. At this time, ONR are awaiting a revised programme for resolution of the outstanding GDA Issues from AREVA-EdF but, in account of the present lapse in the milestone timetable, it is almost a certainty that the issue of the F-DAC (and hence commencement of construction at Hinkley Point) will be delayed well beyond the New Year of 2013.

Moreover, the *Metrics Trending Summary*, also published by ONR, suggests that significant and irrecoverable delays have occurred in a number of GDA Issues categories, particularly those concerned with civil engineering, control and instrumentation, and structural integrity. Of these, civil engineering and structural integrity are lead areas that could delay construction starts for the nuclear islands at Hinkley Point C and D NPPs if, that is, the ONR maintains its commitment not to issue the F-DAC until all of the GDA Issues have been satisfactorily resolved.

EUROPEAN COMMISSION AND ENSREG STRESS TESTS

As the GDA process moved through final stage of design assessment of Step 4, events at the Fukushima Daiichi nuclear complex in Japan prompted the European Commission and the European Nuclear Safety Regulators Group (ENSREG) jointly to set a series of *Stress Tests* against which Member States should evaluate the post incident performance of their NPPs when subject to extreme external events, such as severe earthquake, flooding, aircraft crash, etc. For the UK stress tests ONR excluded this requirement from the GDA process (and hence the EPR design proposed for the UK new-build has not been Stress Test evaluated); instead it requires AREVA-EdF to assess any relevant design changes via an additional GDA Issues drawing on the lessons learnt from Fukushima. Until the final submissions of AREVA-EdF for this particular GDA Issue have been submitted, optimistically aimed for November 2012, this broad area of uncertainty about the types and extent of modifications required to the EPR design, operating rules, etc., will remain unresolved.

However, the nuclear safety regulatory authorities of two other European states, Finland and France, where EPR NPPs are presently under construction did submit their respective EPR NPPs to the stress tests evaluation. Analysis of these Fukushima-necessitated actions to aspects of the EPR NPP design and operating rules add a further 16 equivalent issues to the GDA Issues list yet to be addressed by AREVA-EdF, also tabulated in TABLE 2. This additional work load on the GDA Issues programme that is already behind schedule is likely to further delay the issue of the F-DAC for the AREVA-EdF programme of EPRs at Hinkley Point and Sizewell.

GDA INFORMATION AVAILABILITY

So far the information made publicly available by the ONR GDA Issues documentation (typically with each GDA Issue being no longer than a few paragraphs) is not sufficiently detailed or reasoned to provide a reliable gauge of the effort required to resolve the issues so identified.

Another difficulty is with the documentation trail linking specific GDA Issues back to source document submissions made earlier in the GDA Process. For example, it is not possible to readily source the AREVA-EdF submissions to determine the detailed reasoning why, according to the ONR, it was necessary to raise a particular GDA Issue. In the absence of this information, which must be of greater detail than the specific GDA Issue document raised by the ONR, it is not possible to fathom out the technical/engineering basis of the insufficiency (or whatever) and, thus, independently determine the importance and, possibly, difficulty of the GDA Issues resolution task.

2ND INTERIM AND FINAL LARGE & ASSOCIATES REVIEWS

The proposed Large & Associates **2nd Interim Review** is to report upon the interrogation of the ONR (and EA) by *Freedom of Information Act* and *Environmental Information Regulations* requests for further and specific information of the details of what are considered to be the most significant GDA Issues. Clarification will also be sought on the present (4th Quarter 2011) failure of AREVA-EdF to meet with GDA Issues timetable and milestones and, as 2012 progresses, the deliverables situation will be monitored and reported upon as and when the information becomes available.

The proposed Large & Associates **Final Review**, to be issued around October-November of 2012, will assess the appropriateness of the ONR issuing the F-DAC in advance of civil engineering construction starting on key nuclear safety features of the reactor islands at the Hinkley Point site. If the F-DAC is issued in advance of outstanding GDA Issues still to be resolved, the Final Review will assess the risk of compromise on the future nuclear safety of the EPR NPPs at Hinkley Point and other sites as appropriate.

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INTERIM REVIEW ON THE GENERIC DESIGN ASSESSMENT OF THE PROPOSED GENERATION III NUCLEAR POWER PLANTS FOR THE UNITED KINGDOM'S NEW-BUILD NUCLEAR PROGRAMME

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INTERIM REVIEW ON THE GENERIC DESIGN ASSESSMENT OF THE PROPOSED GENERATION III NUCLEAR POWER PLANTS FOR THE UNITED KINGDOM'S NEW-BUILD NUCLEAR PROGRAMME

INTRODUCTION

The *Generic Design Assessment* (GDA), also referred to as *pre-licensing*, aims to assess the generic safety, security and environmental aspects of new designs of nuclear power plant (NPP). The GDA is undertaken separately and in advance of applications being made for the nuclear (site-specific) licences and permits required for the operation (at certain stages of commissioning) at each of the proposed new-build sites. The GDA process refers to the Health and Safety Executive's (HSE*) Safety Assessment Principles for Nuclear Facilities* (SAPs) as well as to other codes, standards and good practises established in the United Kingdom as benchmarks maintaining nuclear safety.

The GDA process involves those promoting the Generation III NPP designs, referred to as the *Requesting Parties*, submitting their proposed NPP design details to the *Office for Nuclear Regulation* (ONR) and the *Environment Agency* (EA). The ONR is the lead agency responsible for issuing the *Nuclear Site Licence* permitting nuclear activities to be undertaken at each nuclear site, but since the nuclear site licence is site-specific it does not feature in the GDA process.

Following submission of the NPP design and operational details by the requesting parties, there are a number of stages or steps of interrogatory exchange leading to the final Step 4 at which, essentially, sufficient knowledge and assessment of the particular NPP is available for the ONR and requesting party to define and reach agreement on any outstanding issues. At this time, and for the European Pressurized Reactor (EPR) NPP design, there are about 30 outstanding or *GDA Issues* that require resolution before a *Final Design Acceptance Compliance* (F-DAC) is awarded for that particular NPP design.

Being a *generic* evaluation the GDA is not concerned with site-specific issues so before any new nuclear plant may be commissioned it will require a *Nuclear Site Licence* issued under the *Nuclear Installations Act 1965*. However, such is the confidence in the GDA process, that EdF is likely to commence (and have already done so at the Hinkley Point C site reserved for the UK's first EPR) site preparation for major construction works in advance of both the F-DAC and NIA65 Site Licence being granted by ONR.

Two Generation III nuclear reactor designs were under consideration for the later steps of the GDA:

i) EUROPEAN PRESSURED REACTOR (EPR)

This is light water moderated, pressurised water reactor (PWR) design developed from the original US Westinghouse submarine propulsion reactor of the 1950s by the French state-owned industrial energy conglomerate AREVA. The four NPPs proposed for the first tranche of nuclear new-builds in the United Kingdom are to be operated at, first, Hinkley Point and then at Sizewell by *NNB GenCo*.[2]

Currently, there is no EPR NPP in operation worldwide, although 4 units are currently under construction:

TABLE 1 EPR DESIGN, CONSTRUCTION AND COSTS

LOCATION		N° NPPS	START DATE	ORIGINAL 1ST GENERATION	EXPECTED 1ST GENERATION	ESTIMATED COST € ORIGINAL + OVERRUN	REASON FOR DELAY AND/OR COST OVERRUN
Olkiluoto	Finland	1	2005	2009	2014	3.7 + 2.7 = €6.4b	lack concrete construction quality control, safety re-assessment, centralised computer control reassessed
Flamanville	France	1	2007	2012	2016	3.3 + 2.7 = €6.0b	Construction quality control, weld joint cracking, fuel core, central instrumentation, corium catcher reassessment
Taishan	China	2	2009/10	2013/14	unknown	€5b	nothing reported

At this time, the generic EPR design is undergoing final design approval by the *Nuclear Regulatory Commission* (NRC) to pre-site licence status in the United States. The original AREVA application of 2007 is still under review by the NRC and will probably complete in 2014 or thereabouts, making the period for US equivalent to the ONR GDA about 7 to 8 years.[3]

2 NNB GenCo is a subsidiary created by *Électricité de France* (EdF) with *Centrica* to build and operate the proposed EPR NPPs at Hinkley Point and Sizewell.

3 The ONR commenced proper in early 2008 and was originally scheduled to complete in January 2013, giving a period of about 4 years compared to the much greater resourced US NRC preview period of 7 years. For the Olkiluoto EPR, the Finnish safety regulator *Säteilyturvakeskus* (STUK) completed its initial Site-Specific Construction Licensing Review (which enabled construction to commence and advance to a series of pre-determined hold points) within a 13 month

ii) **ADVANCED PASSIVE REACTOR (AP1000)**

Also a light water moderated PWR design developed from the smaller AP600 (600MW_e electricity output) by the *Westinghouse Electric Company* (WEC) was submitted to the GDA process. However, the AP600 design was never adopted for construction, being replaced by a larger unit, the AP1000, which the NRC had certified in 2006, although since that time there have been a number of substantial and fundamental revisions made to the design. Also, events at the Fukushima Daiichi NPPs of March 2011 have prompted re-examination of key aspects of the AP1000 design, particularly resilience of the primary containment (the reinforced concrete shell that dominates the NPP site architecture) when subject to extreme external events. Probably linked to this, Westinghouse had withdrawn from the GDA process early in 2011 and by then was no longer addressing the so-called Step 4 issues raised by the ONR and Environment Agency (EA).

In the United Kingdom new nuclear build programme, the AP1000 design seems to have been favoured and jointly promoted by the German nuclear operators E.On and RWE (via the *Horizon Nuclear Power* (HNP) joint venture) at the *Nuclear Decommissioning Authority* (NDA) Wylfa and Oldbury sites. However, in March 2012 following enforced closure of a number of NPPs operated by the two concerns in Germany, HNP announced that its capital investment plans had been reviewed and that it would no longer be developing the Wylfa and Oldbury sites.

Since no further GDA assessment is presently planned for the AP1000 this NPP design is not considered further in this Interim Review.

A number of other Generation III nuclear power plant designs are currently under development and/or in commission, these include the *Advanced Boiling Water Reactor* (ABWR) by General Electric, the advanced pressurized water reactor (APWR) by Mitsubishi Heavy Industries; the Russian ROSATOM PWR based *VVER 1000*, the *Economically Simplified Boiling Water Reactor* (ESBWR) by GE-Hitachi, and the *Advanced Canadian Deuterium Uranium Reactor* (CANDU – ACR1000) heavy water moderated reactor by the Atomic Energy of Canada Ltd.

The ACR1000 and ABWR designs were submitted to the GDA at its onset in 2007 but, following the initial assessments of March 2008, both designs were suspended from the GDA process. Now with the demise of HNP and withdrawal of WEC from the Step 4 GDA process, further progress of the AP1000 and ACR1000 designs is unlikely unless, that is, some other energy developer adopts either or both of these designs for development in the United Kingdom.

CURRENT STATUS OF THE GDA

Following the Fukushima Daiichi incident of March 2011 in which four light water moderated NPPs were severely damaged, in June 2011 the European Commission requested member states to conduct a series of *Stress Tests* on all nuclear facilities – these stress tests set out the conditions and parameters for re-evaluation of the NPP resilience to and management in the aftermath of an extreme external event. The requirements of the stress tests were set out by individual State regulators (ie ONR, ASN, etc) usually in the form of a requirement for the operator (ie EdF, Electrabel, RWE etc) to undertake and report upon the performance of existing and planned for NPPs when subject to extreme *beyond-design-basis events*, such as severe earthquake, flooding, aircraft crash, etc..

However, despite the imposition of the European Commission's requirement for re-evaluation of NPP performance (existing and planned) via the stress tests, the ONR determined that it would not include for a separate and independent assessment of the lessons learnt from Fukushima Daiichi (ie the Stress Tests) but, instead, require the operator itself to nominate and evaluate these issues as a separate GDA Issue. The 4th Quarter 2011 ONR GDA Progress Report confirms that ONR-EA have granted an *Interim Design Acceptance Confirmation* (I-DAC) and an interim *Statement of Design Acceptability* (I-SoDA) to both the EPR and AP1000 designs, both of which have been issued in the absence of any Fukushima-specific factors taken into account.

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time period, although this design and construction programme has been troubled, encountering many technical and logistical problems during it course, rendering Olkiluoto 3 over budget and much delayed. A significant element of these overruns was considered to stem from STUK's approach to the Pre-Construction Licensing, that is the regulatory process whereby construction was permitted to proceed to certain *'hold points'* or *'milestones'* while that particular issue was addressed – the *Assessment Findings* approach adopted by the ONR in the GDA process bears some similarities, and potential pitfalls, to the STUK's Preconstruction Licensing.

OUTSTANDING *GDA ISSUES*: For the EPR design the I-DAC is dated 14 December 2011 (ONR-GDA-iDAC-11-001 Issue 1) with Annex 2 identifying what are referred to as *GDA Issues*. GDA Issues are those matters of design, operational procedures, nuclear safety management etc., that remain to be finally resolved before the design is qualified by a *Final Design Acceptance Confirmation* (F-DAC). The issue of the I-DAC confirms a general consensus between the regulator and the submitting party (for the EPR being AREVA-EdF) that it will be possible to resolve outstanding GDA Issues within a mutually agreed timescale (the *Resolution Plan*).

The GDA Issues identified by the ONR GDA process are listed in 2nd and 3rd columns of TABLE 2 following and are identified in the 1st column by the prefix **GDA**.

Generally, each specific GDA Issue addresses a point of principle which might, depending on the topic, set design or procedural amendments/requirements over a range of operating and safety equipment, operational procedures, etc. For example, the first GDA Issue of TABLE 2 (GI-UKEPR-IH-01 GDA Issue Revision 2) addresses the requirement for further substantiation and analysis of the damage consequences of dropped loads that might have nuclear safety consequences. In scope this will cover a diverse range of lifting operations generally within the nuclear island, during reactor refuelling, reactor and primary circuit maintenance and replacement, and manipulation and handling operations within the irradiated (spent) fuel ponds. Substantiation is also expected to be diverse, delving into the detail of the equipment and plant involved, identification of proven methodology, and how any improvements or reduction of risk are quantified in terms *defence-in-depth* and *As Low As Reasonably Practicable* (ALARP) and, of course, the proposed actions and measures to resolve the individual GDA issues have to be, singly and collectively, incorporated into the overall nuclear safety case (PCSR).

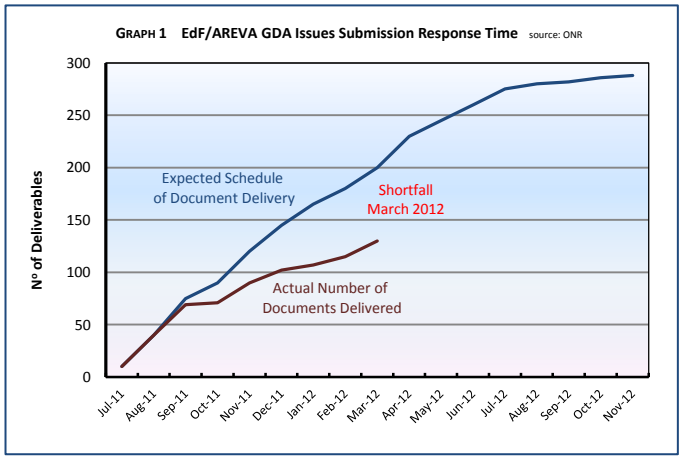
RESOLUTION PLANS: The administrative arrangements for resolving each GDA Issue is that, first, AREVA-EdF jointly submit an issue-specific *Resolution Plan*. For example, in response to the *'dropped load'* outstanding GDA Issue GI-UKEPR-IH-01 GDA Issue Revision 2, AREVA-EdF commits to a GDA Issue-specific Resolution Plan which should, first, provide detail of the analysis and justification methodologies to be adopted and, second, a timetable and milestone programme leading to the so-called *deliverables* from AREVA-EdF to ONR. Again for example, the *dropped load* Resolution Plan nominates 8 different drop scenarios, the selection of each has to be supported by a i) *Justification* report within the nuclear island for a number of different nuclear reactor state and conditions (at power, shut down, reactor pressure vessel closure head off, and so on); then there is a requirement for two supporting task to be undertaken, in this example ii) *Design Basis & Principles* document and iii) *Dropped Loads Safety Case* document; followed by updating of relevant sections of the nuclear safety case dealing with *Internal Hazards* in iv) *Advanced Draft* and v) *Final Update* forms. Overall resolution of this particular GDA Issue is projected by AREVA-EdF to occupy just over 5 months, after which the ONR has to review to accept and close the GDA Issue or, if the submission is deemed to be inadequate, refer to Issue back to AREVA-EdF for further substantiation or whatever.

Considered together, the 31 GDA Issues call for a total of about 300 sets of documentation to be submitted by AREVA-EdF for assessment by the ONR (its *Technical Support Contractors* – TSCs). As the assessment proceeds and queries raised, the ONR is likely to call for greater detail of documentation and/or it may issue specific *Assessment Findings* requiring further demonstration at a later stage of the GDA, during site-specific licensing processes, and/or at specified *'hold'* or *'milestone'* points after the nuclear safety related construction programme has commenced. As the GDA Issues resolution proceeds then the interaction of specific design changes with other safety related areas, not uncommon in a complex engineered system, will introduce further areas and topics requiring re-evaluation thereby increasing the documentation submission or *'deliverables'* beyond the originally anticipated 300 or so.

PROGRESSING THE GDA ISSUES TO RESOLUTION: It seems that satisfying the GDA Issues requirements has caused some difficulty for AREVA and EdF because, with its latest GDA Progress Report, the ONR is still awaiting a full response, noting that *"some of the deliverables"* on the resolution plan for design issues for the UK EPR *"have been late or do not provide the quality of information or depth of evidence that we expected"* adding that *"it is unlikely that the GDA Issues will be closed-out on the timescales indicated in the resolution plans"*. The timescale for the satisfactory resolution of all outstanding GDA Issues, originally intended to complete by November 2012, has now slipped to, at the earliest, March-April 2013 which takes ONR's approval of the F-DAC beyond the intended start date for the two Hinkley Point EPR NPPs. This slippage may compromise the ONR because it has stated that its current intent is *"not [to] grant Consent for nuclear island safety-related construction for a power station based on the UK EPR™ reactor generic design before the unresolved GDA Issues have been addressed to our satisfaction"*.

A sense of the timetable and milestone difficulties now being encountered in the GDA Issues process is given in Annex 2 of the most recent ONR GDA Progress Report (pp 6 and 7) and how these delays might affect the operator's (NNB GenCo) commissioning and generation start dates.

The other index of progress referred to be ONR is the *Response Deliverables vs Time* (p7 – reproduced as GRAPH 1 following). GRAPH 1 summarises the current shortfall in the submissions of the 300 or so documents that are needed to resolve the outstanding GDA Issues showing a widening gap between the expected and actual rates of deliverables in the GDA Issues programme, with about a one-third shortfall in the number of deliverables expected by March-April 2012 (~130 actual compared to ~200 expected). AREVA-EdF put this down the level of involvement with the post Fukushima Daiichi *Complimentary Safety Assessments* (CSAs) analysis and assessments required by the French nuclear safety regulator (ASN - see later) for the European Commission *Stress Tests*, particularly in France where ASN required extensive re-evaluation of the 58 operational NPPs.



Also, it is known that the workload associated with the construction and early commissioning phases of the Flamanville and Olkiluoto NPPs respectively, have eaten into AREVA-EdF's joint resources. In future months, further AREVA-EdF resourcing shortfalls may arise as progress on the Taishan NPPs develops into the construction phases that have already given rise to higher than expected technical/design demands at the Olkiluoto and Flamanville EPR sites.

In organising its own resources and, particularly, having available its *Technical Support Contractors* (TSCs), the ONR's own GDA timetable is being dislodged because it may not be possible to hold over the TSCs' availability in account of the failure of AREVA-EdF to adhere to the mutually agreed resolution plans. At this time AREVA-EdF have in preparation revised resolution plans, so it may be that further setbacks to the Hinkley Point construction start date will occur.[4]

Not only is there slippage with the AREVA-EdF resolution plans that affect the closing of the GDA Issues, but ONR reports that it could not undertake a full Step 4 structural integrity review because AREVA-EdF failed to submit a number of fracture evaluation reports in the run up to the Step 4 assessment, suggesting that AREVA-EdF were experiencing resourcing problems in the first-half of 2011, perhaps as early as March 2011.

The so-called traffic-lights *Metrics Trending Summary* (p6) suggests that significant and irrecoverable delays have occurred in a number of GDA Issues categories, particularly civil engineering, control and instrumentation, and structural integrity. Of these, civil engineering and structural integrity are lead areas that could delay construction starts for the nuclear islands at Hinkley Point C and D NPPs if, that is, the ONR maintains its commitment not to issue the F-DAC until all of the GDA Issues are satisfactorily resolved.

The latest GDA Quarterly Report (January-March 2012) states that just one of the 31 original outstanding GDA Issues under the I-DAC has now been resolved. The particular GDA Issue reported to be closed,[5] (GI-UKEPR-CE-05 GDA), relates to the applicability of the AREVA developed EPR-specific design codes, protocols and standards (ETC-C) to the civil engineering codes adopted in the UK for the seismic and overpressure performance of the primary containment structures of the nuclear island. The resolution of this GDA Issue was, essentially, a paperwork exercise necessitating cross-linking or *'delineating'* to the ETC-C protocol to the relevant international and UK codes, etc. Even so, ONR seem not to be entirely satisfied with the response of AREVA-EdF in that it has raised two new site-specific *Assessment Findings* (*seismic: AF-UKEPR-CE-69* and *overpressure: AF-UKEPR-CE-70*) which have to be satisfied before the first containment pressure tests are undertaken at the Hinkley Point and Sizewell EPR build sites.

4 As of April 30, ONR had not yet received the revised resolution plans. *"We are waiting to receive revised resolution plan programmes from EDF and Areva which will then allow the GDA team to re-baseline its assessment efforts and assess the overall impact", separately noting that "EDF and Areva have agreed to deploy additional resource, but to meet their original resolution plan delivery schedule would be challenging",* I-Nuclear. 1 March 2012.

5 Interestingly, another civil engineering GDA issue (GI-UKEPR-CE-02 GDA) also relating to the use of ETC-C in the UK has not been closed by ONR.

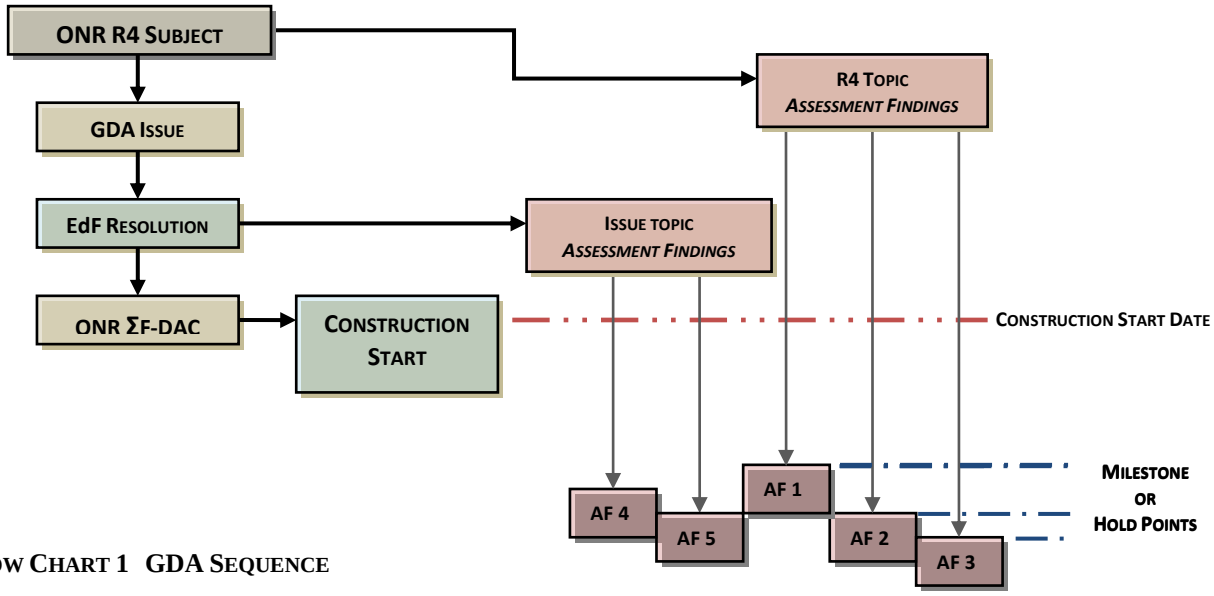
ASSESSMENT FINDINGS: The imposition of a further requirement specified by the somewhat oddly worded *Assessment Findings* (AF) is of interest because, according to ONR, the AFs are:

> *". . .*
> *Issues/findings for important safety items identified during the regulators' GDA assessment, but not considered critical to the decision to start nuclear island safety related construction of such a reactor."*

and that:

> *". . .*
> *Expectation is that they will be addressed during Phase 2 site specific projects . . these assessments findings do not affect the provision of a Final DAC or SoDA."*

In other words, although an important determinant of nuclear safety, the topic identified for an *Assessment Finding* can be considered at a later stage of the design or, indeed, at sometime during the construction and/or commissioning process. Where an outstanding GDA Issue has been raised, the GDA process from the R4 report stage to F-DAC is as follows:



FLOW CHART 1 GDA SEQUENCE

FLOW CHART 1 presents a hypothetical situation where a number of *Assessment Findings* (AF1 to AF3) have been raised at the Step 4 reporting stage and, later and separately, as a condition of the GDA resolution (AF4 and AF5). Both sets of AFs bypass the GDA process and enable the F-DAC to be issued even though specific nuclear safety topics have yet to be resolved. Each AF will, typically, have to be completed by a specified date or *milestone* in the construction and/or commissioning phase of the new build NPP.

Arguably, referring *"important safety items"* that are *"not considered critical"* for resolution until after the construction of the nuclear island has commenced (and its nuclear plant and equipment has been ordered) could only be justified on the basis that resolution of these items would not entail significant design changes or, particularly, result in a variation in the intended function and/or outcome of the nuclear safety relating to that item. In other words, AFs removed from the GDA process should only serve the purpose of endorsing a particular topic rather than provide for a fundamental review, demonstration and/or reassessment *critical* to preserving nuclear safety.

However, certain *Assessment Findings* items would seem to relate to *critical* safety issues. For example, the Step 4 report examining the structural integrity of the reactor pressure vessel and pressure circuit (RPC - ONR-GDA-AR-11-027) raises 41 separate AFs (AF-UKEPR-SI-1 to 41) that have to be addressed by the time

(milestone) that the reactor pressure vessel is installed at the new building NPP or, later, when the RPC is subjected to *'hot operations'*.[6] Resolving some, although not all, of these AFs could result in not insubstantial design changes being required to the physical form of the RPC or, if this is not practicable because the RPC had by then been manufactured and installed, a modification to the safety assessment. For example:

TABLE 3 EXTRACTS FROM ANNEX 1 ASSESSMENT FINDINGS ONR-GDA-AR-11-027

Finding No.	Assessment Findings	MILESTONE (by which this item should be addressed)
. . .		
AF-UKEPR-SI-02	The Licensee shall undertake fatigue crack growth assessments at the limiting locations on the highest reliability components post GDA as part of the demonstration of avoidance of fracture.	Install RPV
. . .		
AF-UKEPR-SI-04	The Licensee shall undertake fracture assessments to show that a postulated defect with a 10:1 aspect ratio defect would not lead to an unacceptably large reduction in the Defect Size Margin (DSM) in the overall demonstration of fracture ie the Licensee shall demonstrate that a 10:1 aspect ratio would not lead to a disproportionate effect on the DSM.	Install RPV
AF-UKEPR-SI-06	The Licensee shall engage with ND to ensure that the fracture assessment procedure used to calculate the limiting defect sizes will be suitable for supporting a UK based safety case.	Install RPV
. . .		
AF-UKEPR-SI-16	The Licensee shall produce a comprehensive material data set for use during the design and assessment process, and also to support through life operation. This will need to cover all relevant data including the basic design data and the confirmatory batch and weld specific test data from the complementary fracture toughness testing programme (Section 4.2.5.3). It will need to be clearly presented such that the pedigree of the data can be traced following the literature trail with comparison to other international data sets where possible and will need to be updated through life following developments in the field and in the light of through life testing of materials subject degradation mechanisms.	Hot Operations
. . .		
AF-UKEPR-SI-22	Where the safety case relies on stable tearing, the Licensee shall perform testing to support both the initiation value and tearing resistance values.	Install RPV
. . .		
AF-UKEPR-SI-31	For Class 2 and 3 piping systems made of austenitic stainless steel, the Licensee shall establish where stress margins are low for RCC-M Level B, C and D Service Limit conditions. Any low margins should be reviewed for their physical significance and whether they are acceptable.	Install RPV
. . .		
AF-UKEPR-SI-35	The Licensee shall undertake a fatigue design evaluation for locations in austenitic stainless steel and ferritic components that are in contact with the wetted environment to ensure that the effects of environment have been properly accounted for in the fatigue design analysis	Hot Operations
. . .		
AF-UKEPR-SI-37	The Licensee shall ensure that the site specific "Stress reports" confirm the adequacy of the design	Install RPV
AF-UKEPR-SI-38	The Licensee shall ensure that the safety cases for component internals include an analysis of the consequences of all the potential modes of failure. Alternatively the components should be added to the list of Highest Integrity Components and a case be developed accordingly.	Install RPV
AF-UKEPR-SI-39	The Licensee shall provide more explicit evidence to demonstrate that failure of the core barrel during normal or upset conditions would not lead to unacceptable fuel damage as a result of flow diversion which was not recognised and caused the reactor control system to increase power as a response.	Install RPV
. . .		

The extracted AFs of TABLE 3 might be considered to be fundamental to nuclear safety, in this case relating to the prediction and margins available in the RPC design to safeguard against in-service catastrophic failure, and should not, therefore, have been removed from the GDA process.

That said, this is not to imply that the deferral to AFs for resolution at some later stage when construction and/or commissioning is underway diminishes the GDA Issues arising in any particular Step 4 assessment. Again for example, the RPC structural integrity assessment (ONR-GDA-AR-11-027) raises 2 outstanding GDA Issues, one of which (GI-UKEPR-SI-01) identifies 7 distinct topics that require further determination by AREVA-EdF before ONR grants the F-DAC.

OTHER ONGOING ASSESSMENTS OF THE EPR

As previously noted, quite separate from the GDA process underway in the United Kingdom, on a pan-European front the European Commission required each national regulator to assess the adequacy of existing and proposed

6 RPV is installed about 2 to 3 years after the contract is awarded but its design and manufactured commences at a relatively early stage in the construction programme and *'hot operations'* are undertaken during the early stages of commissioning, so about 4 to 5 years into the construction programme.

NPPs in responding to extreme external events. This re-evaluation, referred to as *Stress Tests*, was specified in conjunction with the *European Nuclear Safety Regulators Group* (ENSREG) following the Fukushima Daiichi incident of March 2011 during which three operational NPPs were destroyed and a fourth defueled NPP was severely damaged.

In the UK, ONR (which is a party to ENSREG) was required to evaluate and report to ENSREG for peer review, producing its Country or *National Final Report* in December 2011. The ONR's National Report is a general compilation of the stress tests evaluations prepared by the individual operators (for UK NPPs EdF and the Nuclear Decommissioning Authority - NDA), although these NPP-specific evaluations have not been made publicly available. Whereas the European Commission required new NPPs under construction (but yet to be commissioned into generation service) to be subject to the Stress Tests, the ONR argued in its *National Progress Report* of September 2011 that *'As none of the three potential licensees are currently constructing a new NPP they are excluded from the UK national report on the stress tests'*. Instead, the ONR raised a *General Issue* under the GDA process which, for the EPR design, refers the requesting parties to the ONR Chief Inspector's Interim and Final Fukushima Reports of May and September 2011 respectively – this requirement in the form of a *Resolution Plan* is presently being considered by the requesting party AREVA-EdF.

However, in response to the Stress Tests, the French nuclear safety regulator, *Autorité de Sûreté Nucléaire* (Nuclear Safety Authority - ASN), required the sole French nuclear power plant operator EdF to specifically address all issues arising from the ENSREG Stress Tests requirement as these applied to the EPR NPP under construction at Flamanville and the virtually identical NPP presently planned for Penly. This complementary assessment (CSA), reported in *évaluations de la sécurité complémentaires des centrales nucléaires françaises - stress tests européens* of December 2011, addresses and identifies a number of topics and areas relating to the performance and resilience of the EPR design when subject to extreme external events. The topics and areas requiring further analysis and/or design amendment identified by ASN via the CSAs are listed in the 5th column of TABLE 2 following. Those entries not corresponding to a neighbouring GDA Issue are identified in the 1st column by the prefix **ASN –** the 11 ASN requirements, subject to the limited detail available in the CSA and GDA Issues documentation, are additional to the 31 outstanding GDA Issues.

A similar review has been undertaken of the Finnish nuclear safety regulator's (*Säteilyturvakeskus - Radiation and Nuclear Safety Authority* – STUK) stress test evaluation of the lead EPR nearing construction completion at Olkiluoto – the 8 STUK requirements are also included in the 5th column and prefixed **STU** in the 1st column of TABLE 2.

Combined, the ONR GDA and ASN-STUK post-Fukushima assessments identify about 50 serious nuclear safety issues awaiting resolution before the EPR NPP should proceed to acceptably safe operation.

1ST INTERIM REVIEW – FINDINGS

So far the information made publicly available by the ONR GDA Issues documentation (typically with each GDA Issue being no longer than a few paragraphs of somewhat generalised text) is not sufficiently detailed or explanative to provide a reliable gauge of the effort required to resolve the issues so identified. That said, the shortfalls and delays in the GDA Issues process reported by ONR suggest that the combined resources of AREVA-EdF allocated to the UK EPR programme are being stretched.

Another difficulty is with the documentation trail linking specific GDA Issues back to source document submissions made earlier in the GDA Process. For example, it is not possible to readily source the AREVA-EdF submissions to determine the detailed reasoning why, according to the ONR, it was necessary to raise a particular GDA Issue. In the absence of this information, which must be of greater detail than the specific GDA Issue document, it is not possible to confidently fathom out the technical/engineering basis of the insufficiency (or whatever) and, thus, determine the importance and, possibly, difficulty of any particular GDA Issue's resolution task.

The GDA process itself provides a route by which the caveat of completeness for granting of the F-DAC may be bypassed by deferring the topic to an *Assessment Finding* to be determined at some later milestone, usually at some stage after construction of the NPP has commenced and, in some cases, when the nuclear plant is undergoing hot (thermal) commissioning. Whereas some specific topics can only be determined when the plant or equipment is in situ (for example the in situ RPC inter-component weld inspection), for the limited number of AFs examined (applicable to the structural integrity of the RPC), it could be strongly argued that about one-quarter involved topics of a generic design nature that should have been resolved prior to the granting of the F-

DAC. The risk here is that an element of compromise may arise if, at the post-design and manufacture milestone, the *Assessment Finding* reveals a shortfall in the nuclear safety function that cannot be readily resolved practicably by redesign, etc. of the component so, as a result, there is need to relax a particular safety function, target or similar.

The GDA process is also revealed to be incomplete if, that is, any design modification brought about by the European Commission *Stress Tests* arising from Fukushima Daiichi incident are to be approved, integrated into the PCSR, and practicably implemented prior to the Hinkley Point construction start date of January 2013. The CSA process for the *Stress Tests* adopted by the French nuclear safety regulator has taken several months and is likely to stretch on for several more months before the EPR NPP at Flamanville is considered fit for purpose. Much the same applies to the more advanced construction nearing completion at the EPR NPP at Olkiluoto in Finland.

Combined, resolution of the outstanding GDA Issues, already running seriously behind schedule, added to which the European Commission *Stress Tests* evaluations[7] are likely to challenge the resources of both AREVA-EdF and ONR in meeting the F-DAC revised deadline of January-February 2013. The outcome of delays at this late stage of preparations for the new nuclear-build programme could seriously compromise the Generic Design Assessment and ONR's subsequent regulation and licensing of the EPR. This is because further delays in the issue of F-DAC coupled with the pressing urgency of the UK government to implement the *Energy Market Reforms* (EMR)[8,9] are likely to place mounting pressure on ONR to permit construction of the nuclear islands, particularly at Hinkley Point, to proceed ahead of the F-DAC which is contrary to ONR's resolve *"not [to] grant Consent for nuclear island safety-related construction . . . before the unresolved GDA Issues have been addressed to our satisfaction"*.

In fact, the ONR's closure of the first (and only to date) GDA Issue (GI-UKEPR-CE-05 GDA) on the condition that the two outstanding *Assessments Findings* (*AF-UKEPR-CE-69 & 70*) would be undertaken prior to the nuclear island primary containment pressure testing stage, leaves unresolved issues in the civil engineering design well into the construction phase, at which point in time modification to the by then built containment structures will be practicably difficult if not impossible to implement.

Such an undesirable situation could mirror the compromised position that the Finnish nuclear safety regulator, *Strålsäkerhetscentralen* (STUK), placed itself in by permitting the Olkiluoto 3 EPR NPP to proceed with construction in advance of a number of outstanding issues being resolved. The compromise, which involved nuclear safety issues, contributed to the dire commissioning delays and overspend encountered at the Olkiluoto EPR.[3]

2ND INTERIM AND FINAL LARGE & ASSOCIATES REVIEWS

The proposed **2nd Interim Review** is to report upon the interrogation of the ONR (and EA) by *Freedom of Information Act* and *Environmental Information Regulations* requests for further and specific information of the details of what are considered to be the most significant GDA Issues. Clarification will also be sought on the present (4th Quarter 2011) failure of AREVA-EdF to meet with GDA Issues timetable and milestones and, as 2012 progresses, the deliverables situation will be monitored and reported upon as and when the information becomes available.

The proposed **Large & Associates Final Review**, to be issued around October-November of 2012, will assess the appropriateness of the ONR issuing the F-DAC in advance of civil engineering construction starting on key nuclear safety features of the reactor islands at the Hinkley Point site. If the F-DAC is awarded with outstanding GDA Issues still to be resolved, the Final Review will assess the risk of compromise on the future nuclear safety of the EPR NPPs at Hinkley Point and other sites as appropriate.

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7 Additional delays may occur once that the European Council has received the findings and recommendations of the separate *Security Track* assessments now underway to the potential outcome of *beyond-design-basis threats* (mainly terrorist attack), and if such actions could result in a Fukushima-like radiological event.

8 *Energy Market Reforms* (EMR) as specified in the *Draft Energy Bill*, HMSO 22 May 2012.

9 Progress on other aspects of nuclear safety where design changes rather than simply paperwork compliance are required, has not been reported by the ONR. Nuclear safety issues raised by events at the Fukushima Daiichi NPPs may have both generic and site-specific implications for the UK new build EPRs destined for Hinkley Point and Sizewell, and EdF's commercial partner has expressed concern about the mounting (and largely unresolved) costs associated with the EPR.

TABLE 2 OUTSTANDING GDA ISSUES FOR AREVA-EdF EPR DESIGN & ASN CSA REQUIREMENTS

ITEM	GDA ISSUE	ONR REF	DESCRIPTION	ASN CSA SUBJECT – FLAMANVILLE/PENLY EPR
INTERNAL HAZARDS				
GDA 1	Dropped Loads and Impact	GI-UKEPR-IH-01 GDA Issue Revision 2	Drop load impact on reactor plant and fuel pond, etc., requires further analysis and substantiation	
GDA 2	Verification & Validation Studies	GI-UKEPR-IH-02 GDA Issue Revision 2	Internal hazards associated with and deriving from flooding of the site generally and nuclear island specifically.	ASN requires EdF reinforce the robustness of the equipment contributing to the management of a whole-site flooding (H1) situation.
GDA 3	Internal Flooding and Operator Actions	GI-UKEPR-IH-03 GDA Issue Revision 2	Internal flooding arising from failure, etc of internal tanks and reservoirs and external barriers and drainage	ASN requires revision of PSA 1 and 2 in account of internal flooding. STUK requires evaluation of modifications necessary to counter threat against loss of EDGs in the event of flooding.
GDA 4	Substantiation Break Preclusion Claims for RCC-M Components	GI-UKEPR-IH-04 GDA Issue Revision 2	Internally generated missile (debris) penetration and damage	
ASN 1				EdF is required to re-evaluate the maintenance and management strategy for the systems shared between the spent fuel pool and the reactor (such as the fire-fighting water system) in order to minimise their temporary unavailability.
CIVIL ENGINEERING				
GDA 5	Hypothesis and Methodology Notes for Class 1 Structures	GI-UKEPR-CE-01 GDA Issue Revision 1	Nuclear Island built structures requiring further justification on global stability, lack of UK-applicability, no UK ground data, long term consolidation of foundation structures omitted, non-compliance of opening reinforcement	
GDA 6	Use of ETC-C for the Design and Construction of the UK EPR™	GI-UKEPR-CE-02 GDA Issue Revision 1	Inadequate cross-referencing to UK structural Codes and Buildings Regulations.	
GDA 7	Beyond Design Basis Behaviour of the Containment	GI-UKEPR-CE-03 GDA Issue Revision 1	Beyond-design-basis event response and performance of the primary containment structure insufficiently justified	
GDA 8	Containment Analysis	GI-UKEPR-CE-04 GDA Issue Revision 1	Modelling and analysis of the primary containment structure(s) nor adequately demonstrated, seismic methodology and stress models comparisons not	

			possible, foundation system inadequately modelled, mostly related to the inner containment reinforced concrete shell.	
GDA 9	Reliability of the ETC-C	GI-UKEPR-CE-05 GDA Issue Revision 1	Reliability of the seismic design and overpressure design code unsubstantiated.	Now closed out (28 March 2012) but the UK EPR design(s) for the Hinkley Point and Sizewell sites *"may require further justification"* – para 41 of ONR-GDA-AR-12-001 and raises new Assessment Findings *AF-UKEPR-CE-69* and *AF-UKEPR-CE-70* that require substantiation of seismic and overpressure performance ahead of the first containment pressure test.
GDA 10	Seismic Analysis Methodology	GI-UKEPR-CE-06 GDA Issue Revision 1	Justification of the seismic performance of the raft foundation design inadequate.	
STUK 1				STUK requires fire fighting system within nuclear island and other nuclear safety related areas to be verified.
FAULT STUDIES				
GDA 11	Heterogeneous Boron Dilution Faults	GI-UKEPR-FS-01 GDA Issue Revision 0	Safety case for boron (neutron absorbent) dilution fault events required.	
GDA 12	Diversity for Frequent Faults	GI-UKEPR-FS-02 GDA Issue Revision 0	High hot-leg (primary circuit) pressure trip diversity not included requiring a fresh design.	
GDA 13	Spent Fuel Pool Safety Case	GI-UKEPR-FS-03 GDA Issue Revision 2	Fault analysis should include events relating to flask loading area	
STUK 2				STUK requires evaluation of jury-rigged heat removal systems from the spent fuel pond water, including possible use of the fire water system.
GDA 12	Steam Generator Tube Rupture Safety Case	GI-UKEPR-FS-04 GDA Issue Revision 1	Leak-before-break steam generator rupture, safety case submission does not include recent design changes	
STUK 3				STUK requires consideration of proving independent feedwater means, route and source to steam generators secondary side at normal operating pressure.
GDA 14	Design Basis Analysis of Essential Support Systems	GI-UKEPR-FS-05 GDA Issue Revision 0	Missing elements relating to loss of cooling chain faults, electrical system faults and HVAC (heating	

			and air conditioning) and other essential support systems have not been identified	
ASN 2				ASN require EdF to evaluate the robustness of the Flamanville 3 EPR reactor with respect to complete loss of the primary and alternate heat sinks, and the combination of this with a general electrical power loss situation.
ASN 3				ASN requires EdF, EDF to assess the consequences of the successive loss of, first, the primary heat sink, and then the alternate heat sink on the safety of the reactor. This configuration has only been assessed for the spent fuel pools and has to be combined with a total loss of the electrical power supplies. EDF is required to conduct complementary studies to assess the consequences of a complete loss of the primary heat sink (ESWS) and alternate heat sink (SRU) on the damage to the reactor core. Regarding the assessment of the consequences of heat sink loss on the spent fuel pools, the time lapses before the core becomes exposed are purported to be longer than the time specified in the baseline safety standard: a few days with maximum residual power in the spent fuel pool building, and about one week in the states other than APR - RCD. These times seem compatible with an external intervention and with the means that EDF envisages implementing to make an additional water make-up. EDF is required to conduct complementary studies to assess the consequences of a complete loss of the primary heat sink (ESWS) and alternate heat sink (SRU) of the Flamanville 3 EPR on the damage to the reactor core.
ASN 4				ASN requires that the ultimate make-up means must have substantial autonomy and function in a situation of total electrical power supply loss – this relates to the other safety objectives of this ultimate make-up requirement i) to be functional at the natural hazard levels considered in the CSAs, ii) to be able to be implemented under the

				particular conditions that may be present on the site, iii) especially skyshine irradiation from the fuel stored in the BK building spent fuel pit (low water inventory), iv) to be able to be implemented within a time scale compatible with the envelope scenario considered, and v) to allow boration of the water injected into the primary system.
CONTROL & INSTRUMENTATION				
GDA 15	Design Information for Non-Computerised Safety System Required	GI-UKEPR-CI-01 GDA Issue Revision 2	Hardware back-up system design not submitted to GDA and extent of diversity unknown, no basic safety case submitted	
GDA 16	Protection System Independent Confidence Building Measures	GI-UKEPR-CI-02 GDA Issue Revision 2	The method of testing the central control and instrumentation system and its statistical interpretation (validation), number test proposed at 5000 but required (ONR) 50,000, too many elements have yet to be defined.	
GDA 17	Claims, Arguments, Evidence Trail	GI-UKEPR-CI-03 GDA Issue Revision 2	CAE trial requires revision and improvement.	
GDA 18	SMART Devices	GI-UKEPR-CI-04 GDA Issue Revision 1	Method and standard of qualification of SMART devices yet to be defined – a significant programme of work may be required.	
GDA 19	Obsolescence of SPPA T2000 Platform	GI-UKEPR-CI-05 GDA Issue Revision 2	Siemens S5 systems obsolete and not available for UK EPR so replacement systems has to be defined and proven and this may render presently developed code unusable	
GDA 20	Absence of Adequate C&I Architecture	GI-UKEPR-CI-06 GDA Issue Revision 3	Comprehensive justification of diversity and independence of the control and instrumentation systems required, parts of which have yet to be designed	
ASN 5				ASN requires further demonstration of NPPs to manage a degraded situation (H1 or H3) on several plant units simultaneously on the same site – ie Sizewell B and C and/or D.

ESSENTIAL ELECTRICAL SYSTEMS				
GDA 21	PCSR Presentation of Claims Arguments and Evidence	GI-UKEPR-EE-01 GDA Issue Revision 1	Pre Construction Safety Case (PCSR) issues with electrical distribution systems, further substantiation required.	
ASN 6				Further diversification of the '2 hour' standby batteries for continuing instrumentation and control functions to avoid Cliff Edge effects
ASN 7				SBO on-site generator sets to be *'hard-cored'* in accord with ISRN specification for earthquake and flooding tolerance
STUK 4				SBO generator set required to be fitted with auto-start and possibly increasing the quantity of fuel oil stored on site.
REACTOR CHEMISTRY				
GDA 22	Combustible Gas Mitigation	GI-UKEPR-RC-01 GDA Issue Revision 1	Failsafe operation of Passive Autocatalytic Recombiners (hydrogen sparkers) (primary containment + 6 plant rooms) requires further substantiation	
GDA 23	Control and Minimisation of Ex-Core Radiation	GI-UKEPR-RC-02 GDA Issue Revision 0	Mechanisms of fuel clad CRUD and other radioactive (activated) materials transfer in the primary system and fuel storage ponds requires further demonstration	
STRUCTURAL INTEGRITY				
GDA 24	Avoidance of Fracture	GI-UKEPR-SI-01 GDA Issue Revision 2	Crack and fracture detection, including tolerable crack lengths, etc., in High Integrity Components (reactor pressure vessel and primary circuit pipework, etc) – submission from AREVA-EdF late and ONR unable to complete its own review.	
GDA 25	RPV Surveillance System	GI-UKEPR-SI-02 GDA Issue Revision 1	Interpretation of sacrificial samples within reactor pressure vessel requires further justification,	
STUK 5			STUK requires evaluation of the severe management systems effectiveness of managing primary containment integrity.	
RADIATION PROTECTION				
GDA 26	Radiological Zoning and Bulk Shielding	GI-UKEPR-RP-01 GDA	Further information required on effectiveness of	

		Issue Revision 0	radiological zoning and worker dose for the nuclear island required.	
STUK 6				STUK requires re-evaluation of minimum 1m fuel pond water cover to act as sufficient shielding to enable essential mitigation measures and actions to be implemented in the fuel pond building.
HUMAN FACTORS				
GDA 27	Inadequate Substantiation of Human Based Safety Claims	GI-UKEPR-HF-01 GDA Issue Revision 0	Further information and substantiation required on human error events, particularly the so-called Type A and B events, Type C events require further substantiation, and violation potential evidence insubstantial.	
STUK 7				STUK is still evaluating organisational issues which include adverse involvement of all three NPPs on the Olkiluoto site.
ASN 8				To prevent reactor fuel core being damaged (melt down) in a loss of off-site electrical power (Station Blackout – SBO) EdF is required to put in place: i) to extend the electrical supply for the functions supplied by the "12-hour" batteries by implementing supplementary fixed or mobile electrical power sources; ii) to put in place a means of restarting the severe accidents I&C in the event of it is has been cut-off; iii) to put in place devices and mobile electrical power supply means necessary to ensure the habitability of the control room, iv) for the spent fuel pool, supply one cooling channel of the PTR system or a water make-up from the tank of the JAC system; v) to integrate the essential information concerning the development of the situation in the fuel building (fuel pool temperature, water level measurement, etc.) on the severe accidents I&C and vi) the severe accidents console (PAG) which are supplied by the "12-hour" batteries,

				vii) extending the autonomy: mobile means of pumping fuel from the main generator set tanks to replenish the SBO generator sets, viii) extension of the duration of electrical supply for essential functions by deploying supplementary fixed or mobile electrical power sources, and ix) means of restarting the severe accidents I&C.
CROSS-CUTTING TOPICS				
GDA 28	Categorisation of Systems Structures & Components	GI-UKEPR-CC-01 GDA Issue Revision 1	Review of all PCC-2 to PCC-4 events required together with identification of all Safety Related Systems (SRSs) required.	
ASN 9				Level 1 and 2 Probabilistic Safety Assessments (PSAs) to be revised to take account of i) internal reactor events, ii) events associated with fuel pond building, iii) earthquake; iv) internal fire and explosion, and v) internal flooding
GDA 29	Consolidated Final GDA Submission	GI-UKEPR-CC-02 GDA Issue Revision 3	Management trail of GDA invoked changes etc., requires reliable method of management and updating.	
ASN 10				Lightening strike in excess of 200kA for equipment located beyond mesh cage required.
GDA 30	Consider and Action Plans to Address the Lessons Learnt from the Fukushima Event	GI-UKEPR-CC-03 GDA Issue Revision 3	Requirement to address lessons learnt from Fukushima Daiichi incident of March 2011 and submission of any design changes relating thereto – the AREVA-EdF Resolution Plan for this specific GDA Issue comprises 21 pages outlining the range of the tasks to be undertaken all to within a somewhat optimistic completion timescale of November 2012.	
ASN 10				EPR NPP site now required to be autonomous for two weeks, notably after earthquake or flooding leading to isolation of the site, particularly for fuel and oil reserves for on-site generators
ASN 11				Further analysis and justification required by ASN from EdF on missing assessment on fuel pond cooling following total loss of off- and on-site electrical

				power supplies and to include for i) fuel oil transfers between on-site generators, ii) resupply of ASG water tanks form freshwater ponds/reservoirs, iii) means of controlling explosion risk in the event of loss of ventilation in the spent fuel building, iv) provide a passive means of opening fuel pit area vent to inhibit pressure build-up, v) provide for gravity make up of fuel pond water, and vi) improve robustness of fuel pond area instrumentation.
STUK 8				STUK's requirements after the Fukushima accident, are for the licensee (TVO) to report on the following issues regarding exceptional extreme external conditions: i) the adequacy and availability of water supply for the cooling of reactor and spent ii) fuel storage; iii) the reliability of heat removal to ultimate heat sink; iv) the impact of extreme high seawater level on the cooling systems of the spent fuel v) storage; vi) the impact of beyond design basis high and low outside temperatures on the safety vii) functions; and viii) the applicability of procedures, and the adequacy of personnel, equipment and facilities.