2ND INTERIM REVIEW

OF THE

ONR GENERIC DESIGN ASSESSMENT

OUTSTANDING ISSUES

CLIENT: WILKINSON ENVIRONMENTAL

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03 MARCH 2012	R3206-I2-R33		**3 SEPTEMBER 2012**

2ND INTERIM REVIEW

GENERIC DESIGN ASSESSMENT OF THE PROPOSED GENERATION III NUCLEAR POWER PLANTS

SUMMARY

This 2nd Interim Review of the Generic Design Assessment identifies continuing difficulties with Office for Nuclear Regulation's (ONR) progression towards the granting of the Final Design Acceptance Compliance (F-DAC) for the European Pressurised Reactor (EPR) nuclear power plant (NNP) design.

OUTSTANDING GDA ISSUES

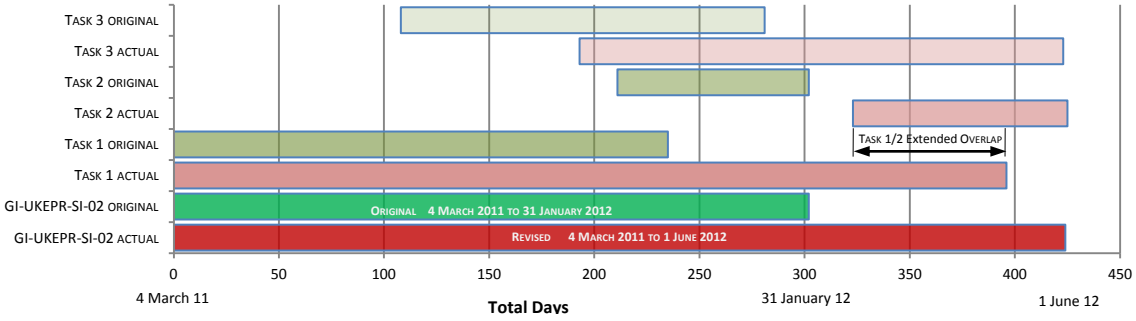
Over the last quarter (April-June 2012) a further two GDA Issues have been closed-out, leaving 28 GDA issues to be resolved within the remaining six months to the ONR's F-DAC target date of the close of 2012.

The 28 outstanding GDA Issues relate to concerns and shortfalls across a number of sectors of the pre-construction nuclear safety case (PCSR). Each of these outstanding GDA Issues has to be closed-out before the ONR will proceed to issue the F-DAC enabling construction to commence at the Hinkley Point site nominated for the UK's first EPR NPP – the outstanding GDA Issues are identified in TABLE 3 and TABLE 4.

REVISION OF THE RESOLUTION PLANS

As previously reported (R3206-I1), the rate of resolving the outstanding GDA Issues was causing the ONR some concern, particularly because of slippage in the time scales set for the *'deliverables'* in the various Resolution Plans (RPs), mostly arising because of lateness and/or poor quality of the AREVA-EdF submissions. In order to facilitate progress, ONR has revised the greater number (20 out of 28) of the RPs associated with each of the individual outstanding GDA Issues.

Full details of the RP revisions are not publicly available but, from the little that has been published, it is clear that the timescales for components of the required AREVA-EdF submissions and their assessment have been lengthened, whereas the overall time period for final resolution of the particular outstanding issue has to remain within the overall F-DAC target date. This has resulted in different segments of the assessment overlapping as shown by the now closed-out embrittlement ageing GDA Issue GI-UKEPR-SI-02:



For this particular GDA Issue, the original forecast of 302 days (shown ■) to close-out compares to the time actually taken of about 424 days to actually complete to close-out (shown ■). The dominant slippage occurs in the completion of **TASK 1** taking 396 compared to 235 days with the effect that continuing involvement with **TASK 1** intruded into the period set aside for the Pre-Construction Safety Report (PCSR) update of **TASK 2,** with this **TASK 1-2** overlap for the revised RP being considerably greater than that originally planned. If and to what extent this overlap into **TASK 2** possibly hindered the final update of the PCSR cannot be determined from the information presently available in the public domain.

Another means of lessening the demand upon AREVA-EdF (and to some extent on the ONR's resourcing for its own assessment) would be for the ONR to reduce and/or relax the scope and detail of the submissions required by the revised RPs. Also, the effort required by the RP could be reduced if elements of the previously required submissions have now been deferred to a later date in the construction/commissioning phases via raising of one or more *Assessment Findings* (as discussed in the 1st Interim Review - R3206-I1). However, information relating to this possible means of lessening the submission/assessment burden of the individual GDA Issues has not been made publicly available by ONR.

OPAQUENESS OF THE OUTSTANDING GDA ISSUES CLOSE-OUT

In 2008, when setting out the objectives of the GDA the HSE promised to *". . introduce high standards of openness and transparency to the GDA process".*

However, taking just one of the closed-out GDA Issues as example (as above GI-UKEPR-SI-02), none of the source reference documents relied upon by the ONR to identify this particular topic as a GDA Issue are publicly available. Also, and for the same GDA Issue, none to the documents submitted by AREVA-EdF to resolve the issue, as identified in the original RP are available; the *revised* RP as referred to above, itself is not fully available; and the ONR's report explaining the reasoning underpinning its decision to close-out this particular GDA Issue is also not publicly available.

In other words, ONR's response to HSE's commitment to openness has been restricted to making public just its commentary on the GDA process without necessarily justifying how it went about, and the facts upon which it has based, its reasoning in, first, identifying and raising the particular topic as a GDA Issue. Second, there is nothing whatsoever publicly available conveying in which ways, and for what reasons, ONR reached its decision to close-out the particular GDA Issue. And, third, whereas it is known that resolving the GDA Issue required amendment to the nuclear safety case (ie the PCSR), the relevant sections of the original and amended PCSR have not been made publicly available.

MEETING THE F-DAC TARGET DATE OF YEAR CLOSE 2012

ONR has opined that even with the recent improvement in the rate of submissions from AREVA-EdF, although now measured with respect to the *revised* RP *deliverables* schedule, that meeting the F-DAC target date of year close 2012 will be a *'considerable challenge'*. In fact, there is little sign of improvement of the *deliverables* performance of AREVA-EdF with ONR repeating the now established mantra echoing its concern raised in the two previous ONR quarterly reports Q4 2011 and Q1 2012:

> *". . . some of the deliverables have been late or did not provide the required quality of arguments or evidence and these topics are highlighted . . indicating that if actions taken do not continue to improve matters, it is unlikely that the GDA Issues will be closed-out on the timescales indicated in the* {revised} *resolution plans".*

The timescales referred to in the majority of the revised RPs are set to 21 November 2012, thereby leaving little margin to accommodate slippage of individual GDA Issues until the end of that same year F-DAC target date.

There is one specialised area that must be invoking considerable concern for the ONR. This is the field of instrumentation and control (I&C) which is absolutely key to the operation and nuclear safety of the NPP. Although not specifically addressed by the ONR in its latest GDA Quarterly Progress Report, all six of the outstanding GDA Issues linked to I&C have been identified to have *'major risks apparent'* and that *'resolution of the GDA Issue is unlikely to be achieved by performing the planned safety analysis or changes to the design of the NPP {EPR} and further GDA Issues Actions and amendments to the Resolution Plan are required".*

In effect this is forewarning that not only are the I&C GDA Issues unlikely to close-out by the F-DAC target date but, moreover, further outstanding GDA Issues are expected to arise in the remaining few months to the F-DAC date with, surely, the consequence that this group of I&C outstanding GDA Issues will significantly spill over into 2013 and, possibly, beyond.

PROGRESS OF THE EPR BEYOND THE GDA PROCESS

EPR NPPs are presently under construction at Olkiluoto (Finland), Flamanville (France) and Taishan (China), and the EPR design is under generic assessment by the ONR (UK) and, similarly, for design certification by the Nuclear Regulatory Commission (NRC – USA).

At the Finnish and French construction sites, very significant time and cost overruns have occurred and, in Finland, there are currently inter-party disputes on costs and liabilities between the designer (AREVA) and the operator (Teollisuuden Voima Oy – TVO). Nothing has been publicly reported for the Taishan EPR construction programme, although unlike the European builds, the Chinese plants are not contracted on a *turnkey* basis, with the Chinese state company sharing and having much greater control over works progress (and the reporting thereof).

A proportion of the cost and time overruns experienced at Olkiluoto and Flamanville stem from design changes necessitated as the design and construction experience matured. It is clear that at the time that the Olkiluoto EPR order was placed (in 2003), a reliable generic assessment of the EPR design had not been undertaken. In late-2008 the Finnish nuclear safety regulator *Säteilyturvakeskus* (STUK) made public its concern over unresolved issues centring around the incomplete design and its reservations about I&C architecture, with this being subsequently picked up by the French regulator (*l'Autorité de Sûreté Nucléaire* – ASN), then I&C issues become known to the ONR (2009) and the NRC (2010). Some consider that deficiencies and uncertainties over the I&C platform should have been known to AREVA much earlier during the detailed design activity phase of 1995 to 1997 yet, as demonstrated by the ONR's continuing concern, little progress has been made by AREVA over the last four years and, indeed, since the EPR NPP detailed design was settled in about 1997 or, at least, since the first EPR build at Olkiluoto was confirmed in 2003.

The point here is that I&C issues have been attracting international regulatory attention for some time but there is little progress to show to date. Set against the international difficulties in settling these same I&C issues, it follows that the expectation that the same EPR UK I&C outstanding GDA Issues will be completely closed-out in time to the ONR's F-DAC

target date of the close of 2012, would seem to be an unobtainable objective, a situation that the ONR has a duty to publicly acknowledge.

FINAL LARGE & ASSOCIATES REVIEWS

The 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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2ND 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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2ND 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

This 2nd Interim Stage Review considers and comments on the progress of the Generic Design Assessment (GDA) reported by the Office for Nuclear Regulation (ONR) in its Progress Report for the period April to June 2012.

Introduction to and background of the GDA is given by the Large & Associates 1st Interim Review R3206-I1 as this mainly relates to the pre-licensing assessment of the European Pressurised Reactor (EPR). At completion of the STEP 4 assessment in December 2011, the ONR awarded an *Interim Design Acceptance Compliance* (I-DAC) for the EPR but, at that time, there remained 31 outstanding GDA Issues to be resolved between ONR and the *Requesting Party*, AREVA-EdF.[1]

ONR has, in several statements, committed to the undertaking[2,3] *"not [to] grant Consent for nuclear island safety-related construction . . . before the unresolved GDA Issues have been addressed to our satisfaction"*. Thus, all outstanding GDA Issues have to be satisfactorily resolved before the *Final Design Acceptance Compliance* (F-DAC) can be issued permitting construction works at any of the proposed UK new-build sites to proceed. However, R3206-I1 identified the raising of *Assessment Findings* as a possible device to set aside certain design issues for resolution at a later time in the construction programme, thereby enabling the F-DAC to be issued ahead of complete and thorough resolution of aspects of certain outstanding GDA Issues.

CURRENT STATUS OF THE GDA – AUGUST 2012

Since the previous ONR progress report (January - March 2012), the ONR reported in its April-June 2012 quarterly Progress Report that two further outstanding GDA issues have been resolved. These are

TABLE 1 OUTSTANDING GDA ISSUES RESOLVED AT 30 JUNE 2012

ONR PROGRESS	ONR REF	DESCRIPTION	FURTHER CONDITIONS/ASSESSMENT FINDINGS
Jan-March 2012[4]	GI-UKEPR-CE-05 GDA Issue Revision 1	Reliability of the seismic design and overpressure design code unsubstantiated.	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* requiring substantiation of seismic/overpressure performance prior to 1st containment pressure test.
April-June 2012	GI-UKEPR-SI-02 GDA Issue Revision 1	Interpretation of sacrificial samples within reactor pressure vessel requires further justification, with respect to the ageing forecasting for the RPV.	ONR closed-out report not publicly available.
April-June 2012	GI-UKEPR-RP-01 GDA Issue Revision 0	Further information required on effectiveness of radiological zoning and worker dose for the nuclear island required.	ONR closed-out report not publicly available.

GI-UKEPR-SI-02: During it operational service lifetime the reactor pressure vessel (PRV) undergoes material degradation. A strong contributor to this degradation is neutron irradiation emanating from the fissioning fuel core which promotes embrittlement of the ferritic steel RPV body. As a result, there occurs a progressive shift in threshold of the brittle-to-ductile fracture transition temperature[5] requiring corresponding

1 AREVA-EdF is the active design and operation element of the joint venture NNB Generation Company Ltd and 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.

2 *GDA Issue close-out for the UK EPR reactor*.

3 *Generic Design Assessment, Progress Report, Reporting Period 1 April 2012* – 30 June 2012, ONR

4 This outstanding GDA Issue was reported closed-out in the ONR 1st Quarterly Report 2012 – see R3206-I1.

5 Since, with increasing hours of operation, the RPV shell becomes more embrittled the temperature-pressure regime has to be modified to avoid the RPV being pressurised when in (or near) the embrittled condition – the Temperature-Pressure Management Rules (TPMR) defines the temperature-pressure envelope to avoid for catastrophic failure – over the lifetime of the RPV the brittle-ductile threshold temperature increases requiring a corresponding adjustment to the TPMR. The overall situation is challenging in that any small defects (ie cracks) present in the body and, particularly weldments of the RPV, are expected to propagate (grow in length) lengthening towards the *'critical crack length'* at which catastrophic failure is abrupt and not reliably predictable (like the sudden growth in a crack in a pane of glass which is a brittle material) – the actual design of the RPV is based on the existence of a hypothetical (crack) defect in size (limiting defect size) at or below that detectable by the NTE technique available at the time of manufacture, although subsequent NDE detection qualifies this with a margin on defect size and a crude probabilistic approach where plausible defects are sub-divided into *likely*,

changes in the operating regimes of the primary pressure circuit that includes the RPV. Particularly sensitive to RPV embrittlement are the *Temperature-Pressure Management Rules* (TPMR).

Over the RPV service lifetime (~60 or more years) the operator carries out an *in-service* irradiation surveillance programme that includes capsules containing coupons representative of the RPV materials (base metals and weldments) being periodically withdrawn from the RPV. The condition of each of these material coupons is checked to verify the ageing formulae deployed to determine the TPMR. From this correlation, the operator is able to assess the degradation of the RPV materials and, particularly important, the likelihood of defect (crack) growth in localities of the RPV which are difficult to access for in situ non-destructive examination (NTE).[6]

For this particular GDA Issue AREVA-EdF were required to submit a range of substantiation arguments, including data and the results of experimental programmes to demonstrate the best irradiation damage correlation, particularly for higher energy levels of irradiation. This further work was required because ONR considered that the planned position of the coupon capsules located in the region of the fuel core thimble were not truly representative of the irradiation dose experienced by the RPV shell materials and weldments.

As a whole, the further work and submissions for this particular GDA Issue are specified in a Resolution Plan (RP) - this particular RP comprised three tasks:

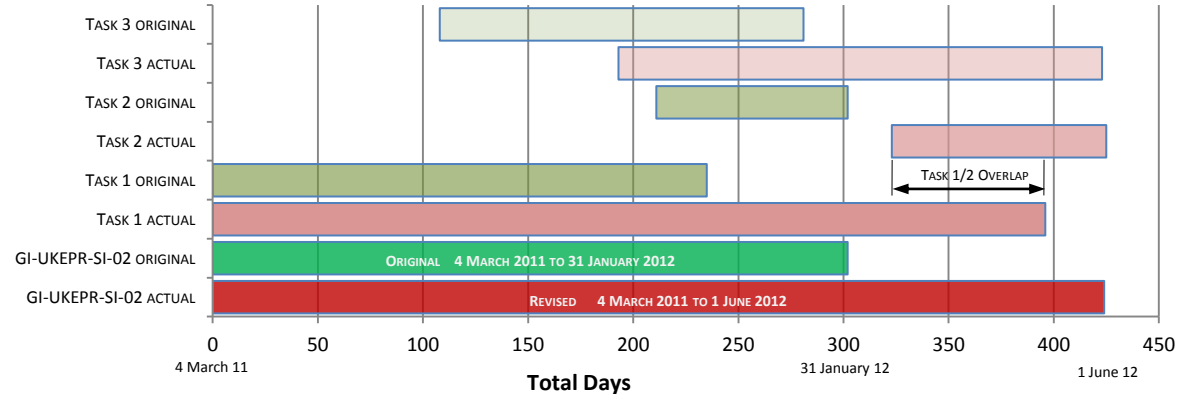
TASK 1 - Production of Reports and ONR Assessment of RPV Embrittlement Data and Models

TASK 2 - Update of PCSR[7] and Supporting Documents

TASK 3 - Convergence Meetings

The RP scheduled for this GDA Issue was originally planned to commence 4 April 2011 and complete 31 January 2012, that is about 248 days or over about 10 calendar months - the actual delivery of the GDA Issue occupied 325 days or about 14 calendar months.

CHART 1 TIME SCHEDULE SLIPPAGE FOR GDA ISSUE GI-UKEPR-SI-02



The above **CHART 1** shows the timescales originally scheduled for the GDA Issue GI-UKEPR-SI-02, with its original RP GI-UKEPR-S102-RP that forecast 302 days (shown ■) to close-out the specific issue, compared to the time actually taken of about 424 days[8] to complete (shown ■) in accord with its *revised* Resolution Plan G1-UKEPR-SI02-RP.

The dominant slippage occurs in the completion of **TASK 1** taking 396 compared to 235 days with the effect that continuing involvement with **TASK 1** intruded into the period set aside for the PCSR update of **TASK 2,** with this **TASK 1-2** overlap for the revised RP being considerably greater than that originally planned. If and

unlikely or *highly unlikely*. Other factors, such as fatigue, hydrogen migration and solubility in the RPV materials, etc., also contribute to the degradation of the RPV during it service operational lifetime.

6 The intent is that capsule samples periodically withdrawn from inside the RPV will exhibit that same degradation as the actual materials and weldments used in the RPV fabrication. This requires a firm and reliable *ageing model* that extrapolates the inner position of the capsules, and their degradation, etc., to the same for the major shell or ring component of the RPV enclosing the fuel core thimble that is located slightly more radially remote from the fuel core than the capsules. Once that the reactor has been in operation and is irradiated, crack detection is difficult because, usually, all of the fuel core and RPV innards have to be removed for the NDE equipment to gain access. Full *in-service* RPV NDE for the presence of cracks and crack growth is usually undertaken at the 10 year periodic review stage so the *ageing model* reliability has to extend over this period.

7 For this particular GDA Issue relocation of the capsules and/or change of the TPMR would require amendment of the PCSR.

8 Days to completion for CHART 1 are total *calendar* days, whereas the ONR Resolution Plans seem to use *working* days.

to what extent this overlap influenced the **TASK 2** final update of the PCSR cannot be determined from the information presently available in the public domain.[9]

Interestingly, at about the same time that the ONR closed-out GDA Issue GI-UKEPR-SI-02, the Belgium national nuclear safety regulator, *Federaal Agentschap voor Nucleaire Controle* (FANC), ordered the Electrabel Doel 3 pressurised water reactor (PWR) NPP to remain shut down following discovery of cracking of the RPV shell in the region of the fuel core. Although full details of the Doel 3 cracking are not publicly available, the limited information known suggests several planar defects (in-shell and parallel to the vessel wall) in the parent metal were generated by a high hydrogen content of the steel and/or hydrisation development over the reactor operational lifetime. If so, the Doel 3 longer term defect development and enforced shut down may have widescale implications for all RPV defect (crack) management systems, including the EPRs presently at the design-construction stages.[10]

GI-UKEPR-RP-01: This outstanding GDA Issue related to the radiological zoning required for the restriction of exposure to ionising radiations to the operator's employees and other persons present in and/or nearby the nuclear island.[11] In effect, the ONR did not consider the design substantiation presented by AREVA-EdF to justify the radiation shielding effectiveness and radiological classification of various areas in and around the Nuclear Island to be sufficient.

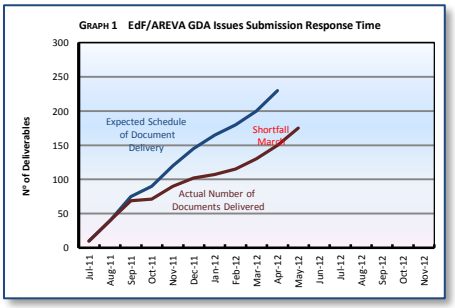
Essentially GI-UKEPR-RP-01 would not have involved AREVA-EdF in any substantial design revisions since it was mainly a paperwork exercise compiling and submitting an *'overview document'*. Although the GI-KEPR-RP-01 RP was not subject to revision, closing out this particular GDA Issue was about three months overdue the originally set mid-April 2012 target date.

REVISED RESOLUTION PLANS

In its latest quarterly progress report, ONR continues to express concern over the slippage of AREVA-EdF in responding to the requirements of the individual GDA Issues, particularly that with just six or so months remaining (at the end of June) to resolve the 28 outstanding GDA Issues. However, although ONR reports that AREVA-EdF have *'strengthened their resources and improved the quality and timelines of their submissions'*, it nevertheless notes that

> " . . . *We do not underestimate the challenges that this poses to EDF, AREVA and ourselves. It requires sustained effort, rigorous project management, and key technical challenges to be addressed. But it is achievable and we will ensure that the resources that are required from both regulators are provided. It is in EDF and AREVA's hands to deliver their part.*"

Large & Associates's first interim report R3206-I1 reproduced the ONR *Response Deliverables vs Time* as **GRAPH 1** (right) summarising the then March 2012 shortfall in the submissions of the 300 or so documents needed to resolve the outstanding GDA Issues. Then there was a worsening shortfall in the number of deliverables expected by March-April 2012 (~130 actual compared to ~200 expected). In its latest Progress Report ONR claim that the AREVA-EdF rate of document delivery has improved and that, if this can be sustained, then all of the remaining 28 outstanding GDA Issues can be closed by the end of 2012.



In fact, achieving such a rapid turnaround from the past flagging situation requires not only a consistent improvement in the rate of deliverables from AREVA-EdF but also significant revision to the RPs[12,13] for the

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9 The ONR has not made publicly available the complete *GI-UKEPR-SI-02 Revised Resolution Plan* (nor any other) so it is not possible to determine the detailed changes (if any) to the requirements of the revised Resolution Plan. Similarly it is not know if any revision has been made of the GDA Issue in order that the Revised Resolution Plan may be completed – these topics are subject to *Freedom of Information Act 2000* requests (see 3206-1 and 3206-2) yet to be answered by ONR

10 ONR considers in-shell defects to be a secondary risk to crack development in the weldments and that any sizeable defects would be detected at the post manufacturing stage *". . I conclude that significant volumetric defects and planar defects parallel to the surface should be detected readily. However it is possible that smooth planar defects may not be detected simply because they are not well oriented to the {ultrasonic) beam."* – the reported RPV defect at Doel3 may have reversed this line of reasoning.

11 The *Nuclear Island* is usually considered to include the primary containment, enclosing the nuclear reactor primary circuit, and the irradiated (spent) fuel building, enclosing the spent fuel pond.

12 A specific *Resolution Plan* is associated with each outstanding *GDA Issue* being established at the time that the GDA Issue is raised. For any one GDA Issue the *Resolution Plan* includes an overview of the scope of the task involved; a set of actions to achieved the tasks; identification of the submissions (ie the *Deliverables*), including inter-relationships with other GDA Issues, required by the ONR; justification of the adequacy of the scope and content of the

greater proportion of outstanding GDA issues. A detailed example of the revised G1-UKEPR-SI02-RP RP is shown in **CHART 1**. According to the ONR, **GRAPH 2** (below) shows the collective outcome of the revisions to the individual RPs each identified in **TABLE 4**.

ONR has not published the full versions of revised RPs with only the single page bar chart summary of the revisions being made publicly available. However, the ONR has published what it claims to be the overall outcome of all of the revised RPs whereby the target date of the end of 2012 for closing out the remaining 28 outstanding GDA Issues can be met, even though a *"considerable challenge"*.

Compared to **GRAPH 1**[14] (above right) the *Revised Schedule of Document Delivery* (—) of **GRAPH 2** (right) is to be achieved either by

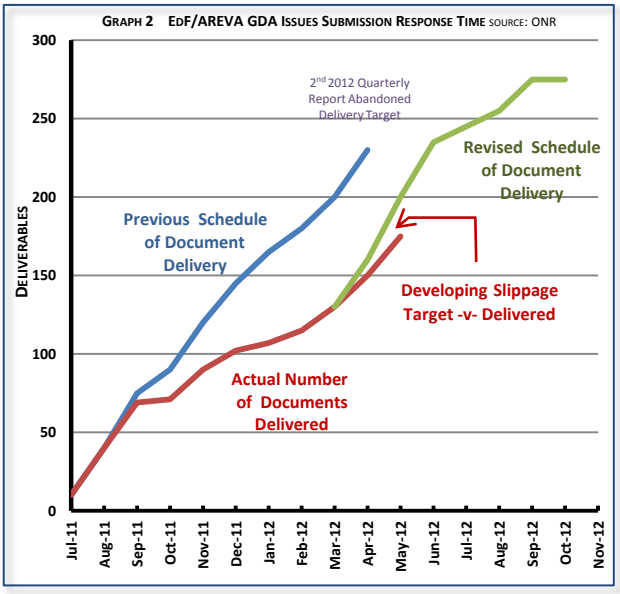
i) a reduction in the scope of work required of AREVA-EdF by ONR to close out specific GDA Issues; and/or

ii) a lengthening of the period in which to address each or some of the GDA Issues.

The second means ii) by a *lengthening of the assessment period* has clearly been adopted in the revised Resolution Plans for 20 of the 28 outstanding GDA Issues as shown by **CHART 1**.

However since the ONR has not disclosed the full text of the revised RPs,[9] it is not possible to determine if there has been any reduction in the scope and detail of the submissions or, indeed, if elements of the previously required submission have now been deferred to a later date via the raising of one or more *Assessment Findings* (see R3206-I1).[15]

GRAPH 2 EDF/AREVA GDA ISSUES SUBMISSION RESPONSE TIME SOURCE: ONR



In fact, the latest data for April-June shows the rate of delivery (—) slipping behind the revised target rate (—). Indeed, ONR note

> *". . . some of the deliverables have been late or did not provide the required quality of arguments or evidence and these topics are highlighted . . indicating that if actions taken do not continue to improve matters, it is unlikely that the GDA Issues will be closed-out on the timescales indicated in the* {revised} *resolution plans".*
>
> my added {clarification}

Such an appraisal of the most recent response and submissions of AREVA-EdF echoes ONR's caution of the earlier Progress Report of October to December 2011, which stated *"some of the deliverables . . have been late or do not provide the quality of information or depth of evidence that we expected"* adding that *"if no action is taken to improve matters, it is unlikely that the GDA Issues will be closed-out on the timescales indicated in the resolution plans"*. Almost identical criticism of the failings of AREVA-EdF was expressed in the ONR's Progress Report for January to March 2012, again *"Some of the deliverables, however, have been late or did not provide the required quality of arguments or evidence . . if no action is taken to improve matters, it is unlikely that the GDA Issues will be closed-out on the timescales indicated in the current resolution plans"*.

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work undertaken for the submissions; and a chart showing the *Timetable* and *Milestone* programme leading to the Deliverables. The *Timetable/Milestones Chart* identifies the overall and sector times (days) to complete the deliverables necessary to close-out the particular GDA Issue, including the times required for the ONR to undertake its own assessment.

13 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-out the GDA Issue or, if the submission is deemed to be inadequate, refer the Issue back to AREVA-EdF for further substantiation or whatever.

14 **GRAPHS 1** and **2** reproduced here are representational only – for the source graphs see the Annex 2 of each of the Q1 and Q2 2012 ONR progress reports.

15 *Assessment Findings* generally relate to instances the safety case can inevitably only be validated by procurement or later testing or commissioning. According to the ONR this Assessment Findings validation process is normal regulatory business and will be subject to appropriate regulatory controls, whereas the GDA is designed to assess the generic safety case for future reactor designs, and not the adequacy of the actual final design and it is also not intended to provide a complete assessment of the final reactor design. That said, R3206-I1 expressed some doubt that certain of the Assessment Findings raised during the resolution process of outstanding GDA Issues might have been adopted in order to bypass blockages in the process of the issues of the F-DAC.

ONR's repetitive criticism[16] on the lateness and quality of the AREVA-EdF submissions in fulfilling its part of the GDA process most likely reflects a continuing frustration of ONR but, also, it may reflect poorly on the authority of ONR itself to manage the GDA process.[17]

That said, ONR's criticism of AREVA is not that dissimilar to the disparagement with progress in the licensing for the Olkiluoto EPR voiced four years earlier by Jukka Laaksonen, the Director General of the Finnish nuclear safety regulator (*Säteilyturvakeskus - Radiation and Nuclear Safety Authority* – STUK), in his December 2008 letter to Anne Lauvergeon of AREVA

> *" . . there have been several meetings among our experts but we have not seen expected progress in the work on Areva side. The systems with highest safety importance are to be designed by Areva NP SAS but unfortunately the attitude or lack of professional knowledge of some persons who speak in the expert meetings on behalf of that organisation prevent to make progress in resolving the concerns. Therefore, evident design errors are not corrected and we are not receiving design documentation with adequate information and verifiable design requirements. This is unfortunate . . "*

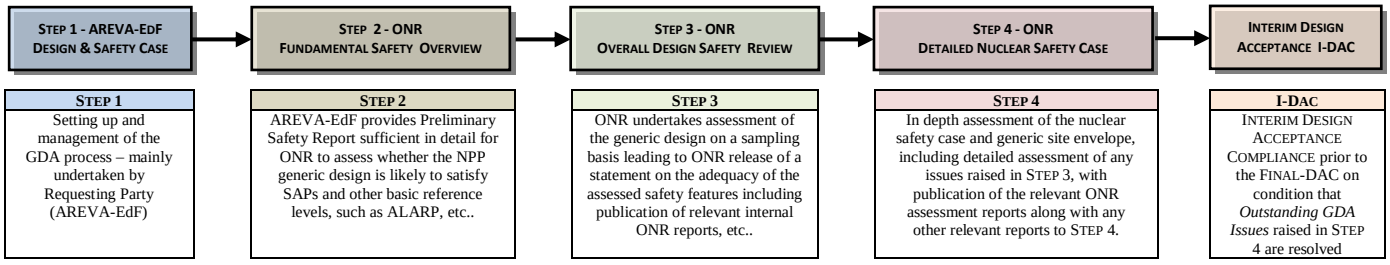
OPAQUENESS OF THE OUTSTANDING GDA ISSUES CLOSE-OUT

In its Guide to Requesting Parties the HSE (ONR) sought

> *". . to introduce high standards of openness and transparency to the GDA process. Arrangements will be agreed between HSE and the Requesting Parties to enable the public to view the safety cases provided by the Requesting Parties on the Internet, excepting commercially confidential and security sensitive information . . . At key stages in the process they will publish their views on the main issues raised . . . They will also publish all their assessment reports and a range of other documentation associated with the GDA process, as part of moves towards greater transparency."*
>
> my . . . truncation . . .

The GDA is the ONR's assessment of the nuclear safety case[18] for a generic design of nuclear plant comprising the following four sequential elements, culminating in the issue of a conditional Interim Design Acceptance Compliance (I-DAC) and, eventually if all outstanding GDA Issues are resolved, the Final Design Acceptance Compliance (F-DAC):

SCHEMATIC A OVERALL GDA PROCESS



It is possible to track the *'openness and transparency'* of the GDA Issues process by following through one of the recently closed-out GDA Issues, in this case GI-UKEPR-SI-02 referred to in **TABLE 1.** GI-UKEPR-SI-

16 There is also reference to AREVA-EdF failing to meet the ONR's delivery timescales in the Step 3 & 4 stages for the GDA process with, for example, in the Step 4 assessment on the structural integrity assessment of the RPV, ONR notes *" . . EDF and AREVA have submitted all the planned reports on avoidance of fracture for the HICs, however a number of the important reports arrived later than had been originally planned and I have been unable to undertake a full assessment within the timescales allowed for GDA Step 4"* and *"EDF and AREVA provided a review of options for the QB but this was received too late for a full assessment . . This is Assessment Findings AF-UKEPR-SI-09".* This latter example, suggests that for reason that the AREVA-EdF was late it was necessary to defer the matter to an AF rather than resolve the issue at the STEP 4 stage.

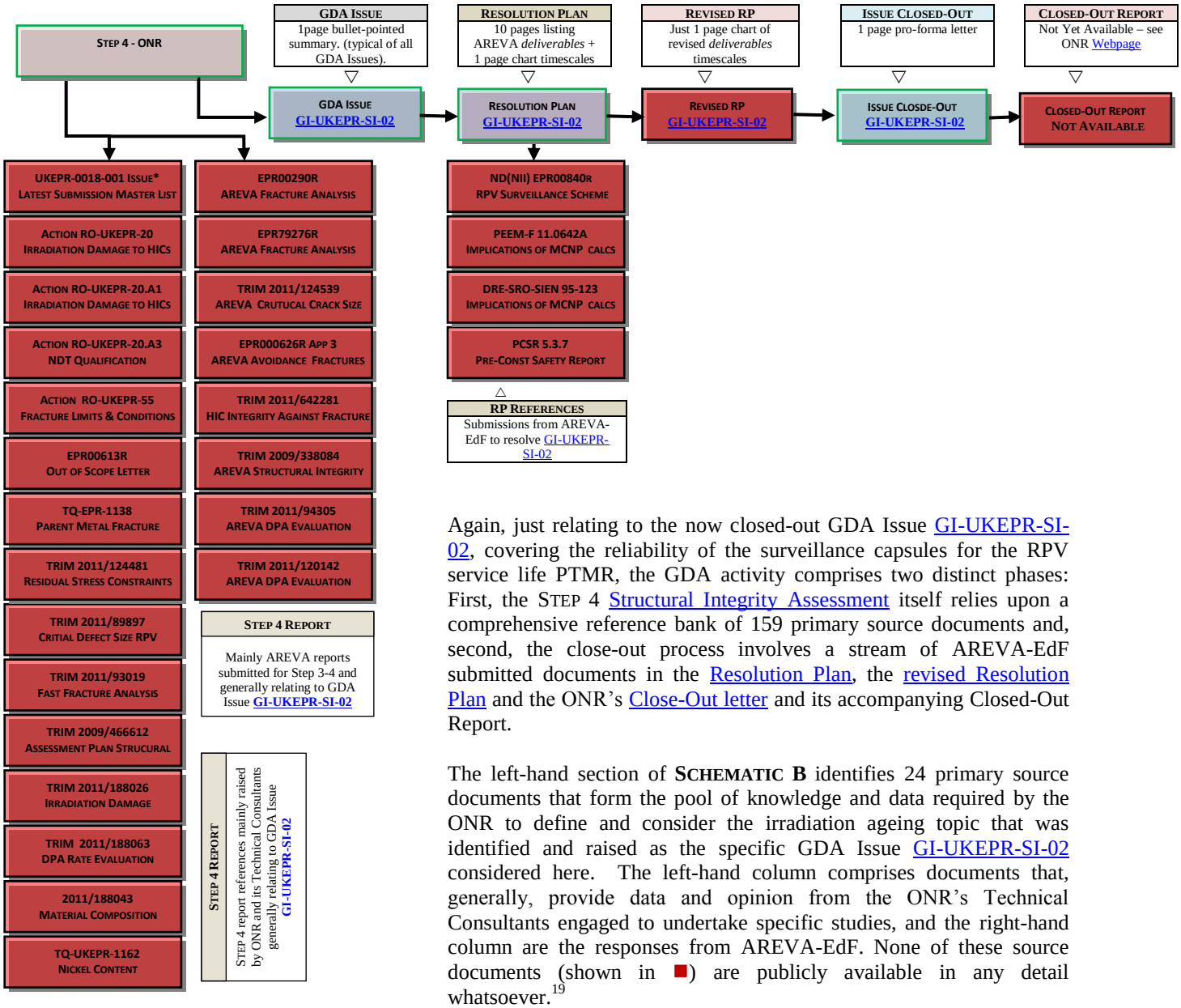
17 Interestingly at this late and crucial stage of the GDA process a change of senior management roles has taken place with Kevin Allars (who has played a key role throughout the GDA programme) apparently being replaced at this late stage by Colin Patchett as the ONR staff member responsible for the GDA Issues – this not insignificant reshuffle is explained by ONR in the Foreword of the Q1 2012 Quarterly Report as *" . . As a result of recent re-structuring within ONR, and to reflect the closer alignment of UK EPRTM GDA Issue assessment with the Hinkley Point C programme, the ONR GDA and Joint Programme Office teams have moved to become part of the operational reactors programme, and the foreword to this Quarterly Progress Report will, in future, be signed for ONR by Colin Patchett . . "* and then in the following Q2 2012 Quarterly Report *" . . This is the first time that ONR's Programme Director for the Civil Nuclear Reactor Programme has signed the foreword to a Quarterly Progress Report. The ONR GDA team moved into this programme on 1 April, and this will further help alignment with the assessment work required before ONR considers licensing and permissioning the construction of the UK EPR reactor design at Hinkley Point C".*

18 The GDA is the first phase of a two phase process where the 2nd phase relates to nuclear site licensing being site and operator specific.

02 relates to the Structural Integrity of the RPV and, in particular, the RPV Surveillance Scheme. This is one of 8 outstanding GDA Issues raised by the STEP 4 *Structural Integrity Assessment of the EDF and AREVA UK EPR™ Reactor* report of November 2011.

The availability of the documentation relating to this single GDA Issue GI-UKEPR-SI-02 is listed in **TABLE 4** (row shaded THUS). The publicly availability of this documentation trail can be represented schematically thus (PUBLICLY AVAILABLE □ - UNAVAILABLE ■):

SCHEMATIC B SOURCE INFORMATION AND DATA DEFINING AND RESOLVING GI-UKEPR-SI-02



Again, just relating to the now closed-out GDA Issue GI-UKEPR-SI-02, covering the reliability of the surveillance capsules for the RPV service life PTMR, the GDA activity comprises two distinct phases: First, the STEP 4 Structural Integrity Assessment itself relies upon a comprehensive reference bank of 159 primary source documents and, second, the close-out process involves a stream of AREVA-EdF submitted documents in the Resolution Plan, the revised Resolution Plan and the ONR's Close-Out letter and its accompanying Closed-Out Report.

The left-hand section of **SCHEMATIC B** identifies 24 primary source documents that form the pool of knowledge and data required by the ONR to define and consider the irradiation ageing topic that was identified and raised as the specific GDA Issue GI-UKEPR-SI-02 considered here. The left-hand column comprises documents that, generally, provide data and opinion from the ONR's Technical Consultants engaged to undertake specific studies, and the right-hand column are the responses from AREVA-EdF. None of these source documents (shown in ■) are publicly available in any detail whatsoever.[19]

The mid- and right-hand sections of **SCHEMATIC B** identify the documentation trail for this particular GDA Issue close-out. Again shown ■, not publicly available are all 4 responses from AREVA-EdF to the Resolution Plan, the main body of the revised Resolution Plan, and the final Issue Close-Out Report that would be expected to explain and justify ONR's decision.[19]

Essentially, the ONR has not made publicly available any supporting documentation that underpins its reasoning and justification in defining and raising the outstanding GDA Issue – for this, a member of the

19 The non-availability of these documents is based on a Google search of the HSE (ONR) website and final confirmation of the non-availability of these documents is awaited via a *Freedom of Information Act 2000* request 3206-A4.

public has to rely solely upon the ONR's reasoning and opinion as presented in its Structural Integrity Assessment report.[20] Much the same applies to the detailed submissions required of AREVA-EdF in the Resolution Plan, of which nothing is publicly available, and the ONR's own report giving reason for closing-out this particular GDA Issue is also not publicly available (although it may be delayed in publication).

In summary: This example of a closed-out GDA Issue illustrates that in identifying and raising the outstanding GDA, the ONR provides a commentary of its approach but it does not substantiate its reasoning by making the source information and facts available. Then, in closing-out the GDA issue, its fails to provide details of any amendment to the RP arising from its revised version of the RP (other than a bar chart of timescales). Moreover, it does not publish the AREVA-EdF submissions[21] specified in the RP (or, if appropriate, by the *revised* RP), nor the amendments applied to the PCSR, and the ONR report that should explain how and in what detail the GDA Issue has been closed-out is also not publicly available.

GDA Issues Progress and Trends

Annex 1 of the latest ONR Quarterly Report Q2 2012 shows the ONR's interpretation of current progress and future trends in resolving the outstanding GDA Issues and the achievability of securing the F-DAC target date of the close of 2012.

Diagram 1 ONR's Outstanding Issues Metrics[22]

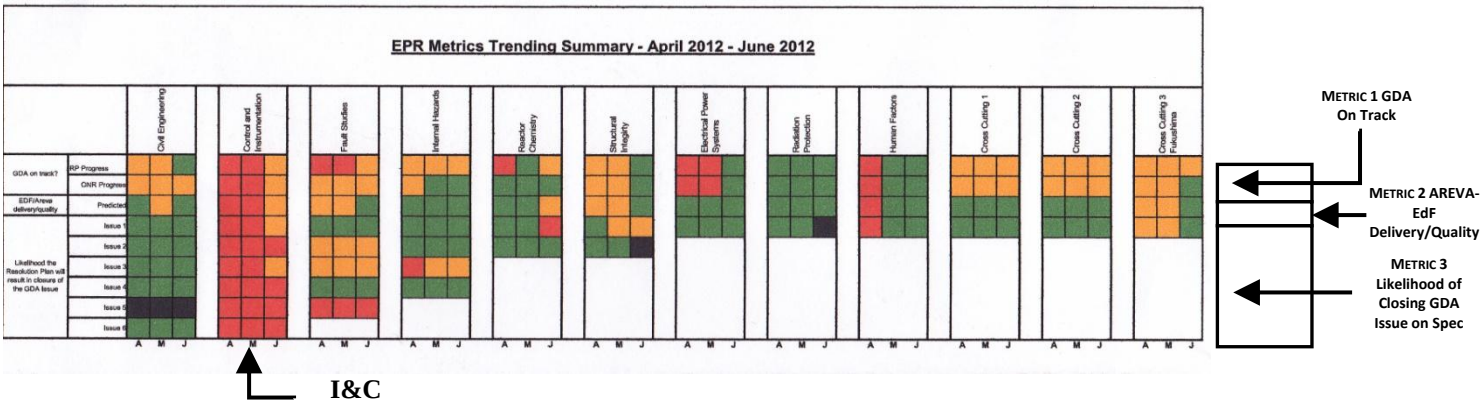


Diagram 1 highlights the difficulties and substantial delays encountered with the instrumentation and control (I&C – 2nd shaded column) aspects of the GDA, being seriously wanting and identified to be at high risk of not being completed by the target date of the close of 2012[23]- all six outstanding GDA Issues in the I&C area are subject to this uncertainty (see Table 3 later). Failure to progress and close-out I&C issues inevitably has a knock-on effect, venturing into *Fault Studies* (3rd column)[24] and *Human Factors* (9th column).[25]

In recent years I&C systems have undergone substantial development, the most significant change being the switchover from analogue to digital, with capabilities to centralise control functions, dependence on microprocessors and other integrated circuits, and effective interaction and management of human-system actions. There have been similar *'advances'* in the instrumentation and transducing, particularly in the roles

20 The Step 4 Structural Integrity Assessment report cites a total of 159 references of which, as a rough estimate, 19 (~12%) are publicly available documents.

21 Whereas some of the information contained in certain documents might be considered by AREVA-EdF to be *'commercially confidential'*, there is opportunity under the *Freedom of Information Act 2000* (FoIA) to redact such detail and information on the proviso that it is in the public interest not to disclose, there being a number of FoIA *Qualified Exemptions* that might be engaged to withhold such sensitive information. That said, it is difficult to envisage that any great amount of information in this particular GDA Issue would be commercially sensitive and/or raise security concerns.

22 The *'dashboard'* diagram sub-divides the outstanding GDA Issues into subject groupings (columns - *Civil Engineering, Instrumentation & Control*, etc) and progress and trends (rows – *On Track, Delivery/Quality*, etc). The block shading ■ indicates that the Resolution Plan is generally on plan to deliver or that any delays can be recovered; ■ is warning that significant prompt action is required to avoid delays and missing the GDA Issues target date; and ■ is that delays already incurred cannot be recovered without at least significant revision to the particular outstanding GDA Issue Resolution Plan; and ■ shows which GDA Issues have been resolved, with the actual issue being identified by cross referencing to the order of issues in **Table 2**.

23 For **Metric 3** (see r/h side of diagram) ■ indicates there to be serious doubt about closure of the GDA Issue and that further amendments to the Resolution Plan are required. In effect this means that resolution of the GDA Issue is unlikely to be achieved by performing the originally specified safety analysis and/or changes to the design of the EPR.

24 The G1-UKEPR-FS05 *Fault Studies* Resolution Plan relates to failures in essential support systems, particularly in electrical engineering systems and the functional capability of the associated protection systems, including the HVAC (Air Cleaning and Heating, Ventilating, and Air Conditioning) that supports the I&C equipment.

25 Like, the *Human Factors* outstanding GDA Issue G1-UKEPR-HF-01 requires considerable substantiation of performance and function relating to the I&C systems.

of remote surveillance, diagnostics and prognostics. However, whereas in general the sensing technologies in the nuclear power industry represent adaptations of well-established measurement concepts, that is the *'new'* sensors are typically evolutionary rather than revolutionary in nature, the character of the control of the plant has fundamentally changed with advances in digital communications systems that have resulted in boosted data transmission and handling speeds, more robust protocols, error correction and encryption and other techniques that are being imported from industrial and military activities outside the nuclear power industry.[26]

Earlier *Generation II* NPPs, such as Sizewell B, deployed some digital I&C architecture with networking capability, although these earlier systems included a considerable element of analogue backup and a great deal of separation of the digital systems themselves and, particularly isolation from non-safety related systems and equipment. In general, use of digital communication systems in NPPs has lagged considerably behind that in non-nuclear systems mostly due to qualification to the stringent nuclear safety requirements for NPP applications. However, *Generation III* NPPs such as the EPR, are bridging this analogue-digital technology gap with the I&C architecture in new plants making extensive use of digital communication and centralised networking, both between safety systems and between non-safety- and safety-related systems.

In certain respects this rapid advance of digital I&C may have confronted a nuclear safety regulatory system that is possibly ill-prepared in this area, particularly in that the regulatory process and supporting *Safety Assessment Principles* (SAPs) seem to be, it could be argued, rooted in a pre-digital age. The I&C outstanding GDA Issues listed in TABLE 3 include a number of uncertainties stemming from, because the technology is new to the regulatory process itself, the lack of a clear regulatory model in these emerging topics, including:

TABLE 2 UNCERTAINTIES & GAPS ARISING FROM THE INTRODUCTION OF I&C DIGITAL ARCHITECTURE

ITEM	TOPIC	DESCRIPTION
1	SYSTEM/SUB-SYSTEM FAILURE MODES	absence of complete characterization of failure modes for digital systems
2	VERIFICATION OF DIGITAL SYSTEMS	a clear definition of what is a digital system (ie binary ON-OFF through to a complex combinatorial logic device) and, in this respect how much verification and validation is required
3	COMMON MODE FAILURE	determining how the surveillance and networking functions might best be protected against a software fault that leads to a *common mode failure* to detect a defaulted protection system
4	HIERARCHAL ORDER	setting the hierarchy of the various online diagnostic systems, some of which could be more complex than a simple protection system function
5	DIVERSITY AND DEFENCE IN DEPTH	*Diversity* and *Defence-in-Depth* issues for a fully digital system where the backup system is also digital, the issue of having adequate defence-in-depth becomes significant
6	COMMON CAUSE FAILURE	*Common Cause Failure* due to identical (software) malfunction may result in the failure of multiple trains
7	INTERDEPENDENCE ISSUES	functional and data independence between *Nuclear Safety* and *Non-Safety Systems* or between *Safety Divisions* (ie *Quadrants*), that is a safety action should not be barred or locked-out by waiting for another *Non-Safety* (or another *Safety*) system to perform its (safety) function
8	CYBER SECURITY	*Cyber Security* in that that each subsystem be critically examined to identify any potential for intrusion from any source, external or internal

It is possible to identify and link these **TABLE 2** regulatory uncertainties and gaps to the, albeit poorly defined, six I&C outstanding GDA Issues:

26 For example the adoption of *spread-spectrum* favoured by the military because signals are difficult to jam and/or intercept, particularly in light of growing concern over the cyber-based threat.

TABLE 3 ONR I&C OUTSTANDING GDA ISSUES

I&C TOPIC	GDA ISSUE	ORIGINAL - REVISED RESOLUTION PLAN	DESCRIPTION	RELATES TO ELEMENTS OF GENERIC REGULATORY ISSUE OF TABLE 2
DESIGN INFORMATION MISSING	GI-UKEPR-CI-01	GI-UKEPR-CI-01 - Rev	*Non-Computerised Safety System* (NCSS) have yet to be provided to the ONR so the *diversity* of these systems to the central I&C system cannot be demonstrated and the *Basis of Safety Case* (BSC) is required – Revised Closure Target 21 November 2012.	1, 2, 5, 7
PROTECTION SYSTEMS	GI-UKEPR-CI-02	GI-UKEPR-CI-02 - Rev	This requires so-called *'confidence building'* of the central TXS I&C systems, essentially involving a fault simulator to conduct upwards of 50,000 tests matched to the actual plant dynamics under fault conditions and, in addition, both software and compiler require validation – currently, too many elements that have not been fully defined - Revised Closure Target 21 November 2012.	1, 3, 5, 6, 7, 8
EVIDENCE TRAIL	GI-UKEPR-CI-03	GI-UKEPR-CI-03 - Rev	The *Claims. Arguments and Evidence* (CAE) trail is insufficient and requires improvement, and doubt has been expressed whether the I&C system satisfies the ONR SAPs - Revised Closure Target 21 November 2012.	
SMART DEVICES	GI-UKEPR-CI-04	GI-UKEPR-CI-04 - Rev	So called *Smart Devices* relating to the nuclear safety function have yet to be qualified as fit for purpose) - Revised Closure Target 21 November 2012.	1, 3, 5, 6, 7, 8
OBSOLESCENCE OF SPPA T2000	GI-UKEPR-CI-05	GI-UKEPR-CI-05 - Rev	The I&C architecture includes systems based upon the now obsolete Siemens S5 which will not be available for the UK EPR so a new BSC is required and which is to relate the installed systems to the overall I&C design and related to the uncertainties of the TXS I&C systems (see GI-UKEPR-CI-02 above)[27] - Revised Closure Target 21 November 2012.	1, 3, 5, 6, 7, 8
INADEQUATE I&C ARCHITECTURE	GI-UKEPR-CI-06	GI-UKEPR-CI-06 - Rev	This requires 5 actions to be undertaken relating to I&C architecture changes agreed with the ONR, including diversity and susceptibility to *common cause failure* modes - Revised Closure Target 21 November 2012.	5, 6, 8

Disagreements and delays in the regulatory and construction programmes for the EPR NPPs presently under construction at Olkiluoto (Finland) and Flamanville (France) have been reported elsewhere. Again referring to the 2008 letter of Jukka Laaksonen (STUK), lack of progress on and concerns about the I&C systems were sufficiently vexing to prompt the following exchange:

> *". . I want to express my great concern on the lack of progress in the design of Olkiluoto 3 NPP automation* {I&C} *. . . The construction of Olkiluoto 3 plant seems to proceed generally well but I cannot see real progress being made in the design of the control and protection systems. Without a proper design that meets the basic principles of nuclear safety, and is consistently and transparently derived from the concept presented as an annex to the construction license application, I see no possibility to approve these important systems for installation. This would mean that the construction will come to a halt and it is not possible to start commissioning tests. . "*
>
> my added {clarification}

PROGRESS OF THE EPR BEYOND THE GDA PROCESS

EPR NPPs are presently under construction at Olkiluoto (Finland), Flamanville (France) and Taishan (China), and the EPR design is undergoing generic assessment by the ONR (UK) and for design certification by the Nuclear Regulatory Commission (NRC – USA).

27 The obsolescence of the Siemens *S5 Simatic* programmable logic controllers (PLC) is an indication of the rapidity of the technical evolution of digital communication systems with one of the original I&C components. PLCs are used for the automation of electromechanical processes (valves, motors, hydraulics, etc.,) using sequential or *'ladder'* logic working in real time (ie the output command is virtually instantaneous to receipt of the input signal). The increasingly complex demands being made up PLCs has been accompanied, in recent years, by the introduction of stand-alone programmable logic relays (PLR) which are only required to handle a few strands of input/output information in both digital and analogue formats. Such PLRs can be introduced into the much more complex PLC system to shortcut the ladder logic which for multi-input processes requires an unacceptable processing time and this, most probably, is cause of the obsolescence of the *S5 Simatic* PLC

At the Finnish and French construction sites, very significant time and cost overruns have occurred and in Finland there are currently inter-party disputes on costs and liabilities between the designer (AREVA) and the operator (Teollisuuden Voima Oy – TVO). Nothing has been publicly reported for the Taishan EPR construction programme, although unlike the European builds, the Chinese plants are not contracted on a *turnkey* basis, with the Chinese state company (China Guangdong Nuclear Power Group - CGNPC) sharing and having much greater control over works progress (and the reporting thereof).

A proportion of the cost and time overruns experienced at Olkiluoto and Flamanville stem from design changes necessitated as the EPR construction experience matured. It is clear that at the time that the Olkiluoto EPR order was placed (in 2003) that a reliable generic assessment of the EPR design had not been undertaken. In fact, the Finnish nuclear safety regulator STUK permitted the construction to proceed via a succession of checks or hold-points on the construction licence but, on this basis, the build programme encountered a series of hitches and hold-ups, often whilst detailed design matters were resolved. In late-2008 STUK made publicly known its concern over unresolved issues centring on the I&C architecture, with this being subsequently picked up by the French nuclear safety regulator *l'Autorité de Sûreté Nucléaire* (ASN), then the ONR (2009) and the NRC (2010).[28]

So far as the ONR is concerned, each of the six outstanding I&C issues, relating back to 2009,[29] have still to be resolved. The point here is that I&C issues[30] have been attracting international regulatory attention for some time (at least 4 years, but quite possibly 9 years or more), yet little progress on resolving these has been achieved. It follows, that ONR's expectation that the I&C and other outstanding GDA Issues are to be completely closed-out in accord with the ONR's F-DAC target date of 2012-2013 seems to be an unobtainable objective, a situation that the ONR has responsibility to publicly acknowledge.

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CONSULTING ENGINEERS, LONDON

28 In April 2009, ONR classified the I&C system as a *'Regulatory Issue'*, demarking it to be a particular feature of the design that might not meet UK regulatory standards. The I&C issue remained a Regulatory Issue and while HSE (now ONR) stated in July 2010 that it anticipated that an acceptable solution could be found, it then had not received details of the modification proposed and it reported that while they believe that an *'acceptable position can be reached for GDA'*, this would depend *'on timely and quality responses from EDF and AREVA and we have already noted difficulties with delivery on other I&C issues.'* The US and Chinese regulators were not party to this process, but in July 2010, it was reported that the US NRC had found that the I&C was too complex and interconnected to meet US regulations. The issue was described by an NRC spokesman as being *'a critical path issue that is going to have to be resolved'.*

29 But the I&C issues were raised earlier by STUK and ASN and, as some would claim, as far back as the completion of the design stage between 1995 to 1997.

30 DIAGRAM 1 shows a number of other areas in which outstanding GDA Issues may encounter difficulties and delays to close-out and, of course, the practicable consequences, in terms of regulatory framework changes and physical alteration of operating and to be built NPPs, of the March 2011 Fukushima Daiichi events have yet to be fully addressed in the GDA process – see r/h column of DIAGRAM 1

ANNEX 1

ONR Q2 – 2012 OUTSTANDING GDA ISSUES FOR AREVA-EdF EPR DESIGN

TABLE 4 OUTSTANDING GDA ISSUES – 30 JUNE 2012

GDA ISSUE	GDA ISSUE	RESOLUTION PLAN	REVISED RP SCHEDULE	ISSUE CLOSE-OUT
Internal Hazards				
Dropped Loads and Impact	GI-UKEPR-IH-01	GI-UKEPR-IH-01	N/A	Not yet closed out
Verification & Validation Studies	GI-UKEPR-IH-02	GI-UKEPR-IH-02	N/A	Not yet closed out
Internal Flooding and Operator Actions	GI-UKEPR-IH-03	GI-UKEPR-IH-03	GI-UKEPR-IH-03	Not yet closed out
Substantiation of Break Preclusion Claims for RCC-M Components	GI-UKEPR-IH-04	GI-UKEPR-IH-04	N/A	Not yet closed out
Civil Engineering and External Hazards				
Hypothesis and Methodology Notes for Class 1 Structures	GI-UKEPR-CE-01	GI-UKEPR-CE-01	N/A	Not yet closed out
Use of ETC-C for the Design and Construction of the UK EPR	GI-UKEPR-CE-02	GI-UKEPR-CE-02	N/A	Not yet closed out
Beyond Design Basis Behaviour of the Containment	GI-UKEPR-CE-03	GI-UKEPR-CE-03	N/A	Not yet closed out
Containment Analysis	GI-UKEPR-CE-04	GI-UKEPR-CE-04	N/A	Not yet closed out
Reliability of the ETC-C	GI-UKEPR-CE-05	GI-UKEPR-CE-05	N/A	GI-UKEPR-CE-05 Close Out
Seismic Analysis Methodology	GI-UKEPR-CE-06	GI-UKEPR-CE-06	N/A	Not yet closed out
Fault Studies				
Heterogeneous Boron Dilution Faults	GI-UKEPR-FS-01	GI-UKEPR-FS-01	GI-UKEPR-FS-01	Not yet closed out
Diversity for Frequent Faults	GI-UKEPR-FS-02	GI-UKEPR-FS-02	GI-UKEPR-FS-02	Not yet closed out
Safety Case for Cask Reloading Pit	GI-UKEPR-FS-03	GI-UKEPR-FS-03	GI-UKEPR-FS-03	Not yet closed out
Steam Generator Tube Rupture Safety Case	GI-UKEPR-FS-04	GI-UKEPR-FS-04	N/A	Not yet closed out
Design Basis Analysis of Essential Support Systems	GI-UKEPR-FS-05	GI-UKEPR-FS-05	GI-UKEPR-FS-05	Not yet closed out
Control & Instrumentation				
Design Information for Non-Computerised Safety System Required	GI-UKEPR-CI-01	GI-UKEPR-CI-01	GI-UKEPR-CI-01	Not yet closed out
Protection System Independent Confidence Building Measures	GI-UKEPR-CI-02	GI-UKEPR-CI-02	GI-UKEPR-CI-02	Not yet closed out
Claims, Arguments, Evidence Trail	GI-UKEPR-CI-03	GI-UKEPR-CI-03	GI-UKEPR-CI-03	Not yet closed out
SMART Devices	GI-UKEPR-CI-04	GI-UKEPR-CI-04	GI-UKEPR-CI-04	Not yet closed out
Obsolescence of SPPA T2000 Platform	GI-UKEPR-CI-05	GI-UKEPR-CI-05	GI-UKEPR-CI-05	Not yet closed out
Absence of Adequate I&C Architecture	GI-UKEPR-CI-06	GI-UKEPR-CI-06	GI-UKEPR-CI-06	Not yet closed out
Essential Electrical Systems				
PCSR Presentation of Claims Arguments and Evidence	GI-UKEPR-EE-01	GI-UKEPR-EE-01	GI-UKEPR-EE-01	Not yet closed out
Reactor Chemistry				
Combustible Gas Mitigation	GI-UKEPR-RC-01	GI-UKEPR-RC-01	GI-UKEPR-RC-01	Not yet closed out
Control and Minimisation of Ex-Core Radiation	GI-UKEPR-RC-02	GI-UKEPR-RC-02	GI-UKEPR-RC-02	Not yet closed out
Structural Integrity				
Avoidance of Fracture	GI-UKEPR-SI-01	GI-UKEPR-SI-01	GI-UKEPR-SI-01	Not yet closed out
Structural Integrity - RPV Surveillance Scheme	GI-UKEPR-SI-02	GI-UKEPR-SI-02	GI-UKEPR-SI-02	GI-UKEPR-SI-02 Close out
Radiation Protection				
Radiological Zoning and Bulk Shielding	GI-UKEPR-RP-01	GI-UKEPR-RP-01	N/A	GI-UKEPR-RP-01 Close out
Human Factors				
Inadequate Substantiation of Human Based Safety Claims	GI-UKEPR-HF-01	GI-UKEPR-HF-01	GI-UKEPR-HF-01	Not yet closed out
Cross-Cutting				
Categorisation and Classification of Systems Structures & Components	GI-UKEPR-CC-01	GI-UKEPR-CC-01	GI-UKEPR-CC-01	Not yet closed out
Consolidated Final GDA Submission	GI-UKEPR-CC-02	GI-UKEPR-CC-02	GI-UKEPR-CC-02	Not yet closed out
Consider and Action Plans to Address the Lessons Learnt From the Fukushima Event	GI-UKEPR-CC-03	GI-UKEPR-CC-03	GI-UKEPR-CC-03	Not yet closed out