

BRIEF REVIEW

**A PROPOSAL TO CHALLENGE THE
HEALTH & SAFETY EXECUTIVE'S
APPROACH TO
STEP 4 OF THE GENERIC DESIGN ASSESSMENT
GENERATION III NEW NUCLEAR REACTOR PLANT**

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SUMMARY

This briefing paper identifies the unnecessary complexity, shortcomings and lack of transparency of the Generic Design Assessment (GDA) underway by the nuclear regulator of the HSE. Particular regard is given to the final and closing STEP 4 stage that the HSE is about to embark upon.

A strategy is outlined whereby an independent scheme of interrogation of the GDA assessments serves to track the progress of the Generation III nuclear plant design assessment, with the objective of compiling and continuously updating those aspects of the nuclear plant design and its management (operating and safety procedures, etc) that remain unresolved.

This ongoing compilation of unresolved and/or unsatisfactory features of the Generation III nuclear plants is to be in the form of an *Issues Register*.

The *Issues Register* would be an entirely open record available as frequently updated on the internet, it would relate in explicable terms the sometimes complex engineering and technological challenges posed by the Generation III nuclear plant designs, and it would serve to hold the HSE regulator to account. Preparing and compiling the *Issues Register* would be undertaken by Large & Associates contracted throughout the remaining term of the GDA and, where appropriate, other skill resources would be engaged on an interim basis to include for non-technological aspects of the Generic Design Assessment as these might emerge.

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NUCLEAR NEW-BUILD PROGRAMME - GENERIC DESIGN ASSESSMENT

STEP 4 TO CLOSURE

Much has been made of the so-called nuclear renaissance and, particularly, the future role of Generation III nuclear power plants in combating global warming. Indeed, some argue that the enthusiasm of the nuclear industry and politicians alike in promoting the resurrection of nuclear power as a key element in the UK energy policy has overshadowed, if not stunted, the reporting and public consultation on important aspects of nuclear safety, security, and environmental impact of the Generation III nuclear plants.

Government claims that the examination of the designs of these reactor plants by the regulators themselves,¹ via a series of *Generic Design Assessments* (GDAs), will provide sufficient safeguards to ensure that the *Infrastructure Planning Commission* (IPC – now to be replaced by the *Major Infrastructure Planning Unit* within the *Planning Inspectorate*)^{2,3} is able to reach an informed and balanced decision in the national strategic interest.⁴ Thereafter and if granted planning permission to develop, each Generation III nuclear plant would be licensed on a site by site basis following established regulatory procedures.



Public consultation and input is excluded from the build, commission and operating⁵ stages of new build nuclear plants; and there is virtually no public engagement during the nuclear site licensing phase that adheres to an established and generally closed legislative pathway. In the planning and development process, the only opportunity for the public to engage directly is via written submission to the IPC but this assumes, albeit without much justification, that at the time when they are permitted to make submissions to the IPC, the public have themselves been sufficiently informed to arrive at meaningful judgments on important issues of public safety. Moreover, the IPC procedure, so far as the public are permitted to be involved, does not allow open cross-examination of the safety and environment issues that may be in the forefront of public concern.

Thus, the opportunity for the public to engage in a meaningful assessment of the introduction of these large, Generation III nuclear power plants is virtually confined to engagement and information dissemination during the progress of the various GDAs. It follows that crucial to a public understanding of the nuclear safety issues is the comprehensiveness and completeness of each GDA and how proficiently its findings have been reported into the public domain. The risks and uncertainties associated with this approach are severalfold, including:

¹ Essentially, the HSE Nuclear Directorate and the Office of Civil Nuclear Security (OCNS), the Environment Agency and the Department of Transport's Radioactive Materials Transport Division (Dangerous Goods Division).

² Nuclear power plant developments are defined as *Nationally Significant Infrastructure Projects* (NSIPs) under the *Planning Act 2008* that also requires the government of the day to produce a National Policy Statements (NPSs)

³ The first draft of this briefing was compiled before these changes with the IPC now to be scrapped and replaced by the MIPU which is to provide, according to the new Coalition's Orwellian-like titled '*Decentralisation Minister*' Greg Clarke, a democratic means by which new infrastructure projects "*critical to the country's return to economic growth . . . to be fast tracked in an accountable way*" reintroducing the final decision with a Minister – details of the decision-making and public involvement structures of the MIPU have yet to be set out by government but here it is assumed that the limited opportunity for public consultation and involvement introduced by the IPC will stand much the same.

⁴ Matters relating to nuclear safety, although the IPC might wish to consider these, remain outside the IPC's remit and the operation of any specific/individual nuclear installation will have to be issued with a Nuclear Site Licence under the *Nuclear Installation Act 1965*. Similarly, the nuclear process itself requires to satisfy the *Justification of Practices Involving Ionising Radiation Regulations 2004* (Justification Regulations, in accordance with the EURATOM 37).

⁵ Other than the somewhat hands off involvement of the site Stakeholder Groups.

- In the absence of the IPC including a detailed review of nuclear safety in its decision-making process (for which it allows a lean six months for public submissions on all topics), there will be considerable dependence on the final outcome and reporting⁶ of the GDA.
- In this way, the GDA outcome enters into a legally binding process even though the GDA process itself does not appear to have any statutory foundation. Instead it is defined, implemented and entirely judged by the particular regulator involved.^{1,7,8}
- The GDA process might become confused with the regulatory framework licensing new-build nuclear power plants, and it can do so in advance of, for example, the nuclear safety regulator NII undertaking the site- and operator-specific Nuclear Site and Licensee assessments required prior to nuclear activities commencing on any nuclear new-build site – such engagement with the potential licensee before the site and licensee assessments have commenced could result in the NII being compromised by its previous (GDA) approval of a design feature or system function in advance of the formalised licensing process, particularly if undertakings given now are not to be binding at the site licensing stage.^{9,10}
- Example of the GDA reporting procedures is given by the combine of the HSE and Environment Agency in terms of quarterly progress reports¹¹ that include the so-called GDA metrics,¹² by the now published NSD's thirty or so STEP 3 Reports,¹³ and, again for example, the HSE has convened a number of 'stakeholder' engagement meetings, conferences and other fora. Public interaction with these various modes of information exchange and accountability has been mixed, although generally:
 - The *Quarterly Progress Reports* tend to be self-promoting, somewhat bland in detail and although comments are invited, any received do not seem to have been openly published.
 - The '*metrics dashboards*' appended to the Step 3 Reports show trends but do not in any way quantify what has been achieved, what remains outstanding, nor do these dashboards detail the design areas that have been 'excluded' from the GDA.
 - The *STEP 3 Reports* are technically detailed and jargon laden, most probably beyond any reasonable public comprehension but, even so, these tend to insufficiently comprehensive for expert analysis and assessment.

Although, or so it seems, the intent of the HSE (and other regulators) is to provide more openness and accountability, the actual reporting and engagement outcomes are mired in bureaucracy, versed in nuclear jabbawocky and beholden to the political diktat to demonstrate, however and by whichever means, whether meaningfully or not, that the public should be shown to have been consulted.

The two principal regulators (HSE and the Environment Agency) are now preparing to move on to the next and final stage of the GDA,¹⁴ publishing a joint consultation paper determining how each will set about managing the GDA outcomes.¹⁵ Large & Associates has previously made available a detailed review of the HSE's (NII)

⁶ The point here is that the *Planning Act 2008* IPC process does not provide for an open public cross-examination of the developer's (EdF, AREVA etc) nuclear safety case (and other topics) nor, apparently, does the IPC have any meaningful input into the various GDA processes to ensure that these have been undertaken at a sufficiently rigorous level and to a robust and credible evidence basis.

⁷ In other words '*Quis custodiet ipsos custodes?*'

⁸ And, this in itself, raises uncertainty about the legal status of the *GDA Design Acceptance Confirmation* which is to be issued by the same regulator carrying out the GDA.

⁹ An example of this is the exchanges, carried out under the GDA process, between the NII and EdF/AREVA relating to the Control & Instrumentation System, in which a *Regulatory Issue* was raised amongst three others, requiring the requesting party to respond in detail on a C&I issue - see *UK EPR Control and Instrumentation (C&I) Architecture Regulatory Issue RI-UKEPR-002* <http://www.hse.gov.uk/newreactors/ri-ukepr-0002.pdf>

¹⁰ The point here is whether the IPC will feel compelled to place legally binding '*Grant Conditions*' drawn from agreements reached between the regulator and on the nuclear new build developer during the GDA process. Much the same applies to the '*Exclusions*' and '*Conditions*' (ie exemptions in the GDA to be left over to the licensing stage) relating to both design and information aspects of the plant being granted by the NII during the GDA process.

¹¹ For example, *Generic Design Assessment, Progress Report*, October 2009 to December 2009, HSE & EA - <http://www.hse.gov.uk/newreactors/reports/gda-q4-09.pdf>

¹² GDA Metrics, HSE - <http://www.hse.gov.uk/newreactors/gda-metrics.pdf>

¹³ For the NII Step 3 is the '*Overall Design Safety Review*' with example of a Step 3 report being *Step 3 Structural Integrity Assessment of the Westinghouse AP1000 Division 6 Assessment Report N°*. AR 09/013-P - <http://www.hse.gov.uk/newreactors/reports/gda-q4-09.pdf>

¹⁴ *Nuclear Directorate, Generic Design Assessment – New Civil Reactor Build - Step 3 Management of Safety and Quality Assurance Assessment of the EdF and AREVA UK EPR, Division 6 Assessment Report N°*. Ar 09/032-p - <http://www.hse.gov.uk/newreactors/reports/step3-uk-epr-msqa-assessment.pdf>

¹⁵ *New Nuclear Power Stations Generic Design Assessment, Guidance on the Management of GDA Outcomes*, Version 1, 23 June 2010 - www.hse.gov.uk/newreactors/reports/management-gda-outcomes.pdf

proposals (but excluded assessment of the other regulatory parties)¹⁶ – this assessment of the HSE’s GDA involvement is summarised as follows:

- 1 **GDA – Basis of Regulation:** The HSE reasons that the nuclear safety case developed (and agreed) during the course of the GDA should, in part at least, form the basis of the regulation of a fleet of reactor plants derived from a common design [1].¹⁷ If so, this might result in:
 - A dilution of the fundamental human protection basis provided by the *Nuclear Installations Act 1965* (NIA), that is moving from a position (albeit somewhat idealised) of absolute intolerance to health detriment to that where a tolerable level of detriment is acceptable. In other words, the nuclear safety case, its acceptable risk and tolerable consequences are linked to the technological capability of the nuclear plant design via the consolidation of thresholds such as the *Basic Safety Limits* (BSL) and *Basic Safety Objective* (BSO), that feature strongly in the Nuclear Safety Directorate’s (NSD) *Safety Assessment Principles*
 - During the GDA process there is little opportunity for the public to cross examine and test the nuclear safety case of new-build nuclear plants and, similarly, the set up for public involvement via IPC (and most probably its replacement the MIPU) process deny interactive involvement in publicly testing the nuclear safety case.
 - Such a ‘*behind closed doors*’ approach, wherein the regulator and the design companies (the *Requesting Parties* - RP) jointly [2] determine the levels of acceptable risk and the tolerability of radiological consequences at sacrifice of information being passed to and the involvement of the public.
 - The structure of the GDA involves the regulator (NII) hitherto more closely in the design process [2, 3], particularly at the front end of the GDA process when key safety parameters are being set. However, some observers consider and opine that the regulator is ill-qualified and not sufficiently experienced for this involvement in the ‘engineering’ of nuclear components and systems, being a participation that could later compromise the regulator and weaken the regulatory authority.

- 2 **ALARP and Risk:** The regulator places hitherto greater emphasis on the ALARP principle (as applied to the NII nuclear safety case) [8] which, applied from a probabilistic (or non-deterministic) basis¹⁸ and if followed through to the licensing stage, may not properly test the design. New and/or novel features of a next generation design, for example the dependence upon a passive response safety systems, the use of higher burn-up LEU and MOX fuels, the claims of extremely robust containment surety, etc., should all be subject to exact examination from a deterministic standpoint, primarily because of the operating and fault experiences upon which a probabilistic ALARP case is resolved are not available:
 - To arrive at a balanced judgement, [9] the regulator (because of lack of design skills) is very dependent upon the services of external consultants but such specialist consultants are likely to have ongoing interests and contractual ties with the RPs, so much so that conflicts of interest may arise.
 - Nuclear technology is complex and multi-facetted and, in some instances, it may be that the regulator is not sufficiently versed in the design and production technologies to determine if the information supplied by the RP is adequate [10] to complete a meaningful GDA.

- 3 **Staging the GDA on an Incomplete Design:** The difficulty here is in establishing the extent and detail of the design, ie the minimum level, necessary for the regulator to complete the GDA [12, 13] to a meaningful outcome – if the GDA process is slack and/or incomplete it could result in a weak and/or flawed nuclear safety case at the following Nuclear Site Licensing stage during which the public have no input.
 - Apparently key to these arrangements [14(i)] is the *Master Document Submission List* and the *Design Reference* [14(ii)] provided by the RPs. However, the extent of detail revealed by and, importantly, whether these are to be publicly available documents (at least in index or summary form) is not at all clear.
 - Accepting an incomplete design at the later stages of the GDA [14(iii)] requires the regulator to be satisfied that there is sufficient leeway in the established design features to facilitate changes to the

¹⁶ The L&A detailed review excluded the Environment Agency, the Department of Transport Division of Radioactive Materials Transportation, and the Office of Civil Nuclear Security (OCNS) which now is within the HSE umbrella (from April 2007).

¹⁷ Pertinent paragraph numbers cross referenced to the HSE-EA paper¹⁵ are shown thus [*].

¹⁸ That involving guessing rather than the experience or heuristically based determinism that follows exact decisions at every stage that might be better suited to the legislative basis of the regulatory framework, as applied in the Nuclear Installations Act 1965.

design, as these are required during the subsequent construction and commissioning stages. This carry over of uncertainty links the GDA and the NIA Nuclear Site Licensing stages and it is dependent upon an effective (*Change Control*) committee system (assumed to comprise the RPs and regulator) to oversee the adequacy of facilitating design, safety and environmental impact aspects of the incomplete design and any subsequent changes thereto - it is not at all clear if independent parties will be included on or are to peer review the *Change Control Committee* findings and recommendations.

- The *Change Control Committee* system proposed could lead to the regulator being compromised at a later time in instances where the regulator participated, say, in an earlier and inadequate decision to progress an incomplete aspect of the design; it may foster an unhealthy symbiosis between RP and regulator; and it may bring forward nuclear safety licensing decisions into the decision-making arena part occupied by the RPs.
- Similarly, the linkage between GDA (a process set by the regulator itself) and the Nuclear Site Licensing (to be carried out in compliance with the NIA) is that the regulator undertakes not to further assess at the site specific stage aspects of the nuclear safety case already assessed and accepted during the GDA [15]. Again, such an undertaking further blurs the distinction between the ill-defined GDA process, in which the RPs participate extensively, contrasted with the underlying interrogatory basis by which the regulator is required by the NIA to independently determine the NIA Nuclear Site License safety case.

4 **Presenting the GDA Final Recommendation – Step 4:** This is to be in the form of a series of public statements from the regulator giving its conclusions in the form of *Summary Assessment Step 4 Report* supplemented by a series of *Technical Topic Reports* [16], followed by the (HSE) *Design Acceptance Confirmation* (DAC) marking the completion of the GDA process [17(a)]:

- The *Step 4 Report* is likely to be not more than a much-simplified public statement contrasted to the *Topic Reports* that will probably be technically detailed and jargon laden, most probably beyond any reasonable public comprehension but, even so, these tend to be insufficiently comprehensive for expert analysis and assessment (if, that is, the *Topic* narratives are in a similar vein to the previously published *GDA Step 3 Reports*).
- If there remain outstanding issues but, nevertheless, the regulator believes itself to be largely content with the GDA outcome, the HSE would issue an *Interim Design Acceptance Confirmation* (IDAC) [19]. However this, in itself, requires the regulator to be sufficiently skilled and experienced in matters of detailed design, manufacture and quality assurance aspects ranging over a range of advancing and, in some instances, emerging technologies – it is doubtful that the relatively small technical and human resource base of the HSE Nuclear Directorate (and the Environment Agency) presently has, or could muster, sufficient skills and experience to cover all possible shortfalls and contingencies arising from an incomplete design submission at the GDA stage. As noted earlier, there are inherent difficulties in relying upon external consultants, particularly in their use for patching the shortfalls of what is intended to be an integrated GDA process.
- Signing off the GDA via an IDAC where there remain outstanding issues would still render the GDA process as complete [26]. However, the limit to the extent and seriousness of the outstanding/unresolved issues has not been specified by the regulator, other than that the RP would need to submit an acceptable *Resolution Plan* – it has not been stated whether the *Resolution Plan* is to be a publicly available document.
- Even with the RP's *Resolution Plan* in place, the IDAC acceptance of an incomplete design (or assessment) could result in a later compromise of the regulator's power to enforce or apply the nuclear safety case at the Nuclear Site Licensing stage. In other words, the RP could effectively put the regulator on risk for earlier permitting an incomplete aspect of the design to proceed only to later require possibly substantial design changes [17b].¹⁹

5 **Legal Status of the GDA:** Whereas the Environment Agency issues its *Statement of Design Acceptability* (ie the EA equivalent to the HSE DAC) in accord with S 37 of the *Environment Act 1995*,

¹⁹ Much the same happened to the NII when it 'half-approved' the boiler containment at the Hartlepool/Heysham II AGR at the design stage only to encounter real difficulties with the final as built and operated reactors – in fact the problem primary containment surety persists today with these reactors. A similar compromise situation may have arisen at Sizewell B with the primary circuit containment failure in the heater sleeves causing the plant to shut down on 17 March 2010 (and which is to remain shutdown until at least September 2010 for repairs) with the NII issuing a Nuclear Site Licence Instruction to start the reactor plant after what it accepted as an adequate outage inspection in or about September of 2009.

the HSE's *Design Acceptance Confirmation* (DAC) carries no legal status and it is not a legal requirement of the NIA Nuclear State Licensing regime [31]:

- This being so, it is not at all clear how the GDA process in itself and the DAC can be legally integrated into the NIA Site Licence, particularly since the HSE's intention is to adopt decisions and design changes made during the GDA process for the site specific Nuclear Site Licence. Also, it is doubtful that the 10 year applicability of the IDAC or DAC would hold [30], and the validity of the caveats expressed by the regulator [28, 33, 34] may be open to legal challenge by the RPs and other parties.

OPENING THE GDA PROCESSES TO PUBLIC SCRUTINY

Even at this late stage in the GDA deliberations it would be beneficial to open up the public reporting processes adopted by the regulators and, importantly, establish a transparent means by which the completeness of the nuclear safety case has been established via the GDA. This model of holding the regulator to account is currently under joint development as an *Issues Register* in the public consultation on the deep geological disposal of radioactive waste.²⁰

The HSE regulator argues, albeit in a somewhat roundabout fashion, that those areas of the design and nuclear safety function that have not been exhaustively reviewed and found to be satisfactory by the GDA (and, it is implied, those that have failed) will be identified as *Outstanding Issues* by the RP's *Resolution Plan*. Moreover, each of the outstanding issues listed by the *Resolution Plan* would, according to the HSE, have been scrutinised by the *Change Control Committee* as being capable technical resolution ahead of the commercial operation of the nuclear plant. In other words, the HSE is likely to claim that it has already developed and has in place the equivalent of an *Issues Register* but, in its case, although the individual 'issues' have not to date been resolved they are resolvable by the time of commissioning of the nuclear plant. On this basis, with the issuing of the IDAC the HSE would consider the GDA process complete.

However this approach is far from transparent to members of the public, in that it is most unlikely that the *Outstanding Issues* schedule and, particularly, the RP's *Resolution Plan* will not be publicly available documents.

A means by which to open up the GDA process and the accountability of the HSE could comprise a two-legged strategy: First, the HSE could be approached indirectly, with requests via the Freedom of Information Act 2000 (FoI) and Environmental Information Regulations 2004 (EIR), whichever apposite, and directly by meetings and negotiation to release non-specific and specific information and data relating to the *Resolution Plan* as this is developed by the RPs. Simultaneously, the STEP 3 reports (and to a less meaningful extent) the *Quarterly Progress Reports* would be trawled through in an endeavour to identify unresolved issues and, in addition, for the European Pressurised Reactor (EPR) progress of STUK with the Olkiluoto and ANS at Flamanville and, to a lesser extent, for the Westinghouse AP1000 the progress of the plants at China National Nuclear Corporation at Sanmen and Haiyang, and via the Nuclear Regulatory Commission (NRC) licensing of the fourteen AP1000 plants currently on order in the United States of which the Vogtle Electric Generating Plant in Georgia is presently at the most advanced ordering stage.

The objective and outcome of this strategy is to compile an entirely transparent and comprehensive *Issues Register* of incomplete or unsatisfactory aspects of the GDA that could, during interim and final stages of the Step 4 closure process, hold the GDA and its outcome to account.

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²⁰ NWAA *Issues Register*, Nuclear Waste Advisory Associates (NWAA), *Outstanding Scientific and Technical Issues Relating to the Production of a Robust Safety Case for the Deep Geological Disposal of Radioactive Waste*, March 2010