

Generic design assessment

UK EPR™ nuclear power plant design by AREVA NP SAS and Electricité de France SA

**Summary of Decision
Document**



We are the Environment Agency. We protect and improve the environment and make it **a better place** for people and wildlife.

We operate at the place where environmental change has its greatest impact on people's lives. We reduce the risks to people and properties from flooding; make sure there is enough water for people and wildlife; protect and improve air, land and water quality and apply the environmental standards within which industry can operate.

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Introduction to GDA

As the leading organisation working to protect the environment, it is the Environment Agency's role to regulate discharges and waste disposals from nuclear power stations in England and Wales and to ensure their impact on air, water and land is acceptable and minimised.

In response to growing interest in nuclear power and potential applications to build new nuclear power stations in England and Wales, we developed a new approach, Generic Design Assessment (GDA), for assessing the environmental impacts of new reactor designs. GDA means that we assess the acceptability of the generic environmental aspects and the nuclear reactor design before individual site applications are made. This approach allows us to get involved at the earliest stage where we can have most influence and where lessons can be learned for site-specific applications. It also gives us additional time to address regulatory and technical issues with designers and potential operators.

The new GDA approach has given us the opportunity to work more closely with the Office for Nuclear Regulation¹ (ONR), providing effectively a 'one-stop-shop' for nuclear regulation. The process is allowing a rigorous and structured examination of detailed environmental, safety and security aspects of the reactor designs, over approximately four years. We believe that GDA is improving efficiency both for the Regulators and the nuclear industry, and delivering greater protection for both people and the environment. GDA cannot provide a complete assessment of a final "site-specific" design as there will be other issues, operator specific or site related, that we would expect to be considered during the environmental permitting and site licensing stages.

When we issued our guidance on GDA in 2007, we envisaged that when we came to a decision on the acceptability of a reactor design, we may need to attach caveats. Previous experience in similar projects has also shown that it is not unusual for industry to take significant time to completely resolve some of the technical issues raised by Regulators, in view of the need for new analysis, tests or research, etc., to be carried out or for the design details to be completed. Also, there will be some requirements for commissioning tests, maintenance schedule, and operating rules, etc., that can only be fully addressed by a future operator. In these instances, a 'satisfactory' response to a technical issue for the GDA could be one where the matter is not fully resolved or confirmed, but we judge it is acceptable for it to be carried forward for future resolution. In the course of GDA we clarified that if we considered any of the issues to be particularly significant but still resolvable, then these would be identified as GDA Issues. In these cases the statement of design acceptability would be labelled as 'Interim', and we expect the Requesting Parties (the reactor designers) to produce a resolution plan that identifies how the Issue would be addressed and closed out.

¹ The Office for Nuclear Regulation (ONR) was created on 1st April 2011 as an Agency of the Health and Safety Executive (HSE). It was formed from HSE's Nuclear Directorate and has the same role. In this report we therefore generally use the term "ONR", except where we refer back to documents or actions that originated when it was still HSE's Nuclear Directorate.

Electricité de France SA and AREVA NP SAS ('EDF and AREVA') submitted their UK EPR™ nuclear power plant design for GDA in August 2007. EDF and AREVA published their submission on their website (<http://www.epr-reactor.co.uk>) and invited people to comment. The submission has been revised during GDA as would be expected to reflect developments. The current version on the website is up to date and is the basis of our detailed assessment and decision.

GDA was in two stages: the preliminary assessment and detailed assessment. We completed the preliminary assessment and published our findings in March 2008. On 28 June 2010, our consultation began on our preliminary conclusions following our detailed assessment of the UK EPR reactor design. This consultation closed on 18 October 2010. We have carefully considered all of the comments received and used them to help inform our decision. Our responses to the issues raised are set out in this decision document.

We conducted our GDA work in an open and transparent way and communicated with industry, academics, trade unions, non-Governmental Organisations and other interested groups and individuals during the process.

Generation of radioactive waste is intrinsically linked to the detailed design of a reactor, together with its associated plant. We require generation of radioactive waste to be minimised, and so GDA has focussed on radioactive waste design issues. Permitting the disposal and discharge of radioactive wastes has also traditionally been the area of regulation that has had the longest lead time for our permitting of new nuclear power stations. Additionally, we have also looked at key aspects of the design relating to other areas such as abstraction and discharges to water, pollution control issues, and management of non-radioactive waste.

This decision document summarises our detailed assessment findings on environmental aspects of the UK EPR nuclear power plant design. We have used the comments and issues raised in our consultation to help inform our decisions. We are content with the environmental aspects of the design, that it should meet the high standards we expect, so will issue an Environment Agency interim statement of design acceptability (interim SoDA, or iSoDA).

At a late stage in our assessment the accident at Fukushima occurred. As a consequence we did not believe that it was appropriate to draw conclusions from our GDA assessment work in June 2011 as originally planned, nor publish our GDA Decision Documents, until the lessons learnt from Fukushima emerged. We extended our assessment to allow us to take account of HM Chief Inspector of Nuclear Installations' report on the implications of Fukushima. We also introduced an additional GDA Issue to take account of the Fukushima lessons learnt work. The Chief Inspector's report has now been issued and EDF and AREVA has provided a resolution plan describing how they are addressing the recommendations. While we will continue to assess their progress on this matter, we feel it is now appropriate to publish our decision on the acceptability of the UK EPR design.

We have also identified in our decision document some assessment findings that we would expect to be addressed during site permitting and licensing, reactor procurement, design development, construction, commissioning, or early operation.

When all GDA Issues have been addressed to our satisfaction then the interim status of the SoDA will be reviewed and, if appropriate, a final SoDA will be provided, together with a report describing the basis of the GDA Issue resolution. Only when all GDA Issues related to the iSoDA have been addressed to our satisfaction will we confirm to ONR that we are content that it considers providing Consent to start nuclear safety related construction of the 'nuclear island' of the power station.

Should a SoDA be issued, the design and safety case will continue to evolve as the detailed design progresses and site-specific applications are developed. We would expect that the generic reactor design submitted for GDA and the SoDA will be used to underpin the permissions to construct a fleet of reactors identical except for site-specific requirements and the requirements of different operators.

Our decision, following consultation

We have now carried out a detailed assessment of EDF and AREVA's submission for the UK EPR nuclear power plant design and our conclusion, following consultation, is that we could issue an interim Statement of Design Acceptability (iSoDA) for the UK EPR. We have considered all the responses to our consultation and ONR's assessment before coming to a final decision on the acceptability of the UK EPR. Our decision is subject to two GDA Issues, both joint with ONR. EDF and AREVA have proposed Resolution Plans to address both GDA Issues. With ONR, we have reviewed these plans, and consider them credible.

The full decision document detailing our assessment of the UK EPR reactor is available at <https://consult.environment-agency.gov.uk/portal/ho/nuclear/gda>, via email gda@environment-agency.gov.uk, or via our National Customer Contact Centre on 03708 506 506.

GDA Issues

The two GDA Issues are:

- Provide a consolidated Final GDA Submission, including agreed design change for the UK EPR. The Issue reflects that EDF and AREVA will need to continue to control changes to the GDA submission documents, resulting from the management of possible changes to the design, until the issue of final SoDA. Design changes are also possible from resolution of the GDA Issues identified by ONR.
- Consider and action plans to address the lessons learned from the Fukushima Event.

Assessment findings

In reaching our decision we identified 18 assessment findings. We expect future operators to address the findings during the detailed design, procurement, construction or commissioning phase of any new build project.

Reference	Assessment finding
UK EPR-AF01	The future operator shall, at the detailed design stage, identify any changes to the 'reference case' for solid radioactive waste and spent fuel strategy, and provide evidence that the site-specific integrated waste strategy (IWS) achieves the same objectives.
UK EPR-AF02	The future operator shall, at the detailed design stage, provide an updated decommissioning strategy and decommissioning plan.
UK EPR-AF03	Future operators shall keep the removal of secondary neutron sources (to further minimise creation of tritium) under review. EDF and AREVA should provide future operators with relevant EPR operational information when available to facilitate their reviews of BAT
UK EPR-AF04	<p>Future operators shall, during the detailed design phase for each new build project, review BAT on minimising the production of activated corrosion products for the following matters, where possible improvements were identified in the PCER:</p> <ul style="list-style-type: none"> i) corrosion resistance of steam generator tubes; ii) electro-polishing of steam generator channel heads; iii) specification of lower cobalt content reactor system construction materials; iv) further reducing use of stellites in reactor components, in particular the coolant pump. <p>Where appropriate, any improvements considered BAT should be incorporated into the new build.</p>
UK EPR-AF05	Future operators shall, before the commissioning phase, provide their proposals for how they intend to implement zinc injection. The proposals shall be supported by an assessment of the impact of zinc injection on waste and crud composition.
UK EPR-AF06	Prior to construction of the conventional and nuclear island liquid effluent discharge tank systems, future operators shall demonstrate that site-specific aspects such as size and leak-tight construction techniques are BAT.
UK EPR-AF07	Future operators shall, before the commissioning phase, provide an assessment to demonstrate that proposed operational controls on the fuel pool are BAT to minimise the discharge of tritium to air.

Reference	Assessment finding
UK EPR-AF08	<p>Future operators shall, during the detailed design phase, provide their proposals for the operational management of the Liquid Waste Processing System to minimise the discharge of radioactivity from the site so that exposures of any member of the public and the population as a whole are kept as low as reasonably achievable (ALARA) and to protect the environment. The proposals should be supported by a BAT assessment to show that the use of the evaporator, the choice of filter porosity and the demineralisation media have been optimised to minimise the dose to members of the public. The future operator shall also provide evidence that the Water Treatment Systems have sufficient capacity and resilience to cope with all the aqueous radioactive waste arisings consigned to the evaporator by the proposals. The proposals should consider all plant states, including for example outages and unavailability due to maintenance or breakdown.</p>
UK EPR-AF09	<p>Future operators shall, during the detailed design stage, provide a predicted mass balance showing how their proposed aqueous radioactive waste management regime will affect the disposal of carbon-14 to the gaseous, solid or aqueous routes. For each route the form of carbon-14 expected shall be provided. For solid wastes the quantities of each type of waste shall be provided with expected carbon-14 content.</p>
UK EPR-AF10	<p>The future operator shall provide confidence that adequate radioactive waste management cases (RWMCs), supported by appropriate stage Letters of Compliance (LoCs), can be developed for all intermediate level waste (ILW) on the timescales identified in EDF and AREVA's plan for disposability of ILW</p>
UK EPR-AF11	<p>The future operator shall provide evidence during the detailed design phase that the proposed specific techniques for preventing and, where that is not possible, minimising the creation of low level waste (LLW) and intermediate level waste (ILW) are the best available techniques (BAT).</p>
UK EPR-AF12	<p>The future operator shall provide evidence during the detailed design phase that the proposed specific techniques for treating and conditioning of low level waste (LLW) and intermediate level waste (ILW) before disposal are the best available techniques (BAT).</p>
UK EPR-AF13	<p>If smelting of any low level waste (LLW) is pursued, the future operator shall demonstrate that the conditions of acceptance of the selected smelting facility can be met.</p>
UK EPR-AF14	<p>If incineration of any low level waste (LLW) is pursued, the future operator shall demonstrate that the conditions of acceptance of the selected incineration facility can be met.</p>
UK EPR-AF15	<p>If incineration of any intermediate level waste (ILW) is pursued, the future operator shall demonstrate that the conditions of acceptance of the selected incineration facility can be met.</p>

Reference	Assessment finding
UK EPR-AF16	The future operator shall, before the commissioning phase, propose techniques for the interim storage of spent fuel following a period of initial cooling in the pool. The future operator shall provide an assessment to show that the techniques proposed are BAT.
UK EPR-AF17	The future operator shall, before the commissioning phase, provide confidence that adequate Radioactive Waste Management Cases (RWMCs), supported by appropriate stage Letters of Compliance (LoCs) and taking due account of necessary storage periods, can be developed for spent fuel on the timescales identified in EDF and AREVA's plan for disposability of spent fuel.
UK EPR-AF18	<p>Future operators shall provide:</p> <ul style="list-style-type: none"> a) during the detailed design phase, the location and arrangement of sampling and continuous monitoring facilities for gaseous and aqueous wastes supported by an assessment that these will provide representative sampling and monitoring; b) during the detailed design phase and before final equipment selection, the details of equipment and techniques to be used for analysis of gaseous, aqueous and solid wastes supported by an assessment that these represent BAT for monitoring.

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