

The required level of design of waste plants for new build reactors in the Generic Design Assessment

Executive Summary

1. The Generic Design Assessment (GDA) process allows a rigorous and structured assessment of detailed Safety, Security and Environmental aspects of the design of new build reactors. For GDA the design of the fuel pond within the reactor building and the ILW processing facilities needs to be in sufficient detail to allow a fully detailed assessment. This paper clarifies the minimum position for GDA so that the output is meaningful and without exclusions. A separate paper will be developed for phase 2.
2. For the other storage facilities, we need confidence through the GDA process that the spent fuel and waste can be retrieved, transported, and disposed of at the end of storage. Therefore the emphasis is less on the specific design details and more on the evidence to show that the chosen route is suitable. For the waste facilities, we need the Requesting Parties to demonstrate that they can safely handle, store and dispose of the wastes they generate. This will require sufficient levels of design to justify credibility of the storage options proposed; understanding how waste streams and their packaging evolve over the storage period; data and records management; knowledge of the constraints placed on the wastes by the disposal facilities; identification of knowledge gaps and the resulting R&D programme; and robust estimates of the required capacity.
3. This paper proposes that for these other storage facilities the details discussed above are incorporated into a strategy that includes key milestones. This detailed strategy would satisfy the needs of GDA. The detailed review of the storage requirements will underpin the plans. This will include:
 - The types of facility that could be used;
 - When facilities will be developed and constructed; and
 - The research needs that are required to ensure the waste and spent fuel can be safely managed on sites, transported and disposed of.
4. These planning requirements are similar to those that both the Regulators and the Nuclear Decommissioning Authority (NDA) are adopting for legacy sites. Therefore, requiring the Requesting Parties to adopt similar approaches to the existing Nuclear Site Licence Companies will provide the level of information required by the Regulators and give synergies across the UK nuclear industry. It will also allow the Operators and Requesting Parties to incorporate knowledge gained across the industry as the waste management techniques develop, to make use of best available techniques and provide a cohesive inter-generational UK strategic approach to waste and spent fuel management.

Introduction

5. The Generic Design Assessment (GDA) process allows a rigorous and structured assessment of detailed Safety, Security and Environmental aspects of the design of new build reactors. This paper clarifies the strategy for waste facilities in the generic Design Assessment (GDA) process. The Environment Agency, Department for Transport and Health and Safety Executive's Nuclear Directorate (ND) have developed the paper.

Background

6. The management of radioactive waste in the UK has developed over the last sixty years. A recent change was the establishment, by government of the Nuclear Decommissioning Authority (NDA). Its mission is to deliver safe, sustainable and publicly acceptable solutions to the challenge of nuclear clean-up and waste management. Of interest are the Lifetime Plans required from operators and development of a disposal facility.
 - The Lifetime Plan, or equivalent, is the over-arching document that describes the totality of activities required to take the site from its current state and mission to the assumed or agreed site end-state.
 - In 2006, the government gave the role of repository development to the NDA. Subsequently the NDA created the Radioactive Waste Management Directorate. The directorate's role is to develop and implement a Geological Disposal Facility for the UK's higher-activity wastes. As part of this, they are looking at whether the Geological Disposal Facility can accommodate wastes from new build reactors.
7. The development of the geological disposal facility is an aspect of government's Managing Radioactive Waste Safely process. This is an open process involving a significant amount of public participation. As part of this process, the government established the Committee on Radioactive Waste Management to provide independent scrutiny and advice on the UK's management of its solid radioactive waste, including wastes from new build; plans for interim storage; and geological disposal of higher activity waste.
8. The approach to management of radioactive wastes in other countries is diverse. The selected examples indicate the range of approaches to spent fuel management.
 - In Finland, spent fuel is stored at the reactor sites pending disposal in a repository. Final disposal of spent fuel is anticipated to commence in 2020. (For more information see <http://www.posiva.fi/en>)
 - In France, spent fuel is initially stored at the reactor site before transport to Le Hague for reprocessing. (See <http://www.irsn.org/en/index.php> for more information)
 - In USA, following the announcement by President Obama about the future of Yucca Mountain the US government is reconsidering the national spent fuel management strategy.

9. The range of international approaches to waste and spent fuel management generally reflect the availability (or not) of final disposal sites. When reviewing international experience it should be remembered that the LLW and ILW activity classification systems may differ from those used in the UK. Therefore it is not possible to identify a situation that is directly analogous with the situation in the UK.
10. Within this context the UK government is ensuring that operators estimate the full costs for decommissioning and waste management through the Funded Decommissioning and Waste Management Programme (FDWMP). This requires the operator to provide for the steps necessary to decommission and manage and dispose of radioactive waste. The information produced by the Requesting Parties on waste management for GDA can also be used to inform the work on FDWMP.

Expectations of GDA

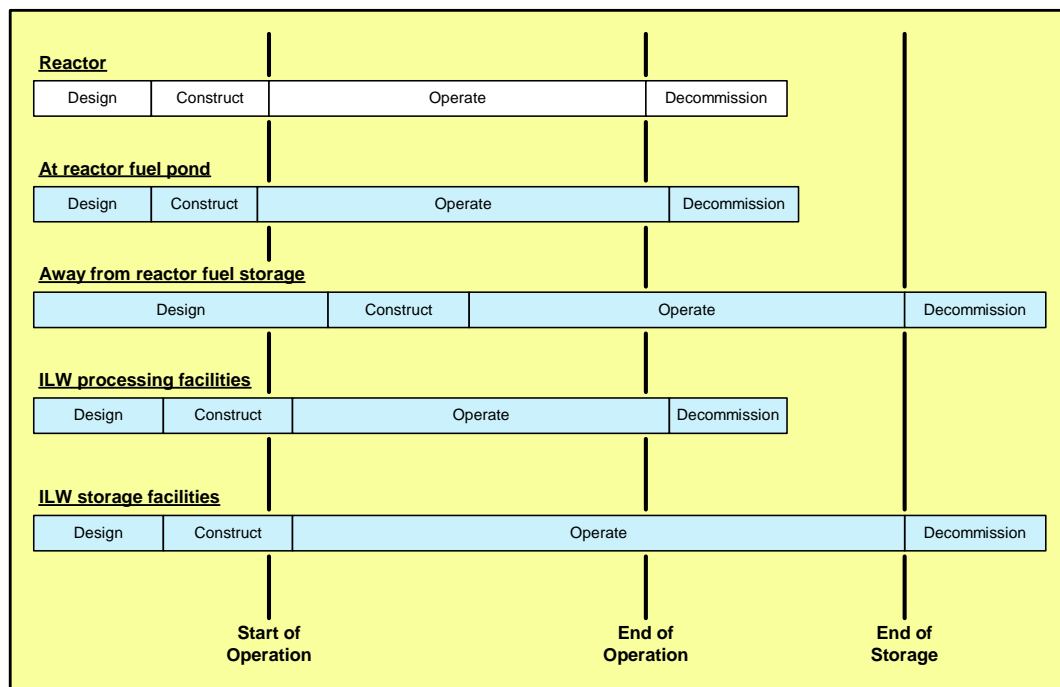
11. The GDA process allows a rigorous and structured assessment of detailed Safety, Security and Environmental aspects of the design of the reactor. At the end of the assessment, we will confirm whether the Requesting Parties have adequately addressed these aspects within their designs.
12. For the waste facilities, we need the Requesting Parties to demonstrate that they can safely handle, store and dispose of the wastes they generate for the whole lifecycle of the reactor. This will require sufficient levels of design to justify credibility of the storage options proposed; understanding how waste streams and their packaging evolve over the storage period; plans for data and records management; knowledge of the constraints placed on the wastes by the disposal facilities; and robust estimates of the required capacity.
13. The documents published as part of GDA request designs for waste management facilities, but do not specify the amount of detail required in the design. In 2008 Regulatory Issues were raised on each Requesting Party about waste management, these stated similar expectations. More recently, two Technical Queries to EdF/Areva outlined aspects to address in the design of storage facilities. To support these interactions this paper clarifies the Regulators' expectations for the level of design required in the GDA submissions.

Discussion

14. Waste storage and processing facilities at a reactor fall naturally into four general areas, these are:
 - the spent fuel storage pond within the reactor complex used for loading and unloading fuel and initial cooling;
 - the facilities for the longer term storage of the spent fuel;
 - the facilities for management and processing of LLW and ILW wastes; and
 - the storage facilities for ILW.
15. The figure below outlines when these facilities are likely to be required and their probable lifetimes. It is noted that there will be a requirement for export/transport

facilities at the end of the storage period. In this paper it is assumed that these aspects are part of the bars related to storage.

Figure 1: Possible lifetimes for waste facilities at a reactor



16. It is clear that for each of the facilities different levels of design are likely to be acceptable at the end of GDA.
17. The at-reactor fuel ponds are an integral part of the reactor building and are needed early in the reactors life. It is a facility common to other reactors in the UK or overseas. Therefore, their development should be to the same level of design as the reactor, within the same timescales. So this paper does not consider the at reactor fuel pond further.
18. Facilities for processing¹ ILW and LLW are available and have been used in the UK. The processing is fundamental to the safety, transport and environmental effects of storage and disposal of the wastes. The mobile units suggested in the submissions are currently in use. Therefore, the development of the processing facilities should be to the same level of design as the reactor, within the same timescales. So this paper does not consider the ILW processing facilities further.
19. The two remaining areas are the away from reactor fuel storage and the ILW storage facilities. These are areas where:
 - Operators will optimise designs against their own strategic objectives. For example, if an operator uses a standard approach to waste management across their reactor fleet they may want to apply the same approach to their UK reactors. This is outside the control of the Requesting Parties.

¹ In this case processing can mean all the activities undertaken on the waste up to the point when conditioned waste is placed in storage, for example storage of raw waste and segregation prior to conditioning would be covered by the term processing.

- Operators and Requesting Parties need to understand the evolution of the spent fuel or waste to specify storage facilities, data and records management and any inspection procedures necessary to underpin the safety cases for storage and/or transport.
 - In the early development of the facility, the Requesting Parties and the Operators need to develop designs in sufficient detail to understand the interface with the reactor and the export facilities; show how to refurbish key equipment; and the types of potential failure or degradation in the waste or spent fuel; the consequential effects upon the storage and transport safety cases and the options available for managing these.
20. As can be seen from figure 1 the requirement for an Away From Reactor Fuel Store is a significant period after the reactor starts operation, because of the capacity provided in the At Reactor Fuel Pond (typically 5 – 15 years). Within this period, there will be more experience of long-term storage and disposal. Therefore, Operators will be able to take account of changes in spent fuel management practices and have a clearer specification for disposal. To give the Regulators the required level of confidence that the operators can safely handle, store and dispose of spent fuel viable options will have to be identified by the Requesting Parties and a strategy/plan developed to show that one of these could be developed and implemented. This will allow a conclusion at the end of GDA that the management of spent fuel has been adequately addressed.
21. ILW stores will be required on a shorter timescale. There are examples within the UK of stores built for this type of waste with design lives of at least 50 years. Therefore, we can be confident that the reactor operator can develop a suitable store, as credible designs are available. The more challenging issues are the size and location of the stores. For example, the amount of ILW will increase significantly when decommissioning the reactor, so should an operator build a store for all wastes, or a small store now and a larger one when the site is decommissioned? The public will want these issues debated. Therefore, as part of GDA we should encourage the Requesting Parties to look at all possible options that are consistent with the governments base case for new build.
22. The storage facilities that the NDA is developing for legacy wastes face similar problems. Therefore, there are synergies with the NDA approach that Requesting Parties and potential Operators should look at exploiting.
23. The NDA is developing their approaches in recognition of the availability of their resources and the repository. For example, the lifetime plans are looking at the scheduling of wastes to the repository to give realistic lifetimes for different stores. The lifetime plans are comprehensive; at their heart are the Detailed Volumes. The Detailed Volumes contain the key information relating to the scope, schedule and costs of the lifetime work programme to be undertaken on the site. Therefore, the Detailed Volumes should contain a similar level of information to that required in GDA.
24. The Department for Transport also has an interest in the characterisation and conditioning of waste streams, data and records management, storage environments and regimes, packaging design, and monitoring and inspection regimes as waste and spent fuel will be eventually transported in the public

domain. Furthermore, in view of the significant timescales involved, they wish to know the main constraining factors, consequential effects, and risk mitigation plans associated to meet a possible need to transport off site at any point in time during the reactor operating window, during the subsequent shutdown period, and during the decommissioning phase. The development of a strategic plan will allow incorporation of the requirements of the transport case into the plan.

Conclusion

25. The regulators need to ensure that the provision of information on waste management issues in GDA is proportionate, compliant with the regulations and consistent with public expectations. It is in the Requesting Parties interest to provide this information so that the conclusions at the end of GDA are meaningful and without exclusions.
26. For the at-reactor fuel pond and the ILW processing facilities, this is simply a case that we require a detailed design for detailed assessment in GDA.
27. For the other storage facilities, we can be more flexible. For the waste facilities, we need the Requesting Parties to demonstrate that they can safely handle, store and dispose of the wastes they generate. This will require sufficient levels of design to justify credibility of the storage options proposed; understanding how wastes evolve over the storage period; knowledge of the constraints placed on the wastes by the disposal facilities; and robust estimates of the required capacity. So for the other storage facilities detailed plans showing key milestones can satisfy the needs of GDA. A detailed review of the storage requirements will underpin the plans. This will include:
 - The types of facility that could be used;
 - When facilities will be developed and constructed; and
 - The research needs that ensure the waste and spent fuel can be stored, transported and disposed of.
28. These planning requirements are similar to those of the NDA for legacy sites. Therefore, requiring the Requesting Parties to adopt similar approaches to the Site Licence Companies will provide the level of information required by Regulators and give synergies across the UK nuclear industry. It will also allow the operators and Requesting Parties to incorporate knowledge gained across the industry as the processes develop.

Chris Fisher
HM Nuclear inspector
Unit 6D, New Reactor Build
19 May 2009