

CoRWM's Understanding of the UK Requirements for the Assessment and Mitigation of the Risks of Aircraft Impact on Stores for Higher Activity Wastes and Spent Fuel

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Background

1. The topic of possible 9/11 style attacks on stores for spent fuel or higher activity wastes has been of concern to stakeholders (eg NGOs, communities local to existing and prospective nuclear sites) for several years. It was raised during the work that led to CoRWM's 2006 Recommendations (CoRWM doc. 700) and again during the work described in CoRWM's 2009 report to Government on interim storage (CoRWM doc. 2500). The topic is currently of interest in two main contexts: the British Energy proposal to build a dry store for spent fuel at Sizewell B, and the Government consultations and regulatory assessments for new build reactors.
2. In early December 2009 CoRWM held two meetings with staff from the Health and Safety Executive's Nuclear Directorate (HSE ND). One was with the Office of Civil Nuclear Security (OCNS) and was about prospects for making more information available to the public about assuring security at existing and new nuclear facilities (CoRWM doc. 2746). The other was with Nuclear Installations Inspectorate (NII) staff about the Generic Design Assessment (GDA) process for new reactors (CoRWM doc. 2747). Environment Agency staff were also present at the GDA meeting.
3. After these meetings CoRWM still had questions about the assessment and mitigation of aircraft impact risks. It was agreed with NII at the GDA meeting that the best way to proceed was for CoRWM to summarise its current understanding and remaining questions and ask NII and OCNS to respond. This note is based on that summary and the response from NII and OCNS.

UK Regulatory Approach to Aircraft Impact Risks at Nuclear Facilities

Accidental Impacts

4. The approach for accidental aircraft impacts is described in the HSE Safety Assessment Principles for Nuclear Facilities (SAPs) (HSE, 2008). Such impacts are treated as accidents resulting from external hazards. Operators are required to determine the total predicted frequency of aircraft crashes on or near any facility with structures, systems and components important to safety (SAPs principle EHA.8). If the total frequency is less than 10^{-4} per year but more than 10^{-7} per year then operators should make efforts to understand and minimise the potential consequences of impacts (SAPs paras 218 and 219). This means that operators should establish aircraft impact scenarios, analyse their consequences for structures, systems and components important to safety and consider whether measures to prevent or mitigate adverse consequences are needed.
5. For high consequence impacts (offsite individual dose more than 100 mSv), the SAPs principles for severe accidents apply (principles FA.15 and FA.16, paras 543-550). These state that consequence assessments should generally be realistic rather than pessimistic, and require the identification of reasonably practicable measures to prevent or minimise consequences.

Malicious Impacts

6. For the purpose of considering the measures required to mitigate their consequences, aircraft impacts arising from malicious acts are treated as beyond design basis accidents resulting from external hazards and, if consequences are high (offsite individual dose more than 100 mSv), as severe accidents. NII examines the results of the operator's

assessments of the consequences of accidental aircraft impacts and may ask the operator to perform additional assessments. From these assessments the operator is required to either make a case that the design is safe or propose reasonably practicable mitigating measures. NII judges the adequacy of the case and proposals as part of its normal regulatory activity.

7. Limiting the probability of malicious aircraft impacts is a matter for Government. Various measures are in place at a national level to protect against this threat but details cannot be released into the public domain (eg improved security at airports).

Sizewell B Dry Fuel Store

8. Throughout 2009 British Energy worked on options for spent fuel management at Sizewell B from 2015 onwards. It reviewed the options and held a number of exhibitions and community meetings (British Energy, 2009a, b). In September 2009 it submitted an Environmental Scoping Report to the Department of Energy and Climate Change (DECC) (British Energy, 2009c). A public consultation on its chosen option, dry storage in concrete or metal casks housed in a building, ended in December 2009 (British Energy, 2009d). British Energy will submit a planning application to DECC for its dry store in 2010. It aims to obtain planning consent and regulatory approvals during 2010 and 2011 and to construct the store in 2012-14.¹
9. One of the highest priority concerns expressed by the public about managing spent fuel at Sizewell B was terrorist attack (British Energy, 2009b). In response to this concern British Energy has stated that the type of storage facility it proposes “has been tested to withstand major impact and fire” and that HSE would need to be “entirely satisfied” about “safety and security systems” before the facility could be built (British Energy, 2009b). HSE has confirmed to CoRWM that this is the case.

New Build Reactors

10. HSE completed Step 3 of the GDA process for the AP1000 and EPR reactor designs at the end of November. Its assessments of security arrangements and external hazards have so far focused on the reactor buildings and the fuel buildings (which house the cooling ponds). Spent fuel storage facilities have yet to be considered (HSE, 2009a-d).
11. Westinghouse documentation for the AP1000 (HSE, 2009c) shows that it meets the requirements of the United States Nuclear Regulatory Commission (USNRC) for the impacts of large aircraft. The requirements of particular interest to CoRWM are set out in 10 CFR 50.150 and can be summarised as (USNRC, 2009):
 - The operator must perform an assessment of the effects of an impact of a large aircraft and show that the design has features and functional capabilities such that the reactor core remains cooled or the containment remains intact, and that spent fuel cooling or spent fuel pool integrity is maintained.
 - The assessment must be based on the impact of a large commercial aircraft, with a fuel loading typical of that used for long distance flights in the US, and an impact speed and angle of impact considering the ability of both experienced and inexperienced pilots to control large commercial aircraft at the low altitude representative of a nuclear plant’s profile.

¹ EDF proposes to build two new reactors at Sizewell, starting in 2013. The spent fuel management options work for Sizewell B does not include these new reactors and “does not preclude the choice of any other equally safe and mature technology solution” for their spent fuel (British Energy, 2009d).

12. As far as CoRWM has been able to ascertain, there are no corresponding USNRC requirements for spent fuel storage facilities. Westinghouse has put forward a reference design for a spent fuel storage facility but it is for the reactor operators to decide whether to adopt it or an alternative. The reference design has casks in a structure below ground level (CoRWM doc. 2765).
13. The aircraft shell of an EPR is designed to protect against military and commercial aircraft crashes. EDF and AREVA have told HSE that the systems important for the safe operation of the reactor are protected against aircraft impact either by this thick concrete shell or by physical separation (ie there are duplicated systems in separate areas that could not be affected by a single aircraft impact). They have also stated that the design was verified and modified as necessary after 9/11 to address the possibility of the direct impact of a large commercial airliner (HSE, 2009d). Since there are proposals to build EPRs in the US, CoRWM concludes that it can be inferred that the design will meet USNRC requirements.
14. EDF and AREVA have put forward various options for spent fuel storage for EPRs. These include wet and dry facilities, at each reactor, at one reactor serving a whole fleet and at a central location away from reactor sites. The two companies have told CoRWM that the store designs being considered have the same degree of protection against aircraft impacts as the reactor and its fuel pond (CoRWM doc. 2767).
15. HSE ND has informed CoRWM that it will be looking to ensure that the final designs for spent fuel stores for new nuclear power stations will offer the same order of magnitude of protection as will be provided for the reactors and fuel ponds.

References

CoRWM Documents

CoRWM doc. 700. *CoRWM's Recommendations to Government*, 2006.

CoRWM doc. 2500. *Interim Storage of Higher Activity Wastes and the Management of Spent Fuels, Plutonium and Uranium*. CoRWM Report to Government, March 2009.

CoRWM doc. 2746. *Meeting with OCNS, 7 December 2009*.

CoRWM doc. 2747. *Meeting with Regulators' GDA Team, 8 December 2009*.

CoRWM doc. 2765. *Meeting with Westinghouse, 20 January 2010*.

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Other Documents

British Energy, 2009a. *Managing spent fuel at Sizewell B. Finding the right interim solution beyond 2015*.

British Energy, 2009b. *Managing Spent Fuel at Sizewell B. Feedback on Public Exhibitions and Community Meetings*.

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