

NUCLEAR NEW BUILD?

ASSESSING THE CONSEQUENCES

JOHN LARGE, LARGE & ASSOCIATES, CONSULTING ENGINEERS, LONDON
Brighton University, Brighton -10:00 Friday, 20 February 2009

Plans announced (24 September 2008) by EdF at its takeover of the present nuclear power operator British Energy, suggest that of the 4 European Pressurised Reactor (EPR) nuclear plants that it has planned for the UK, two will be built alongside the existing nuclear plants at Hinkley Point, and the other two alongside the closed down and defunct twin Magnox reactors and the single pressurised water reactor (PWR) at Sizewell, Suffolk. The first EPR is planned to be in electricity generation by 2017 so, with the expected retirement of the fault ridden and troubled existing Hinkley AGRs within a few years, the spare electricity distribution grid capacity from Hinkley strongly favour this first EPR being commissioned at Hinkley Point.

Yet to be announced, but in the Government's planning pipeline, are the transfer of at least four existing nuclear sites from the Nuclear Decommissioning Agency (NDA). These sites at Bradwell, Oldbury, Sellafield and Wylfa in Wales, will be licensed for further new nuclear builds by a yet-to-be-agreed developer committed to, most probably, the Westinghouse Advanced Passive (AP) reactor system,

Compared to the AGR reactors, each of 600MWe capacity, the French designed EPR is rated at about 1,600MWe generating capacity. With a projected operational life of 60 to 65 years, the EPR nuclear plant is capable of utilizing uranium based nuclear fuel to much higher irradiation (burn-up) levels from the present level of about 40MWd/tU to in excess of 75 MWd/tU and also of being fuelled with plutonium based fuel (MOX).

In 1982 the then National Radiological Protection Board (NRPB but now part of the Health Protection Agency) published the results of its comprehensive analysis into a radiological incident at the proposed Sizewell B pressurised water reactor (PWR) nuclear power station. For this analysis it was assumed that a severely damaging incident would rupture the reactor containment dome (*containment failure*) giving rise to a very significant release of radioactivity into the environment, yielding a maximum of 2,600 (130 probabilistic expected value) or so deaths in the short term and around 31,000 (3,300 expected) deaths in the longer term. This projection of health detriment assumed that countermeasures would be judiciously implemented, including the speedy evacuation of about 300,000 (24,000 expected) members of public from the locality around the Sizewell site. However, for its mortality and morbidity projections the NRPB relied upon the then ICRP 26 standard that is now superseded by the universally adopted ICRP 60 recommending a x4 increase in the causal effect of radiation exposure, so much so that the 1982 analysis is now considered to be an *under-estimate* of the potential consequences of such a release. The next projection for the radiological consequences of a PWR reactor accident carried out in the UK was in 1988 for the PWR nuclear plant proposed at Hinkley Point in Somerset. For this study, obviously in account of the Chernobyl disaster two years earlier, the damage and worse case incident considered to be credible comprised a very limited release of radioactivity with the reactor containment remaining intact throughout and following the incident, thereby constraining the radioactive release to a *containment bypass* for which no early or longer-term deaths were projected.

For the EPR the designer, AREVA, reckon that the nuclear plant is entirely protected from accidents and malicious acts that could result in significant release of radioactivity. In making this claim AREVA place extraordinary reliance on its failsafe engineered systems and containment, so much so that, in the very worst and most severe incident, the release would be limited to just 0.03% of the reactor fuel radioactive inventory. Put another way, over the six days following the explosion at the Chernobyl Unit N° 4 reactor, it is reliably estimated that at least 30% of the total reactor fission product radioactivity released uncontrolled into the atmosphere. The equivalent worst case reactor incident release from an operational EPR at Hinkley Point would, according to AREVA, result in no more than (6 x 0.03%) 0.18% of the radioactive inventory.

John Large will give an illustrated presentation that provides an up to date prediction of the radiological consequences of a severely damaging incident at Hinkley Point and at Sizewell, this being the first time since 1982 that a revised radiological impact assessment for PWR has been publicly aired. Based on EdF's undertaking that two EPRs, will be commissioned at Hinkley Point, the radiological health consequences of these larger nuclear plants will be analysed taking into account upwards revisions to the causal factors linking radiation dose to health detriment, the larger core mass of nuclear fuel, the increased irradiation or burn-up of uranium fuel rendering it more radiotoxic, and the impact of MOX (plutonium) fuelling, all in account of the lessons learnt from Chernobyl. The modelling and analysis will draw upon the outcome of highly confidential terrorist attack exercises carried out on nuclear plants in the United States, it will assume the same capabilities of the terrorist to penetrate the security at Hinkley Point, seek out the vulnerabilities of the nuclear plant, and to contrive effective means by which a radioactive release will take place; and for the radioactive dispersion and consequences the European standard COSYMA software has been deployed, together with NOAA satellite data to provide real time imaging of the dispersion and radioactive fall-out in the aftermath of the release.

The analysis and projections for the EPR power plants will be expressed in terms of the risk of any one individual sustaining health harm in the aftermath of a radioactive release and, related to the increased health risk from the larger EPR plant operating with a greater extent of irradiation (burn-up) and/or with a plutonium based fuel core, the need to extend both the range and resources allocated to the local authority off-site plan (under the Radiation (Emergency Preparedness and Public Information) Regulations 2000).

LARGE & ASSOCIATES
CONSULTING ENGINEERS, LONDON
<http://www.largeassociates.com>

JOHN LARGE

John Large is the Chief Executive of Large & Associates, a company of consulting engineers based in London that specializes in the nuclear field. He is a Chartered Engineer, a Fellow of the Institution of Mechanical Engineers, a Graduate Member of the Institution of Civil Engineers, a Member of the British Nuclear Energy Society and a Fellow of the Royal Society of Arts. John Large has completed a number of investigation and analyses relating to the PWR EPR plants at Olkiluoto in Finland and at Flamanville in France, and on the current situation at Chernobyl, all of which can be accessed at:

<http://www.largeassociates.com/3155%20Jersey/R3155-3.pdf>
<http://www.largeassociates.com/3155%20Jersey/3155-R1%20-%20Draft%2031%20July%202006.pdf>
<http://www.largeassociates.com/3150%20Flamanville/r3150-final-1.pdf>
<http://www.largeassociates.com/3149%20Olkiluoto/R3149-A1%20Final%20Issue.pdf>
<http://www.largeassociates.com/R3123-a2%20final%20Issue.pdf>
<http://www.largeassociates.com/3143%20Chernobyl/R3143-A3%2022%20April%202006.pdf>