RISKS AND HAZARDS OF THE EXISTING AND POSSIBLE EPR/PWR NPPS AT SIZEWELL

Market Hall, Saxmundham – 8.00 PM Thursday 12 July 2007

The present operational nuclear power station at Sizewell B is a pressurised water reactor (PWR) of about 1,200MW_e generating capacity. The plant was commissioned in 1995 and is expected to continue in operation until 2035 with, during this 40-year period, much if not all of the radioactive waste and irradiated (spent) nuclear fuel being retained at the Sizewell site. The Sizewell site has been identified in government DTI and DEFRA reports to be favoured for the development of one or two further nuclear reactors, probably the larger Generation III PWR plants, such as the 1,600MW_e European Pressurised Reactor (EPR) presently under construction at Olkiluoto in Finland and at Flamanville in France. 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 and 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 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 However, for its mortality and morbidity projections the NRPB relied upon the then ICRP 26 standard that is now superseded by the universally adopted ICRP 60 recommending a x4 increase in the causal effect of radiation exposure, so much so that the 1982 analysis is now considered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. Then, in 1986 the worldwide nuclear industry reeled in response to the Chernobyl accident with its across Europe radiological consequences, permanent isolation of an exclusion zone of 30km around the Chernobyl nuclear plant and the need today and for future decades to radiologically manage a total of upwards 3 million persons in regions of the Ukraine, Belarus and Russia. Thereafter, 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, 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.

Thus and in the absence of any significant structurally engineered design change of the reactor and its containment at Sizewell, and most probably spurred on by the totally unacceptable consequences of the Chernobyl disaster, the nuclear industry determined that a *containment failure* of the existing and any future PWR nuclear plant at Sizewell could not occur. However, in 2001 the tragedy of 9/11 demonstrated that a well-organised terrorist group could mastermind and successfully carry through utterly devastating attacks on public and government buildings. The events of 9/11 left the nuclear industry's probabilistic based argument that it could design out severely damaging accidents in disarray, so much so that *containment failure* and the opportunity that it provides for a massive radioactive release now has to be considered in terms of inevitability of terrorist attack and not dismissed to be a remote possibility of accident. At two recent UK criminal trials, evidence was given to show the malevolent interest of these now convicted UK terrorists in radiological and nuclear matters so, in this respect, nuclear plants in the United Kingdom, such as at Sizewell, should not be considered somehow exempt from the threat of terrorist action.

John Large will give an illustrated presentation that provides an up to date prediction of the radiological consequences of a severely damaging incident at Sizewell B, this being the first time since 1982 that a revised radiological impact assessment for Sizewell has been published. Also, based on the likelihood that a third and, possibly, fourth nuclear power plant, such as the EPR, will be commissioned on the Sizewell site, 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 increased irradiation or burn-up of the fuel rendering it more radiotoxic, 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 Sizewell, 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.

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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.

Prior to founding Large & Associates, from the late 1960s through to the early 1990s, John Large was a full time member of the research and teaching academic staff of Brunel University, where he undertook research for the United Kingdom Atomic Energy Authority (UKAEA) on reactor systems, high temperature reactor fuel, moderator core coolant flows and aspects of other nuclear topics and devices. For Large & Associates he has presented evidence to the UK parliament select committees on Environment and Energy, given evidence at the Court of Human Rights in Strasbourg on the dose exposure to HM services personnel exposed during the Christmas Island nuclear tests, and been involved in investigating nuclear programmes in South Africa, Taiwan, Japan, Korea and, most recently, Iran. John Large was personally responsible for selecting and heading up the team of specialists, engineers and scientists that undertook the nuclear and radiological assessments of the reactors and weapons systems on board the sunken submarine *Kursk* throughout the world-first salvage operation of 2001, being awarded a commemorative medal for his contribution from the authorities of the Russian Federation.

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:

Terrorist Threat at the Flamanville EPR	http://www.largeassociates.com/3155%20Jersey/R3155-3.pdf http://www.largeassociates.com/3155%20Jersey/3155-R1%20-%20Draft%2031%20July%202006.pdf
Potential Radiological Consequences of the EPR	http://www.largeassociates.com/3150%20Flamanville/r3150-final-1.pdf
EPR at Olkiluoto, Finland	http://www.largeassociates.com/3149%20Olkiluoto/R3149-A1%20Final%20Issue.pdf http://www.largeassociates.com/R3123-a2%20final%20Issue.pdf

Chernobyl: 20 Years On http://www.largeassociates.com/3143%20Chernobyl/R3143-A3%2022%20April%202006.pdf,