ELSEVIER

Cement & Concrete Composites 25 (2003) 1

Cement & Concrete Composites

www.elsevier.com/locate/cemconcomp

Editorial

Remediation, Recycling and Reuse continue to pose major challenges not just to Planet Earth but also to civil engineers and material scientists. With the pressure to find alternative forms of energy that will not pollute our environment, it is becoming clear that the nuclear waste problem—the management, decommissioning and clean-up of radioactive waste—needs a new research focus and technological innovation. There is not at the moment enough sound, scientific and engineering basis to find safe solutions for the storage and disposal of nuclear waste, and nations are not taking a sufficiently critical and urgent review of the nuclear waste problem. Nuclear engineering is no longer a subject taught in Universities, and there is little focused national and international initiative to develop a holistic and inter-disciplinary approach involving nuclear physics, radio-chemistry, civil engineering and material science to repair the damage and depletion of the engineering science base that is essential to lead an informed debate on nuclear waste management.

The clean-up of the Hanford site in the state of Washington in the USA is the sort of problem that is likely to confront us in the future. The site bears all the legacy of the cold war—it contains massive amounts of leftover contaminated material as well as nine reactors used to produce plutonium. Some 200,000 m^3 of high-level radioactive and hazardous waste is stored in underground tanks, and it is reported that many of these tanks have exceeded their design life, and have begun to leak. The cost and time scale for the clean-up and remediation of sites like that of Hanford are both staggering. The remediation of the 1450 km^2 site was originally expected to continue over a period of several decades—this is now to be accelerated and completed within the next 25 years or so. The funding for the clean-up for the fiscal year is about US$2.0 billion for 2002, but the total cost is estimated to be much, much higher. As part of the decommissioning of the nine reactors, more than 3 million Mg of contaminated soil have been moved away from the reactors to on-site landfills. The clean-up of the 200,000 m^3 of high-level waste presents a big challenge to engineers and material scientists. The waste is stored in 177 underground tanks, 149 of which have only a single shell. Both durability, and safety against leaking are thus limited in time-scale. It is intended that the waste will ultimately be treated in a vitrification plant.

In the UK, we have nine nuclear reactors closed for decommissioning. A further six reactors which are currently in operation are due for closure by 2010—thus all the UK's first generation Magnox nuclear power stations will be closed by the end of this decade. And we have one reprocessing plant at Sellafield which has two reprocessing works and waste facilities. It is now reported that there is a staggering £44 bn gap in the estimation total cost of cleaning up all the old nuclear power stations, and the cost of cleaning up existing waste continues to rise. Commonsense tells us that we cannot and should not rule out the nuclear option in our review of energy requirements for the future. Developing nations need energy resources desperately—it is said that Brazil, for example, requires new energy resources, the equivalent of that produced by the giant Itaipu dam, every five years if the country is to keep up with its development projects. We know that there will be huge rises in the estimated cost of tackling the nuclear waste legacy, and it needs time, thinking, and new, innovative technologies to find safe, efficient and cost-effective solutions. Research— holistic, inter-disciplinary research—seems to be the answer to keep us at the forefront, nationally and internationally, of nuclear environmental restoration.

0958-9465/03/$ - see front matter
PII: S0958-9465(02)00064-1