



Welcome to the June 2011 INSIGHTS published by acumen7. This month, acumen7 member Tony Roulstone looks at the major issues arising from the Fukushima nuclear disaster. The members of acumen7 bring their skills and experience together so that they can offer innovative solutions to today's complex problems. Full details about our network can be found at www.acumen7.com

Facing Up To Fukushima



In the wake of the disaster at the Fukushima reactor, Japan and other nations are re-evaluating their attitude to nuclear energy. In this interview, acumen7 member Tony Roulstone - who is also a member of the Cambridge Nuclear Energy Centre - says that he believes it is vital for governments and industry to proactively and openly develop nuclear strategy in light of this incident.

Introduction

With the daily media coverage of the tsunami aftermath focusing on the Fukushima power plant and possible worst-case scenarios, the safety question around nuclear energy has returned to the forefront of many people's minds around the world. Japanese Prime Minister Naoto Kan recently announced that his government will be 'starting from scratch' with its energy plans and the country's reliance on nuclear power following the crisis.

Tony Roulstone, Course Director of the Nuclear Energy Graduate Programme at Cambridge, argues that the Fukushima reactor may have long held the potential for an incident of this nature, being an old power plant with a potentially flawed design which doesn't reflect contemporary nuclear standards.

Inadequate Standards

"The safety standards that these old reactors were built to are nothing like today's standards. Fukushima is the second oldest Boiling Water Reactor (BWR) in the world, completed in 1971. Some of these early models have a weak design. At the very time you need the containment facility to protect you, when the core is overheating, the containment has to be vented to prevent it exploding. In reducing pressure, radioactivity is released."

"The reactor and the radiation containment should function for at least a week after an incident without external help, which is the way modern reactors are designed. Nuclear safety is very simple in principle: Don't damage the core, make the containment effective. But what do you do about these old reactors? We can use our ingenuity to try and fix them or shut them down, but either way we need to address the problem."

The earthquake didn't actually damage the reactor itself, which held firm, but the ensuing tsunami knocked out the diesel generators and systems that were used to pump water around the core, keeping it cool. Once the power failed, the core was critically damaged a mere 16 hours after the tidal wave hit.



Roulstone calls this 'common cause', where the initiating event triggers a domino effect that inevitably leads to core damage. In this case: tsunami hits, grid goes down, batteries fail, cooling pump stops, core damage results. "You can't have a reactor which destroys itself within a day when all you need to do is pump water in – this is unacceptable. What is required is: more batteries, more diverse and protected pumping systems. These must be provided whatever the cost.

Learning From The Past

Nuclear engineering has come a long way since the construction of the Fukushima plant. Modern reactor design has focused on the threat from 'external hazards' during the last 20 years: Earthquake, terrorism, plane crash, flooding etc. New designs have more robust and varied safety systems, such as the pump and generators, compared to those that failed at Fukushima. These are built to the same robust standards as the reactors, preventing the potential for a 'common cause' cascade of failure.

When the Fukushima plant was built forty years ago, the core damage frequency was probably once in every 1,000 reactor years. After the accident at Three Mile Island in the US, all reactors were modified to reduce the likelihood of core damage to at least one in 10,000 years. According to Roulstone, this likelihood has decreased dramatically during the 50 years of power reactors: "Plants from the 80's and 90's such as Sizewell in the UK have an expected core damage of once every 100,000 years, and the new generation of nuclear plants is being built to once every 1 million years, as good as we can do."

What To Do About Legacy Plants?



But this leaves the question of what to do with old reactors such as Fukushima, and the worldwide perception of nuclear power following such disasters in a media-saturated age, which taps into the public fear of nuclear radiation still prevalent from the Cold War and the much worse accident at Chernobyl.

For Japan, a heavily industrialised island nation with very little natural energy resources, there are no easy answers. "The Japanese committed to nuclear power because they had no other option," says Roulstone. "Post-Fukushima, all they can do in the short term is import gas and fossil fuels. The only way they'll reassure the public about nuclear energy is by saying: 'We don't care about the past energy policy, we need to look at everything on its merits right now as they stand'."

This openness in communication to the public from governments and the nuclear industry is something that Roulstone sees as crucial, on a local and global level. "In nuclear what happens in one country affects everyone else. The Japanese haven't yet been open enough with the global community; they need to get more international people involved. The nuclear industry needs to be seen to be learning from this; the only way we can progress effectively is by being open and responsive."

Conclusion

For Roulstone, the question of how to deal with ageing reactors such as Fukushima is a thorny one, but this is not the time to shy away from these issues. "As an industry, we need to learn from this and make things substantially better, not just a little bit better. We learned a hell of a lot about operating and designing reactors from Three Mile Island... the game is to learn from accidents – making the likelihood of these so remote that the public can trust nuclear to generate the energy we need"

"You don't live without risk; the question is what you do about it in these situations. You either give up, or you tackle problems and make progress."



Tony Roulstone is an engineer with over twenty years experience in the nuclear industry; he was previously Chief Executive of Rolls-Royce Nuclear. At Rolls-Royce, he also held a variety of roles in both the power and aerospace parts of the business. He now provides business advice to major industrial and service clients and is Course Director of the Cambridge University Graduate Nuclear Energy Programme.

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