Focus 11

Nuclear reactors as 'pre-deployed weapons'

"There is no regulatory system in the world that can guarantee that a power station will not be damaged by a crash involving a large aircraft."

Jérôme Goellner, Assistant Director, DSIN (now ASN), quoted in *Les Échos*, 13 September 2001

To some experts, nuclear reactors appear to be 'pre-deployed nuclear weapons'. The idea suggests that a successful attack on a nuclear reactor would cause devastation comparable to that unleashed by an actual atomic bomb. In reality, the same instantaneous force as produced by a nuclear explosion would not be liberated, but the impact of the massive contamination that the destruction of a nuclear reactor could cause would be just as great.

Can this vision, chilling as it is, be regarded as realistic? The question was barely asked before 11 September 2001. But the attacks carried out in the United States that day clearly changed everything. The question of nuclear reactors' degree of resistance to airliner crashes, which people were simply not considering only a few days before, became a major preoccupation over the following period. The debate which developed at that time in France, rapidly stifled by the convenient pretext of "defence secrecy", brought no reassurance.

In fact, the traditional response to the question of a threat to French reactors – as far as that risk was actually taken into account – lay in the military doctrine of nuclear deterrence, since it was thought that an attack on this scale could only be organised at a military or paramilitary level, with the direct support of a foreign government. The country in question would be laying itself open to the same response – a nuclear strike – as if it had actually aimed an atomic weapon at France. But as soon as it was possible to imagine such an attack being carried out by a group not associated with a foreign government, as 9/11 showed, this doctrine fell apart.

An important consequence of this doctrine had been that any large-scale attack was ruled out of consideration when drawing up the design basis for nuclear installations. This was essentially based on the constraints that could result from accidental external impacts, assessed in terms of probability – since the only malicious acts judged plausible at the time would not have an effect greater than that of the earthquakes or chemical explosions that were taken into account. By this reasoning, only an accidental light aircraft crash seemed probable enough (over one change in a million per reactor per year) to insist that a reactor be designed to withstand it. The impact of such an aircraft bears no resemblance to an airliner crash, particularly when one takes account not only of the collision but of the burning of its fuel.[71]

The 'plausibility' of terrorist attacks on nuclear installations using airliners loaded with aviation fuel is unfortunately no longer in doubt, any more than the fact that such an attack could have catastrophic consequences if it succeeded in hitting one of the 58 reactors operating in France (or anywhere else in the world). What is more, reactors are not the only nuclear installations at risk (to say nothing of the fact that other industrial installations could also be targeted). For example, nuclear fuel cycle plants and the various storage and stockpile sites for radioactive material sometimes have a larger radiological inventory than reactors, without enjoying a level of protection equivalent to that provided by a reactor containment building. This is particularly true in the case of the irradiated fuel storage ponds at La Hague, as the debate of autumn 2001 revealed.

[71] The thermal energy that would potentially be released by the burning of between 20,000 and 200,000 litres of aviation fuel (two-thirds of the maximum fuel payload of the Airbus A320 and A380 respectively) is much greater than the 2,300 to 19,000 megajoules of kinetic energy that these aircraft would have (on the basis of their maximum weight and speed).

Today's official response – apart from preventing any public analysis of the situation from developing, by invoking official secrecy – consists of reassuring the public that such an attack would be stopped before it reached its target, thanks to intelligence systems and alert and reaction plans: fighter aircraft would be mobilised to intercept any threatening airliner and shoot it down if necessary, after confirming the threat and going up the chain of command according to an established protocol. All the same, in the case of La Hague, radar-guided surface-to-air missiles were deployed close to the site for a time.

The vulnerability of existing installations and the impossibility of adapting them to a threat that postdates their design create a very difficult situation for the authorities. Any discussion beyond platitudes is impossible. The questions that one might want to ask as to the effectiveness of these preventative measures against an attack like 9/11, or about the possible resistance of installations to other conceivable types of massive attack and about the prevention of these, receive no reply beyond the need for secrecy.

The question is – or should be – framed differently in the case of new installations. One might therefore have thought that new requirements for protection against malicious acts would have been set out, or at least discussed, before new projects were built. Nothing could be further from the truth. The EPR reactor whose construction has been authorised at Flamanville was designed in the 1990s to the standards current at the time. In terms of air crashes, it has merely benefited from Franco-German cooperation to incorporate into the design basis resistance to a military aircraft crash (which was considered more likely in Germany in light of the accident statistics for aircraft from American airbases).

The lessons of 9/11 have not led the authorities to review the design basis requirements. They have been content to ask the operator to carry out studies on resistance to an air crash outside the design basis process, without making this a regulatory obligation. The final results of these studies are not publicly available. EDF states about the EPR that "in consequence of several additional precautions decided after 2001, it is capable of resisting airliner crashes."[72] The constructor of the EPR, Areva, and the authorities do not contradict this. Nevertheless a leaked provisional document, published by numerous sources even though covered by defence confidentiality, seems to suggest that "crashes" does not mean "all crashes", or in other words that in some cases the EPR might not be able to withstand the kinetic shock. Moreover, no information exists regarding evaluation of the combined effect of impact and heat, and still less on the consideration of other design basis threats, even the list of which is secret. Conceived at the end of the 20th century, the EPR does not seem ready to face the dangers of a new century inaugurated by the collapse of the Twin Towers.

[72] EDF, *Débat public 2005/2006, Projet Flamanville 3 – Construction d'une centrale électronucléaire "tête de série EPR" sur le site de Flamanville – Le dossier*, document submitted to the public debate, July 2005.