Focus 12 Transports, a weak link in the nuclear chain

Hundreds, if not thousands of packages of radioactive material criss-cross French territory every day, mostly intended for medical or industrial purposes not involving nuclear power. These numerous journeys do of course pose some security problems, particularly in terms of the risk of misappropriation, since some of them contain sources that could be used in a 'dirty bomb' (combining a conventional explosive device with a radioactive source in order to spread contamination).

But the main security issue with transportation concerns the more significant transfers of radioactive material generated by the nuclear industry, and in particular the transportation of nuclear materials used in fuel (which are the same as those used in nuclear weapons, although usually of a different grade and form). On average, there are over four transports of such materials on France every day.

Each of these carries enough material to qualify, if it were stationary, as an *installation nucléaire de base* (INB – regulated nuclear installation, the French term for a nuclear facility significant enough to require a certain level of regulation). Any vehicle park, railway station or service station where one of these transports stops also effectively becomes an INB, albeit without having any of the protection required by this specific regulatory status. This is the root of the problem: beyond its walls, the nuclear industry needs to put in place protective measures suited to a mobility which by its very nature weakens the traditional mechanisms. For example, the containment barriers are necessarily less thick and the restrictions on public access less controllable than in the case of a fixed site.

Some of these transports are vital to the functioning of the nuclear industry. However, France has made industrial choices which hugely increase the risks, by developing reprocessing and plutonium reuse activity, not only for its domestic purposes but also for foreign clients.

This increase in risk is in the first instance quantitative. The very principle of separating and reusing plutonium implies additional transports between the places where the various stages in this cycle are carried out. The increase is all the greater in that, for other reasons, these locations are spread all around the country – in particular the spent fuel reprocessing and new plutonium-based fuel manufacturing plants, located respectively at La Hague in the North-West and Marcoule[73] in the South-East, and so necessitating a journey right across the country.

The increase can be measured by calculated the total number of kilometres covered by packages of nuclear material containing plutonium, or even the kilometres covered by the tonnages of plutonium involved in the different transport stages (expressed respectively as 'package kilometres' and 'tonne plutonium kilometres' – see Figure 14). By this method it can be estimated that, in a typical year of flows generated by the industry, over 250,000km are covered on French territory by transport packages containing plutonium. In addition to uranium transports further up the fuel cycle, the choices associated with plutonium reuse lead to a trebling in tonne kilometre terms of transports related to the lower part of the cycle, half of it attributable to domestic and half to overseas users.[74]

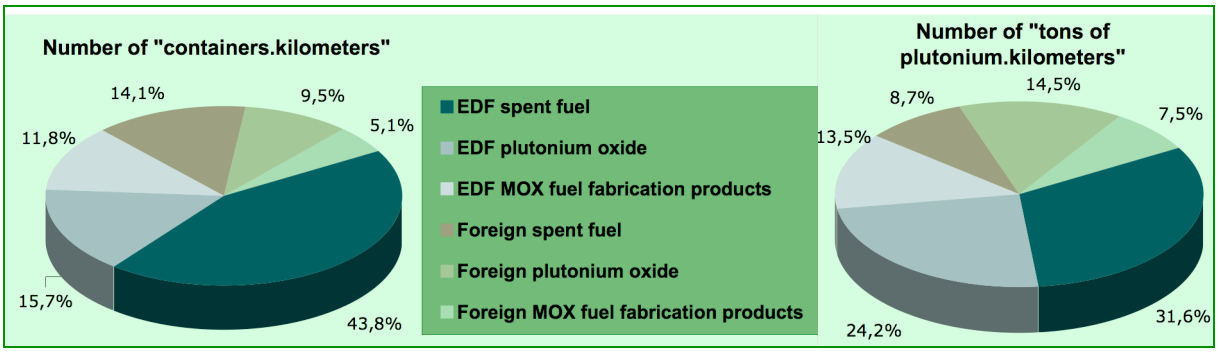
The increase is also – and perhaps above all – qualitative. In accordance with the stages in its reuse, plutonium is transported in forms very different from the one form encountered in the absence of reprocessing. In this instance, plutonium remains included within the matrix of spent fuel in which it was formed. Its reuse entails an initial transport of the separated plutonium to the MOX manufacturing plant, in the form of oxide powder, then a transport of non-irradiated MOX fuel to the power station that is going to use it. Finally, the spent MOX, hotter and more radioactive than conventional spent fuel, is transported to La Hague for storage. These different forms represent an additional sensitivity in terms both of the risk of misappropriation of material and of the potential impact if they were

[73] Two other plants, now closed, used to receive plutonium separated at La Hague: Cadarache, even further to the South-East than Marcoule, and Dessel in Belgium.

[74] These figures, representative of the beginning of the decade, are tending to fall as a result of the halting of massive imports of foreign fuel with the gradual ending of all the big foreign reprocessing contracts.

dispersed. This applies particularly to the first two forms which, in the classification of transported nuclear materials, belong to the best-protected category of non-irradiated nuclear materials.

Figure 14 Total transports[a] linked to the plutonium industry (2003[b])



a. The total level of nuclear material transports in France is here broken down into French and foreign material, and according to the main transport stages after discharging of the fuel (transfer of irradiated fuel to storage, transfer of separated plutonium from reprocessing to the MOX manufacturing plant, transfer of the products of the MOX manufacturing process (including waste from manufacturing). This total is calculated in terms of two scales:
• the estimate in 'package kilometres' corresponds to the total number of kilometres covered by packages of material of each of the categories included
• the estimate in 'tonne plutonium kilometres' relates the distances covered to the quantities of plutonium transported, according to the average content of each category.

b. The estimates presented have been produced by WISE-Paris in terms of a 'standard' year – in other words one representative of the average flows of material associated with EDF's reprocessing services and with foreign customers (before the decline in the latter activity).

Source: Estimates from WISE-Paris, 2003

Moreover, transports of this category of material go by road, unlike the other categories which are generally carried by rail. The idea, in view of the particular threats to which these sensitive transports can be exposed, is to enable greater flexibility in their organisation and to offer possible alternatives in the event of a known threat. Of course, this choice of policy is not a neutral one in terms of the risk of an accident and of the potential for the public to be exposed.

An intense controversy has developed in the last few years around the security of these transports and the associated risks. Greenpeace in particular observed that the transports between La Hague and Marcoule, amounting to one or two transfers of 150kg of plutonium over more than 1,000km every week, were taking place at fixed days and times and following a regular route – to the point that the organisation was able to observe the transports and reconstruct their timetables and itineraries. In 2003, in a spectacular action intended to call attention to this situation, Greenpeace blockaded a lorry carrying this plutonium in the middle of Chalons-sur-Saône, where it was preparing to spend the night in a barracks.

The logic of secrecy dictates that no failing can be acknowledged. The authorities accordingly turned the burden of responsibility on its head: the problem was not that these transports were regular and completely identifiable on the public highway, but that Greenpeace was making this information public. Those in charge of security thus maintained that the system of protection was based above all on intelligence, in the sense that it was precisely when observing the transports to obtain this information on timetables and routes that a malicious group would be spotted. So, they went on, Greenpeace's activity was indeed spotted; conversely, the publication of the information that the organisation had collected would enable a genuine malicious group to prepare an attack without attracting the attention of the intelligence services.

By the same logic, the authorities maintained that the straightforward immobilisation of the lorry did not show any weakness in the onboard protection systems, but on the contrary demonstrated the effectiveness of the decision-making chain, since rapid identification of the nature of the group had enabled certain methods of defence (whose nature is unknown) not to be brought into play. It is true

that the Greenpeace activists were wearing visible signs that they belonged to the organisation. But what would happen if actual terrorists adopted a disguise of this sort?

The controversy also extends to the possible consequences of an attack on these transports. In several successive reports since 2003, the independent British and French experts of Large & Associates and WISE-Paris have analysed the risks of a plutonium release in the event of an accident or a malicious act. These studies note that while the IRSN considers "that a transport accident could not cause a rupture in the container" of the type used (FS47) – a point on which they cast doubt elsewhere – the same institute has published test results showing that this container would not withstand the impact of a rocket, a type of weapon plausibly accessible to organised sub-national groups.[75]

It seems relatively clear that actions intended expressly to cause damage, if they succeeded in their goal, could have a major impact on the integrity of the containment and result in significant releases of plutonium powder. Quite apart from the socio-economic impact of contamination, the health consequences could be serious, in view of the acute radiotoxicity of plutonium. Inhaling just a few dozen microgrammes (less than one ten-millionth of the contents of a transport) is enough to trigger lung cancer with certainty. For example, Large & Associates estimate that a zone of 250km^2 could be affected, which in an urban area would represent around 125,000 inhabitants, with some 500 resultant fatal cancers.

More broadly, analysis of the infrequent published explanations of the French approach to the security of nuclear material transports suggests a failure fully to apply the recommendations of the International Atomic Energy Agency (IAEA), even though these recommendations precede 11 September 2001 and there are currently calls for them to be revised. The particular attention aroused by an exceptional transport of 150kg of American military plutonium from La Hague to Cadarache[76] in October 2004 led to a double standard: the visible security measures for this transport, including a heavily reinforced escort and the guarding of all the bridges, tunnels etc on the route, seemed to have nothing in common with the light measures applied every week to the French transports.

However, one anecdote calls into question the seriousness of the highly conspicuous arrangements deployed in this media-friendly context. Parked in order to refuel at a service station previously 'secured' by the arrival of armed personnel, the lorry could be seen and approached, with nobody on board, in the midst of the petrol pumps… Besides, the measures deployed for the occasion have remained exceptional: transports of plutonium and other nuclear materials subsequently recommenced in the same form as before. Barricaded behind their defence secrecy, the authorities show no sign of developing their doctrine on the security of these high-risk transports.

[75] The seizures occasionally carried out by the police show that modern weapons, capable of striking a vehicle travelling at 80km/h at a range of several hundred metres, are in circulation in some quarters.

[76] This plutonium was transported for the manufacture in Europe of four MOX fuel assemblages intended to be tested in an American reactor, with the aim of adopting this procedure generally as a means of eliminating the 34 tonnes of military plutonium declared surplus by the USA.