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PARLIAMENTARY OFFICE FOR THE ASSESSMENT OF SCIENTIFIC AND TECHNOLOGICAL CHOICES (*OPECST*)

Assessment of the National Plan for Radioactive Materials and Waste Management (PNGMDR) 2016-2018

Summary of the report written, on behalf of the OPECST, by Mr. Christian Bataille, MP, and Mr. Christian Namy, Senator.

The National Plan for Radioactive Materials and Waste Management (PNGMDR) was set up by the Law of June 28, 2006, providing for a program concerning the sustainable management of radioactive materials and waste. This same law also provided that the program would be established and updated every three years by the Government and subsequently transmitted to Parliament which would refer it to the OPECST for assessment. In accordance with these provisions, Mr. Christian Bataille, MP, and Mr. Christian Namy, Senator, were appointed to assess the PNGMDR 2016-2018. In the course of their study, which led them to meet with around fifty actors directly involved in the management of radioactive waste, both in France and abroad, the rapporteurs *specifically looked at the program itself as well as at three major issues concerning the future of the management of radioactive waste in France: the reprocessing-recycling of spent fuel, the management of very low level waste and the project concerning a deep geological storage center for high-level and intermediate-level long-lived waste.*

The article 6 of the Law of June 28, 2006 very precisely defines the objectives of the National Plan for Radioactive Materials and Waste Management and the guidelines which must be followed. Beyond such objectives and guidelines, the PNGMDR must also follow the framework laid down by the laws of December 30, 1991, of June 25, 2006 and of July 25, 2016, concerning the management of radioactive materials and waste. Mr. Christian Bataille was the initiator of the first of these and Mr. Christian Namy, along with Senator Gérard Longuet, was the initiator of the third.

Progress in the drawing-up of the PNGMDR

Comparison of the successive versions of the PNGMDR shows that the work carried out by the joint cross-party working group led, as the publications advanced, to progress in the different branches of the management of radioactive materials and waste, as well as in the consideration of additional types of waste.

The relative stability in the make-up of the working group which initiated the PNGMDR, has, in fact, allowed for substantial continuity in the treatment of the different, often complex, subjects dealing with the management of radioactive waste.

In accordance with the wishes of the legislature, the development of the PNGMDR thus represents an efficient steering tool for the management of radioactive materials and wastes and such a tool, leads, in complete transparency, to providing a direction for studies and developments, to identifying possible discrepancies and to requesting the necessary corrective measures.

The issues at stake in reprocessing-recycling

More than half a century ago, France made the choice to provide itself with an industrial tool which would allow it to reprocess spent fuel. In 1976, the adaptation of the factory at La Hague to new electricity-producing nuclear reactors was decided upon at the very moment that their introduction was beginning. These two parallel steps were taken in order to achieve a major strategic objective: a growth in the energy independence of the country.

In fact, such reprocessing aims at recovering energy-bearing materials, i.e. uranium and plutonium, still present in large quantities in spent fuel. In this regard, it is worth remembering that 100g of uranium, or even 1g of plutonium, provide more energy than one tonne of oil.

At a time when humanity is facing major climatic and energy challenges, the *rapporteurs* judge that it is difficult to accept that such a resource could be abandoned forever.

The nuclear industry has undoubtedly been a pioneer in the field of the circular economy and sustainable development. Such an economy is precisely based upon the principle of a loop

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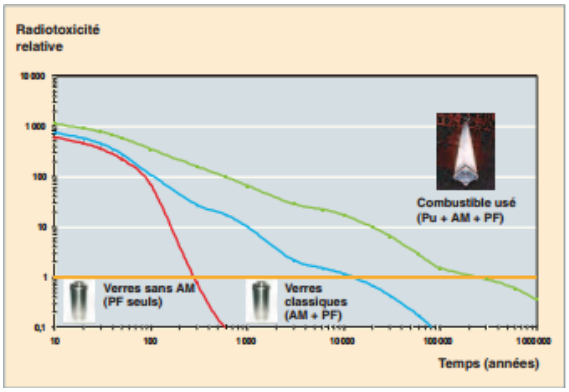
operation which aims at reusing resources still present in the waste so as to limit consumption and the waste of raw materials.

By extracting the main actinides (plutonium and uranium) from the waste to be stored, the reprocessing of spent fuel also leads to an important secondary objective being achieved: the reduction of their toxicity (notably their radiological toxicity), as well as their volume.



Decrease in the radiotoxicity of spent fuel, of classic vessels and of vessels without minor actinides (*Source* : CEA).

This advantage, which concerns waste storage and disposal, must be taken into account with the production of waste and effluent throughout the reprocessing cycle of the fuel. Like any industrial procedure, it is true that the reprocessing leads to a certain form of pollution. It would thus seem necessary to consider its environmental impact. This requires carrying out an analysis which takes the whole life-cycle of the fuel into account, from the extraction of the uranium to the disposal of the resulting waste.

Other countries with a high scientific know-how level have chosen to directly dispose of their spent fuel. The example of the United States illustrates the difficulty and the uncertainty of the management of un-reprocessed spent fuel for a substantial fleet of nuclear reactors, even though this solution might, at first sight, appear easier to handle from a technical point of view and thus more attractive than reprocessing.

Recovering the energy-bearing materials present in spent fuel clearly makes no sense unless the former can, in fact, be reused, in the short or in the long term, in order to produce more electricity. In the short term, this reuse is possible in the form of MOX fuel (made up of depleted plutonium and uranium) in the pressurized water reactors (PWR) of the current nuclear fleet. In the longer term, it requires the development and then the installation of a new type of reactor called the fast neutron reactor.

In anticipation of the definitive closure of 900 MW nuclear reactors, (the only ones authorized to use MOX fuel), Messrs Christian Bataille and Christian Namy recommend that studies should be carried out, as of today, on the possibility of extending this capacity to the most modern fleet of nuclear reactors.

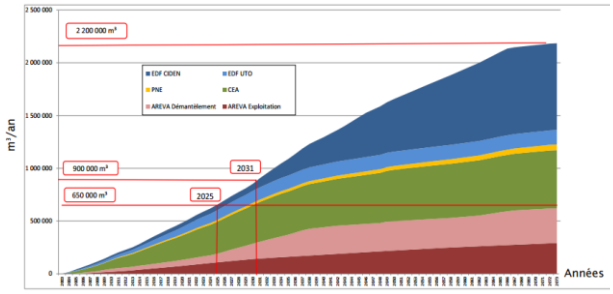
Today, France has a dominant position on the world stage in the field of reprocessing and recycling, both on account of the size of its installations and because of its know-how in all the necessary technologies. Countries, mainly in Asia, which are developing their nuclear production fleet, envisage, or by necessity, will envisage, obtaining their own capacities for reprocessing and recycling. China has already opened negotiations with AREVA in this respect. Even the United States no longer seems to completely rule out the possibility of returning to this option.

The *rapporteurs* consider that it would be paradoxical for France to give up, after more than forty years of investment, the advantage it has achieved through its dominant position in this area. Thus, they believe that the reprocessing and recycling of spent fuel must not only be continued, but that it is necessary, more than ever, to strengthen our efforts in research, both on the life-cycle of nuclear fuel as well as on the development of a new generation of safer fast neutron reactors which will represent its complement.

Advances in the management of VLLW

The French approach to the management of radioactive waste favors centralized disposal solutions which provide better protection measures for the population whilst, at the same time, minimizing the costs. Thus, all the very low-level waste (VLLW) produced in the coming years should be brought together in the Industrial Waste Collection, Storage and Disposal Center (the CIRES) with a capacity of 650 000 m^3, of which 328 000 m^3 have already been used.

With the progression of the decommissioning of nuclear installations, it became very quickly clear that, on account of an annual flow of between 25 000 m^3 and 30 000 m^3, the residual capacity of the CIRES would not be able to handle the needs in VLLW waste for more than the next ten years. An extension of the capacity of the CIRES to 900 000 m^3 is, in fact, envisaged. However, that will remain insufficient to deal with the provisional increase in the volume of VLLW waste production, which has doubled since the setting-up of the CIRES and which will ultimately reach 2 200 000 m^3.



Forecast of the progression in m^3 of the cumulated volumes stored at the CIRES (*Source* : ANDRA).

Even if the storage capacity of the CIRES were to be sufficient, it would nonetheless be necessary to assess the impact upon the environment and health of the transport of millions tonnes of waste across France.

During hearings, the producers of radioactive waste, just as the Nuclear Safety Authority (ASN) and the National Agency for Radioactive Waste Management (ANDRA), showed their openness to seeking alternative solutions to storage, such as:

- the retaining, on long-term industrial sites of buildings which, in the past, have not been contaminated and which, therefore, could be reused;

- the creation of local simplified disposal facilities which could house the least active VLLW waste

- the recovering of metallic waste coming from homogeneous batches, like those originating from the decommissioning of the Georges-Besse I factory and those from steam generators, with an annual flow of between 15 000 and 20 000 tonnes.

One of the unknowns in this last solution concerns the reusing of metal after decontamination, as the possibilities are limited in the nuclear industry. It would need to be ascertained if other industries, e.g. the making of pipelines in the oil sector, would accept to reuse such metal.

Several Northern European countries such as Germany or Sweden which are usually not suspected of negligence in the environmental field, implemented clearance thresholds, as of the end of the 1990s, allowing certain very low-level radioactive waste to be reused, recycled or simply disposed of outside of the nuclear installations. These clearance thresholds are, in particular, based on the recommendations of the International Atomic Energy Agency (IAEA) and on European directives.

Taking into account the skepticism of the French stakeholders interviewed, concerning the relevance of such a mechanism, it seemed useful to check it out in Germany itself.

Indeed, the usefulness of the clearance thresholds in this country is hardly arguable because of the absence, from 1998 and until 2022, of any operational radioactive waste disposal facility. In addition, the results obtained appear convincing since only 2.4% of very low level waste exiting the secure zones of German nuclear installations are, in the end, considered and treated as radioactive waste.

However, the social acceptance of this mechanism still appears limited and this, no doubt, explains the relative discretion of German stakeholders concerning the final destination of this cleared waste. Nonetheless, these destinations do exist, and wherever they are, perhaps even outside Germany, nothing prevents cleared waste from crossing borders.

Quite clearly, the situation in France is different. Here the existence of the CIRES means it is still possible, at least for several years, to store in a secure way, and at a moderate price, this type of waste. Whether or not the principle of clearance thresholds can fit in with the management of French radioactive waste remains to be assessed, particularly concerning its social acceptance. Thus, in November 2016, the OPECST made a referral to the High Commission on Transparency and Information on Nuclear Safety (HCTISN) concerning this issue.

In any case, from the moment new channels regarding the management of certain categories of very low level waste are envisaged, the notion of clearance thresholds could be useful as a reference point allowing the transparent justification of the authorization of specific solutions.

The impossibility of avoiding the question of deep geological disposal

The first contact Parliament had with the issue of highly active waste dates back to the 1980s when the previous Prime Minister asked Mr. Christian Bataille, through the OPECST, to take on a mission concerning the management of radioactive waste, in the perspective of setting up a laboratory on a deep geological repository.

In 1991, Mr. Christian Bataille was also the *rapporteur* on the law framing research on high-level radioactive waste. This law, which was unanimously passed, set down three main lines of research: deep geological disposal, the reduction of radioactivity in the long term, through a process of separation-transmutation and lastly, the long term storage whilst waiting for a definitive solution. This law also made provision for a future law, fifteen years down the line, which would take stock on progress in research and decide upon the implementation of identified solutions.

The ANDRA submitted a report in 2005, which concluded that a deep geological repository was feasible in the Meuse department. This suggestion had been examined by the ASN, by the National Committee for the Assessment of Studies and Research on Radioactive Materials and Waste Management (CNE) and by the OPECST. In the same year, a public debate on the management of radioactive waste was organized.

With all these elements in hand, Parliament decided, through the Law of June 28, 2006, also passed unanimously, despite some abstentions, on the construction of a deep geological repository, reversible for a period of, at least, one hundred years. As the previous law, that of 2006 made provision for a future law which would define the notion of the reversibility of the future repository.

In 2012, the ANDRA prepared a new report putting forward the main aspects of the future repository. On the basis of this report, a second public debate about this project was organized by the National Commission for Public Debate (CNDP) in 2013.

The assessment report of the previous PNGMDR called for the passing of a new law on the CIGEO geological repository project which was to remove the last barriers to its construction and to take the results of the public debate into account.

The Law of July 25, 2016 was passed, upon the initiative of members of the OPECST, by legislators of the ruling majority and of the opposition, firstly in the Senate and, then, in the National Assembly. It defines the notion of reversibility, as requested by the Law of 2006, and makes provision, at the beginning of the construction of the future installation, for an industrial pilot phase, aimed at trying out, on a full-size scale, the solutions set down in the laboratory. A future law is envisaged at the end of this pilot phase, around 2035, and it will be based on the assessment of the results by the ASN, the CNE and the OPECST.

The *rapporteurs* note that no decision concerning the construction of a grand installation has been the subject of so many precautions and consultations: Parliament, the population, the security authority and other stakeholders.

All the conditions have now been fulfilled for the geological repository project to enter its implementation stage with the next step being the filing, by the ANDRA, of an application for the authorization of the setting-up of the future installation. Research work will also continue so that the best solutions for the execution of the disposal facility may be found.

Conclusion

At the end of their assessment, Messrs Christian Bataille and Christian Namy welcome the progress made by the joint, cross-party working group on the National Plan for the Management of Radioactive Materials and Waste. The PNGMDR 2016-2018 is more easily accessible than the previous one and is more complete.

The *rapporteurs* welcome the relevance of this new edition as well as the investment of all the participants in the working group of the PNGMDR: the representatives of associations, the industrialists and the administrations.

Concerning the second part of their assessment, they consider that the research work carried out on the reprocessing of spent fuel and the fast neutron reactor, ASTRID, which is its essential complement, should not only be continued but accelerated if France wishes to maintain its dominant position in this field.

As regards the problem of the management of large quantities of very low-level waste following decommissioning, they encourage the members of the PNGMDR's working group to continue the work embarked upon to find alternatives to centralized disposal. They call upon the ASN and the HCTISN to reassess the relevance, within a French context, of an examination of the clearance threshold approach.

Finally, the *rapporteurs* note with satisfaction that, after twenty-five years of studies and research and after the passing of the Law of July 25, 2016 by Parliament defining the notion of reversibility, that the project for a deep geological storage center for high-level and intermediate-level long-lived waste is starting to materialize.

Independently of the opinion of each one on nuclear energy, nuclear waste is, today, a reality in our country which cannot be ignored. It is up to our generation, which has benefited from electricity based on nuclear energy, to implement the management of our waste and to ensure its financing.

The report may be consulted on the website of the OPECST:

http://www.assemblee-nationale.fr/commissions/opecst-index.asp
http://www.senat.fr/opecst/index.html

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