For a consistent management of radioactive waste: The national plan for the management of radioactive material and waste

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After 15 years of research on the strands for the management of high-level long-lived radioactive waste, the French Government has submitted in 2006 a bill on the sustainable management of radioactive material and waste to the Parliament. The Government drew up the bill after a national debate on the management of radioactive waste that involved many stakeholders at the end of 2005. The law was adopted and published in June 2006.

The law of 28 June 2006 requires that the Government establish a National Plan for the Management of Radioactive Material and Waste every 3 years. The national plan appraises the existing management modes of radioactive materials and wastes, identifies the foreseeable needs for storage or disposal installations, states the necessary capacities for these installations and the storage timeframes and, for radioactive wastes which are not yet the subject of a definitive management mode, determines the aims to be reached.

The first edition of the National Plan for the Management of Radioactive Material and Waste (PNGMDR) was drawn up at the end of 2006 and sent to the Parliament for assessment in January 2007. This plan was prepared in a wide-ranging working group leaded by the Nuclear Safety Authority since 2003.

The PNGMDR forecasts the development of managements schemes for different types of radioactive waste, depending on the level of activity and the duration of the hazard posed by the wastes. The different streams are presented in the table 1.

Table 1 : classification of radioactive waste

<table>
<tr><th>Half-life
Activity level</th><th>Very short lived
< 100 days</th><th>Short-lived
< 30 years</th><th>Long-lived
> 30 years</th></tr>
<tr><td>Very low level</td><td rowspan="4">Management by radioactive decay</td><td colspan="2">Dedicated surface repository
Recycling channels</td></tr>
<tr><td>Low level</td><td rowspan="2">Surface disposal (Aube repository)
except tritiated waste and certain sealed sources,</td><td>Dedicated shallow depth repositories under study</td></tr>
<tr><td>Intermediate level</td><td>Channels being studied under article 3 of the 28 June 2006 Act</td></tr>
<tr><td>High level</td><td colspan="2">Channels being studied under article 3 of the 28 June 2006 Act</td></tr>
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The contribution is organized as follows:

In the first part, a brief description of the objectives and the content of the PNGMDR is developed. In the second part, a practical case of one element of the French policy, which is related to the management of Very Low Level waste without universal clearance levels, is addressed. In the third part, the advantages and drawbacks of the two possible options are discussed.

1°) PNGMDR : objectives and content

The main objectives of the PNGMDR are therefore as follows:

- to ensure that management solutions either exist or are sought for each category of waste;
- to take account of older, possibly "forgotten" waste;
- to take account of the concerns of the public, who rightly or wrongly may be worried about the fate of radioactive waste;
- to optimise waste management at the nuclear licensees;
- to contribute to better management of the waste from other sectors generating radioactive waste: more conventional industries, activities using radioactive sources, medical sector, sites polluted by past activities.

The PNGMDR should enable solutions to be found guaranteeing clear, rigorous ands reliable long-term management of all radioactive waste in France, regardless of its origin.

The first part of the report of the PNGMDR is devoted to a description of existing radioactive waste management solutions or those arising from current activities.

This part is thus broadly based on the detailed data on radioactive waste made freely available by the inventory of radioactive waste and recoverable materials published by ANDRA, the public operator responsible for the disposal of radioactive waste in France. It presents a number of solutions for the management of the various types of radioactive waste identified (see table 1).

The second part of the report looks at the radioactive materials used in the nuclear power generating industry and which are today considered less as waste than as recoverable materials, owing to their high energy potential if used in certain nuclear reactors of the future. These materials are described in the inventory of radioactive waste and recoverable materials published by ANDRA. However, as a precaution and with a view to the longer term, it would seem wise to examine the long-term management solutions if, for whatever reason, they were one day to be considered to be waste.

This part identifies the particular case of depleted uranium, of which large volumes exist (several hundred thousand tons) and reprocessed uranium (several tens of thousands of tons), for which there is a degree of uncertainty regarding which existing or planned disposal channels could be used in the eventuality of these materials one day being classified as waste. Research could be initiated in this area.

The third part examines the overall consistency of the existing or planned solutions for long-term management of radioactive waste. The main characteristics of the existing and planned repositories are described, along with the existing or planned solutions for very low level waste (VLLW).

The adequacy of existing or planned disposal capacity for the volumes of radioactive waste is examined. It would seem that this capacity is consistent with the waste that is scheduled to be produced by the existing installations.

A number of factors could however significantly call into question the disposal channel capacity requirements:

- significant renewal of the population of nuclear installations would require an increase in the volumes to be considered for all projects and would require that the waste disposal channels be available for a far longer time-frame;
- given the volumes involved, if for whatever reason, depleted and/or reprocessed uranium were to be considered as waste.

With regard to consistency, the following points in particular are examined:

- the consistency of the various radium-bearing waste disposal solutions (VLLW repository, uranium mining residues, long-lived LLW shallow depth repository project);
- the problem of long-lived waste accepted during the first years of operation of the Manche repository;
- the consistency between the management approach for VLLW waste produced by nuclear activities in France and the approach to management of waste from the non-nuclear industry liable to comprise TENORM;
- the question of waste clearance, in particular with respect to European practices;
- the consistency between the various procedures for management of effluent from nuclear activities and the problem of coordinating releases on the scale of cities and hydrological basins.

Finally, the fourth part goes back over all these data, in particular the problem areas or areas requiring further considered examination and discussion. It justifies the steps finally adopted in the Government decree to be justified.

2°) The managements of Very Low Level waste without universal clearance levels

During the 90s, French operators, but also authorities, were facing the challenge of the management of very low level waste produced mainly by the nuclear sector. The problem was twofold, first, the nuclear operators thought that the cost to dispose very low level waste in a disposal designed for low level waste (centre de l'Aube disposal) was high. They tried to find solutions to, at least, limit the volume of VLLW sent to the centre de l'Aube disposal. One of the solutions was to develop an incinerator of VLLW that would be able to produce waste acceptable to the centre de l'Aube. The CENTRACO incinerator, located in Marcoule, was designed and commissioned for this purpose at the end of the nineties. Nevertheless, incineration is not appropriate for the disposal of large amount of slightly contaminated concrete blocks or grounds.

The possibility to recycle materials used in nuclear activities was another issue. Some stakeholders were concerned by the possibility for the nuclear industry to clear large amounts of slightly contaminated materials which could be recycled in goods used by the man in the street. During the nineties, non governmental organisations pointed out a few examples of non very appropriate management of such wastes.

If there is a need to regulate some radioactive materials as soon as this material is contaminated beyond exemptions levels, there is also the need to clear some materials from nuclear activities if those materials are not contaminated enough to pose radiation protection hazard. Nevertheless, as in many countries where this topic was discussed, the question then is: "what should be these levels and which organisation should be responsible to establish them?". This last question means that at a political level, someone is ready to make the decision and to face the concerns of the stakeholders and the public.

At the end of the 90s, the authorities (mainly the nuclear safety authority – ASN), decided to implement an approach which would not justify the clearance of non radioactive material on the sole argument of "clearance levels". The approach is based on the zoning of nuclear installations in "nuclear waste zones" and "conventional waste zone". The operator has to classify a zone in a "nuclear waste zone" if there is a risk that wastes produced in this zone may be contaminated because of the nuclear activity. For example, this zone may have been contaminated by the past after an incidental spread of contamination, or because there is a possibility of neutronic activation of the materials. Each waste produced in a "nuclear waste zone" must be managed as a "radioactive waste".

The interministerial order of 31 December 1999 has made this approach binding to the nuclear operators. The nuclear operators have practically implemented this approach and documented it in "waste studies". One part of this document (the zoning and the referential) was submitted to ASN for

approval. After the approval of the first studies, ANDRA opened its VLLW disposal in Morvilliers, not far from the centre de l'Aube disposal, dedicated to SL-LL waste.

The first VLLW were disposed of in the repository of Morvilliers in 2003. Since then, this disposal has disposed of nearly 75 000 tonnes of concrete, metallic scraps, former transport casks...

This disposal is designed so that, after a period of survey of 30 years, the impact for a person who would live not far from this disposal should not exceed a limit of 0,25 mSv/year, taking into account that the principle of optimisation should also apply.

3°) A practical way to manage VLLW (waste zoning versus clearance levels ?)

At the beginning of the implementation of this approach, some people may have thought that this approach was dramatically different from the management of such waste using "clearance levels". After a few years of practice, the main difference in the two approaches remains more philosophical and financial than really practical.

In the case of disposal of VLLW in a repository, the idea is to apply the "concentrate and contain" principle developed for many years by the International Commission for Radiation Protection, especially in its publication n°81. The very low level waste are disposed of in a single place where the authorities will keep the control of the waste, until the moment when it will not be possible to guarantee an administrative control and then, the operator must demonstrate that its disposal remains safe for the future inhabitants of those lands. Indeed, the radioactive content of the wastes are limited in that case. This approach is different of the clearance levels, where the principle "dilute and disperse" applies.

The PNGMDR recognizes that the approach of universal clearance levels has advantages :

- "the existence of universal clearance thresholds simplifies the regulations, by clearly defining the materials considered to be radioactive as opposed to those considered to be conventional (differentiated clearance thresholds can however be defined for certain particularly sensitive materials, such as food or drinking water);
- these simplified regulations can then be applied uniformly to any human activity, whether or not covered by a radioactivity handling license, and make for easier supervision of international commercial trade;
- the existence of clearance thresholds offers an indisputable and scientific way of proving a radioactive or conventional nature, which is not subject to approval of clean-up methodologies based on arbitrary criteria."

This approach can however be criticised in several ways. First of all, the scientific and technical criticisms are as follows:

- "it is not possible to demonstrate the exhaustiveness or effectively penalising nature of the scenarios which were considered;
- furthermore, these scenarios often involve dilution coefficients (for example dilution of the VLL steel flow from the nuclear industry in the usual recycled steel flow), which must be called into question once they no longer offer a conservative safety margin, for example if a major decommissioning programme is implemented for a particular period; it is very hard to take account of these variations;
- the values which are determined in this way as candidates for the universal clearance thresholds are extremely low and can only be measured using highly sophisticated protocols and instruments, measuring waste in very small quantities. This makes measurement difficult and is hardly compatible with projects involving industrial quantities of VLL waste, such as the decommissioning of installations in which nuclear activities had been carried out."

“Criticism has also been made from a more ethical standpoint: not everyone feels that simply issuing clearance exemptions for VLL waste can justify the dissemination of radioactivity into the environment, which could run the risk of artificial radioactivity eventually becoming ubiquitous. Some criticisms also question whether the harm done by low doses, even of about 0.01 mSv/year, is in fact negligible.”

On the contrary, the PNGMDR admits also the issue of consistency of the policy without universal clearance levels:

- “This decision could therefore lead to problems of consistency with other European countries, which for their part implement universal clearance thresholds. This problem will need to be dealt with in the future.”

The fact that the European countries do not have the same clearance levels, when they have ones, is already also a lack of consistency. The operators may wish an harmonisation of such clearance levels in the future.

It must be pointed out that, at the beginning of the discussions on the management of VLLW in France, when the regulation was under preparation, the possibility to use the conditional clearance of slightly contaminated materials was kept as a possible option. The experiences undertaken essentially by COGEMA to recycle decontaminated steel of former UF6 containers in two non nuclear steel factory nevertheless failed. The first try of recycling was granted by all the authorities, including the former Office for the protection against ionising radiation. But the factory which should have recycled this steel has been bought by another company. The new owner has decided to stop this recycling before it began, because he worried about the image of its products in the case of recycling “nuclear waste”. The second try failed after a few demonstrations against the project of people living in the vicinity of the factory where the scraps may have been recycled.

In a country where 80% of the electricity is provided by nuclear power plants, the fate of millions of tonnes of materials due to the dismantling of nuclear installations is a strong concern, and not only for a few stakeholders. That explains the need to implement stringent conditions in order to guarantee that the clearance of materials from nuclear installations, in particular in the case of installations in the decommissioning phase. Clearance of materials remains possible as far as it is demonstrated that the material has not been contaminated or activated by the nuclear activity.

The dismantling of nuclear installations will produce huge amount of materials that will have to be decontaminated before clearance. Some concepts, like the zoning of the installations, have been or will be retained, also in countries where universal clearance levels have been set. The concept of disposal for VLLW remains also interesting, since the interest to decontaminate some materials, like concrete, will remain economically limited and the level of activity of some waste will remain beyond the clearance levels, which are very low. For those kinds of waste, a surface disposal with less stringent design options will constitute a good opportunity for the management of those waste, in some cases, a modification of existing disposal for low level waste is also possible. One option which should be also retained is the possibility to recycle the waste in the nuclear industry, like recycle the lead to provide new radiation shielding equipments, or produce waste packages.

Conclusion

The first edition of the National Plan for the Management of Radioactive Material and Waste constitutes a reference document for the next 3 years, but more over, it should constitute the basis to build the necessary consensus on the management of radioactive waste for the next decade.

One of the objectives of the Plan was to verify the general consistency of waste management modes. For some kinds of radioactive wastes, the Plan compares the existing pathways with the overall

capacities of disposals, or to national or international practices or guidance on the management of nearly identical wastes. For example, the policy for the management of very low-level waste without regulation on clearance limits is justified in the Plan. This justification is not only based on radiation protection criteria, but it takes also into account the public concerns on the possibility to release a huge amount of slightly contaminated waste. Those concerns arise in a context of the up-coming decommissioning of the first generation of nuclear power plants.

The difference of approach between different countries could appear as a lack of consistency, which at least should be justified. It seems that, instead of harmonising clearance levels, the European countries should first pursue an harmonisation of the objective to protect people from radiation by enhancing the conditions of clearance of materials from nuclear installations. Some means to improve it, like the zoning of the contaminated parts of nuclear installations, the appropriate disposal of wastes beyond clearance levels, the traceability of the operations, the possibility to reuse slightly contaminated materials in nuclear installations, where a control of radiation is implemented, may also be harmonised in the future.