

## Optimization of Waste and Materials Disposition in France – Policy, Strategies, and Techniques

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The general legal and regulatory framework for waste management in France is described in the « Code for the Environment ». A specificity of the French regulation is that it prescribes the implementation within nuclear facilities of a waste zoning to segregate areas where waste cannot be contaminated or activated and areas where waste are or may have an added radioactive content. The first category may be managed in conventional routes; the second category (nuclear waste) requires a dedicated management in licensed facilities with a reinforced traceability. The purpose of this regulation is to prevent a misdirection of waste from the very large French nuclear fleet without a need of an increased control by the regulatory body. Furthermore there is a reluctance of some stakeholders for free release of materials. As a consequence disposal for very low level waste must have an economical relevance in comparison with conventional waste disposal.

The regulation includes principles that are provided by the Planning Act of June 2006, the 28<sup>th</sup>, related to the sustainable management of radioactive Materials and waste. In particular this act sets a schedule for research into high level waste and intermediate level long-lived waste and confirms the implementation of a national plan for the management of radioactive materials and waste (PNGMDR). This plan, which is chaired by the ministry of energy and the nuclear regulatory body (ASN) involves elected officials, waste generators, the national waste management agency and members of the civil society. It is updated every three years. The plan deals with all types of radioactive waste and materials, with already available management routes and routes under development. It identifies areas to be improved and makes recommendations. It describes the research works to be performed. The follow up is done through periodical meetings, the conclusions of which are used to update the plan. The first version of PNGMDR was published in 2007, the present version, the third one, is applicable for the period between 2013 and 2015. As an important input for the PNGMDR a National Inventory of Radioactive Material and Waste is updated every three years by Andra.

Dedicated chapters of the PNGMDR focus on disposal in available repositories, on the incineration of waste, on the recycling of waste after melting. Centre de l'Aube disposal facility can accommodate for low and intermediate short lived waste. It started up in 1992. Its capacity is 1,000,000 m<sup>3</sup>. At the end of 2013 280,000 m<sup>3</sup> have been disposed of. According to the National Inventory it should be able to accommodate all waste for presently operated or decided nuclear facilities, including decommissioning waste. Centre de Morvilliers disposal facility started up in 2003 and is dedicated for very low level waste. It has a capacity of 650,000 m<sup>3</sup> and was designed for 30 years of operation. At the end of 2013 252,000 m<sup>3</sup> have been disposed of. Waste production identified in the National inventory doubled since the start up and suggest an anticipated saturation of this facility. Therefore the PNGMDR recommends efforts on several fronts: densification of waste, increase of disposal capacities and recycling of metals.

The enforcement of the French regulation leads to recycle very low level metals, even after decontamination, within the nuclear industry. Furthermore secondary waste should also be considered as secondary waste. Reinforced traceability has to be kept through all sequences of recycling: waste melting, production of new metallic parts and their incorporation in a nuclear facility. Furthermore the amount of metallic waste is low (in the range of 10,000 tons per year for steel, which is one thousandth of steel that is yearly recycled in France) is a handicap for the development of a relevant industrial route. However France experienced successfully the recycling of steel in Centraco/Socodei facility where 21,700 tons of metals have been melted between 1999 and 2011 and 600 tons were recycled as shielding in waste packages, lead has also be recycled (100 tons per year), after decontamination to 0.5 Bq/g by a melting furnace in Marcoule nuclear facility, by processing in dedicated workshops in conventional facilities.

The challenges for the development of an industrial recycling route are the following:

- The identification of reuse routes within the nuclear industry. The most promising track seems to be a reuse in waste packages.
- The implementation of dedicated treatment processes of waste (foundry) that complies with the traceability principles.

The economical relevance of the route is an important issue as it will compete with the direct disposal route.