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 28th, 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 m³. At the end of 2013 280,000 m³ 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 m³ and was designed for 30 years of operation. At the end of 2013 252,000 m³ 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) that complies with the Code for the Environment. 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 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.
Optimization of Waste and Materials Disposition in France – Policy, Strategies, and Techniques

Michel DUTZER
Andra (National Radioactive Waste Management Agency)

The present paper summarizes the findings of a working group within the PNGMDR that included representatives from Areva, CEA, EDF and Andra.

1- Introduction

Since 1969 France has implement disposal solutions for low and intermediate level short lived wastes (low level wastes according to IAEA classification). These wastes have been first managed at Centre de la Manche disposal facility till 1994: a total amount of 527,000 m³ of waste packages have been disposed of. In 1992 this facility has been replaced by Centre de l’Aube, the capacity of which is 1,000,000 m³ of waste packages. At the end of the 1990th, it appeared clearly that there would be an emerging issue for the management of decommissioning wastes and that a doctrine and a regulation had to be established. This regulation had to comply with European directives, in particular with directive 96/29 (now updated by directive 2013/39). To avoid any mistake in the orientation of wastes, and probably to anticipate public acceptance issues, the French regulatory body decided for nuclear facilities (“basic nuclear installations” according to French regulation) not to develop clearance levels and clearance processes but to require the implementation of a waste zoning within the facilities. In parallel it was decided to develop a new disposal routes for very low level wastes that should be safe but also cost effective.

The very low level waste disposal facility of Morvilliers (presently called Cires: industrial facility for logistics, storage and disposal) was designed in this context. It has a licensed capacity of 650,000 m³, consistent with the estimated needs for 30 years, and started up in 2003. Very quickly the experience of the management of very low level waste on decommissioned sites showed that the needs were underestimated. It is presently considered that they presently correspond to the double of what was previously taken into account. Therefore new solutions have to be identified to avoid an anticipated saturation of disposal resources.

2- Waste zoning

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.

Every French nuclear facility must establish a waste zoning with a view to segregate any sector where waste is actually or likely to be contaminated or activated (nuclear waste zone) from all other sectors where there is no waste-contamination or activation risk (conventional waste zone).

![Waste Zoning Diagram](image-url)
As a second line of protection systematic radiological controls secure the accuracy of the waste zoning. In case of a deviation waste zoning has to be reconsidered. The detection systems that implemented in conventional waste disposal facilities or other facilities that process waste make a third line of protection.

A consequence of waste zoning is that a large part of nuclear wastes may be just potentially radioactive. It is difficult to assess the actual distribution of activities as, for safety reasons, activities declared by waste generators are generally overestimated (mean activity is about 15 Bq/g). However dose rate monitoring of the workers of the disposal facility shows a very low impact in the range from 1 to 15 µSv per year.

3- Experience gained at Morvilliers disposal facility

The basic principle of the repository design was to comply with regulations governing disposal facilities for non-radioactive hazardous waste. Containment therefore relies on the properties of a low-permeability surface clay layer in which the repository is implemented.

Fig. 2: Morvilliers disposal facility

After the start-up of the facility, waste generators asked Andra to increase the technical ability to accommodate waste as their needs appeared quickly higher than expected. There was indeed no experience of waste zoning. Furthermore for facilities that were designed before this specific regulation, it was difficult to establish an optimized waste zoning.

Fig. 3: Disposal operations at Morvilliers

At the end of 2013 252,000 m³ have been disposed of, that is above what was forecast for the design of the facility. It shows a risk that the saturation of the facility would occur earlier than planned.

This risk seems to be confirmed by data related to the generation of waste within the French National inventory for radioactive materials and waste. Indeed, according to these data, produced waste volumes could be higher by about 100,000 m³ than the capacity of Morvilliers facility by 2020 and could be twice than this capacity by 2030.

This situation needs to be managed, with the involvement of the actors who are in charge of the different phases of waste management in France, in particular waste generators and the waste
management agency. It is a topic of work within the French National plan for the management of radioactive materials and waste (PNGMDR).

4- The National plan for the management of radioactive materials and waste (PNGMDR)

The Planning Act of June 2006, the 28th, related to the sustainable management of radioactive Materials and waste, confirms the implementation of a National plan for the management of radioactive materials and waste (PNGMDR). This plan is chaired by the ministry in charge of ecology, sustainable development and energy and by the nuclear regulatory body (ASN). It involves waste generators, the national waste management agency and members of the civil society. It is updated every three years. 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 also updated every three years by Andra.

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 prepare the next plan.

Considering the forecast inventory of VLL waste, the PNGMDR addressed the question of recycling in its program for 2010-2012 and asked the main French nuclear operators, AREVA, CEA and EDF, and Andra to perform a shared study in order to assess the opportunity and economical/technical feasibility of the implementation of recycling routes.

In accordance with the French doctrine related to waste management within nuclear facilities, recycling should be performed within the nuclear industry. Therefore stringent constraints on the traceability of materials are to be considered. There are also potential constraints in the facilities that could process these materials in terms of radiation protection and also in terms of management of secondary wastes generated by the processes.

5- Recycling challenges

5.1 Present experiences of recycling in France

The experience of SOCODEI/Centraco

SOCODEI is a company that was created in 1990 and that is now a 100% subsidiary of EDF. Since 1999 SOCODEI is operating a facility, Centraco, which includes an incinerator and a melting workshop. The objectives of the facility are to reduce the volume of waste, to condition them in a way that it can be accepted in disposal facilities and to recycle metallic waste. The facility processes both very low level and low level waste: metal structures, valves, pumps, stainless steel tools, steel and nonferrous metals from maintenance and dismantling of nuclear facilities.

Metallic waste is sorted and melted in an electric induction furnace with a capacity of 4 tons. The furnace has treated an average of nearly 1,700 t / year.

According to the physico-chemical characteristics of these metal waste outlets or two uses are possible:

- volume reduction : non-recyclable waste are shipped as ingots to disposal facilities.
- Recycling: waste which correspond to specific metallurgical criteria are used to manufacture internal cylindrical shieldings for packages used for intermediate level waste (spent resins).

The mean activity of metal that was process to make shielding was 6 Bq/g with a maximum value of more than 160 bq/g.

Between 1999 and 2011, 21,700 tons have been processed and 600 tons have been recycled in shieldings.

The experience of lead recycling

This recycling route was implemented by Areva in 2003 and operated by the CEA since 2005. The process includes:

- Collection of lead inside Marcoule nuclear facilities,
• First melting inside Marcoule facility to make ingots. The activity of metal after melting is less than 1 bq/g;
• Second melting in a conventional facility to manufacture shieldings,
• Recycling in nuclear facilities.

100 tons of lead per year are currently recycled. However this is a fourth of the capacity of the melting furnace and this route appears to be costly in comparison with a direct disposal in a very low level disposal facility. Therefore it is planned to stop this route.

5.1 Metal resources

The forecast inventory of very low level metallic waste was reviewed for the next thirty years by main generators and the part with the lowest activity was assessed. It was estimated that among the 400,000 tons of metallic waste, between 250 and 375,000 tons could be reused. About 90% of them are ferrous waste. This corresponds to a mean flow of very low level iron in the range of 10,000 tons per year.

This amount is small in comparison of the overall mass of metals that are presently recycled in France. The mean yearly mass is about 0.1% of conventional recycled steels in France.

Fig. 4: Metallic waste disposed of in Morvilliers (Cires) disposal facility

This inventory includes very homogeneous components, as about 140,000 tons that could be provided by the dismantling of a gaseous diffusion enrichment plant and more heterogeneous components provided by other fuel cycle facilities, power plants...

5.2 The potential use of recycled metals

Main waste generators and Andra investigated the potential use of recycled ferrous metals and considered different types of products:

• Construction products in nuclear facilities with a focus on steel frames to reinforce concrete,
• Packages to condition wastes.

For the second reuse the present metallic packages that accommodate wastes to be delivered to existing or planned disposal facilities were taken into account. But the possibility to replace a part of concrete packages by cast iron packages was also assessed for Centre de l'Aube disposal facility; for some types of waste this option could both save disposal space at Morvilliers facility and at Centre de l'Aube facility.

The study showed that for the next 30 years a potential reuse of 300,000 tons could be identified. The main contribution is provided by waste packages (about 70%). Furthermore a significant part of them could be made with cast iron. The needs could meet the available metals to be recycled.
However for the replacement of concrete packages by cast iron packages conditioning tools and handling tools have in most cases to be adapted to the new geometry of containers. In addition safety assessment may have to be reconsidered with the new types of packages. This is true in particular for the safety assessment in the long term for Centre de l'Aube disposal facility where the durability of packages is taken into account for the containment of wastes. The corresponding costs can have an impact to appreciate the overall relevance of the required modifications and, then, of the recycling route.

Fig. 3: Disposal of low level concrete packages at Centre de l'Aube

5.3 The relevance of the recycling route

The interpretation of regulatory constraints for the implementation of a recycling route leads to consider dedicated facilities to process the materials into new products. Provisions for radiation protection should be taken with respect to hazards and secondary wastes should be managed as nuclear wastes.

The amount of metal scraps appears too small to dedicate facilities for the fabrication of steel products with mills, extruders or wire drawing machines in a relevant industrial and economical way. The industrial organization should rather include a foundry; the capacity of such facilities can be indeed consistent with the quantities to be treated (in the range 10,000 tons per year). This is also relevant for the manufacture of cast iron containers.

But, if a recycling route may be relevant in terms of the industrial tools to be implemented, it must also have an economical relevance. Costs in a new configuration with recycling options have to be compared with the present available route of direct disposal, i.e. the recycling route has to compete with the direct disposal route. It was considered that investments costs to modify waste generating and conditioning facilities were too high to achieve profitability, even if a weak but actual economic interest could be shown downstream of these facilities to process and dispose of the wastes, especially when savings of disposal space was possible for very low level wastes as well for low level wastes.

It was concluded that recycling would be a more relevant option to consider for the reuse of metals in new facilities or in new disposal facilities. The opinion of some members of the working group within the PNGMDR was that such a route would only be feasible with a clearance process. Or there could be routes developed in a marginal way connected with the management of some specific decommissioned facilities or units.

6- Conclusion

To face an early saturation of disposal capacities for very low level waste, the development of alternative routes to disposal could be a solution. Recycling of metallic waste could save a part of these capacities. They indeed represent about one half of the forecast inventory that was taken into account for the design of the disposal facility of Morvilliers. Therefore the French National plan for the management of radioactive materials or wastes tried to impulse the development of recycling of very low level metallic wastes. In accordance with the principles of waste management within nuclear facilities recycling should be performed within the nuclear industry.

The amount of available metals could meet the needs for metal in the identified recycling routes, provided some changes in the conditioning of some low level wastes were decided. However for some uses as the replacement of concrete low level waste packages by cast iron packages that could absorb a significant part of recycled metals, waste generators considered that investments to adapt conditioning and handling tools in the presently operated nuclear facilities would be so high that it
would not provide any profitability in comparison with direct disposal. Recycling would be more a relevant option to consider for a reuse of metals in new facilities or in new disposal facilities.

Therefore there is still a need to find reuse modes for the 5 to 10,000 tons per year of very low level metallic wastes that would have to be accommodated in a disposal facility and to explore new options. There may be also marginal developments for some dedicated wastes. But they will have to compete with direct disposal option in the framework of the present French regulation. Recycling of very low level wastes remains a sustainable development challenge.
Optimization of waste and materials disposition in France
Policy, strategies, and techniques

Michel Dutzer – Andra

With the contribution of Jean François Rives (SOCODEI)

IAEA-OECD/NEA – Studsvik
symposium April 6-10, 2014
Recycling of metals arising from operation and decommissioning of nuclear facilities: the challenges in France

1. The landscape and involved actors in waste management in France

2. Present status of waste disposal in France: the issues

3. Policy, strategies: the national governance
   - The National radioactive wastes and materials management plan

4. Metals recycling
   - Present experiences in France
   - Very low level metallic waste recycling: some issues

5. Conclusion
The landscape and involved actors in waste management
A significant nuclear industry

Main waste generators
Nuclear power plants
Nuclear fuel cycle
Research
Military applications

Fuel Cycle Facilities (enrichment, fabrication, reprocessing)
Waste Storages
Nuclear Research Centres
Laboratories

58 PWR in operation
• 1 PWR under construction
Fuel cycle facilities
Nuclear research centres
Military activities

Many different operating facilities, a significant decommissioning program,
The landscape and involved actors in waste management
EDF decommissioning programme

1 heavy water reactor

1 pressurized light water reactor

6 natural uranium graphite gaz cooled

1 fast breeder reactor
The landscape and involved actors in waste management
AREVA decommissioning programme

Reprocessing plant

Fuel fabrication plants

Enrichment plant

MOX Fuel fabrication plant

Some operations already completed
The landscape and involved actors in waste management

CEA decommissioning programme

Nuclear submarines

Fontenay aux Roses Pilot facilities for reprocessing

Some operations already completed

Marcoule Reprocessing plant

Grenoble Various facilities

Fontenay aux Roses
Pilot facilities for reprocessing

Marcoule
Reprocessing plant

Grenoble
Various facilities
The landscape and involved actors in waste management

The involved actors

**Independent authority**
- Advises on regulation
- Controls
- Takes technical decisions
- Informs

**A State owned agency in charge of implementing solutions for long term radioactive waste management**

**Industrial operators**

- **700 small producers**
- **Services providers**
  - Including
  - Socodei

**Involvement in decommissioning waste management**
- Industry R&D
- Services (studies)
- Support to authorities

- **Services**
- **Support to authorities**

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IAEA-OECD/NEA – Studsvik symposium April 6-10, 2014
The landscape and involved actors in waste management
A specific regulation for nuclear facilities

No free release for nuclear wastes

areas where there is no possibility of contamination or activation

Conventional waste

areas in which waste is or may be contaminated or activated

Nuclear waste
Present status of waste disposal in France: the issues
Disposal operated and planned routes

More than 90% of the volume of waste have a disposal solution

**RADIOACTIVE WASTE CLASSIFICATION**

- **Short lived waste** (period of main nuclides < 30 years)
- **Long lived waste**

<table>
<thead>
<tr>
<th>Level</th>
<th>Operating Centre</th>
<th>Mining Residue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very low level</td>
<td>Operating Centre de l’Aube</td>
<td>To be implemented</td>
</tr>
<tr>
<td>Low level</td>
<td>Operating Centre de l’Aube</td>
<td>Waste Act 28th June 2006</td>
</tr>
<tr>
<td>Intermediate level</td>
<td>Deep geological disposal</td>
<td>(graphite, radium bearing)</td>
</tr>
<tr>
<td>High level</td>
<td>Deep geological disposal</td>
<td>Near surface</td>
</tr>
</tbody>
</table>

- Storage for tritiated wastes

- Centre de Morvilliers
- Centre de la Manche
  - In operation since 1992
  - Institutional control period since 2003
  - First deliveries: October 2003

- Bures URL

- More than 90% of the volume of waste have a disposal solution

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9
Present status of waste disposal in France: the issues

Situation of the operational routes

Centre de l’Aube
Operated since 1992
Licensed capacity : 1 000 000 m³
Volume disposed of : 280 000 m³
(end 2013)
(Centre de la Manche: 527,000 m³ disposed)
Present deliveries: 14 000 m³
Initial design for operational waste (30 000 m³/year). Initially forecast for 30 years of operation

VLLW disposal at CIRES (centre de Morvilliers)
Surface : 45 ha
Licensed capacity : 650 000 m³
Operated since 2003
Volume disposed of (end 2013) : 252 000 m³
Initial design for 30 years of operation
Present status of waste disposal in France: the issues
Disposal of large components

Overall optimization

Read this book!

The Management of Large Components from Decommissioning to Storage and Disposal
A Report of the Task Group on Large Components of the BEA Meeting 2000 on Decommissioning and Disposing (VHEG)
Present status of waste disposal in France: the issues
The issues for the operated disposal routes

### Low level wastes

<table>
<thead>
<tr>
<th>Waste generation forecast (2012)</th>
<th>1 200 000 m³ in 2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>(including 527,000 m³ at Centre de la Manche)</td>
<td></td>
</tr>
<tr>
<td>1 500 000 m³ after decommissioning of present or decided facilities</td>
<td></td>
</tr>
</tbody>
</table>

No volume problem to be anticipated

### Very low level wastes

<table>
<thead>
<tr>
<th>Waste generation forecast (2012)</th>
<th>1 300 000 m³ in 2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 000 000 m³ after decommissioning of present or decided facilities</td>
<td></td>
</tr>
</tbody>
</table>

New disposal capacities needed
Policy, strategies: the National governance
The National radioactive wastes and materials management plan

Legal framework: June 28th, 2006, waste act

Code of Environment: laws and regulation

Implementation of a National radioactive wastes and materials management plan (PNGMDR)

- Co-chaired by Ministry and ASN
- Involves
  - Ministries
  - ASN
  - IRSN
  - Operators
  - NGO
- Input: national inventory by Andra
- Develops the strategy for waste management
- Update every 3 years
Disposal should be considered as a rare resource

- For VLL waste
  - Densification of waste
  - Densification of the disposal facility
  - Re-use of concrete scrap to backfill disposal cells
  - Recycling of metallic wastes

Program for 2010-2012:
- A shared study by the main French nuclear operators, AREVA, CEA and EDF, and Andra
- To assess the opportunity and economical/technical feasibility of the implementation of recycling routes.

In accordance with the French doctrine:
- Recycling should be performed within the nuclear industry.
- Therefore stringent constraints on the traceability of materials.
- Potential constraints in the facilities that could process these materials
  - Radiation protection
  - Management of secondary wastes generated by the processes.
Implementation by Areva in 2003 and operated by the CEA since 2005.
Collection of lead inside Marcoule nuclear facilities,
First melting inside Marcoule facility to make ingots (activity < 1 bq/g)
Second melting in a conventional facility to manufacture shieldings,
Recycling in nuclear facilities.
100 tons of lead per year currently recycled.
However
• a fourth of the capacity of the melting furnace
• costly in comparison with a direct disposal in a VLL disposal facility.

Therefore it is planned to stop this route.
Metals recycling
Experiences in France: melting facility of Socodei

Electric induction furnace with a capacity of 4 tons

Treatment of an average of nearly 1,700 t/year.

Waste outputs:
- Volume reduction: non-recyclable waste shipped as ingots to disposal facilities
  - LL → VLL
- Recycling: internal cylindrical shieldings for packages used for intermediate level waste (spent resins).

Mean activity of metal that was processed to make shielding: 6 Bq/g, with a maximum value of more than 160 bq/g.

Between 1999 and 2011 21,700 tons processed
- 600 tons recycled in shieldings.
LOW LEVEL RAD-WASTE VOLUME REDUCTION: THE CENTRACO FACILITY
Waste acceptance criteria (melting)

Radiological criteria

- $\beta\gamma$-emitters: 20,000 Bq/g max + 20,000 Bq/g 3H
- $\alpha$-emitters: 370 Bq/g max

Physical and chemical criteria: limits on:
- Non ferrous

Conditioning accepted
- Melting: Reusable ISO CTRS & boxes, single use drums
Tubular radiological shields (MERCURE ctrs):

- Material: carbon steel
- Size: 100 x 100 cm,
- Thickness: 40 mm or 70 mm,
- Top, bottom & stirring bar: non radioactive carbon steel,

These shields are incorporated in concrete shells to form shielded containers (300 years certification). They are used for waste conditioning in the embedding processes.
TUBULAR SHIELD FABRICATION PROCESS

Decontamination by melting
Centrifugation
TUBULAR SHIELD FABRICATION DESCRIPTION

Control of finished products
A review of the forecast inventory of metallic VLL waste to be generated

- 400,000 tons for the next 30 years
  - 250 to 375,000 tons with a very very low level activity
  - 90% of ferrous waste

5 to 10,000 tons easy to be recycled

- But 0.1% of conventional recycled steels in France

Homogeneous components: 140,000 tons from the dismantling of a gaseous diffusion enrichment plant

Other more heterogeneous
Recycling within the nuclear industry

Different types of products considered with a potential re-use of 300,000 tons for the next 30 years:

- Construction products in nuclear facilities with a focus on steel frames to reinforce concrete,
  - But
  - Mainly steel materials
    - Not relevant to be processed in a dedicated steel facility (low quantities)
    - Generally manufactured prior use
    - Traceability constraints for re-use
      - During implementation
      - When decommissioning the facilities (if planned)
  - Industrially and economically not relevant

- Packages to condition wastes with a focus on the replacement of LL concrete containers
  - Cast iron containers
    - Relevant with a dedicated cast iron facility (foundry)
    - Could enable volume reduction for LL and VLL waste packages
  - But
    - Re-assessment of disposal safety case needed
    - Modification of conditioning and handling tools in facilities where wastes are processed
  - Significant industrial impact on operated facilities
  - Significant costs forecast on waste conditioning facilities
Conclusion

No obvious short term outlet for VLL recycled metals in presently operated facilities

➡ Should rather be considered for new built facilities or opportunities
  ▪ New nuclear facilities
  ▪ New disposal facilities: components or packages
  ▪ ...

Economical and industrial relevance as a major challenge

◆ Competition with direct VLL disposal route
◆ Sensitivity to constraints derived by the interpretation of the French regulation

New options to be explored and assessed

Still a sustainable development challenge!