French safety policy regarding radioactive waste disposal

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General principles (1/3)

- ASN considers that long term management of radioactive waste is a nuclear safety stake:
  - ➔Then, safe management routes have to be developed for **every type** of waste,
  - ➔ However, ASN does not promote any project in particular. It is tasked to control the safety of those projects;
- ASN considers as an obligation to avoid any undue burden on future generations related to radioactive waste management;

General principles (2/3)

- ASN considers that clearance of radioactive waste is not acceptable and requires traceability of waste produced by areas of nuclear facilities where these waste may be activated or contaminated;

- ASN considers that management of waste cannot be dissociated from management of radioactive materials (Uranium, Plutonium, spent fuel)

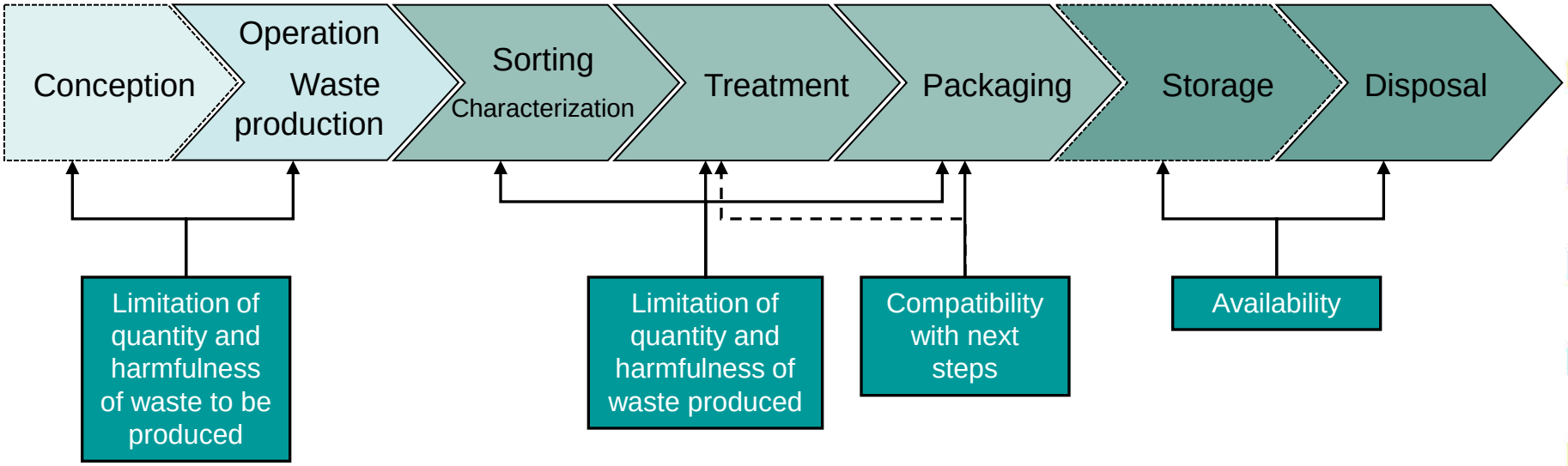
- ASN considers that management of radioactive waste shall be integrated from production to disposal, as comprehensive as possible and sustainable;

An integrated view

The national plan assesses management routes and defines objectives and milestones for developing new routes — **National level**

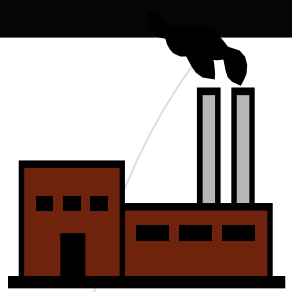
ASN reviews the operators overall strategy — **Operator level**

ASN reviews the strategy for management of each type of waste produced — **Facility level**

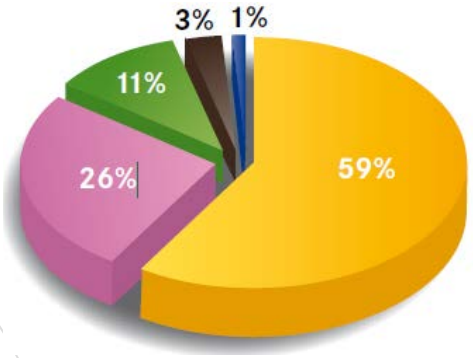


A comprehensive view

Non-nuclear industry:
- TENORM waste
- Sealed sources



Medical sector



Waste management

Defence sector

Nuclear cycle
Nuclear fuel cycle, including uranium mines
Nuclear Power Plants

Research sector
-Laboratories and universities
- Research reactors

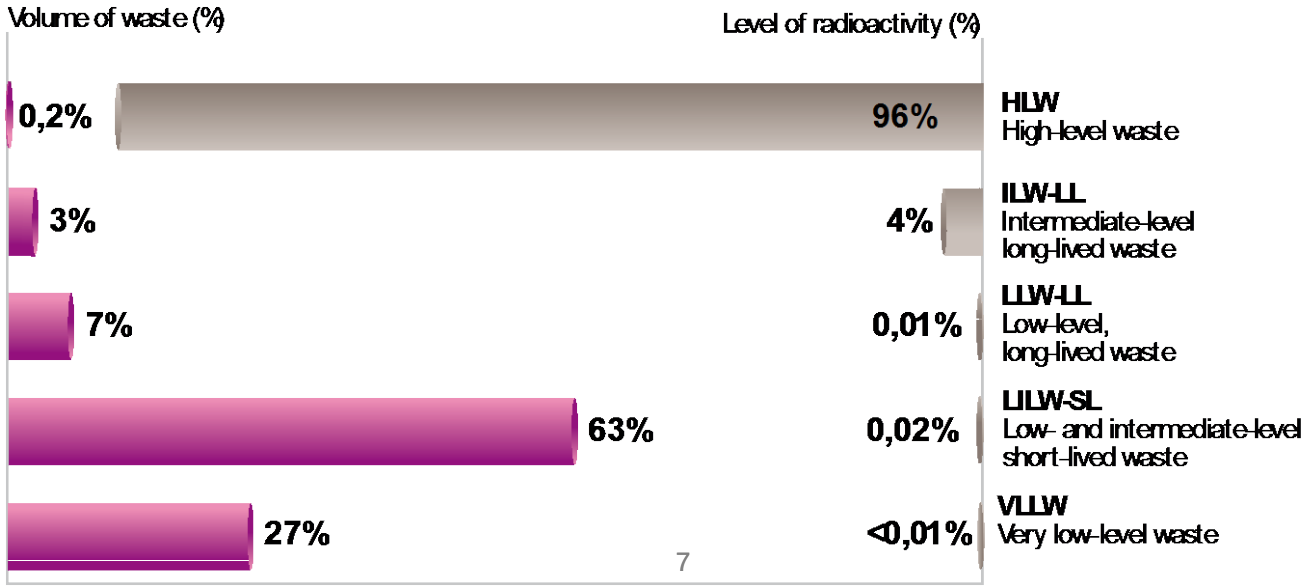
A comprehensive view

<table>
<tr><th></th><th>Very short lived (half-life < 100 days)</th><th>Short lived (half-life ≤ 31 years)</th><th>Long lived (half-life > 31 years)</th></tr>
<tr><td>Very low level (VLL)</td><td rowspan="3">Management by radioactive decay on the production site

then elimination in the conventional management solutions</td><td colspan="2">Surface Disposal
<u>The Aube disposal centre for VLL waste in operation since 2003</u></td></tr>
<tr><td>Low level (LL)</td><td rowspan="2">Surface Disposal
<u>The Aube disposal centre for LL/IL-SL waste in operation since 1991</u></td><td>Low depth disposal
Under study in compliance with the law of 28th June 2006</td></tr>
<tr><td>Intermediate level (IL)</td><td rowspan="2"></td></tr>
<tr><td>High level (HL)</td><td>Not applicable]</td><td colspan="2">Deep geological disposal
Under study in compliance with the law of 28th June 2006</td></tr>
</table>

A comprehensive view

Category	Volume at end 2010 (m^3 equivalent conditioned)
HLW	2,700
ILW-LL	40,000
LLW-LL	87,000
LILW-SL	830,000
VLLW	360,000
DSF*	3,600
Grand total	**~ 1,320,000**



A sustainable view

Scenario involving non-renewal of the nuclear power production facilities: estimation of the waste in equivalent conditioned cu. m

Category		Non-renewal of electricity production using nuclear power
HLW	Spent UOX Fuel	~ 50,000 assemblies*
	Spent ENR Fuel	~ 1,000 assemblies*
	Spent MOX Fuel	~ 6,000 assemblies*
	Vitrified waste	3,500
ILW-LL		59,000
LLW-LL		165,000
LILW-SL		1,500,000
VLLW		1,900,000

Scenario involving ongoing electricity production using nuclear power: estimation of the waste in conditioned equivalent cu. m.

Category	Ongoing electricity production using nuclear power
HLW	10,000
ILW-LL	70,000
LLW-LL	165,000
LILW-SL	1,600,000
VLLW	2,000,000

<u>Need to anticipate waste generation</u>

Prospective overview of the waste and materials that would be generated by all the facilities licensed at the end of 2010 until the end of their service life, including dismantling

General principles (3/3)

- ASN considers that involvement of all stakeholders is necessary for a transparent and efficient management of radioactive waste, e.g. :
  - ➔ Establishment of pluralistic working groups,
  - ➔ Transparency of decision-making process,
  - ➔ Local committees for information;

- ASN actively participates to international cooperation and exchanges about nuclear safety
  - ➔ Mainly in the frame of IAEA (Joint convention on the safety of spent fuel management and on the safety of radioactive waste management, WASSC committee), WENRA (Working group on waste and decommissioning, ENSREG and bilateral work.

Responsibilities

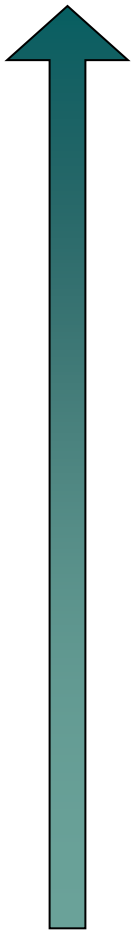
- Producers of radioactive waste are tasked to manage safely their waste during production, treatment, conditioning and storage. They stay responsible for them;

- Andra, French national agency for radioactive waste management is tasked by law with designing, sitting and managing storage and disposal facilities for radioactive waste;

- ASN is responsible for the control of installations during all phases: conception, construction, operation, decommissioning, monitoring.

ASN duties related to waste management

Global approach



Approach by installation

- Regulation drafting and review
- Elaboration of the national Plan
- Assessment of definition of decommissioning and long term management of radwaste costs
- Assessment of strategies for decommissioning and management of radwaste
- Licensing
- Oversight: inspections and enforcement actions

Pillars of radioactive waste management

- A dedicated regulatory framework:
  - ➔The “Planning act” of 28th June 2006 as a cornerstone;
- A national agency for management of radioactive waste : Andra, independent from waste producers;
- A national plan for management of radioactive materials and waste (PNGMDR);
  - ➔Roadmap for a comprehensive, transparent, integrated and sustainable management of radioactive material and waste.

The « Planning act » of 28th June 2006

1. Institutes the French national Plan for management of radioactive waste;
2. Defines a schedule for development of routes for management of radioactive waste;
3. Bans disposal of waste from foreign countries;
4. Defines Andra’s missions in radioactive waste management;
5. Creates a framework for securing financing of decommissioning and waste management costs.

« Planning act »

The « planning act » of 28th June 2006 requires development of management routes for :

- ➔ Disposal for IL-LLW and HLW;
- ➔ Disposal for LL-LLW : radium-bearing and graphite waste;
- ➔ Storage solutions for tritium contaminated waste;
- ➔ Disposal of spent sealed sources;
- ➔ Long term management solutions for waste with enhanced natural radioactivity (TENORM);
- ➔ Appraisal of impact of uranium mining waste.

National Plan (PNGMDR)

- The “Planning Act” requires the elaboration of the French National Plan for Management of Radioactive Materials and Waste (PNGMDR) :
  - ➔ Latest version of the Plan covers the period 2013-2015,
  - ➔ It is the third version of this three-year plan;

- This Plan is completed by a ministerial decree, giving it a binding framework;

- This Plan is made public;

- This PNGMDR is transmitted to the Parliament for evaluation.

National Plan (PNGMDR)

- The objectives of this plan are twofold :
  - ➔To draw up a periodic assessment of the radioactive substance management
  - ➔To define improvement path or needs for new waste routes and set objectives to be met in the future, mainly in terms of research and studies

- The PNGMDR organizes the implementation of the research and studies following three principles defined by law :
  - ➔Reduction of the quantity and the harmfulness of waste, mainly by reduction at the source and by spent fuel reprocessing
  - ➔ **Storage as a possible previous stage, notably for radioactive materials waiting for treatment and for ultimate waste waiting for disposal**
  - ➔ **Deep geological repository as the most sustainable solution for ultimate waste that cannot be disposed of in a surface disposal or in a low depth disposal for safety reason**

National Plan (PNGMDR)

- The PNGMDR is part of the transparent approach of dialogue

- The PNGMDR elaboration leans on a pluralistic working group composed of :
  - ➔ The French Nuclear Safety Authority (ASN) and the ministry of energy, that both codirect this working group
  - ➔ Environmental protection associations
  - ➔ Experts
  - ➔ Regulatory and assessment authorities
  - ➔ Radioactive waste producers
  - ➔ The French agency for waste management (Andra)

Conclusions of the latest plan

The latest version of the national plan (PNGMDR) requires:

- ➔ Further studies on management of high level and intermediate level long-lived waste;
- ➔ Definitions of scenarios for management (including disposal) of low-level long-lived waste;
- ➔ Definitions of scenarios for management (including disposal) of waste originating from non-nuclear activities;
- ➔ Optimization of existing routes by :
  - ➔ enhanced solutions sorting, characterization and treatment of waste,
  - ➔ recycling or valorization of waste,
  - ➔ development of tools to anticipate need for new facilities.

Deep geological repository (DGR)

Deep geological repository (DGR)

- In terms of principles, ASN considers that deep geological repository constitutes a key solution for management of high level and intermediate level, long-lived waste;
  - ➔ Long term storage is not a sustainable solution,
  - ➔ Separation and transmutation is a incomplete solution whose industrial feasibility is, furthermore, not proven;

- Beyond that principle, if ASN has to review an application file for deep geological repository, it will be allowed only if there are sufficient elements to demonstrate that its level of safety is sufficient.

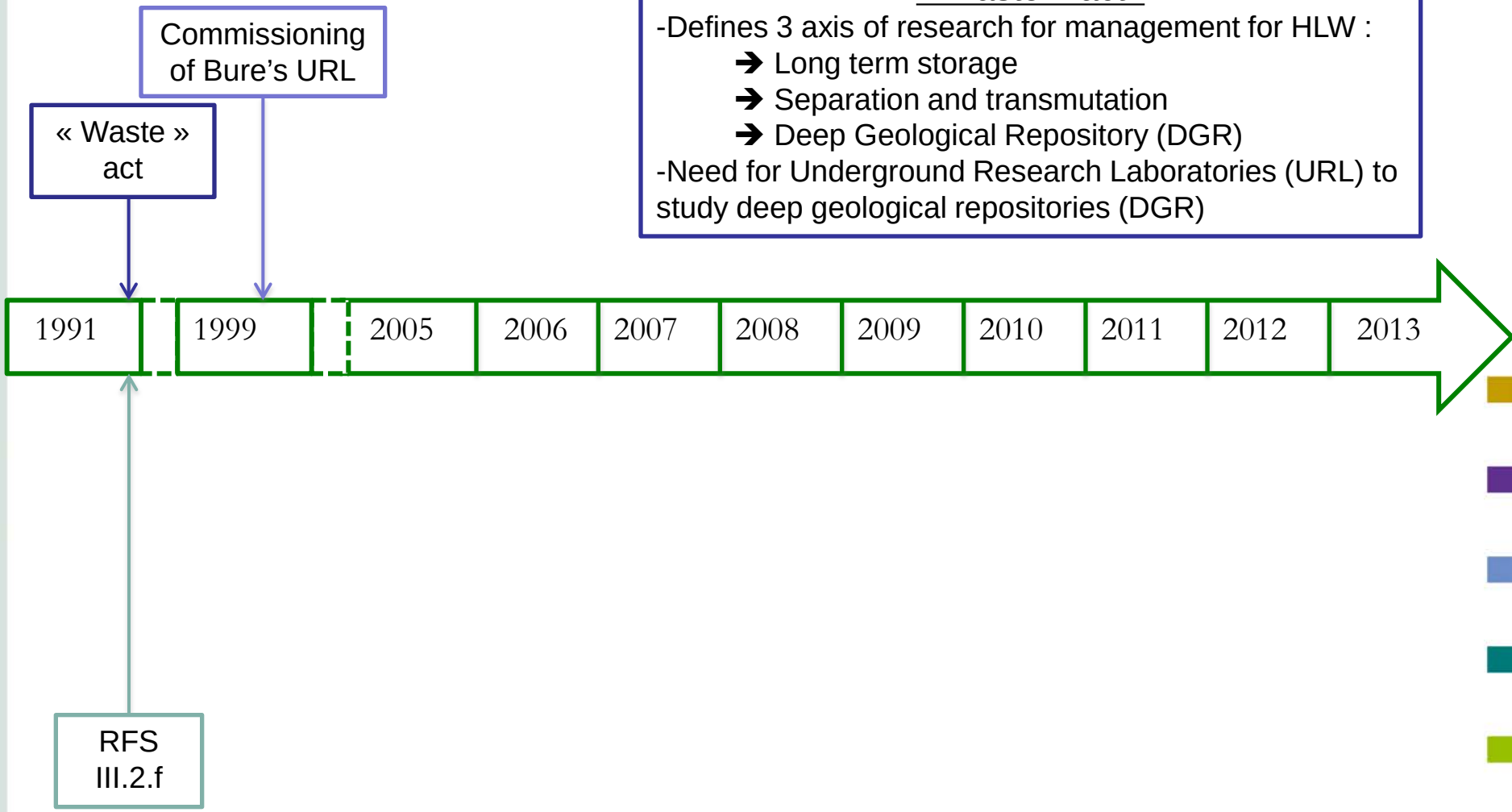
Overall process

« Waste » act :

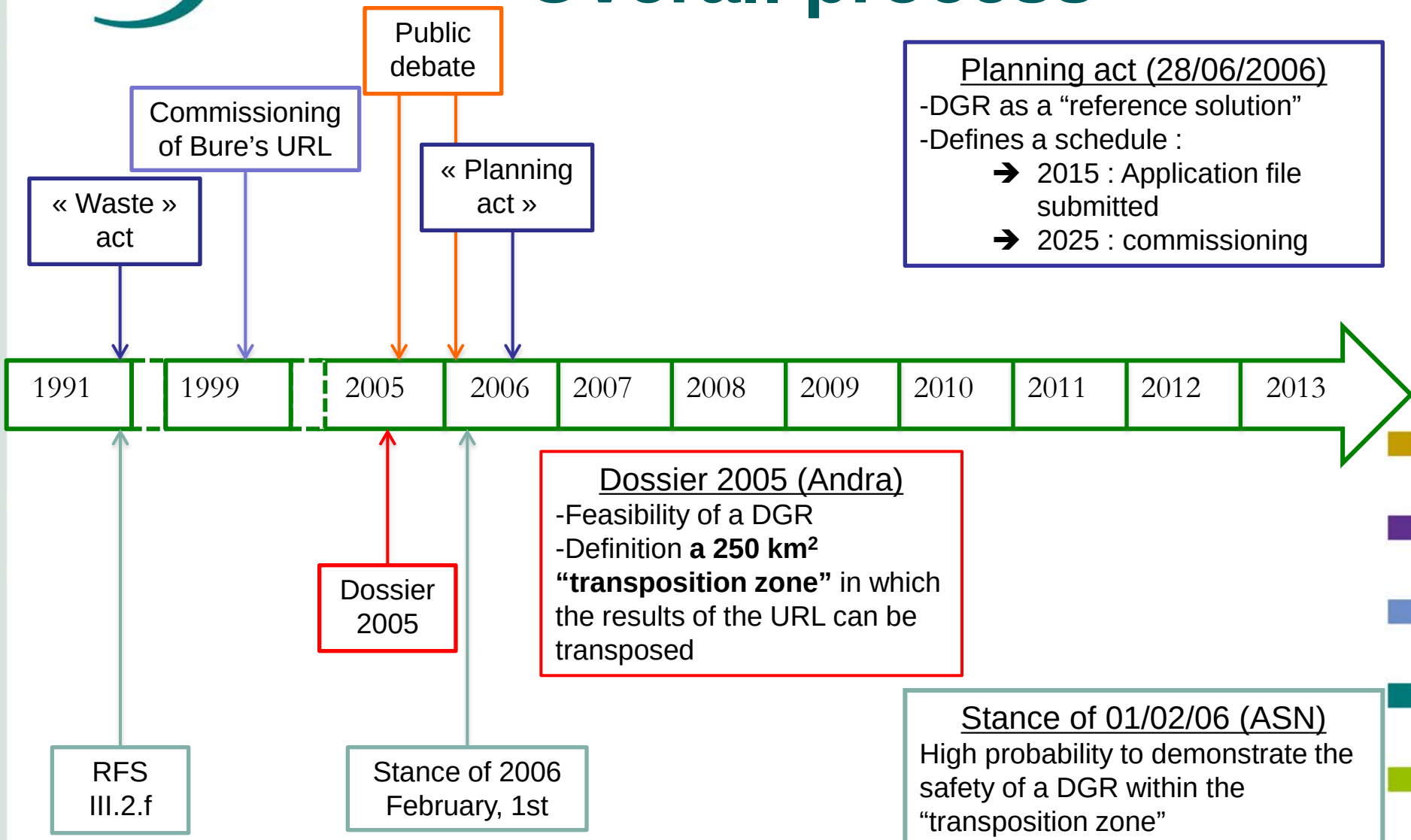
-Defines 3 axis of research for management for HLW :

- ➔ Long term storage
- ➔ Separation and transmutation
- ➔ Deep Geological Repository (DGR)

-Need for Underground Research Laboratories (URL) to study deep geological repositories (DGR)



Overall process



Planning act (28/06/2006)

-DGR as a "reference solution"

-Defines a schedule :

- ➔ 2015 : Application file submitted
- ➔ 2025 : commissioning

Dossier 2005 (Andra)

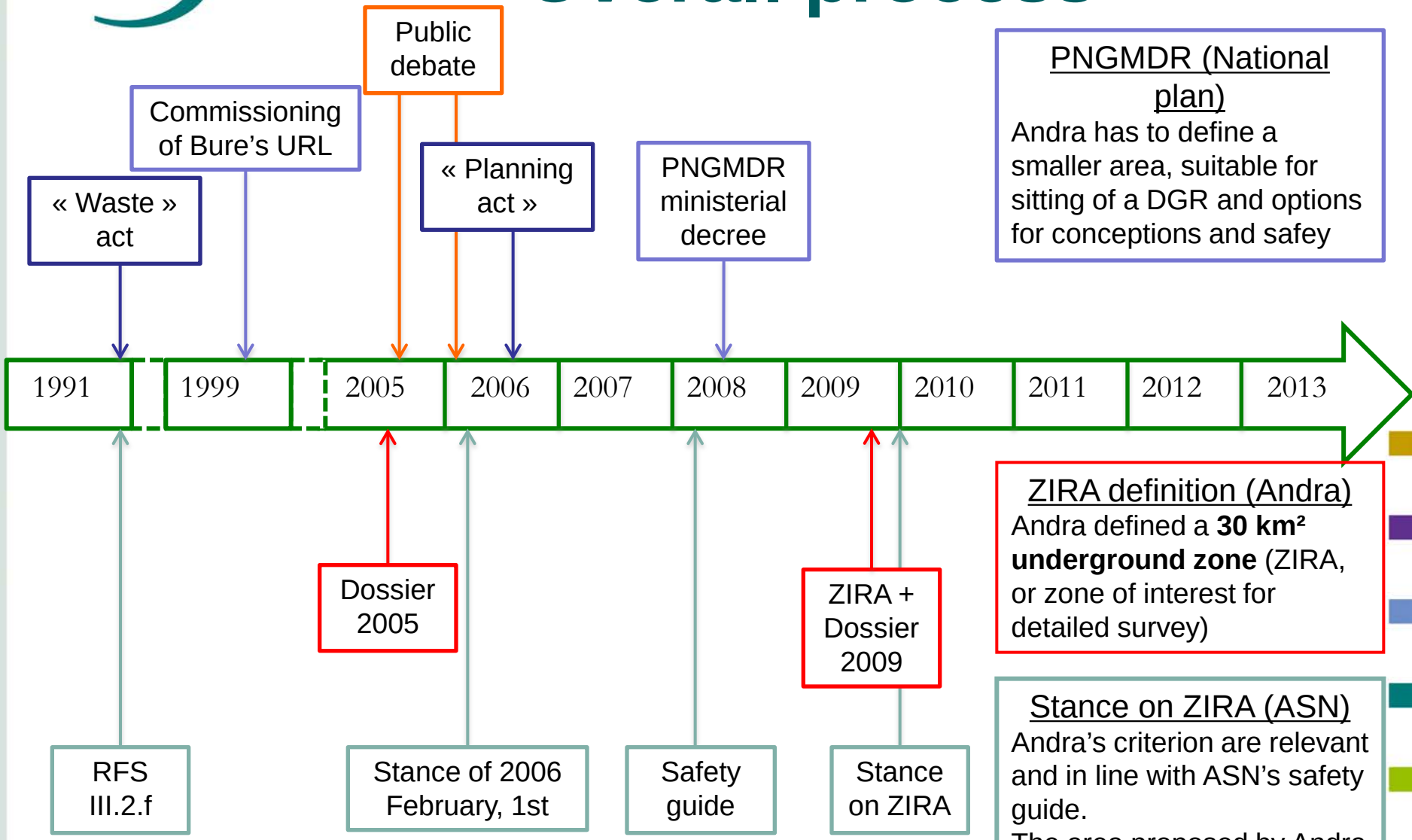
-Feasibility of a DGR

-Definition **a 250 km²** **"transposition zone"** in which the results of the URL can be transposed

Stance of 01/02/06 (ASN)

High probability to demonstrate the safety of a DGR within the "transposition zone"

Overall process



PNGMDR (National plan)

Andra has to define a smaller area, suitable for sitting of a DGR and options for conceptions and safey

ZIRA definition (Andra)

Andra defined a **30 km² underground zone** (ZIRA, or zone of interest for detailed survey)

Stance on ZIRA (ASN)

Andra's criterion are relevant and in line with ASN's safety guide.
The area proposed by Andra is satisfactory in the point of view of safety

Overall process