Geological disposal of radioactive waste as a “megaproject”: the French experience and prospects

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REFORM group meeting
26 August 2013, Salzburg
Current situation of “Cigéo”: the high- and medium-level radwaste repository

- **2009**: proposal by Andra (the radwaste management agency) for the creation of a geological disposal site at Bure, between two “départements” and two regions (Lorraine & Champagne-Ardenne)
- **March 2010**: government validates the proposal, after consultation with the safety authority, evaluation commission, and local stakeholders
- **May-December 2013**: mandatory public debate on Cigéo
- **2017**: Construction of Cigéo to begin
Waste volume and radioactivity

- HA: Déchets de haute activité
  - 96%
- MA-VL: Déchets de moyenne activité à vie longue
  - 4%
- FA-VL: Déchets de faible activité à vie longue
  - 0.01%
- FMA-VC: Déchets de faible et moyenne activité à vie courte
  - 0.02%
- TFA: Déchets de très faible activité
  - <0.01%

Volume de déchets en %
- 0.2%
- 3%
- 7%
- 63%
- 27%
Waste by source

- 59% Industrial non-nuclear
- 26% Medical
- 11% Defence
- 3% Research
- 1% Nuclear

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Main civil nuclear sites
History & timetable of Cigéo (I)

1986-89: failed site investigations (local opposition)
  • 1) Geol disposal; 2) interim storage; 3) partitioning & transmutation
1998: Choice of Bure (between Meuse & Haute-Marne) for an URL
2000: URL construction & economic compensations begin
2005: Andra concludes that Bure site is “perfectly apt to host a repository”
2005-06: “public debate” on the general options of radwaste management
2006: “Planning Law”: reversible geological disposal as the reference; further research on transmutation and interim storage
2006: Law on transparency and safety in nuclear matters – creation of ASN (independent safety authority)
History & timetable of Cigéo (II)

2010: government validates a 30 km2 zone for the site
2013: public debate organised by CNDP
2015: application by Andra for a construction licence
2016: law on reversibility
2017: beginning of construction work
2025: start of disposal
Polluter pays principle

1. Commercial agreements: Andra with EDF, Areva & CEA
   - Andra estimates the cost, the Ministry verifies
   - EDF 78%, CEA 17%, and Areva 5%

2. Tax for research on interim storage and final disposal

Total cost (2005): 13.5-16.5 billion euros over more than 100 years
- Uncertainties!! Discounting, placements in investment funds…
- Court of audit: 35 billion a more realistic figure
Waste storage concept
Principles and volumes

*Reprocessing*, MOX; vitrification

*Reversible* geological disposal

*Clay* formation

**Volume** of waste to be disposed of:
- 10 000 m³ high-level waste (appr. 60 000 packages)
- 70 000 m³ long-lived medium-level waste (180 000 packages)

**Size of the underground repository area**: 15 km² (FIN: 2.4 km²)

**Most of the waste exists already**
- 60% of medium-level waste
- 30% of high-level waste
Reversibility, adaptability, flexibility

1991 Bataille Law

Since 1998 a key requirement as defined by government

2006 Planning Law: reversible geological disposal as reference option

Andra to define the details of reversibility

1) Technical reversibility (retrievability)
2) Decisional reversibility (able to return to an earlier decision-making stage)

The key aim still stepwise closure – where’s the true reversibility?
Institutional framework
National level (I)

Government in the lead – Parliament has gained more power

Ministry of Energy (Min of ecology, sustainable development and energy)
Andra: the state agency (industrial and commercial) for radwaste management
(1979; independent of waste producers since 1991)
• Ministries of energy, research and the environment
• Headquarters in Paris, but local office in Bure
• Also responsible for research on interim storage and geological disposal &
  public information

Waste producers: EDF, CEA, Areva
National level (II)

Safety authorities
- ASN (2006 Law on Transparency – independent safety authority)
- IRSN (expert safety organisation)

Advisory & evaluating bodies
- OPECST (parliamentary office for science and technology)
- CNE (national evaluation commission)
- HCTISN (High committee for transparency and information on nuclear security)
- Court of Audit (examines the finances of the project)
- CNEF (national commission in charge of evaluating the financing and pricing of radioactive waste management)
Local/regional level

Central government
• Regions
• Departmental prefects
• Andra at Bure

Local/regional self-government
• Regions (Lorraine & Champagne-Ardenne)
• Départements (Meuse & Haute-Marne)
• Municipalities (‘zone de proximité”) & federations of municipalities

Local businesses
• Chambers of commerce, agriculture, sectors of industry
• “Energetic”

Civil society
• CLIS (Bure)
• NGOs

GIPs of Meuse & Haute-Marne
La gouvernance externe du projet Cigéo

Figure 7
Local siting challenges
La question en débat public

- Faut-il, ou non, autoriser la réalisation du centre de stockage profond CIGEO ?
- pour quels déchets ?
- avec quelle sécurité ?
- avec quelle mesure sur les sujets qui suivent ?
Uncertain local/regional impacts in a poor, declining region

Needs of transport, electricity, water, materials, etc. – estimates exist, choices to be made

Job creation
• Up to 2500 direct jobs during construction

Uncertainties and questions
• Local or external enterprises to benefit?
• Insufficient local skills base?
• Where will the employees settle?
• Spouses, children: jobs, schools, services, cinema…?
“Compensation” schemes

EDF, Areva, CEA: direct support through projects (e.g. 2nd generation biofuels, archives)

GIPs (Groupements d’intérêt public) for both départements

- since 2000 (URL)
- officially not compensation, but “economic support” designed to help the local communities enable the installation of Cigéo
- 30 million euro per year for each department
- 10% to be used at discretion by municipalities, 90% project-based
- decision-making & governance: head of dépt council, prefects of the 2 depts, the “other” GIP, Andra, waste producers, the nearby municipalities and federations of municipalities
Tensions and debates around economic support

- “Structuring” or one-off investments?
- Which municipalities have the right to receive the money?
- Who is to decide on the utilisation?
- Different strategies of the two départements
- *Bribery, “prostitution”, blackmailing?*
- “Without the opponents, GIPs would never have come about”
Communication & participation
Main venues/instruments for participation

Local information and surveillance committees (CLIS) since 1999

Mandatory public debates organised by CNDP as the main vehicle for participation

- CNDP nominates an ad hoc committee (CPDP) for each debate
- Duration 4 months (in the case of Cigéo, about 6 months)
- Background documentation prepared by the developer
- Stakeholders prepare position papers prior to and during the debate
- Public meetings as the main form of debate
- Only consultative function; no recommendations
First “public debate” (CNDP) in 2005-2006

• to inform the parliamentary debate in preparation of the Law 2006
• “National debate on energy” (2003): atmosphere of scepticism
• concomitant with CNDP debates on the Flamanville EPR and a transmission line from Flamanville to the grid
• long-term interim storage identified as a major option to be examined further; yet the Law retained reversible geological disposal as the preferred option
• frustration and scepticism amongst the opponents/critics
• yet, the debates of 2005-06 allowed CNDP to gain authority & legitimacy

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Public debate 2013
Public debate on Cigéo 2013

- launched 15 May 2013
- debate on energy transition: compromise on timing – Cigéo debate in two phases
- first two local debates (23/05 & 17/06) cancelled after being obstructed by the opponents
- decision by CPDP to no longer hold public meetings (cf. debate on nanotech), and to extend the debate until mid-Dec
- future of the debate uncertain
Conclusions
Dimensions and scale

Scale – megaproject?
• one of the largest ever industrial projects in France/Europe: the usual problems associated with megaprojects…

Levels and structures of governance
• complex accountability structures – making the best of uncertainty? Reversibility – “imposed” flexibility, adaptability, reflexivity?

Schedule
• unlikely to hold – already judging by the way the public debate has started…

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Local/regional siting challenges

Economically declining, sparsely populated, “non-nuclearised” area

- low skills and competence level; poor infrastructure, in an area without a nuclear industry tradition
- problem compounded by the very small size of many municipalities
- ambiguity: huge expectations of economic (and social) benefits, yet scepticism and mistrust (“Radwaste here? Really not a great idea, but we’ll be doomed unless we get the project…”)
- economic support as “bribery”, “prostitution”…
- if something goes wrong, e.g. if the socioeconomic benefits do not materialise, then what?
Complexity of the governance arrangements

Multiple levels
- central state (national, regional, departmental, local…)
- local/regional authorities
- Andra: Paris vs. Bure

Responsibilities
- the central state unwilling to make hard decisions – in order not to appear to impose an undesired project
- the local/regional authorities expect the state to decide and “tell us where the road is going to pass, so that we can plan”
Participation and (mis)trust

Combination of revolutionary & state-centric *tradition*

- central state simultaneously called for rescue and despised for its authoritarianism

Persistent atmosphere of mistrust, despite the 20+ years of more participatory policy (sincerity?)

Lack of “empowerment” of the local communities (cf. FIN, SWE)

- e.g. GIPs: state actors in majority; “divide and rule”

CNDP & its operation model & cycles of participation: is the “honeymoon” over?

- Cigéo debate as an opportunity for innovation?
Evaluation of “the socioeconomic”

- Downplayed, even criticised, by the opponents (“if Andra has money to spend, it should spend it on risk and safety research”)
- For the advocates of the project, crucial to legitimise, demonstrate the expected socioeconomic benefits
- Dilemma of the advocates of the project: must demonstrate the socioeconomic benefits (to ensure acceptance), but exaggerating the benefits risks to provoke a backlash
Participatory tradition and culture

- Progressive opening up of the French “nucleocracy”
- Radwaste disposal as a test case: preparation of the Bataille Law, opening up, separation of responsibilities, independent regulatory authorities
- Lack of tradition in institutionalised local participation:
  - state-led authoritarianism (must be public to count as legitimate), and
  - “revolutionary grassroots romanticism”
- Extremely small municipalities (Bure: 98 inhabitants…)

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Key legislation

- **1991 Bataille Law** (country’s first law on nuclear)
- **2006 Planning Law** (reversible geological disposal as the preferred option)
- **2006 Law on nuclear transparency and security**
- **National plan** for the management of radioactive materials and waste (PNGMDR); safety authority & Ministry prepare, Parliament approves
- **1995**: “public debate” on large projects becomes mandatory
- **2018 law** to authorise the construction of Cigéo
Legal framework
Principles as laid out in Law 2006

- Sustainable management of radioactive materials and waste
- Search for a permanent solution; future generations…
- “Producers of spent fuel and radioactive waste are responsible for those substances, without prejudice to the responsibility their holders have as nuclear activity operators”
Stepwise definition of the site

2005: zone de transposition (250 km²);
2009: “ZIRA” (30 km²)
## Forecast for the future: waste for Cigéo (m³)

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<th>Pour 2020</th>
<th>Pour 2030</th>
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<tr>
<td>HA</td>
<td>4,000</td>
<td>5,300</td>
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<tr>
<td>MA-VL</td>
<td>45,000</td>
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<td>FA-VL</td>
<td>89,000</td>
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<td>FMA-VC</td>
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<td>1,200,000</td>
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<tr>
<td>TFA</td>
<td>762,000</td>
<td>1,300,000</td>
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<td>Total général</td>
<td>~1,900,000</td>
<td>~2,700,000</td>
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</tbody>
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Underground (pink) and surface (blue) installations
Provisional timetable

La vie du centre de stockage

- **2005**: Dossier 2005 (faisabilité du stockage Profond des déchets HA-MAVL)
- **2013**: Débat public
- **2016**: Fin 2014
- **2016**: Demande d’autorisation de création
- **2025**: Mise en service du centre
- **Observatoire pérenne de l’environnement**
- **Surveillance**
- **Fermeture du centre de stockage**