



## Assessment of long term behavior of uranium mining sites in France: The GEP approach (Groupe d'Expertise Pluraliste)

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## SUMMARY

### Background

- Uranium mining, post-mining and concerns

### Setting Up

- Mission, organisation and means of GEP

### Addressing Issues

- Priorities and current work of GEP

### Long Term Concerns

- Questions raised and first thoughts

### Achievements / Prospects

- "Balance sheet" and follow-up

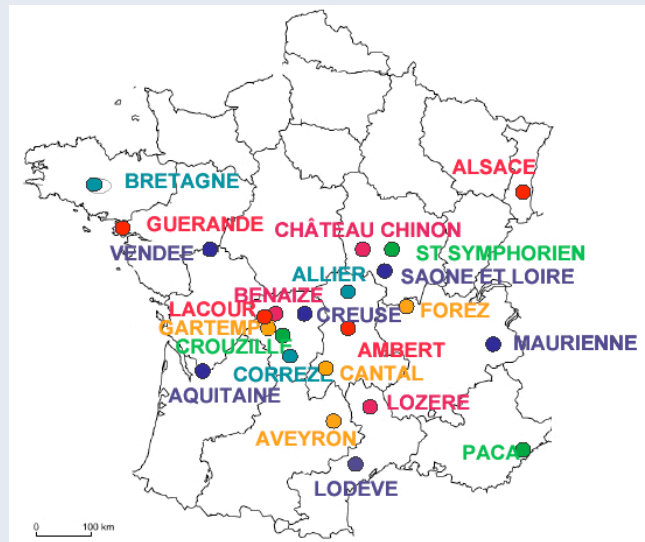


## BACKGROUND (NATIONAL)

### Uranium Mining in France

#### □ 50 years of operation

- Started in 1948, ended in 2001
- More than 200 sites in 23 mining zones
- 76 000 tons of uranium produced
- 50 million tons of mill tailings on 17 storage sites
- From scattered owners to a major operator Cogema (now AREVA)



Uranium mining zones in France



## BACKGROUND (NATIONAL)

### Post-Mining Activities

#### □ Scattered and complex legacy

- Legacy of more than 200 sites, 52 million tons of mill tailings, > 200 million tons of waste rocks

#### □ Closure work completed at most sites

- now monitoring and control plus some water treatment
- issue of (long term) sustainability of the systems implemented

Mill tailings storage site after rehabilitation (MCO 68 - 105, Bellezane)





## BACKGROUND (NATIONAL)

### Local and National Concerns

- **Controversies on rehabilitation / local pollution** particularly in Limousin
  - actions of environmental NGOs
  - independent counter-assessment of risks
  - media coverage
  - juridical trials opposing NGOs and AREVA
- **Update of national policy** on long term management of radioactive residues and contaminated sites
  - 2006 Act on radioactive waste management
  - Provisional programme for long term management of mill tailing disposals to be prepared by the end of 2008



## BACKGROUND (LIMOUSIN)

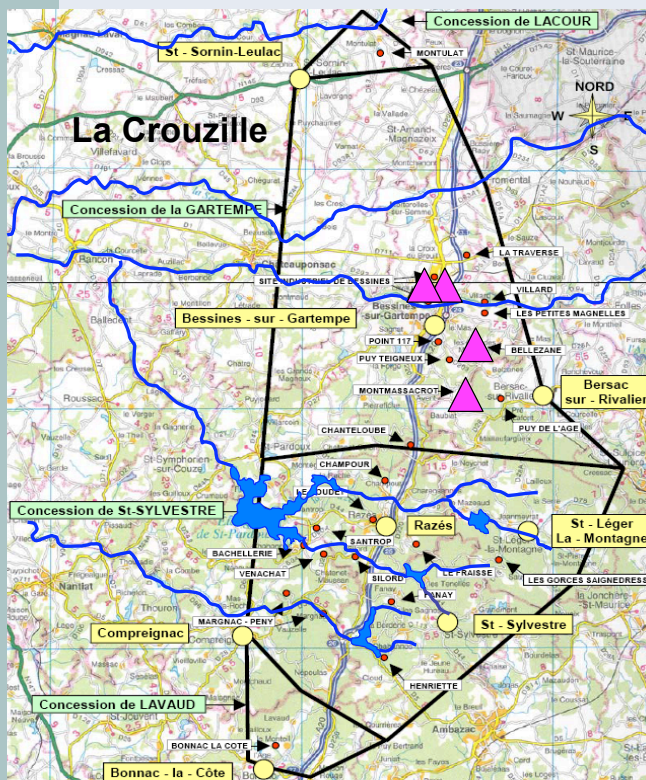


### Uranium in Limousin

- **The core of uranium mining in France**
  - From the first mine to the last closure
  - 40% of French production
  - 30 mining sites, 2 milling sites, 5 tailings disposal sites
  - Division La Cruzille: 24 mining sites, 23 324 tons uranium from 12,8 million tons



## BACKGROUND (LIMOUSIN)



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### Local Context / Crouzille

- 24 mining sites  
(58 Mt waste rocks; 100 ppm)
- 4 mill tailings storage sites  
(20 Mt ; mean Ra226 conc. 30 Bq/g)
- 7 watersheds
- enhanced concentration found in some sediments  
(up to ~10 Bq/g)
- water collection network  
(up to ~1Bq/l en Ra226 and 1mg/l en U), water treatment where necessary
- calculated added effective dose up to the order of 1 mSv for some local groups

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## SETTING UP

### Part of a Global Effort

- End of 1990s: elaboration of guidelines (mill tailing storages)
  - Recommendations of a working group commissioned by the Ministry of environment with IRSN, AREVA
- From 2004: new effort by local authorities
  - 10-year environmental assessment on Crouzille by Areva
  - Technical review of this assessment (mainly by IRSN)
- From the end of 2005: commissioning of a national pluralistic expertise group (**GEP**) on Limousin uranium mines
  - End 2005, joint letter by 3 Ministers: Environment, Industry, Health
  - End 2007, additional letter by Ministries of Environment and Industry and Nuclear Safety Authority (ASN)
- Coordination / 2006 Law on radioactive waste management

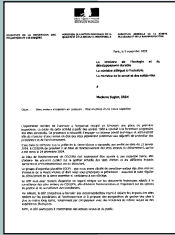
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## SETTING UP

### Comprehensive Commitment (mid 2006-end 2009)



- ❑ Contribute to the critical analysis of AREVA's documents and their technical review by IRSN
- ❑ Help choices with management and monitoring options:
  - Recommendations for the reduction of impacts from mining sites in Haute-Vienne / *in Limousin*
  - **Medium to long term perspectives** with focus on:
    - comparison (other industries, foreign remediation experience)
    - *technologies for water treatment, discharge limits, passive protection on mill tailings disposal sites*
    - *local remediation work already implemented*
    - *methodology for extending recommendations to all French sites*
- ❑ Contribute to information of local stakeholders and the public

Note: first commission letter (end 2005) / *second commission letter (end 2007)*



## SETTING UP

### Pluralistic Composition

- ❑ **Composition of the GEP:**
  - Around 30 experts gathered
  - Various technical fields e.g. earth sciences, metrology of radioactivity, radioecology, radiation protection, nuclear safety...
  - Representatives from IRSN, AREVA, local/national authorities, local/national NGOs, independent experts, foreign experts

Public Institutes and Administration	NGOs and independent	Industry	Foreign experts
- IRSN, InVS - Academics - Authorities	- Independent experts - Local NGOs	- Areva NC	- International REX (IAEA) - UK, Switzerland, Belgium, Israel, Luxemburg...
<b>16 experts</b>	<b>5 experts</b>	<b>3 experts</b>	<b>6 experts</b>



## SETTING UP

### Organisation and Means

#### □ Means for pluralism

- Plenary Group + Working Groups open to more members
- Shared animation of groups: IRSN / independent or academics
- Public funding, including for independent / foreign experts work

#### □ Support of external technical expertises

- Environmental assessment by the operator AREVA
- Third-part assessment by the public institute IRSN
- Relevant work from other sources (academics, independent, foreign bodies...)
- Further studies could be recommended if needed



## ADDRESSING ISSUES

### Priorities / Working Groups

#### □ Priority themes

- Rehabilitation status of mill tailings storage/disposal sites
- Environmental impacts (primarily related to liquid releases) and relevance of the actions taken or planned
- Broader approach to address:
  - health and environmental monitoring
  - regulatory concerns and long term issues

#### □ Issues addressed by 3 (+1) working groups

- WG 1: Source term and releases to the natural environment
- WG 2: Impacts on populations and the environment
- WG 3: Regulatory framework and long term issues
- WG 4: Measurement issues (support to other WGs)



## ADDRESSING ISSUES

### WG 1: Transfers to the Environment

#### □ Rehabilitation status of disposal sites

- Site by site approach - *Focus: Bellezane*
- Studies:
  - hydraulic characteristics of the site (hydrogeology)
  - monitoring efficiency for waterborne transfers
  - efficiency of the cover for airborne transfers
- Understanding current level of efficiency  
Assess *future efficiency* in various scenarios

#### □ Transfers to the environment from liquid discharges

- Approach by catchment basin - *Focus: Ritord*
- Studies:
  - sources of radioactivity added to natural
  - efficiency of water treatment
  - retaining reservoirs and clay sediment deposition
- Adapt water treatment and target activities to impacts



## ADDRESSING ISSUES

### WG 2: Environmental and Health Impacts

#### □ Go beyond health and environmental impact assessment set forth in regulations

**1** Environmental Impact  
*radiological and chemical*

**2** Health Impact  
*radiological and chemical*

**3** Health monitoring

- First application of an innovative method to evaluate impact of radioactive substances on local ecosystems
- Feasibility of quantitative evaluation of radioactive risk other than additional effective dose to reference groups
- Health monitoring:  
reviewing public health surveillance
- Development of assessment of the chemical risk

#### □ Develop capacity to assess evolution of impacts according to various scenarios



## ADDRESSING ISSUES

### WG 3: Regulatory Issues and Long-Term

- **Link between technical analysis and:**
  - Changing priorities in the area of environmental protection
  - Sustainability of rehabilitation works
  - Long term liability (transfer from the operator to the state)
  - Stakeholders involvement
- **Past and current investigations:**
  - Legal qualification of the materials and sites  
Discuss the most appropriate implementation of the regulatory framework for long-term management
  - Long-term aspects of monitoring  
Timescale and scenarios to consider  
Move towards less active monitoring and features



## LONG TERM PERSPECTIVE

### Starting Point (Working Group 3)

*Initial scope* • Le GT3 porte sur « les **modalités de surveillance** des résidus miniers d'uranium sur le long terme et le **cadre réglementaire** assurant l'efficacité de cette surveillance »

- **The weight of past debates**
  - Political debates on the global legislative framework (nuclear / non nuclear)
  - Controversies and court actions in Limousin
- **The need for references**
  - Lack of basis on those issues in existing work by AREVA or IRSN
  - Lack of external « ready-to-use » references
- **The need for further pluralistic approach**
  - Mix of scientific and societal issues
  - Need to embed other disciplines (economy, law studies, sociology...)
  - and potentially to include other stakeholders





## LONG TERM CONCERNS

### Existing Reports

July 1991	Pierre Desgraupes (Pdt), Commission d'examen des dépôts de matières radioactives <i>Rapport concernant les dépôts de matières radioactives</i>
April 1992	Jean-Yves Le Déaut, OPECST <i>Rapport sur la gestion des déchets très faiblement radioactifs</i>
June 1993	Barthélémy-Combes, Conseil général des Ponts et Chaussées <i>Déchets faiblement radioactifs</i> <i>1<sup>ère</sup> partie : stockage de résidus de traitement de minerai d'uranium</i>
March 1996	Claude Birraux, OPECST <i>Rapport sur le contrôle de la sûreté et de la sécurité des installations nucléaires</i> <i>Tome 2 : Déchets miniers / Effluents du CEA</i>
March 2000	Michèle Rivasi, OPECST <i>Les conséquences des installations de stockage des déchets nucléaires sur la santé publique et l'environnement</i>
June 2003	Conseil supérieur d'hygiène publique de France <i>Les sites miniers d'uranium</i>

- Developing consideration for the medium and long term
- Raising questions rather than shaping a clear vision



## LONG TERM CONCERNS

### Themes identified by WG3 in its first stage

#### Four themes of "organisational" nature

✓ 1- Juridical status of materials and sites	Mostly concluded
✓ 2- Responsibility over sites and memory	Under discussion
3- Financing the long term	To be discussed
4- Control, expertise, stakeholders involvement	Issues identified

#### Four themes of more "operational" or technical nature

✓ 5- Scenarios to take into account (hazards, timeframe)	Under discussion
✓ 6- Scope and nature of «active/passive» monitoring	Under discussion
7- Long term impact on health	Link with WG2
8- Long term impact on the environnement	Link with WG2



## LONG TERM CONCERNS

### Discussion of regulatory issues

#### □ Objectives and method:

- Main issue: regulatory characterization of materials and sites
- Hearing of specialists of environmental law
- Recognizing diverging views on the political context to focus on what specific regulatory framework applies and how

#### □ Conclusions:

- Recent evolutions clarify the status of materials and sites
- Some specific situations remain to be clarified
- Discussions can shift to what appropriate prescriptions are in each situation
- Need to better link discharge limits with (re)concentrations in the environment
- Need for a global approach including impact on populations / ecosystems and including radiological / chemical risks
- Need for a reflection with all stakeholders on the full implementation of the principles of protection of the environment (including information and concertation) as *guidelines for the long term*



## LONG TERM CONCERNS

### Putting the « Doctrina » in Perspective

#### □ Basis for analysis:

- French doctrina regarding uranium mining sites remediation  
Ministry of Ecology (**DPPR**) document, 1999

#### □ Method:

- Comparison with / return of experience from the nuclear industry
  - Short-lived, low-level radioactive waste disposal
  - Long-lived, high-level radioactive waste disposal
- Comparison with / return of experience from other sectors
  - Other mining activities?
  - Other long-lived waste disposal?
- Comparison with other countries and international return of experience
  - IAEA
  - Germany - WISMUT
  - Other countries?



## LONG TERM CONCERNS

### Priorities of work

#### □ First stage of work shows:

- No sound doctrina framework from international level
- No sound doctrina framework from inter-sectoral level
- Interest for clarification of the DPPR doctrina regarding medium and long term

#### □ Axis for further work:

- Technical analysis about scenarios:
  - hypothesis and time horizons
  - key features for modeling (understanding interactions)
  - indicators of impact
- Global analysis of the different functions of monitoring and their appropriate phasing (difficulty with the term « passive »)
- Interest to take into account the socio-economic dimension (development projects for the concerned territories)
- Integration of stewardship issues as a condition of appropriate management (step by step implementation of long term strategies)



## LONG TERM CONCERNS

### Discussion of the DPPR Doctrina

#### □ DPPR Doctrina:

- Present population groups
- Exposure scenarios:
  - 1 normal scenario
  - 5 altered scenarios (depending on site):
    - Cover loss
    - Dam integrity loss
    - Residence on storage with / without cover
    - Excavation on site (road)
- Evaluation of effective added doses following exposure pathways

#### □ Open questions:

- Clarify reference / alternative scenarios after end of “active” management
- Broaden the scope of hypothesis and include all potential consequences of alterations
- Develop sensitivity analysis for main factors



## LONG TERM CONCERNS

### Timeframe issues: first comparisons

		GT3 Discussion	Doctrine DPPR (1999) Mill tailings	RFS 1.2 (1984) Surface disposal (SL-LLW)	Guide sûreté (2008) Geological disposal (LL-IHLW)
	0	Existing site	Existing site	Conception	Conception
A few years	10 y	Current situation <b>Operation and monitoring+</b>	End of first remediation <b>Active monitoring</b>	Opening <b>Operation</b>	Future opening <b>Operation</b>
A few decades	30 y	Transfer to public admin. ?		Closure	
	50 y	<b>Monitoring</b>	End of treatment <b>Passive monitoring</b>	<b>Monitoring</b>	Closure <b>Passive safety</b>
A few centuries	100 y	↑			
	300 y	Loss of memory?	Possible decrease of containment quality	Max. deadline end monitoring	
	500 y	Decrease of quality of some containment components ?	Loss of memory	<b>Lifting site constraints</b>	Loss of memory (human intrusion becomes possible)
	1,000 y	↓	Certain decrease of containment quality	Possible end of efficiency of built containment	
	10,000 y	???	<b>Not guaranteed monitoring</b>		Term of demonstration of geological stability

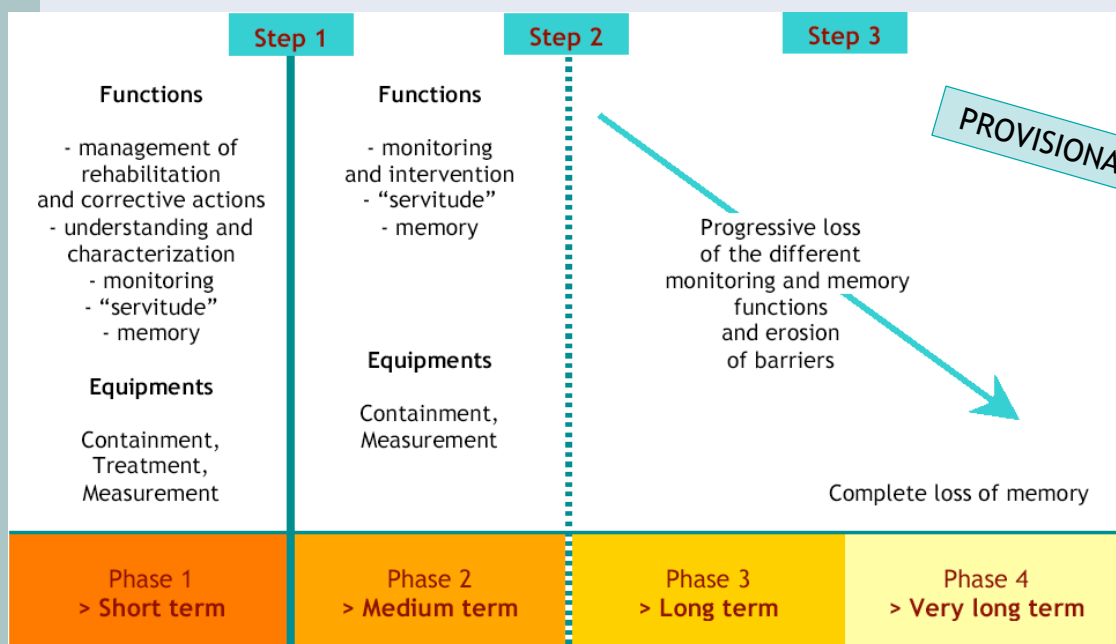
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## LONG TERM CONCERNS

### Timeframe/scenarios issues: a global view



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## LONG TERM CONCERNS

### Status of reflection

#### □ Some questions raised regarding scenarios:

- Include hypothesis on hazards upstream of the sites
- Further analyse consequences downstream
- Include hypothesis on potential change of climate
- Discuss hypothesis on the evolution of flora and fauna
- Better characterize reference and alternative potential evolutions of land use for the medium term

#### □ Some questions raised regarding objectives and indicators:

- Need to include, besides radiological impact,
  - chemical impact,
  - impact on the environment
- i.e. potential need for other indicators than the added efficient dose
- Which long term objective for protection:  
same limit as current limit or... what else?
- Need to consider the costs and optimisation

#### □ Need to develop reflection on other sites (than tailings disposal)



## ACHIEVEMENTS / PROSPECTS

### Interim “Balance Sheet”

#### □ Operational

- 1<sup>st</sup> interim report after 6 months, 2<sup>nd</sup> interim report end of 2007
- first specific and local recommendations implemented
- started reporting to local commissions in Limousin
- website on-line: [www.gep-nucleaire.org](http://www.gep-nucleaire.org)

#### □ Added value

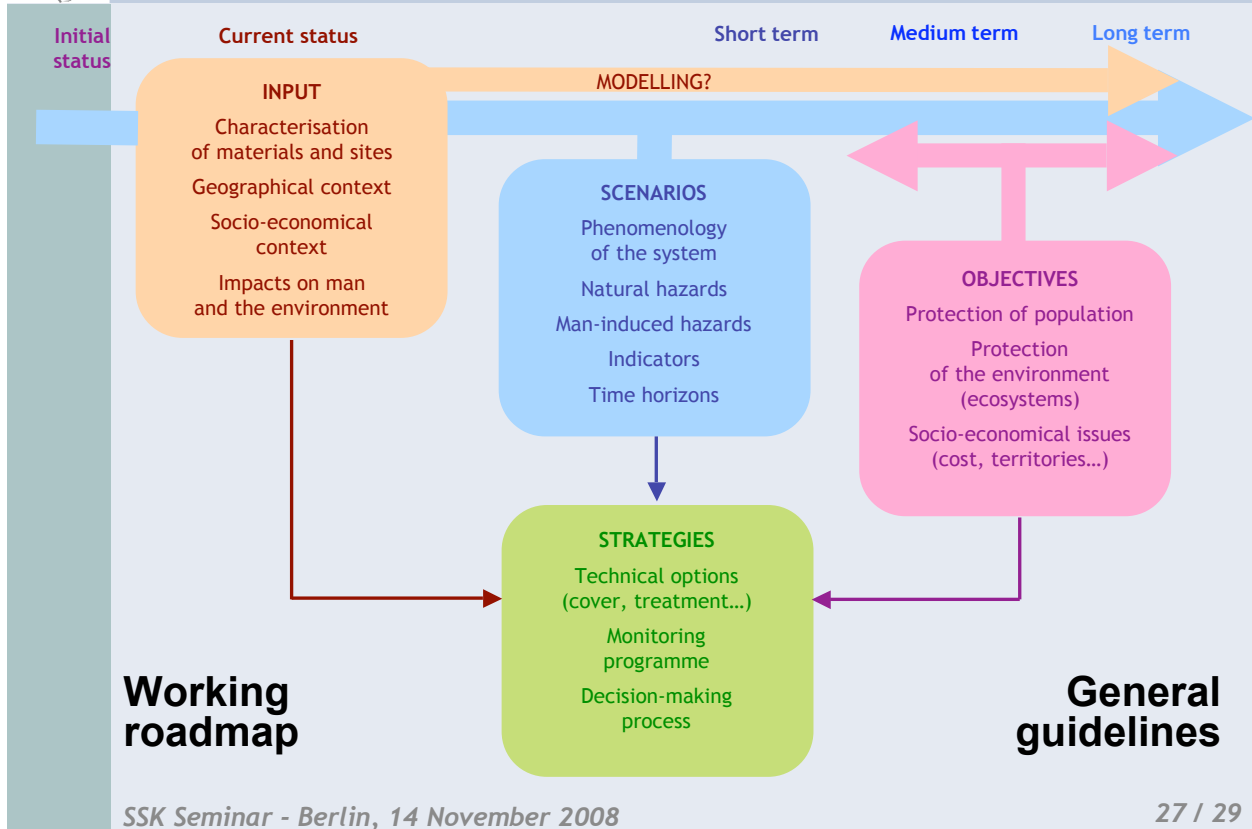
- playground for broader technical and scientific dialogue
- multiple approach, enhanced methodology
- interlinking technical and societal analyses to address long term issues

#### □ Challenge / final delivery (end of 2009)

- from analysis of current situation to prospective options
- from site-specific analysis to a global approach



## ACHIEVEMENTS / PROSPECTS



## ACHIEVEMENTS / PROSPECTS

### International Perspective

#### □ International return of experience

- Large REX... but very few specific lessons regarding long term issues
- Less shaped international doctrina than expected
- Need to connect with evolution of radiation protection concerns

#### □ International openness

- Participation of IAEA and foreign experts
- Regular exchanges with WISMUT (March 2007, April 2008,...)
  - Different in size and context
  - Convergent in general options, with some technical differences
  - Confronted to similar issues mostly linked to long term
  - Step-by-step discussion from the comparison of general approaches down to specific issues

#### □ Looking forward to further international exchanges



Thank you for your attention

**More information:**

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[www.gep-nucleaire.org](http://www.gep-nucleaire.org) (French)

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