

INDICO #228

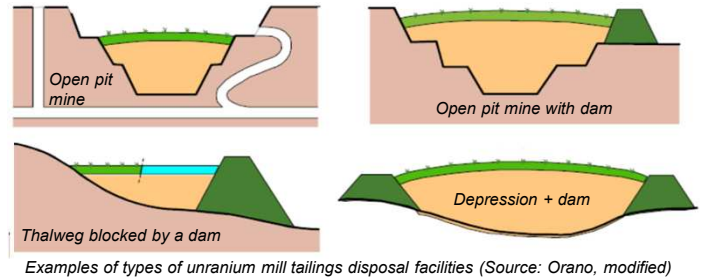
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CONTEXT

- ✓ **Exploitation of uranium mines in France from 1948 to 2001** → 50 million tons of mill tailings placed in 12 disposal facilities with dams to contain the tailings
- ✓ **Main radionuclides present : Ra and U** → these facilities and especially their dams need to be stable over the long-term
- ✓ **Ensuring safe and sustainable management of mill tailings** requires assessing the mechanical stability of the dams, as a basis to support decision-making regarding these facilities



A methodology was developed in the framework of a pluralistic working group of the French National Plan for Radioactive Materials and Waste Management (PNGMDR) to clarify the issues involved in evaluating the long-term stability of the dams and to propose a methodological approach to address them. The outcomes are documented in [1].



FEEDBACK

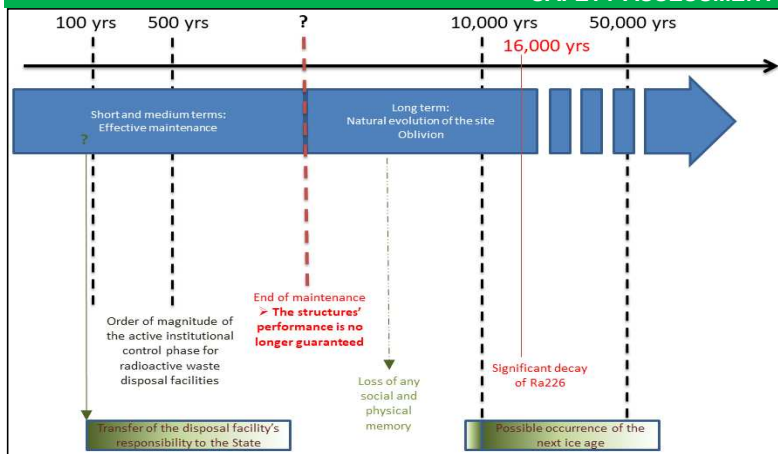
Causes of failures of tailings dams throughout the world

Accidents are mainly linked to geological and geotechnical reconnaissance faults, design faults, inadequate maintenance or management of water levels in the dam, or extreme events such as heavy rainfall or earthquakes



Dam stability evaluations need to consider the occurrence of such situations on time scales relevant to the risks associated with these facilities

SAFETY ASSESSMENT TIME SCALE



The radiological and chemical risks associated with the disposal of mill tailings will persist over time scales of the order of tens of thousands of years

In this respect, it is considered that no provision (reasonably envisaged at the design stage or through reinforcements) can guarantee, in the absence of maintenance, the mechanical strength of the dams over a period of more than a few hundred years, in particular to offset the effects of natural erosion



It is considered essential that these structures be monitored and maintained for as long as possible
This constraint will be passed on to future generations → need to preserve the memory of these facilities as long as possible

APPROACH TO ASSESSING THE PERFORMANCE OF TAILINGS DAMS

Objective : ensure the mechanical resistance of the dams, over a period of about a thousand years, to natural hazards (rainfall, earthquakes) and to high water levels resulting from the absence of maintenance of the dams' drainage systems



- ✓ The stability of the dams shall be evaluated under current conditions as well as, in the most unfavorable cases, by considering a maximum water level in the dam as well as the occurrence of an exceptional rainfall or an exceptional earthquake
- ✓ The risks of liquefaction, internal erosion and external erosion shall also be analyzed

Given the time periods involved, the resistance of the dams to natural hazards **requires regular re-evaluation**

Situation	Life phase of the disposal facility	Water level in the dam	Natural hazards
1	« Effective maintenance »	Normal (functional drains)	No hazard
2		Normal (functional drains)	Earthquake associated with a 10,000-year return period, or to a deterministic assessment
3		High hydraulic head (high water level due to very heavy infiltration)	Exceptional rainfall
4	« Lack of maintenance »	Maximum hydraulic head (due to inefficient drains)	No hazard
5 (sensitivity study)		Maximum hydraulic head (due to inefficient drains)	Earthquake associated with a 10,000-year return period, or to a deterministic assessment

Situations to be considered when assessing the stability of the tailings dams [1]

CONCLUSION

- ✓ The set of situations to be considered for assessing the long-term stability of uranium mill tailings dams were established, together with a review of the most relevant methods for assessing their performance



[1] Working group report (in French): <https://www.asn.fr/Media/Files/00-PNGMDR/rapport-final-du-groupe-de-travail-relatif-a-l-evaluation-de-la-tenue-des-ouvrages-ceinturant-les-stockages-de-residus-de-traitement-de-minerais-d>



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