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STAKEHOLDER STATEMENT N°18

For a responsible and rational management of radioactive waste and materials

SUMMARY OF THE VIEWS OF THE ACADEMY OF SCIENCES AND THE NATIONAL ACADEMY OF TECHNOLOGY OF FRANCE

The laws of 1991 (framing studies and research on geological storage and establishing the National Evaluation Commission (NEC), 2006 (establishing a tri-ennal update of the radioactive materials and waste management plan (PNGMDR)) and 2016 (specifying the objectives of reversibility) form a coherent framework. It is envied by many foreign countries. The fourth edition of the PNGMDR provided confirmation but also important new information on three key points developed in this guide:

1.The assessments of IRSN (Technical Safety Organisation) and ASN (Safety Regulator) on the preliminary safety analysis of the Cigeo project located in Bure clay (Meuse - Haute Marne) confirm the quality of this rock for the deep disposal of HA(High Activity) and ILLLW (Intermediate-level long-lived waste) wastes. It had been recommended by the NEC in 1998 after Andra's assessment of other rocks, including granite (Andra is the French Nuclear Wastes agency). The practical implementation of reversibility has yet to be defined. In addition, a position should be taken on the interim storage solutions for HA and ILLLW, which have been considered for a while.

2) The deployment of fast neutron reactors (FNRs) must be continued to close the fuel cycle, ensure plutonium recycling and sustain the circular nuclear energy economy.

3. The first dismantling operations highlight the inconsistencies and limitations of the current strategy for the storage of very low-level waste (VLLW). Release thresholds must be put in place

TOWARDS THE COMMISSIONING OF CIGEO

Meuse argillite is a grey, massive and waterproof rock. It is a fairly old sedimentary rock (160 million years) in a tectonic and seismically very quiet area. The work carried out in Bure showed the total absence of open cracks or fractures, through which water could circulate. It is insensitive to the effects of seismicity and tectonic movements. The only mechanism for the migration of radioactive species into argillite is then diffusion, which is extremely slow. This rock also has very important "retention" capacities by sorption of radioactive molecules on the sheets of clay minerals, further reducing their diffusion rate: the retention time of radioactivity in the argillite layer is in the hundreds of thousands or even millions of years (depending on the nature of the molecules), allowing this radioactivity to be reduced by natural decrease to insignificant values. Finally, the argillite is strong enough to allow the safe excavation of access shafts, main galleries and parcel storage cells. The feasibility of sealing all these structures has been tested in situ; in the long term, it benefits from the plasticity of the rock, which leads to the slow convergence of the cells and the closure of any gaps at depth. All possible handling of the waste containers for their placement or removal during the operating period has been tested in the surface facilities.

ASN (Nuclear Safety Authority) and IRSN (Radioprotection and Nuclear Safety Institute) consider that the Cigéo project has reached satisfactory technical maturity and that its safety options represent a significant step forward. This view is shared by NEC (National Assessment Committee, established by French State). The priority of the fifth PNGMDR must therefore be for Andra French Nuclear Wastes Agency) to respond to the ASN's latest requests on the safety options file and prepare the application for authorization to create the facility, which can be submitted mid-2020.

Under these conditions, the Academies consider that alternatives for long-term storage of HA and ILLL waste should be ruled out. Andra has indeed shown that the radiological consequences of Cigeo, even in the very long term, and even taking into account the risks of human intrusion, are much lower than those of natural radioactivity. The Academies consider this to be a particularly robust solution.

Our generation is responsible for preventing and limiting the burdens passed on to future generations. Storage of waste packages would contravene this principle, while a definitive deep disposal solution is within reach. In addition, surface storage is always more vulnerable than deep disposal. The option of fissioning or transmuting HA and ILLL waste is not credible even with recent pulse laser technologies, which require coupling to a reactor and complex facilities not yet defined. In any event, they cannot apply to waste already packaged.

On the other hand, it is necessary to store unprocessed spent fuel, which should not be reprocessed now. This is particularly the case for irradiated MOX fuels (mixed oxide of plutonium and depleted uranium). Dry and wet storage alternatives, local or centralized, should be compared without bias. The possibility of geological disposal of MOX in the event that it is not used should be studied.

The 2016 law provides that future generations can continue to build and operate the disposal facility, or conversely re-evaluate the choices defined previously and develop management solutions.

It is therefore according to the progress of Cigéo's operations that the project's governance will have to

adapt the operating methods, in particular the objective of recovering packages.

After the operating period, passive safety involving the closure of the geological disposal should be given priority. It is the responsibility of the current generation to pass on to future generations a situation where the waste it has produced is stored safely, without the need for recovery. It is on the basis of this principle that the strategy for the gradual closure of the cells must be defined.

The Academies suggest to the public institutions in charge of managing this public debate to better involve them alongside certain public bodies (NEC, HCTSIN,...) to discuss the complexity of the subjects dealt with and the options presented.

In conclusion, the Academies consider that the work in the Bure underground laboratory was carried out with great rigor; they confirmed the very good suitability of the argillite as host of the proposed geological disposal center and allowed the acquisition of the necessary know-how for the construction and operation of this center.

SUSTAIN THE CIRCULAR FUEL ECONOMY

The nature and quantities of radioactive waste depend on the strategy adopted for the fuel. France has long taken the decision to reprocess spent fuel and recycle plutonium in the form of MOX, which reduces the natural uranium consumption of 12%; if retreated uranium is re-enriched, the gain on the total consumption of natural uranium is in the order of 20%.

Recycling of recoverable materials, uranium and plutonium, is a major objective in accordance with the model of circular economy promoted by the code of the environment. It reduces the volume and facilitate the geological storage of the most important radioactive waste.

A complete multi-recycling requires deploying fast neutron reactors (FNR). The countries with significant nuclear programmes have all projects under construction or in the study of fast neutrons, sodium cooled reactors.

FNRs can use plutonium and depleted uranium, thus limiting consumption of natural uranium. Multi-recycling plutonium in pressurized water reactors, envisioned while waiting for the FNRs, presents complex problems related to isotopic degradation of plutonium: the Academies consider that this is not a sustainable solution.

The deployment of FNRs is being considered in France by the the project owner's file for the end of the century; the Academies consider that it is necessary to set objectives closer to commission a demonstrator. They wish that the study of concepts of intrinsically safe FNR reactors be actively relaunched, including modular small power FNR solutions.

Both Academies recommend that the renewal of fuel cycle plants be envisioned for 2040/2050, in line with the progressive deployment of FNRs. Their discontinuation would lead to fundamentally reconsider high activity waste management.

CHANGE THE RULES FOR DISPOSING VERY LOW LEVEL WASTES

The current principle of VLLW waste management is that all waste from a classified part of a nuclear installation is managed as if it were radioactive, whereas to a large extent it is not. They must therefore be directed to a specific storage facility. France is one of the few European countries that

does not implement the recommendations of the International Atomic Energy Agency (IAEA) and the European Union, which have proposed release thresholds that do not increase population exposure by more than 0.5% of natural radioactivity. The Academies recommend that the French safety authorities define thresholds to optimize waste management while ensuring its safety.

Decommissioning programs in the coming decades will target 900 MW reactors and fuel cycle plants. Andra estimates that 30 to 50% of the waste from these operations will have no or negligible radioactivity. The collection and transport on a single site of the large quantities expected would generate greater impacts and risks (dust, traffic, etc.) than the specific risks generated by their very low radioactivity. This point of view is shared by both Academies.

Recycling after decontamination of materials would be virtuous in the context of a circular economy. The management principles currently recommended by the safety authorities for VLLWs are not consistent with the Environmental Code, which imposes a hierarchy of management methods giving priority to the prevention and reduction of waste production and its harmfulness, its recovery through reuse or recycling and, finally, storage.

It is therefore desirable that VLLW waste management take into account thresholds that allow for recycling or local storage. The expenses and charges generated by the present management rules cannot be justified by a real reduction in all risks (radiation but also transportation).

Ensuring that all waste disposed of meets the release threshold can be very complex, particularly for waste that is heterogeneous in origin or composition. It is conceivable that thresholds could only be defined for waste from characterized sectors, whose flows can be controlled. Thus, metallic materials from nuclear installations could, after decontaminating sorting and fusion operations, be reused in the public domain. The same could be true of materials resulting from the demolition of buildings (concrete, rubble, etc.).

A possible storage of released non-reusable materials could be done on site or in dedicated landfills that do not have to be equivalent to Hazardous Waste Storage Facilities.

CONCLUSION

The remarkable qualities of Bure argillite for the storage of radioactive waste are demonstrated. The compactness, impermeability, and chemical and mechanical properties of this rock will allow it to isolate and contain this waste for "geological" periods of time. French granites are very fractured and unable to contain waste over very long periods of time.

In 2018, IRSN and ASN stated that the Cigéo project is mature. There is no longer any need to focus on an alternative for intermediate storage in "subsurface". The pilot phase should make it possible to better define reversibility. The implementation of this concept should give priority to passive security, which can be acquired as soon as the packages are definitively disposed of.