

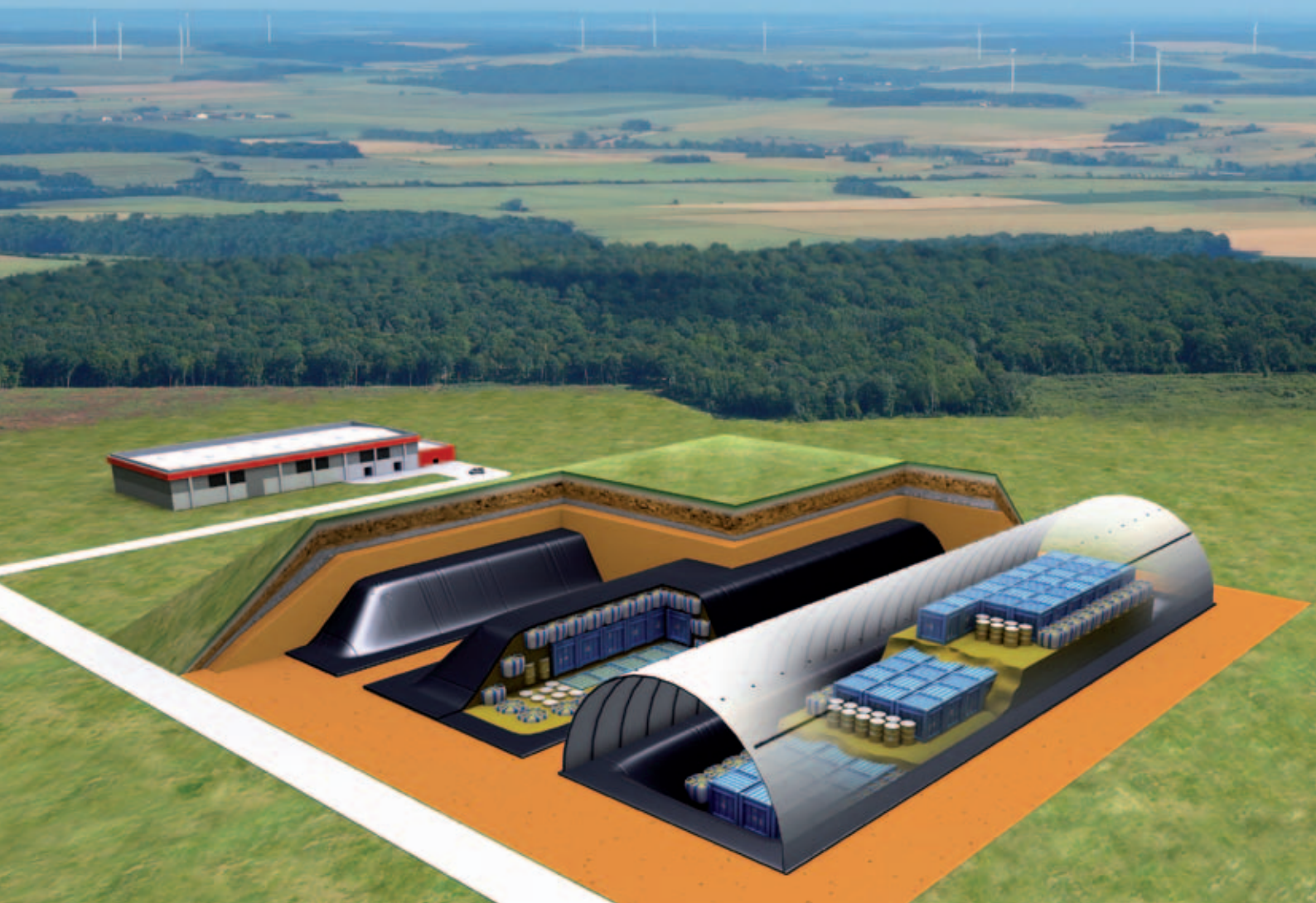
# Andra

## The surface disposal concept for VLL waste

- Over 10 years of experience
- A reference concept and facility for such waste

### Waste

Disposal facilities for very-low-level (VLL) waste have been designed to accommodate both residues originating from the decommissioning of nuclear facilities and used components. Those residues have very low specific-activity levels that lie below a few hundreds of becquerels per gram (Bq/g). As for the average activity found in any disposal facility, it never exceeds more than a few tens of becquerels per gram. In that case, waste disposal involves no special processing or conditioning, except for handling requirements or volume-gain purposes.



# Basic disposal concept

**The main barrier against radionuclide dispersion is provided by the geological formation being used for waste disposal.**

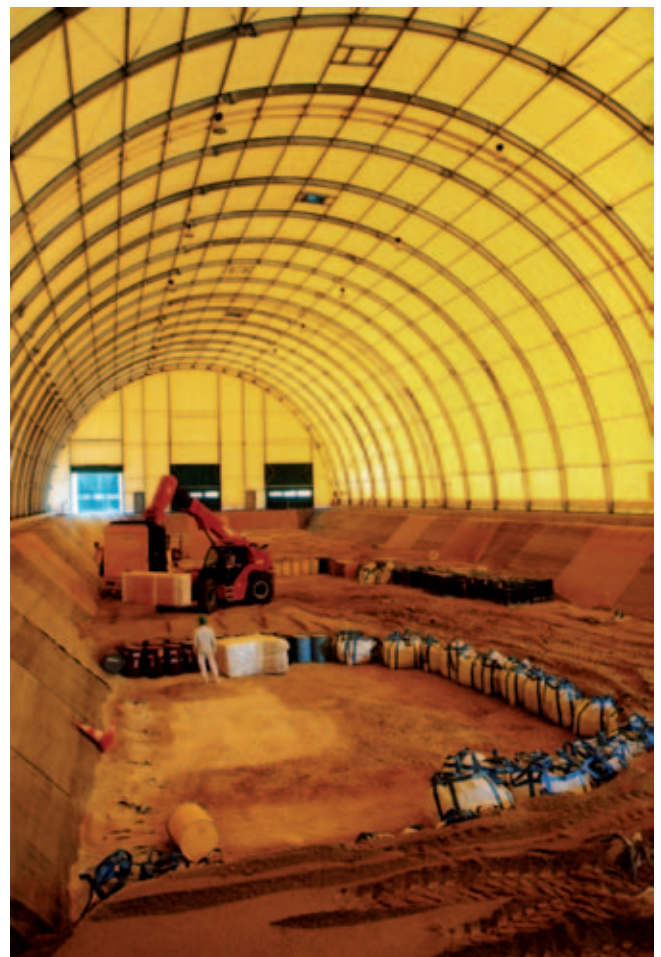
The design and construction provisions allow for the optimal operation of the disposal facility without any risk of altering the required safety level. They also ensure a satisfactory containment level for several

centuries at the end of the operating lifetime. Hence, the natural materials in their original context constitute a particular advantage for the safety demonstration over the long term.

## A concrete achievement: the disposal facility for very- low-level waste (CSTFA)

With due account of the nature of VLL waste, their containment envelope (drums, big bags, etc.) has no role in confining radioactivity, but rather in facilitating handling and disposal operations, while protecting operators.

Approximately 30% of all waste received at the CSTFA undergo a specific treatment before disposal. Low-density residues (plastics, thermal-insulation materials, etc.) are first compacted by a baling press, then strapped and wrapped in clear plastic-sheet. Another bundle press is used to reduce the volume of scrap metal. Some waste, such as the polluted waters generated on site or the sludges sent by producers, are processed in the solidification and stabilisation unit.



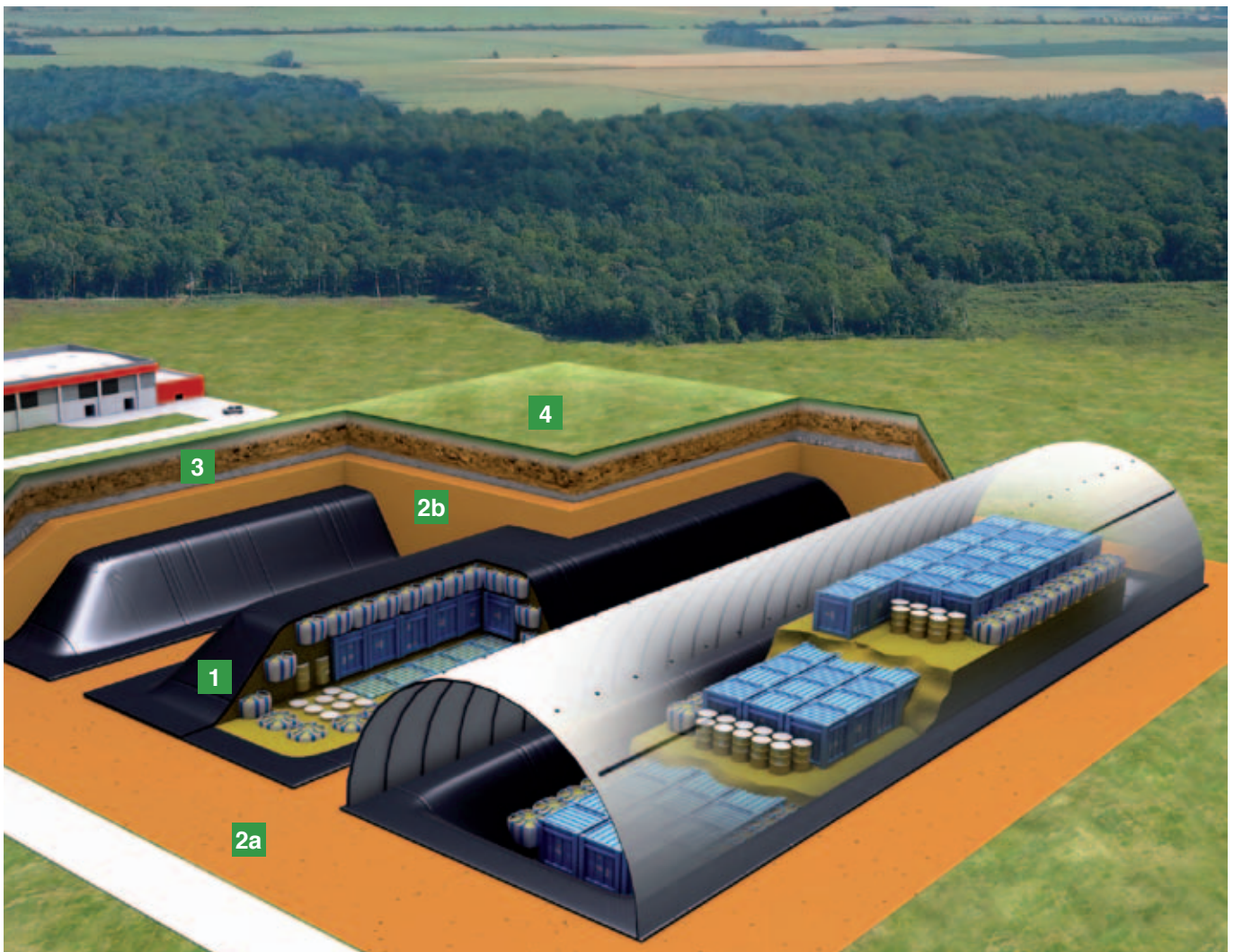
VLL disposal cell  
under operation

# Disposal cells

Disposal cells are excavated progressively, as needed, directly in the clay formation down to a depth of 8 m and are operated in sequence. Cell design has evolved to maximize the disposal volume, and now offers 25 000 m<sup>3</sup> in a 26 m wide by 174 m long and up to 8.5 m deep structure. Cells are filled up in successive waste packages layers (about 10 on average), while void spaces between waste packages are gradually backfilled with sand.

> a 2-mm-thick high-density polyethylene (HDPE) geomembrane **1** is first fitted at the bottom and on the sides of the cell before emplacing the waste. Once each individual cell is filled up, an identical membrane is laid over it and thermo-welded to the first, in order to form a continuous and water-tight barrier around the waste. The geomembrane is fully waterproof and is designed to prevent any dispersion of radioactivity and any seepage of external waters (rain, infiltrations) over several decades;

- > a containment envelope made up of natural clay-based materials. **2a** The lower part of the envelope corresponds to the first 5 m of the clay layer located immediately under the geomembrane and characterized by a very low permeability (at least 10<sup>-9</sup> m/s). The upper part **2b** is made of clay-based materials that were removed during cell excavation and consists of a layer measuring 1 to 5 m in thickness, shaped and compacted mechanically in order to restore its initial low permeability (at least 10<sup>-9</sup> m/s).
- > Ultimately, a clay backfill, **3** approximately 2.5-m in thickness, will isolate the clay-based containment layer from:
  - weathering (frost, draught);
  - burrowing animals, and
  - erosion.
- > Lastly, a permanent 30-cm-thick layer of grass-covered topsoil **4** will be laid over the entire structure.



# A unique array of skills and services

**To provide its wide-ranging competences in the field of waste management and disposal, Andra offers multiple solutions, from consultancy and documents reviewing, to technology transfer and turnkey projects**

## Waste management policies

- > *Development of framework for radioactive waste management*
- > *Waste management organization implementation*

## Waste management strategies

- > *National strategy and waste management plans*
- > *National, corporate & site waste inventories*
- > *Waste characterization and tracking*
- > *Waste compliance verification*
- > *Data archiving and site memory*

## Communication & public relations

- > *Stakeholder engagement and communication strategy*
- > *Communications resources: web, edition, video, public debates and consultations*

## Research and Development

- > *Geology, geophysics, rock mechanics, geochemistry, sensors & networks...*
- > *R&D program design & management*

## Training

- > *Specific or generic waste management courses*
- > *Training program design*
- > *Extensive use of Andra facilities and R&D resources*

## Site remediation

- > *Site characterization*
- > *Site clean-up*
- > *Waste management*

## Disposal facility design: VLLW, LLW, ILW, HLW & Spent Fuel

- > *Conceptual to detailed design : waste treatment, conditioning and disposal*
- > *Siting of facilities: early bibliographical studies to site characterization management*
- > *Safety analysis: modeling, simulation, studies*

## Disposal facility licensing

- > *Environmental and safety reviews*
- > *Site and waste disposal licence preparation*

## Disposal facility construction

- > *Construction management*
- > *Project owner support*

## Disposal facility operation

- > *Waste treatment and packaging facilities design*
- > *Operations and quality reviews and improvements assessment*

## Disposal facility closure

- > *Site closure planning*
- > *Safety reviews*
- > *Final site capping design*

## "Small scale nuclear activities" waste producers

- > *Collection, sorting, treatment, packaging and disposal of radioactive waste*
- > *Environmental monitoring*



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