Geosynthetic Materials in French Industrial Waste Storages : New Concepts

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ABSTRACT : The paper presents the use of geosynthetic materials in french industrial waste storages and the new concepts proposed according to the new regulation through two examples.
The industrial waste is, at the present time, stored in modern landfills including a lining system and a technical man-inspectable gallery running under the site. The connections between this gallery and the geosynthetics are described in the paper.
After solidification and stabilization processes, the waste will be transformed into blocks similar to concrete or, at least, gathered in geometric forms to be piled up. The corresponding future storage centres could include concrete walls and mobile roof. The choice of geosynthetic products will be quite different in this kind of storage according to the mechanical aspects. An european research program (EUREKA Label) called "SITINERT" is dedicated to these aspects. An experimental centre is under construction in 1994.

1 INTRODUCTION

Every year, France produces nearly 250 millions metric tons of waste, including about 20 million tons of special industrial waste (Déchets Industriels Spéciaux = D.I.S.). Disposal of this latter until now involved a number of processing methods ; recycling, incineration, neutralization, detoxification. The technical storage centres, hitherto considered as a separate branch, should, according to the new long-terme storage centre regulation, become an exclusive outlet specifically for the D.I.S. which cannot be subjected to additional techniques not exceeding excessive costs. Moreover, the D.I.S. will be treated with stabilization and solidification processes (SSP's) before landfilling by 1995.

Regarding geosynthetics, the French ministerial decree of 12/18/92, imposes the following rules on a landfill site (Gisbert, 1993) :

- a 2 mm thick geomembrane on bottom and banks ;
- a gravity drainage to a gallery running under the operational areas (cells) ;
- a geotextile filter to protect the drainage layer (optional).

This geosynthetic system, called "active safety barrier", has to be installed over a 5 m thick clay layer.

These drastic modifications of the french landfilling practises require an efficient synergy between the geosynthetic materials providers and the storages operators. This will be described in the following two examples. The first one is an operating storage centre located in Champteusse/Baconne (France) and the second one is still in development trough the "EUREKA" european research program called "SITINERT".

2 INDUSTRIAL WASTE STORAGE CENTRES : THE EXAMPLE OF CHAMPTEUSSE /BACONNE

The first industrial waste storage centre in France equipped in accordance with the new regulations is located at Champteusse (Maine & Loir dept.). The use of geosynthetics, present throughout the construction of the work, provides an effective answer to the requirements imposed by the new regulations (Vovard et al., 1993).

2.1 Sealing and drainage system (see figure 2.1)

The bottom of the site is sealed by a 2 mm thick HDPE geomembrane. The banks are covered with a double seal of the same geomembrane with a HDPE geospacer connected to a control drain controlling the watertightness of the upper geomembrane. HDPE has been chosen because of the chemical quality of the leachate, still agressive as the waste stored in the present time is not yet stabilized but conditionned in big bags. This lining system is protected by puncture-proof non woven geotextiles. Then, the bottom of the site has been covered with an 0,5 m thick drainage layer of washed sand, and above it has been placed a filtering non woven geotextile.

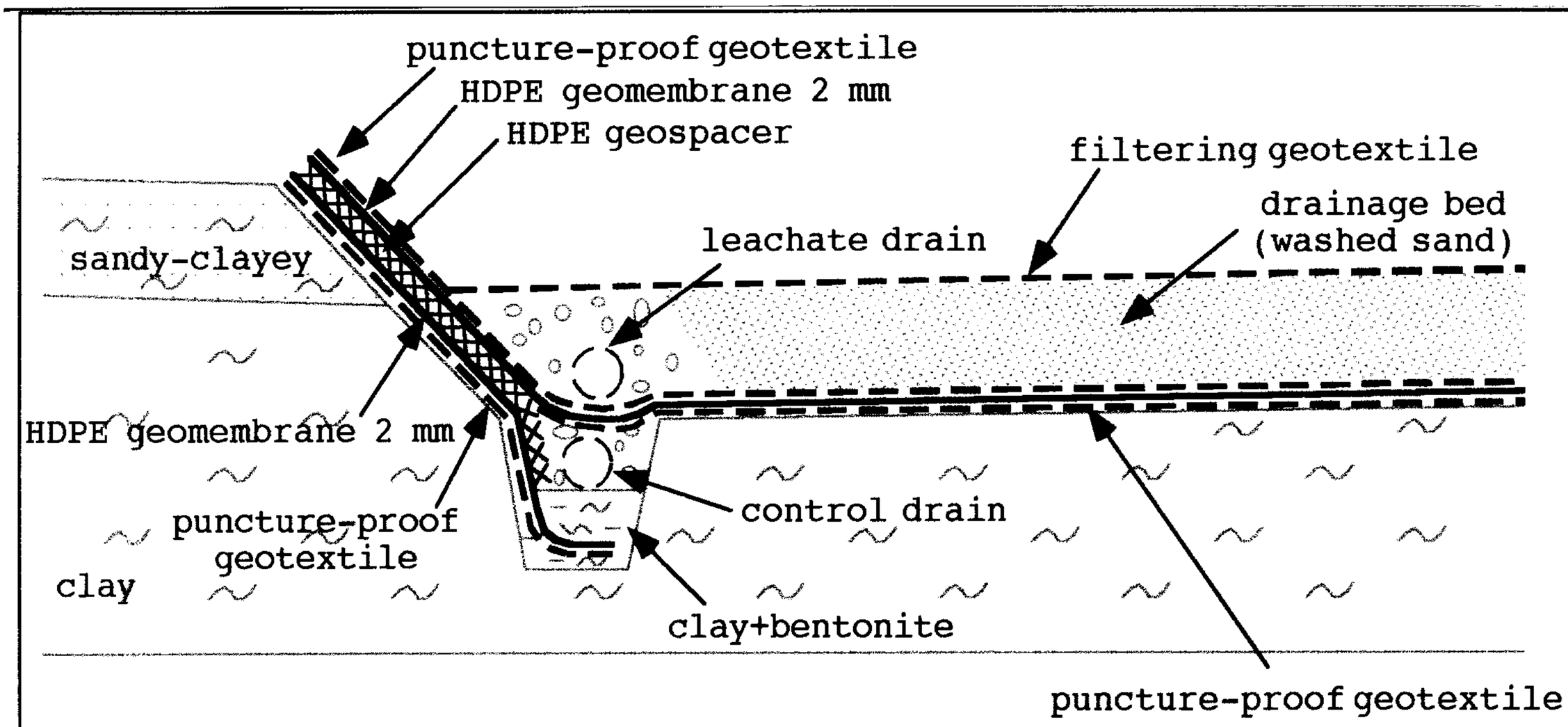

figure 2.1 Sealing and drainage complex

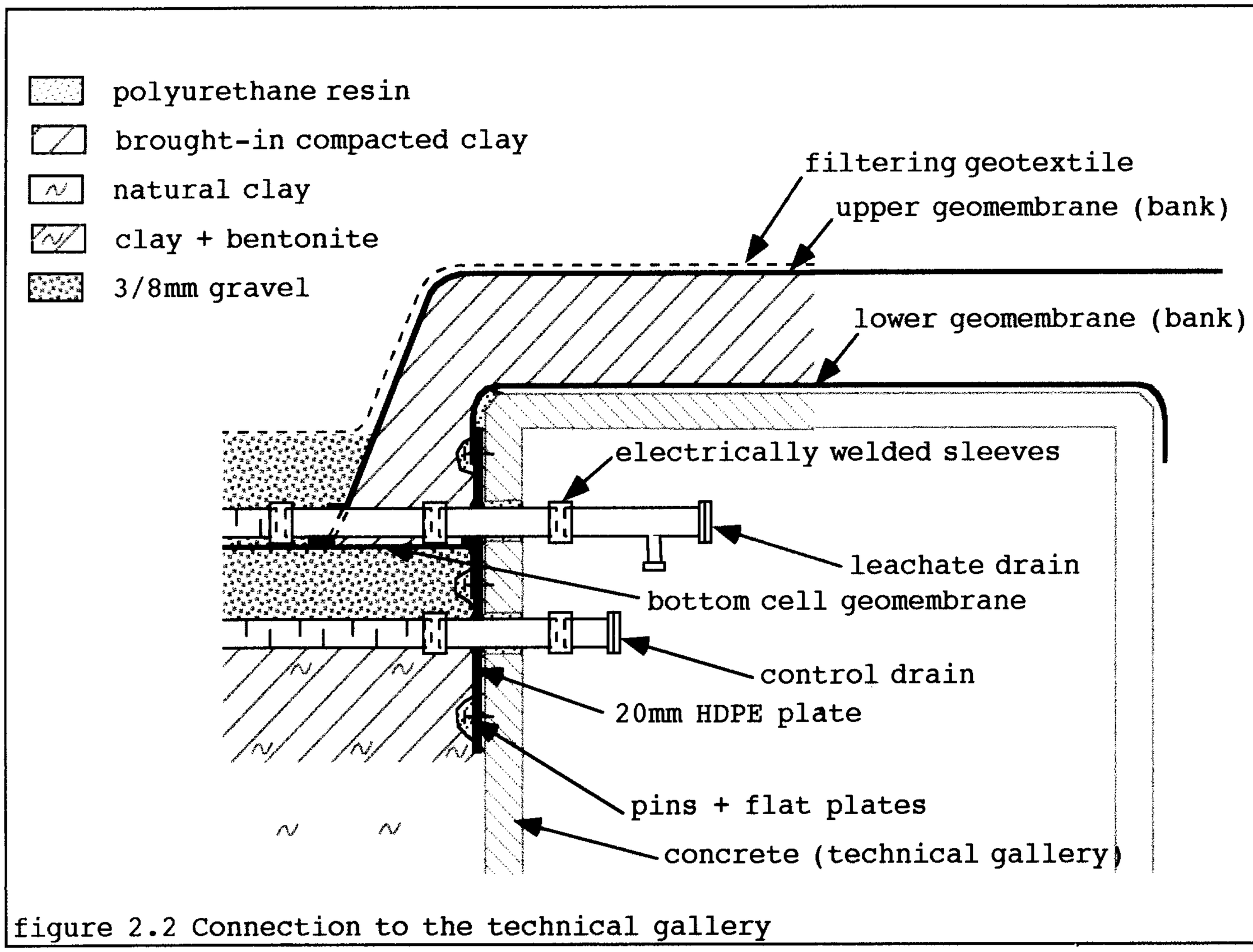

figure 2.2 Connection to the technical gallery

2.2 Special point : connection to the technical gallery

Each storage cell includes a separate HDPE drain (160 mm diameter) which collect by gravity, the leachate towards a man-inspectable gallery, enabling the network to be checked (see figure 2.2).

To connect the drains (leachate and control) to this technical gallery, a 20 mm thick HDPE plate as been fixed by polyurethane resin, drive pins and flat plates to the concrete wall of the gallery. This HDPE plate is crossed by the drainage pipes. All the geomembranes (bottom and banks) are welded to this HDPE plate. The figure 2.1 displays the cross-section E-W and the figure 2.2 the cross-section S-N : by the way, it's possible to observe the location of the leachate and control drains.

3 - EUROPEAN RESEARCH PROGRAM "SITINERT": STORAGE FOR INDUSTRIAL WASTE AFTER SOLIDIFICATION AND STABILIZATION PROCESSES

3.1 - Research program presentation

In relation to its quality, industrial waste will have to be treated by solidification and stabilization processes (SSP's) by 1995 or 1998 before storage, according to the french regulation. To fit this regulation, a working group was constituted by France Déchets, including the University of Grenoble (IRIGM), the CEMAGREF and the Laboratoire Central des Ponts et Chaussées. It proposed several new concepts.

Firstly, it appears that after SSP's, the waste is often transformed into blocks, or at least gathered in geometric forms to be piled up. This specificity of the solidified waste induces some new storage concepts which modify the whole usual feature of traditional landfills : a cavity with a double lining system.

To prevent the blocks from settling, concrete levels can be added to landfill clay bottoms. Traditional embankments can be replaced by concrete walls, more convenient for blocks storage. The walls can therefore support a mobile roof or any other structure designed to protect waste from rain water. These modifications induce new constraints on the geosynthetic materials which must be fixed on the walls and must be able to support heavy dump trucks traffic. For all of these reasons, mechanical properties of geosynthetic products become at less as important than chemical ones.

The european research program called "SITINERT" is already studying these new concepts ("EUREKA" label). Its main aim is to design a new concept storage centre for solidified industrial waste. This experimental centre using and testing several geosynthetic components, is under construction in Vernon (Eure & Loir, France).

3.2 - Experimental storage centre

According to the new regulation and to come up to public expectations (the "NIMBY" syndrome - for Not in My Back Yard - is still effective), this centre will fit with the following requirements :

- the storage must be reserved for waste blocks (after SSP's)
- the storage concept should be adapted to different fields topographies
- optimisation of the storage volume is searched
- the storage must stay "out of water" : several lining systems will be necessary.
- monitoring of the storage centre is required
- if necessary, the storage reversibility must be possible.

The whole storage will be built on a lining system quite similar to the one described in chapter 2 and called the "mother cell". The storage itself will consist in several "rooms" delimited by concrete walls and arranged in levels, each rotating through 90° from one to an other (see figure 3.1). Each room will contain a separate drainage and lining system to facilitate the monitoring of the centre (see figure 3.2). The site will have a general slope of about 1 % to permit the gravity drainage.

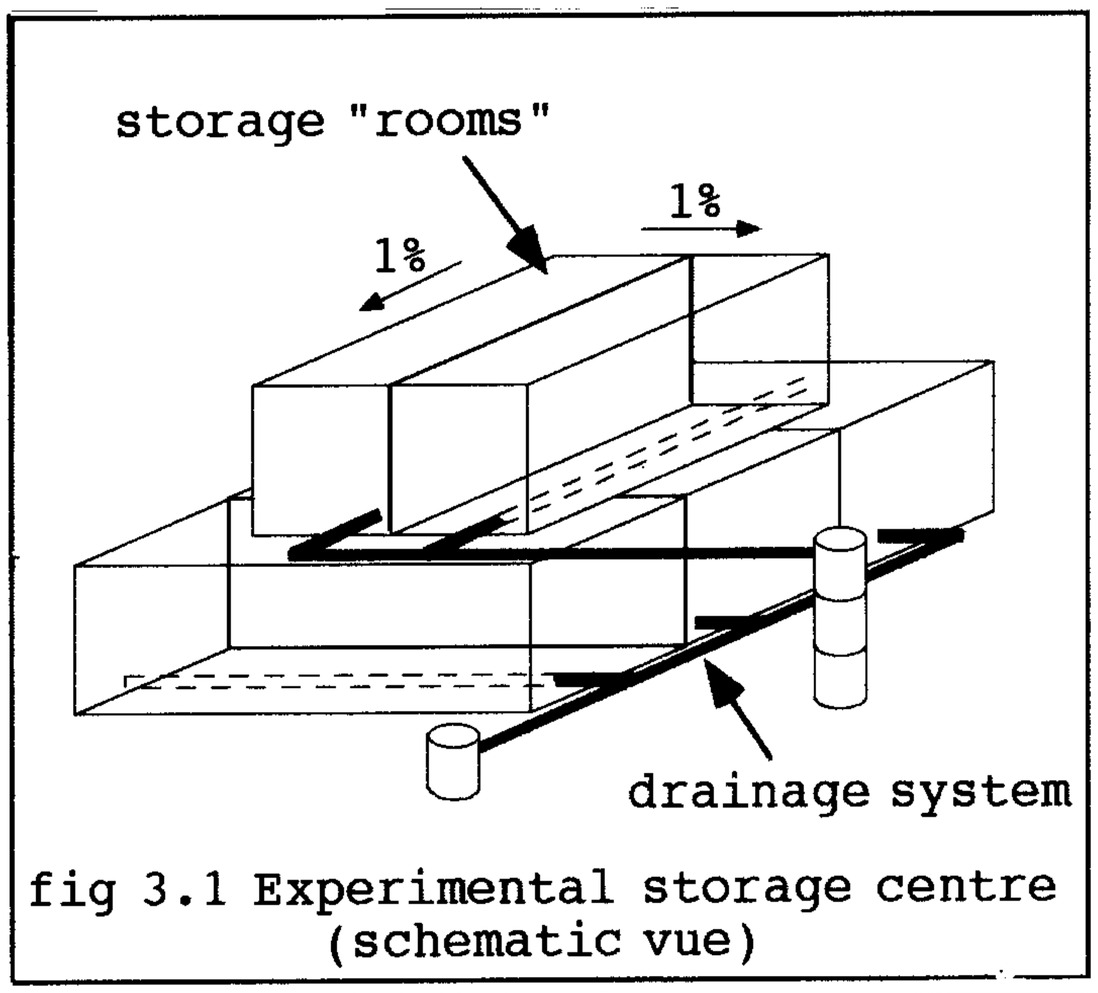

fig 3.1 Experimental storage centre (schematic vue)

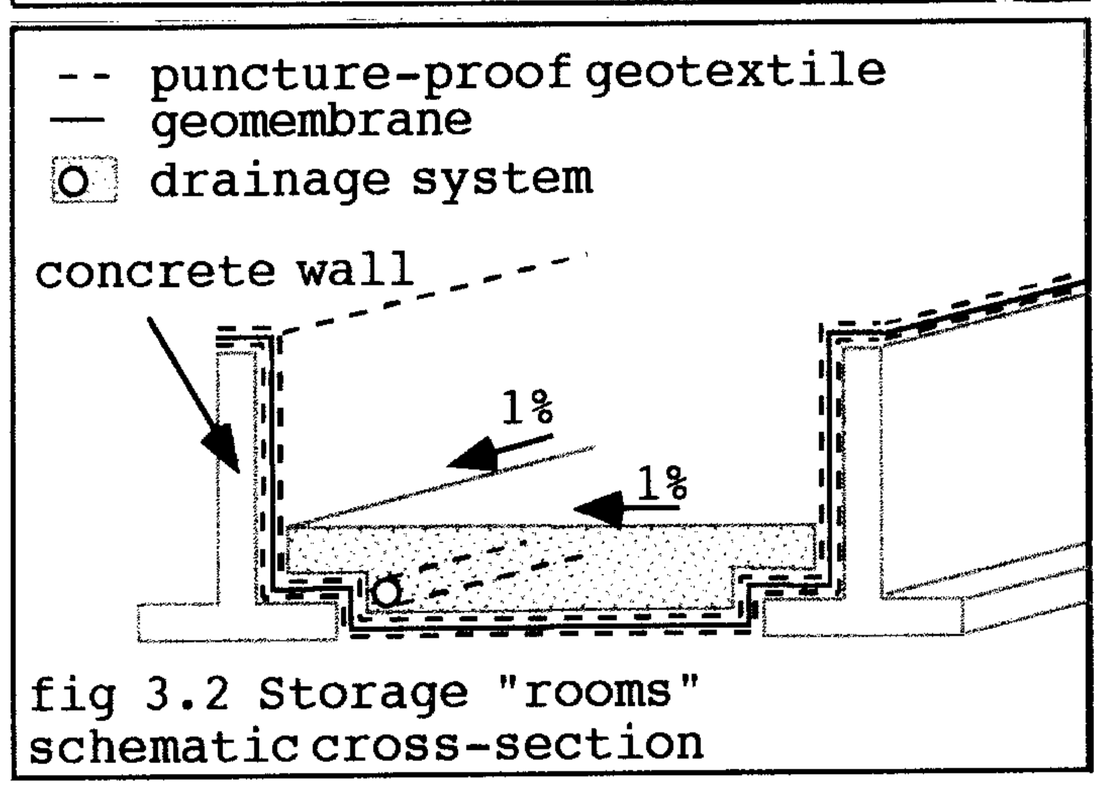

fig 3.2 Storage "rooms" schematic cross-section

3.3 - Discussion

On the bottom and on the walls of each room, a geomembrane, protected by puncture-proof geotextiles, must assure the watertightness. This lining system is to be installed before the waste storage. Different kinds of products will be tested.

If leachates are supposed to be rare and chemically non agressive, a special attention will be given to the possibilities of differential settlements of the structure. A little shift between two walls could induce a local disorder in the geomembrane, according to the yield peak of HDPE for example (Giroud, 1993 ; Peggs, 1993). Mechanical properties of geomembranes seem to be the most important ones in this kind of storage.

Furthermore, in order to protect the waste blocks from rain water, each room will be covered by a mobile roof during its working operation. According to the moving of this roof, it will be necessary to weld the upper geomembrane of each room to the vertical one as and when required (see figure 3.3). In order to save money, it could be necessary for the operator of the storage to be able to do by himself this upper welding day after day (or each week). In that case, how could it be possible to provide quality assurance on this phase ? Which product could permit the easier welding ?

The good quality of this welding is very important if the operator wants to design the final cover of the whole storage without geomembrane, to be able to plant trees after the site exploitation. In an opposite way, if the quality of the upper geomembrane welding of each room cannot be garanted, a geomembrane becomes necessary in the final cover, and trees forbidden... In that case, the quality assurance plan for the geosynthetic products is directly related to our future landscapes !

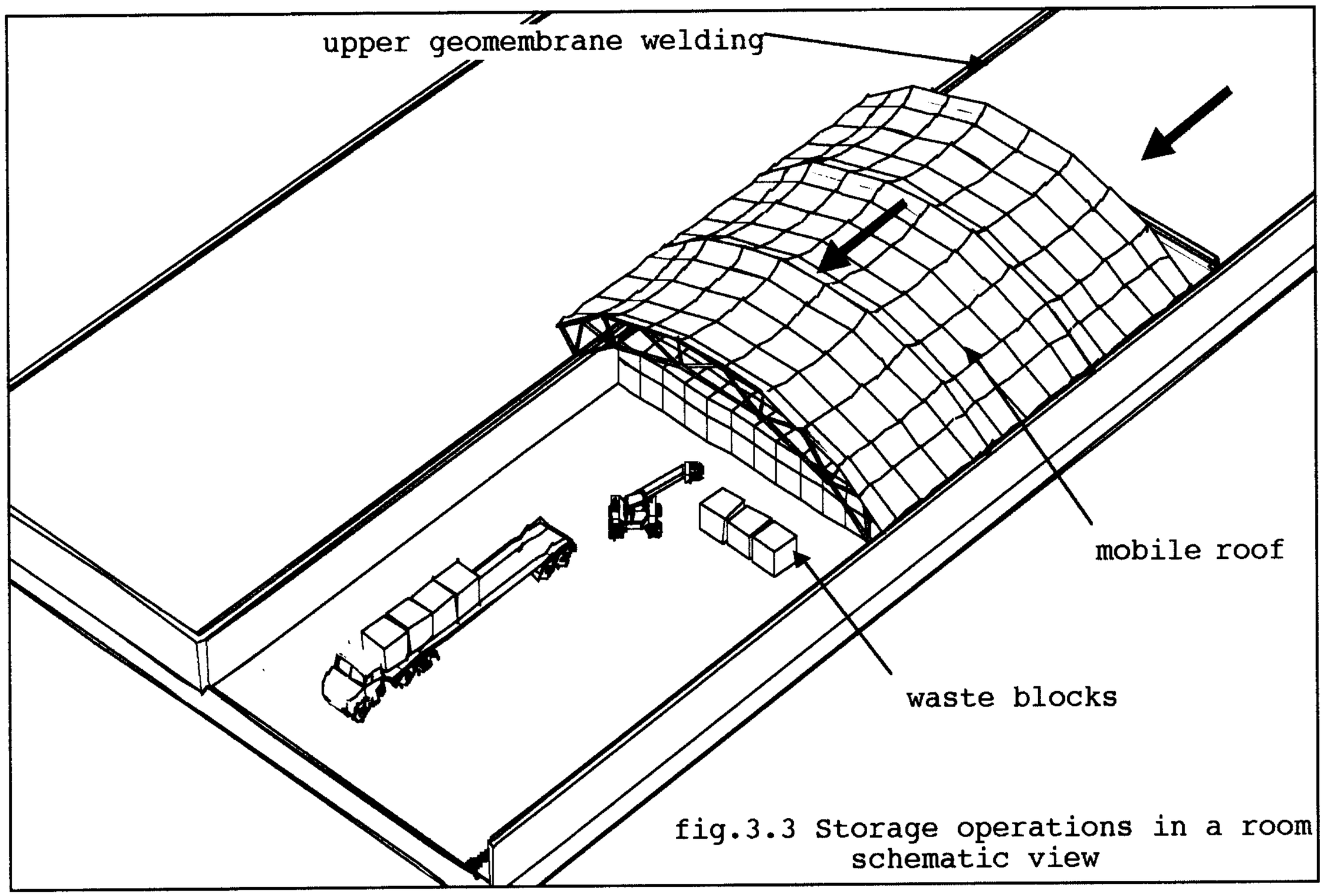

fig.3.3 Storage operations in a room schematic view

4 - Conclusion

Actual storage centres as well as the future ones need several geosynthetic components to assure with efficiency the containment of industrial waste with respect to the environment. According to the evolution of the french regulation, and to waste treatment and storage concepts, it appears that mechanical properties of geosynthetic products could become more important than the chemical properties. A good synergy between the geosynthetic and the waste specialists is already going-on to assure the best future of geosynthetics in waste storages. This will also concern the domestic waste storages for which a new regulation, including the use of geosynthetics is in progress.

REFERENCES :

Gisbert, T. (1993) Present and potential uses of geosynthetic materials for industrial waste disposal facilities, *Proc. Geoconfine 93* , Montpellier, France, 201-206.

Giroud, J.P. (1993) Lessons learned from studying the performance of geosynthetics, *Proc. Rencontres 93* , Joué-les-Tours (37), France, 15-46.

Vovard, S. ; Robillon, C. and Gisbert, T. (1993) Application of geosynthetic materials to industrial waste storage centres : an example at Champteusse/Baconne (Maine & Loire Dep.), *Proc. Rencontres 93* , Joué-les-Tours (37), France, 439-447.

Peggs, I.D. (1993) Geomembranes for landfill liners and covers : is there a choice ?, *Proc. Sardinia 93* , S. Margherita di Pula (Cagliari), Italy, 325 -332.