Anti flood Protection System at the Tihange Nuclear Power Plant

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Summary

This paper describes the main aspects of a current project of an anti-flood system for the Belgian nuclear site of Tihange, situated along the Meuse River. The project includes the various aspects related to the construction of a 2 km-long concrete wall and of other special buildings subjected to seismicity, special hydro-geological and geotechnical conditions, shocks due to floating objects, and constraints imposed by the plant operations, in particular the necessity of keeping the plant operational during the construction process.

Keywords: aquifer, dike, flood, hydrogeology, Meuse, nuclear, protection, shocks, Tihange, wall.

Fig. 1: Tihange nuclear plant

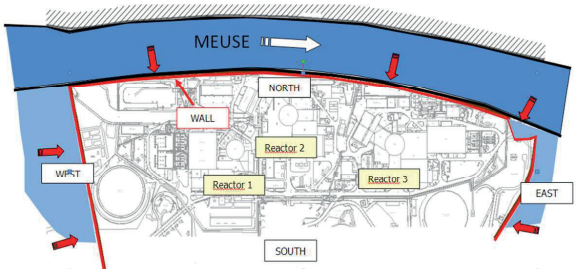

Fig. 2: Plan view of the site in case of flood

The Tihange nuclear power plant is situated along the Meuse River (Fig. 1 and 2). In 1995, very heavy rains caused an exceptional water level rise, equivalent to a probability of 1%, which yet had no consequences upon the plant operations. A more recent event was the Fukushima accident, where the power plant was flooded during the tsunami, with the consequences that everybody knows.

Tractebel Engineering was commissioned to perform without delay a pilot study for the construction of a technical solution in order to avoid any future risk in the plant area, by taking into account a decamillenial flood as a reference, where the occurrence probability is 1 in 10.000.

The chosen solution was a 2 km-long concrete wall (fig. 2,3 and 4) to be constructed along the West, North and East borders of the plant area, by taking into account, among others, the existing inlet and exit canals, the strict criteria related to seismicity, the level of the aquifer, underground

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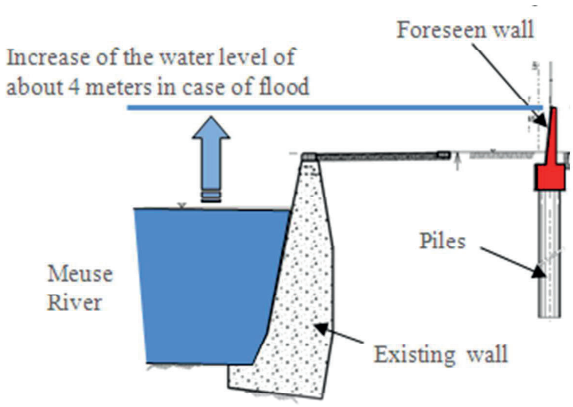

Fig. 3: The Meuse and foreseen wall

water flows, the minimum water flows necessary during a plant shutdown/stop, the thermal effects, the shocks due to floating objects, the tight budget and the short time of execution.

Each of the three units of the plant needs large water flows, so that the water flow in the inlet canal can reach 107 m^3/s.

After use, the water must be returned either into the atmosphere (via the cooling towers) or into the Meuse. Therefore, the plant has currently three exit water civil works that also have to be equipped with valves to allow fast closing and a waterproof connection to the wall.

In case of flood, the reactors are stopped and the valves are closed, yet bypass devices must still feed the plant with minimum water flows needed to cool the reactors. The cooling water is then discharged into the river, above the wall.

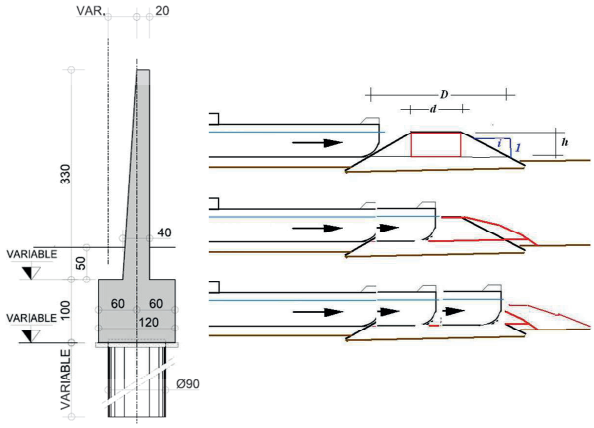

Fig. 4: On the left, an extract of a formwork plan. On the right, the dike capable of stopping vessels.

The complete foreseen device essentially consists of:

- The 2 km-long wall itself (Fig. 2, 3 and fig 4 (left));
- A 500 m-long dike in the West side of the plant, capable of stopping floating objects, including non-controlled ships of 9.000 tons (Fig. 4, right);
- A building in the inlet canal, equipped with automatic valves to allow fast closing of the site in case of flood (Fig. 5);
- Motorized valves to add into each of the three exit water works, with a waterproof connection to the wall;
- Pumping chambers used to release over the wall the rainwater falling within the site in case of flood.

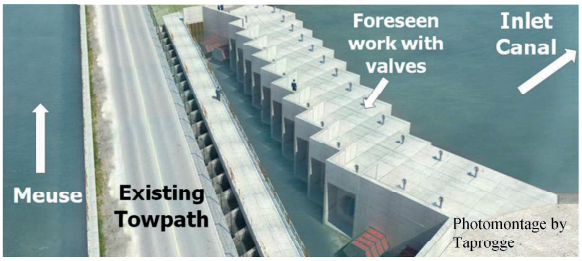

Fig. 5: Building with valves foreseen in the inlet canal

This paper will outline five subjects:

- The design of the concrete wall;
- The design of the dike;
- The building with valves in the inlet canal;
- The geotechnical aspects;
- The hydro-geological aspects.