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21ST CENTURY GASOIL STORAGE IN TWENTE, THE NETHERLANDS

STATE-OF-THE-ART, MULTIPLE-BARRIER DESIGN

BASED ON A NOVEL RISK MANAGEMENT APPROACH

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Abstract

AkzoNobel mines Röt salt from its brinefield near the city of Enschede at depths of approximately 400 meters. Since 1933 more than 200 disc-shaped caverns have been developed in a bedded salt deposit with a thickness of roughly 50 m. The first feasibility studies on the conversion of salt caverns to gasoil storage caverns were conducted in 2009. Following a stringent selection process, five caverns underneath the industrial area “De Marssteden” in Enschede were selected based on their technical suitability (e.g. stability and cavern shape) and the above ground situation. In 2010 a storage permit was granted and contracts were signed between AkzoNobel and Argos Energies (the largest independent player in the Western European downstream oil market) and between Argos Energies and the Netherlands Petroleum Stockpiling Agency (COVA) for strategic storage of 300,000 m^3 of gasoil.

Underground storage of gasoil has not been realized before in the Netherlands. In order to make gasoil storage possible within the framework of spatial planning, an amendment to the municipal spatial plan was necessary. Because the project is of national interest, i.e., security of supply of fuel in times of crisis, this spatial amendment and the overall permit procedure were coordinated by the Ministry of Economic Affairs. Permits to be obtained included an environmental permit (including civil activities) and allowance for the Storage Plan. These permits were granted in October 2013 and became irrevocable on 1 April 2014. Eleven days later, the oil leakage from the underground oil storage facility near the town of Epe (Germany), just 10 km east of Enschede, was discovered, which caused a renewed discussion on the safety of the Twente gasoil storage plans.

Safety and risk management form an integral part of all plans and permits. In the context of the Storage Plan (a requirement under Dutch Mining Law) a Risk Management Plan was developed, based on results from an extensive risk assessment regarding leakage of gasoil from the storage system. Associated Bow-tie models were developed for several hazardous events. In the Risk Management Plan a multiple-barrier approach is used to minimize risks and maximize safety. This Plan forms the basis of the Monitoring Plan.

A good example of the state-of-the-art, double-barrier design that will be used for gasoil storage is the twin-tubed well design, which is actually a requirement under Dutch Mining Law. The Enschede caverns will have dedicated boreholes for oil and brine flows. In each borehole, the existing last cemented casing will be equipped with a new inner tubing through which the oil (or brine) flows. The annular space between the last cemented casing and the tubing will be closed off with a packer and filled with a pressurized, environmentally benign corrosion inhibitor. In this way, there are always at least two barriers that must fail before the oil escapes the storage system. Annular pressure and the composition of the annular fluid will be permanently monitored, thereby in fact monitoring the integrity of the barriers (casing, tubing and packer). In this way, the risk of oil leakage is minimized.

Key words: The Netherlands, gasoil, storage, caverns for liquid storage, risk assessment, Bow-tie, safety