Solution Mining Research Institute Fall 2017 Technical Conference

Münster, Germany, 25 - 26 September 2017

Enhancing well integrity in the Hengelo brine field
Continuous improvement of well integrity in one of world's largest brine fields

Tjeerd Koopmans[1] & Marinus den Hartogh

Mining Development & Compliance - AkzoNobel Industrial Chemicals
Boortorenweg 27, 7554 RS Hengelo, the Netherlands

Abstract

AkzoNobel mines Röt salt from its brinefield between Hengelo and Enschede at depths of approximately 400 meters. Since 1933, over 250 relatively flat caverns with over 550 connecting wells have been developed in the bedded salt deposit.

Early 2016 oil was detected in the shallow groundwater near well 335. Well 335 was drilled in 1986 and gives access to a so-called multi completion cavern (MCC) with three access wells. During a video run two distinct leaks were encountered at depths of 54 and 97 meters (177 and 318 ft) . Subsequent investigations showed that a breach of integrity of the cemented casing had probably caused the leakage of oil to the environment. As the annular space only contained blanket oil in 1986-1987, this integrity breach probably dated back to those years. The volume of oil that potentially had leaked into the environment was assessed to be 12 m^3 (424 cf).

Next to the necessary environmental investigations near well 335, AkzoNobel immediately started an extensive integrity program covering all its wells. Due to the relatively small amount of salt that can be produced from one cavern in this bedded salt, compared to the larger caverns in salt domes, the number of wells is large (over 550). Until the early 2000s approximately 140 wells were abandoned, leaving over 400 in open connection with the underlying caverns. The integrity program was split in three parts:

1. A desk study to find out which abandoned wells were potentially suspect to have had any historical integrity issues. Being abandoned, well specific investigations could then only consist of environmental investigations;
2. A desk study to find out which inactive wells were potentially suspect to have had any historical integrity issues. Although inactive, these wells are still accessible, and can be subjected to well investigations, such as a USIT/CBL/PMIT-run, plugging, pressure testing and, if necessary, running a video through the cemented casing;
3. Pressure testing of all active wells, most of which were recently drilled wells to single completion caverns (SCC-wells, with one access well). These pressure tests provide proof of integrity of the wells that are currently producing brine. This was done by placement of a retrievable plug during a normal, scheduled workover.

Since mid-2016 almost 70 active and inactive wells have been tested. All 37 tested active wells (until August 2017) were found tight providing confidence that the current brine production methods are sound. Besides well 335, eleven of the suspect inactive wells were found to be not tight. To prevent any ongoing leakage of fluids present in the wells these remain plugged. These wells divide in two groups:

1. Seven wells drilled in the late 80s which are very comparable to well 335;
2. Four wells drilled in the period 1963-1970 with characteristics quite different from well 335.

Subsequently to the well integrity investigations, a root cause analysis resulted in a number of indicators for wells to be not tight. More indicators means more suspicion and this was used to prioritize the further testing of other wells.

Key words: well integrity, casing, oil blanket, soil pollution, root cause analysis