

Searching for the Crucial Piece of the Plume Puzzle: A Case Study from Central Denmark Region, Denmark

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Background/Objectives. When the public authority in Denmark carries the economic liability a risk-based approach is applied. This entails that the remediation goal is risk reduction, ensuring attainment of drinking water standards and indoor climate standards in dwellings.

A machine factory with a long running period and still in operation is situated in a drinking water catchment area. Preliminary investigations indicated contamination with chlorinated solvents requesting supplementary investigations on site and at neighbor dwellings. Simultaneous chlorinated solvents were detected in a mandatory control sample at the local waterworks supply tap. Economic liability was appointed to CDR as the factories application of chlorinated solvents was prior to a defined actionable cut-off date.

Approach/Activities. The waterworks extract from four wells (A-D) less than 300 meters from the point source. Individual analysis revealed that only the well (D) furthest from the point source was affected. Well D is the most recent established well and has only operated in a few years whereas the wells A-C has operated in a thirty-year period. Well screens are located at same level.

The geologic setting consists of sandy quaternary deposits with minor incoherent clay layers. The minor clay layers do uphold local secondary aquifers as well as chlorinated solvents somewhat. At present drinking water standards are attained. It is crucial to determine whether a change in well performance will trigger an impact on wells A-C.

The scope of the investigation is to clarify the extent and strength of the source and delineate the plume in order to evaluate whether or not the drinking water resource can be saved.

Boreholes, pore air samples and water level logging are applied. Field campaigns are carried out stepwise as geologic information and findings are assessed in-between each campaign to optimize the next investigation stage. Boreholes are executed carefully as perforation of clay barriers may be critical. Hotspot investigations are challenged by the fact that the factory is in operation. Geophysical measurements are considered but are challenged by the urban surroundings and have not yet been in use.

At present well performance is maintained and water quality monitored. Risk management is continuously deliberated with the waterworks and the municipality. Scenarios discussed are:

- A. Remediation can be performed ensuring that the drinking water resource is affected in a limited period of time and that drinking water standards are attained in the period.
- B. Well D can be closed down without impact on wells A-C.
- C. The drinking water resource cannot be secured within reasonable time and financial scale and a new well field must be located.

Results/Lessons Learned. At present four field campaigns has been conducted. A fifth campaign is scheduled.

At the conference the stepwise approach, findings, adapted strategies and considerations of risk management will be presented. At present water level logs indicate that there is hydraulic contact between all extraction wells.