

Flow Dynamics in Sewer Systems and Potentials on VI Preferential Pathways

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Background/Objectives. Vapor Intrusion (VI) has been a major concern in Denmark for more than two and a half decades, and numerous mitigation actions to prevent VI have been carried out. These projects and additional research projects have led to a good conceptual understanding of pathways and patterns for VI, resulting in a focused use of mitigation measures. In recent years, it has been good practice to renovate drainage systems and waste pipes in connection with VI measurements, when the drainage system is a pathway for VI. Renovation includes re-lining, use of stainless steel pipes and installation and venting of drainage and waste pipe systems (DWV).

Nevertheless, in a number of cases, it has not been possible to achieve sufficient reduction of the VI. Subsequent studies have indicated that this was caused by VI through the drainage system. In a co-operation between the Region of Southern Denmark, Region Zealand and COWI, research projects have been carried out to investigate the penetration routes via the drainage system and the effect different measures have in relation to reducing VI.

Approach/Activities. This presentation combines the results from three different research projects performed in the period 2016-2018. All carried out as field-scale work on locations where VI problems were identified.

Project 1 includes three sites where preliminary investigations were conducted to identify possible pathways, including investigations using perfluorocarbon tracers (PFC's). Evaluations were made to identify which measures could provide the best effect with the least possible interference. DWV was selected. To document the effect of these measures, measurements were carried out afterwards. Project 2 was carried out on a temporary test site. Originally, mitigation actions had been carried out, but since these did not reduce VI sufficiently, the site was bought by the Region of Southern Denmark to be used as a test site. A measurement program was set up to document the dynamics of the drain system. Subsequently, the drainage system was changed to its original design, in order to evaluate the effect of the implemented measures. The measurement program (more than 880,000 datasets) was based on concentration measurements and extensive continuous logged flows and pressure measurements. For visualization, smoke tests were carried out. Finally, an alternative measuring technique was tested. Project 3 tests a new investigation technique for source tracing in sewers combining tv-inspection and field measurements for chlorinated solvents.

Results/Lessons Learned. Preliminary results show that there is no clear effect on establishing passive DWV. It is very site-specific whether VI can be reduced sufficiently and not pose a risk. An alternative measure to perform internal DWV in residential buildings, is to set up external venting of the sewer to prevent VOC pathways to the internal wastewater system with the overall aim to reduce the risk of VI to the indoor climate.