IMPACT-CO2 Project: Assessment of CO2 health risk in indoor air following a leakage: results from the first representative scale experiment

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Leakage of CO_2 from geological reservoirs is one of the most fearsome unexpected scenarios for CO_2 storage activities. If a leakage reaches the ground level, exposure to high CO_2 concentrations is more likely in low ventilated spaces (pit dug in the ground, basement, building).

We present the first results of the IMPACT-CO2 project that aims at understanding the possible migration of CO_2 to indoor environment and to develop an approach to evaluate this risk. The approach is based on modelling and experiments at laboratory scale and at representative scale. Experiments at representative scale were performed on the PISCO2 platform (Ponferrada, Spain) specifically instrumented and designed for understanding the impacts of CO_2 migration at the soil surface. The experiment is composed of a 2.2 m deep basin filled with sand. A specifically designed prototype representing the indoor condition of a building (with controlled depressurization and ventilation) is installed on the basin.

Results show that the presence of thebuilding prototype significantly influences the transport of CO_2 in the surrounding soil, leading to two competing phenomena: 1) seepage in the atmosphere mainly controlled by diffusion gradient and 2) advective/diffusive flux entering the prototype due to its depressurization. Important variations of indoor CO_2 concentrations correlated with meteorological parameters have been evidenced. Thus, a significant part of the study is dedicated to the analysis of the influence of environmental parameters (including atmospheric pressure, depressurization in buildings, soil saturation and temperature) and their respective contribution to the resulting exposure.Models have been established to quantitatively assess the proportion of CO_2 entering the building and the resulting indoor concentrations. Models have then been used to assess a wide range of possible scenarios of exposure for configurations that are representative of inhabited areas at CO_2 storage sites.

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