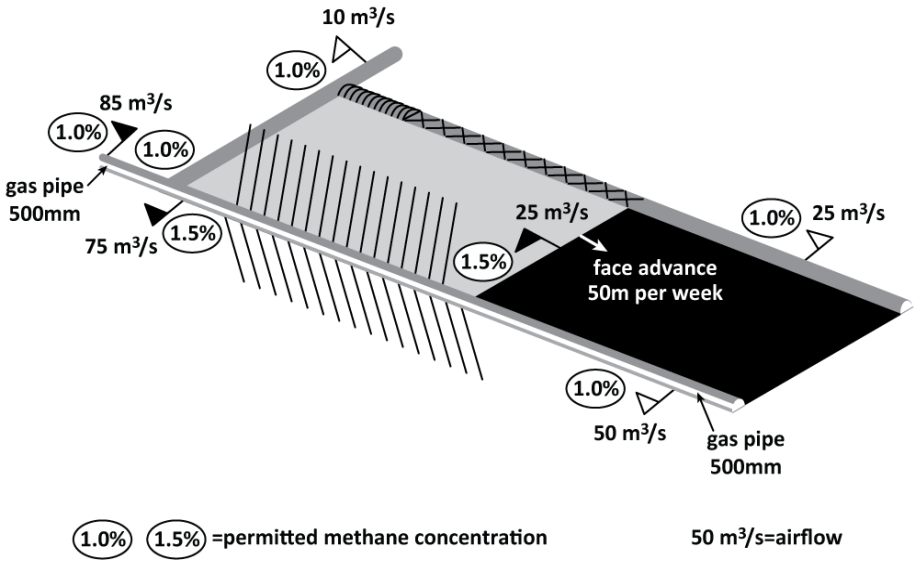
Case study: High performance longwall operations in areas with high gas emissions – Germany

Initial conditions: In a seam of 1.5 m thickness, a longwall with a length of 300 m, and a planned production of 4,000 tonnes per day (t/d), and a face advance rate of about 50 m/week. The overburden depth is 1,200 m, the seam near horizontal, and there are no previous workings to partially degas the coal seams. Gas predictions indicated likely specific gas emissions of 25 m^3/t from the roof, 3 m^3/t from the worked seam, and 8 m^3/t from the floor (in total 36 m^3/t). The coal was known to be prone to spontaneous combustion.

Gas control problem: The maximum methane flow that must be captured or diluted by ventilation to a safe concentration is 1.875 m^3/s (112.5 m^3/min). Predrainage was evaluated and determined to be ineffective. There were two main constraints. Firstly, a maximum permissible airflow of 25 m^3/s across the longwall coalface could only dilute a maximum gas inflow of 0.37 m^3/s (22.2 m^3/min), despite a relaxation by the mining authority which raised the maximum permitted methane concentration from 1.0% to 1.5% (a reduction in factor of safety from 5.0 to 3.3). The latter change was conditional on enhanced monitoring and gas drainage. It is important that such changes are only made on a site-specific basis and additional measures taken to ensure no significant increase in risk. The second constraint was the airway into which the district ventilation air was to discharge, in which a maximum of 1% methane is permitted.

Solution: A Y-ventilation system (Figure 1) was designed to introduce a further 50 m^3/s of air and add to the 25 m^3/s passing across the face, the combined flow passing behind the face diluting the methane emitted from the coalface and the goaf. The ventilation configuration allows cross-measure boreholes to be drilled, connected to the drainage system and individually monitored and regulated—generally cross-measure boreholes drilled behind the longwall face achieve higher captures and maintain higher gas purities than those drilled in front of the coal face. These drainage holes have a long lifetime and high effectiveness, and are expected to capture 70% of the roof gas and 40% of the floor gas.

Figure 1. Longwall with Y-shaped, advanced ventilation design and drainage boreholes in the roof and the floor behind the longwall



(Source: DMT GmbH & Co. KG)

Seals (pack wall) on the goaf side of the open roadway behind the face served to enhance roadway support and isolate the goaf from air ingress to minimise spontaneous combustion risk and from creating methane concentrations in the explosive range.

The limiting concentration of 1% outbye of the return ultimately limited the coal production to 4,000 t/d, which was in accordance with the planned target. About 80,000 m^3/d of pure methane could be extracted by the gas drainage system and utilised in a power station. Despite the severity of the mining conditions, the longwall was a success due to the advanced ventilation design and the highly effective gas drainage.