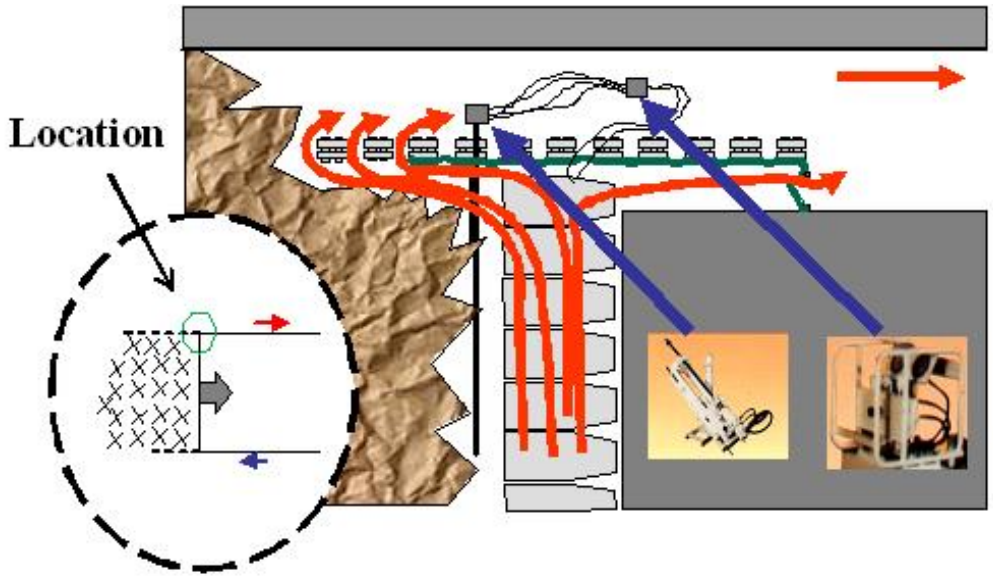
***Case study: Achieving planned coal production from a gassy, retreat longwall with severe strata stress and a spontaneous combustion prone coal seam – United Kingdom***

**Initial conditions:** 980 m working depth, 50 $m^3$/t specific emissions from a 2 m high retreat longwall required to produce 1 Mtpa, high spontaneous combustion risk coal, ultra-low permeability coal, severe horizontal stresses at the coalface and floor heave in the longwall access roadways—one intake and one return.

**Gas control problems:** Predrainage was not feasible due to the low permeability of the coal, and cross-measure boreholes angled above the longwall front of the face were disrupted by the high stresses; hence, gas capture and purity was too low. The high spontaneous combustion risk and a large pillar size requirement for stability precluded use of multi-entry or bleeder road systems.

**Solution:** The requisite production was achieved using the available 30 $m^3$/s of ventilation air by drilling cross-measure boreholes behind the face in a specially supported and ventilated "back-return" (Figure 1). The optimum drilling pattern was found to be a series of up-holes, at right angles to the longwall roadway, angled upwards at 55$^o$ to the seam plane, and 7.5 m apart. Down-holes were drilled 100 m apart to minimise floor emission risks.

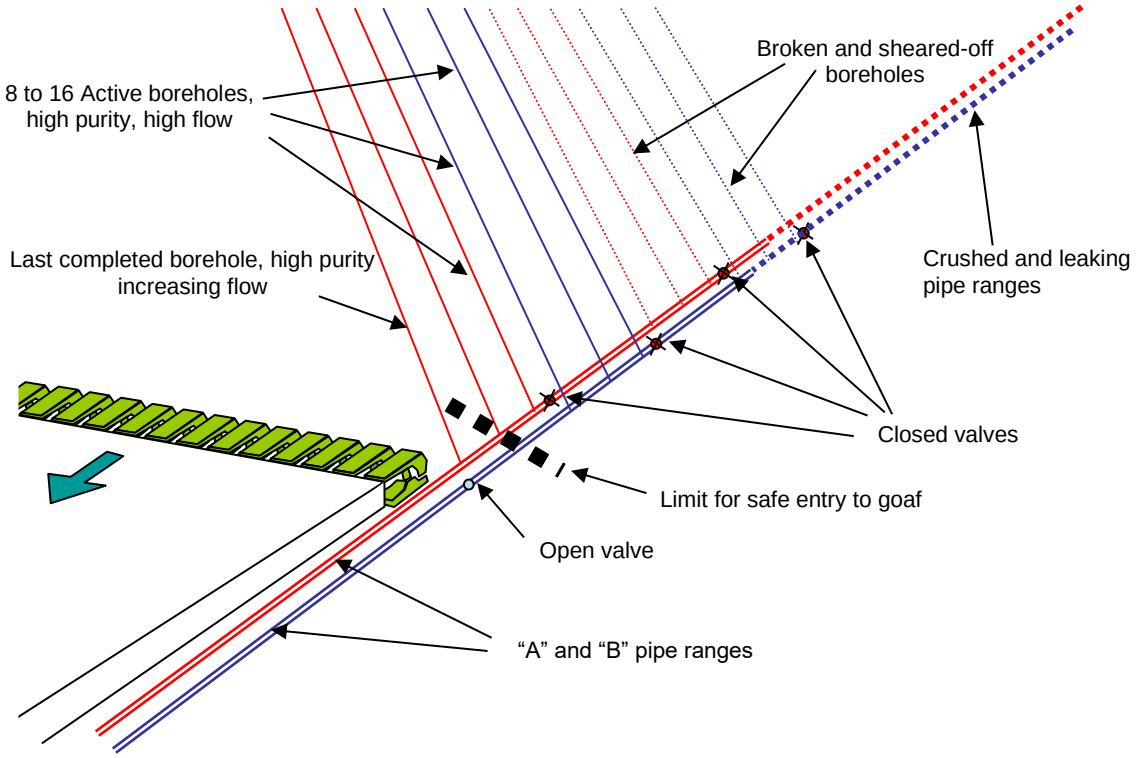
**Figure 1. Back-return system**




*(Courtesy of Green Gas International)*

Two drainage collection pipes were installed in parallel. Boreholes were progressively connected to one of the pipes until the gas quality declined; that pipe was then regulated to prevent excessive dilution of the gas and boreholes were subsequently connected to the other collection pipe. This "leapfrog" process was continued, allowing at least eight boreholes to remain connected to the gas drainage system at any time (see Figure 2). The coarse regulation was sufficient to optimise gas quality and quantity and a capture rate of 67% was achieved without requiring personnel to venture into the hazardous goaf to adjust individual boreholes.

**Figure 2. “Leapfrog” system**




*(Courtesy of Green Gas International)*

The rate of retreat of the longwall was very rapid, and the space available for drilling operations was limited, so each borehole had to be drilled, the standpipe installed and sealed, and connected to the drainage collection pipe within an approximately 10-hour cycle. This was achieved using a small, portable and powerful drilling machine (Figure 3) powered from the hydraulic circuit of the longwall powered roof supports to obviate the need for electricity.

**Figure 3. Cross-measure drilling rig**

*(Courtesy of EDECO Ltd.)*