



UNITED KINGDOM  
QUALITY ASH  
ASSOCIATION

# CASE STUDY

## Small Grouting Contracts

### ***Introduction***

Pulverised Fuel Ash (PFA) grouts are widely used for filling caverns, abandoned mine workings, etc. Published information concentrates on larger contracts, however, in areas where there are poor ground conditions due to local geology, mining or similar in the sub surface, grouting using PFA is routinely carried out to strengthen and stabilise the sub-soils before construction. This is known as permeation grouting. Such contracts can be on a small scale, even down to an individual house level.



**Figure 1 - Drilling the grid**



**Figure 2 - A grout injection point**

### ***The techniques***

The land to be stabilised is normally drilled in a grid pattern at 6m spacing, though this may subsequently be reduced to 3m if the grout does not flow. The perimeter of the area is grouted first; this acts as a grout curtain reducing the loss of subsequent grout from the main area.



**Figure 3 - Flow measuring equipment**



**Figure 4 - Taking test cubes**

The grout is typically a 10:1 PFA:CEM I grout with water:solids ratio of 0.50, see Technical Datasheet 3. Such grouts are prepared using hydraulic or air operated grout mixers. Volumetric proportioning is employed using a high shear mixer, which is hydraulically or air powered. The grouts are mixed to the correct fluidity using a visual assessment with confirmation using occasional measured flow tests. Normally six test cubes are taken daily, typically achieving 2 to 5N/mm<sup>2</sup> at 28 days with standard 20C curing.



**Figure 5 - Feeding the mixer with PFA**

Conditioned or screened stockpiled PFA is used and simply stored on site in a stock pile adjacent to the mixer. The PFA is either loaded by mechanical shovel or hand shovel into the mixer, depending on the size of the operation, with cement being added as whole bags, normally 25kg. The grout is mixed until it is of consistent colour and fluidity. It may then be screened to remove any lumpy material and/or put into a reserve tank. Thereafter, it passes into the grout pump, where it is pumped into the grout injection point. Again the grout pumps are either hydraulically or air powered and normally piston type systems. The grout is injected into the ground until sufficient back pressure is achieved, indicating the grout has filled all the voids required.



**Figure 6 - A hydraulically powered, piston type grout pump**



**Figure 7- Moisture vapour - not dust from warm, conditioned PFA**

Freshly conditioned PFA may be quite warm, which may lead to condensation when the stockpile is disturbed. This should not be confused with dust that will occur if stockpile is allowed to dry out, PFA must be kept moist at all times to prevent dust. It should be sheeted overnight to prevent moisture loss, if drying conditions are expected. As PFA is an alkaline material that may cause skin irritation, proper Personal Protection Equipment should be used and site security adequate to prevent accidents.

### **Acknowledgments**

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In general usage the term 'fly ash' is used for pulverized coal ash but it can also cover ash from burning other materials. Such 'fly ash' may have significantly differing properties and may not offer the same advantages as ash from burning pulverized coal. UKQAA datasheets only refer to PFA / fly ash produced from the burning of coal in power stations.