# Combustion emissions from a smoldering coal heap in North Lanarkshire, Scotland

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A derelict coal waste heap in North Lanarkshire, Scotland began to undergo smoldering combustion around 2008, approximately 80 years after the closure of the associated Herdshill colliery. Burning coal and shale heaps are a common phenomenon in central Scotland, but less common in heaps formed after the 1960's following the introduction of improved mining methods, which reduced waste volume and the transition of the Scottish coal industry to open cast mining. Volatiles and combustion products released at a low rate but during long periods of time from the smoldering heap represent a potential health concern for landowners and local residents.

Thermal and gas analysis, and direct observations on the heap have confirmed that it is a smoldering fire, a process that is common in burning of sub-surface fuel layers (e.g., coal deposits and peat lands) and is known to account for significant amounts of global carbon emission. It has been established that the combustion front is traversing the heap along its long axis from west to east, moving at a rate of approximately 1 m per month. The combustion process is accompanied by physical changes to the structure, the development of fissures and changes to the geotechnical properties of the waste material. Four zones have been identified, based on sub-surface temperature distributions, gas analysis, vegetation loss and physical changes: undisturbed virgin heap, drying front, combustion front and burnt-out zone. Results are presented which show that the gas composition released in each zone is also characteristic of the combustion stage.

There are few studies of the environmental impact of coal waste heap fires. It has assumed in the past that the gases released during combustion represent more of a nuisance, but the lower temperatures and reduced oxygen supply during smoldering combustions result in higher emissions of carbon monoxide, methane and the volatilisation of PAH's and other organic compounds. Further, there is evidence that metals present in the carbonaceous shale that forms the bulk of the heap can be mobilised during combustion.

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