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# Coal Field Fire Fighting – Practiced methods, strategies and tactics

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Subsurface coal fires destroy millions of tons of coal each year, have an immense impact to the ecological surrounding and threaten further coal reservoirs. Due to enormous dimensions a coal seam fire can develop, high operational expenses are needed. As part of the Sino-German coal fire research initiative "Innovative technologies for exploration, extinction and monitoring of coal fires in Northern China" the research team of University of Wuppertal (BUW) focuses on fire extinction strategies and tactics as well as aspects of environmental and health safety.

Besides the choice and the correct application of different extinction techniques further factors are essential for the successful extinction. Appropriate tactics, well trained and protected personnel and the choice of the best fitting extinguishing agents are necessary for the successful extinction of a coal seam fire. The chosen strategy for an extinction campaign is generally determined by urgency and importance. It may depend on national objectives and concepts of coal conservation, on environmental protection (e.g. commitment to green house gases (GHG) reductions), national funding and resources for fire fighting (e.g. personnel, infrastructure, vehicles, water pipelines); and computer-aided models and simulations of coal fire development from self ignition to extinction. In order to devise an optimal fire fighting strategy, “aims of protection” have to be defined in a first step. These may be:
- directly affected coal seams;
- neighboring seams and coalfields;
- GHG emissions into the atmosphere;
- Returns on investments (costs of fire fighting compared to value of saved coal).
In a further step, it is imperative to decide whether the budget shall define the results, or the results define the budget; i.e. whether there are fixed objectives for the mission that will dictate the overall budget, or whether the limited resources available shall set the scope within which the best possible results shall be achieved.

For an effective and efficient fire fighting optimal tactics are requiered and can be divided into four fundamental tactics to control fire hazards:
- Defense (digging away the coal, so that the coal can not begin to burn; or forming a barrier, so that the fire can not reach the not burning coal),
- Rescue the coal (coal mining of a not burning seam),
- Attack (active and direct cooling of burning seam),
- Retreat (only monitoring till self-extinction of a burning seam).
The last one is used when a fire exceeds the organizational and/or technical scope of a mission. In other words, “to control a coal fire” does not automatically and in all situations mean “to extinguish a coal fire”. Best-practice tactics or a combination of them can be selected for control of a particular coal fire.

For the extinguishing works different extinguishing agents are available. They can be applied by different application techniques and varying distinctive operating expenses. One application method may be the drilling of boreholes from the surface or covering the surface with low permeability soils. The mainly used extinction agents for coal field fire are as followed: Water (with or without additives), Slurry, Foaming mud/slurry, Inert gases, Dry chemicals and materials and Cryogenic agents.

Because of its tremendous dimension and its complexity the worldwide challenge of coal fires is absolutely unique – it can only be solved with functional application methods, best fitting strategies and tactics, organisation and research as well as the dedication of the involved fire fighters, who work under extreme individual risks on the burning coal fields.