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Coal Fires in China

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Introduction

Coal fires in China leads to huge CO_2 emissions. It is difficult to quantify the emissions, but several sources estimates that there could be 200 coal fires in China producing 2 - 3 percent of global CO_2 emissions[2,3].

China has 115 billion ton coal reserves, and the coal production was 1.3 billion ton in 1997. Annually 100 - 200 billion ton coal is lost due to coal fires[3], leading to large economic loss and enormous CO_2 emissions. The coal fires stretches across a 5000 km wide belt in the north of the country as indicated in Figure 1. There are two types of coal fires; surface fires in coal fields (Figure 2) and fires in sub-surface coal mines (Figure 3).

Extinction of coal fires in China will give a considerable reduction in global CO_2 emissions, but so far the environmental hazard of coal fires has been undermined. The reasons are lack of information, limited research on coal fires, and reluctance to even acknowledge the occurrence and magnitude of the problem[4].

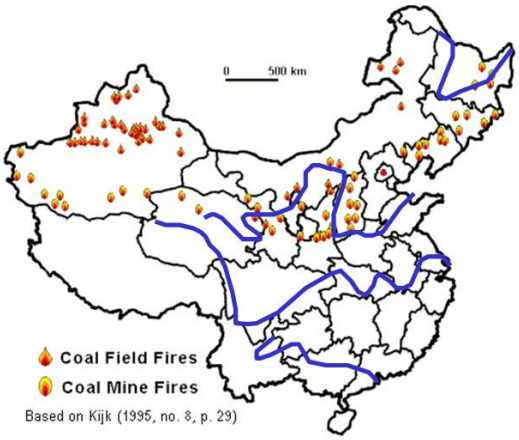

Figure 1 – Localization of coal fires in China[3].

Spontaneous Combustion

Spontaneous combustion is one of the most frequent reasons for coal fires. Coal has the ability to react with oxygen from air in an oxidation process which increases the temperature. If the temperature reaches a certain temperature the coal reaches the flash point and starts to burn. Coal mines are often a result of forest fire, thunderstorms and lightning, improper mining techniques, or accidents during mining[3].

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[2] Source Netherlands Earth Observation NETwork, http://www.neonet.nl/browse/www.neonet.nl/Document/XHCFRJGIVMUWUYOTOVMWSXKLG.html

[3] Source: International Institute for Geo-Information Science and Earth Observation, http://www.itc.nl/personal/coalfire/problem/china_coalfire.html

[4] Source: Anupma Prakash, http://www.gi.alaska.edu/~prakash/coalfires/coalfires.html

Environmental Consequences of Coal Fires

Coal fires releases large volumes of CO_2, CO, CH_4, NO_x, NO_2, SO_2, ash, particles and aerosols, leading to both local pollution and global warming. Soil, ground and air are polluted, and the fires pose a danger to humans, animals and buildings. Quantification of greenhouse gas emissions is difficult. Some sources indicate conservatively that Chinese coal fires produce 0.1 - 0.2 percent of global CO_2 emissions, but several sources estimates that the Chinese fires produce as much as 2 - 3 percent of global CO_2 emissons[2,3].

Figure 2 – Open surface coal fire[3].

Fire Fighting

There is several fire fighting techniques. Water, slurries or liquefied nitrogen can be injected to cool down the coal or cut of air supply and thereby extinct the fire. Air supply can also be cut of by covering the coal by soil or by sealing of the coal mine. Smaller Fires can also be handled by taking out burning coal by bulldozing or blasting. The traditional fire fighting techniques described above are applicable to small fires, but they do not work well in extinction of large coal fires.

A Strategy to Extinct Coal Fires in China

The work carried out in Norway and Europe for capturing CO_2 represents a new option for combating large coal mine fires**.** Large volumes of CO_2 can be produced from CO_2 capture technologies, and such technologies are therefore applicable for fire fighting. The Norwegian company Sargas develops CO_2 capture technology, and by applying their concept, large amount of CO_2 can be injected into coal mines to extinguish the coal fires. Sargas has demonstrated their technique by putting out a coal mine fire at Spitsbergen in 2006. By developing a transportable module based on Sargas' technology an efficient strategy for putting out coal mine fires can be established. This strategy is probably not yet applicable to surface fires in coal fields, but it has the potential for effective fire fighting in sub-surface coal mine fires. It is recommended to carry out a study to identify the potential for extinction of coal fires by CO_2 capture technology. Demonstrating CO_2 capture technology as described above can also pave way for a wide establishment of Carbon Capture and Storage (CCS) in China, and a study should be carried out to identify strategies for deployment of CCS in China.

Figure 3 – Clouds of noxious gases coming out of an exhalation crack above a near-surface coal fire[3].

Conclusion

Coal fires in China lead to huge CO_2 emissions, and extinction of coal fires has a large potential for reducing global CO_2 emissions. Coal mine fires can be extinct by injecting CO_2 to coal mines in order to cool down the burning coal and cut of the air supply. The large volumes of CO_2 required can be produced by CO_2 capture technology from the Norwegian company Sargas. Introduction of CO_2 capture technology as a fire fighting strategy can be the starting point for wide implementation of CCS in China.

In addition to reducing CO_2 emissions, deployment of CCS in China can make a significant positive impact on the Chinese economy and development of welfare. Therefore, Bellona and Sargas seek partners for a project on identifying the potential for extinction of coal mine fires in China by CO_2 capture technology. Furthermore, Bellona recommends that a Norwegian-Chinese Working Group on CSS is established on a five year basis to exchange information, carry out studies and develop common projects.