

THE STORAGE OF HIGH VOLATILE COAL

Self Ignition or Spontaneous Oxidation:

Freshly mined high volatile coal when stored in bulk undergoes low temperature atmospheric oxidation due to the presence of methane and other volatile matter on the surface. This exothermic oxidation causes the rise in temperature of the coal and if the heat is not removed, a stage comes when coal begins to burn on its own. This is called **Spontaneous Combustion** which leads to outbreak of fire in the stored coal.

If the temperature rise due to oxidation does not exceed a critical value (500° C for Lignite and about 800° C for bituminous coal), spontaneous ignition does not take place but the quality of coal is affected depending on the degree of oxidation.

Spontaneous oxidation can cause:

- Decrease in Calorific value
- Decrease in Carbon and Hydrogen content and increase of Oxygen %
- Size grading may get reduced (due to crumbling, the coal lumps gets broken down into small pieces)
- Fire, if the temperature exceeds the critical value

As the maturity of coal increases, its tendency to catch fire during storage decreases. It should be noted that for every 10 degree Centigrade increase of storage temperature the rate of oxidation gets doubled.

Ways to avoid Self Ignition or Spontaneous Oxidation:

1. Cooling by ventilation or by water spraying to avoid increase of coal stock temperature
2. Storing the coal in smaller lots of stock pile (Less than 200 MT/Pile) to enable better cooling to prevent heating up of coal stock
3. Reducing access to air, i.e. by storage in compressed piles (packing coal tightly and compacting by running Dozer / Loader compactor over stock pile) or storage in closely covered air tight enclosure. This is an alternate for point 1 & 2 if adding moisture is not desirable.
4. Reducing the fine powder content in the coal
5. Height of stock pile limited to less than 3 meters for High volatile coal and less than 2 meters for Lignite
6. Get coal which was mined six months back. (Storage period after mining more than six months). **Coal which was mined and supplied with in 4 to 5 weeks is more risky.**
7. Conical heaps are to be avoided. It increases the surface area and the risk of fire.
8. The storage location should be such that any external source of heat is to be avoided. (Like steam pipes, flue ducts etc.)
9. Follow the practice of first in first out in stock pile management. The old coal should go for consumption and fresh coal should go for storage. Regularly check the pile with long portable thermocouple temperature indicator the pile temperature.

10. Water hydrant points to be provided near to the pile. When fire is noticed in pile with small emanation of smoke, large volume of water should be sprayed. Spraying very small quantity of water will not quench the fire instead it will further enhance the fire due to water gas reaction($C + H_2 O \Rightarrow CO + H_2$).

Self Ignition or Spontaneous Oxidation is usually predominant in fresh coal. If the material is mined one to four months back and stored then it is less susceptible to Self Ignition. Coal already stored longer than six months with exposure to air are usually not liable to Self Ignition. However, if the coal is stored over six months on economical front blockage of large money and increase of handling cost may arise. Further wind loss, Oxidation loss of coal (weathering of coal), Carpet loss are bound to a happen.

Coal stored over longer period absorbs oxygen as explained above and its calorific value decreases. For every 1% increase of oxygen content the CV of coal decreases by 1% like increase of ash. However if the temperature of storage is not allowed to go more than 600° C, High volatile coal suffers less depreciation in heating value.

Carpet loss is the loss of material stored on the unprepared ground. The soil and clay matter mix up with coal and some quantity of coal is lost by this.

Care and Safety in grinding and handling of High volatile coal:

Given below are the salient points to be considered while going for use of high volatile coal in coal grinding plant with Bag filter as de-dusting system which is the risky part on account of self ignition / fire of coal particles in a typical coal grinding application:

- ❖ Looping of all the duct joints and casing interconnections and effective grounding / earthing to avoid build up of static electricity and potential sparking/ignition in the mill circuit.
- ❖ Elimination of dust settlements inside the bag house as a measure against self ignition of coal / lignite particles.
- ❖ Adequate nos. of explosion relief doors (spring operated) to be provided in the B/F housing. The explosion relief doors side of bag filter shall be free of electrical cablings and the installing of delicate electronic gadgets on this side should be avoided for equipment safety point of view.
- ❖ Foolproof puncturing type CO₂ storage cylinders operated based on fire alarm signal.
- ❖ Pneumatically operated type Isolation dampers at the bag filter inlet / outlet for effective fire quenching with CO₂ flooding.
- ❖ Bag filter inlet / Outlet temperature monitoring with quick sensing type RTD. In case of the outlet temp exceeding the inlet temp by one Degree the fire quenching with CO₂ flooding should get activate.
- ❖ Bag filter system differential Pressure monitoring to avoid excessive build up of material coating on the bags remaining static over longer period which will result in self ignition.
- ❖ Hopper / Valley angles set at 700 to Horizontal.
- ❖ All welded construction of bag filter casing to eliminate the chances of false air infiltration.