

Auto Fire Quenching Using CO₂ in the Conveyor System

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ABSTRACT: Flue gas stack is a type of chimney, a vertical pipe, channel or similar structure through which combustion product gases are exhausted to the outside air. It usually composed of carbon dioxide (CO₂), water vapour as well as nitrogen oxide, sulphur oxide and some other pollutants like carbon monoxide etc. It is privilege to us to focus on this project, as we are using ammonium treatment method for the separation of carbon dioxide from flue gases, once it is blown out from the boiler. The separated carbon dioxide is made useful for quenching the fire accident in the coal conveyor system such that the O₂ content is reduced, which is one of the major cause for firing. The separation process is installed in underground to achieve faster escape velocity, so that more flue gases could be treated at the same time efficiency can also be increased

KEYWORDS: Fire quenching, Usage of CO₂ by-product, Conveyor belt prevention

I. INTRODUCTION

In the present technological world electricity plays a vital role. Production of electricity is based upon proper maintenance of power plants. For example in NCTPS, Ennore 630mw of electricity is produced for unit/hr. But nowadays there are more in number of fire accidents in thermal power plants, this leads to cause damage in coal conveyor belt. Especially during summer season due to hot temperature and the heat produced between rollers coal gets overheated and leads to fire so the coal conveyor belt gets damaged. Coal conveyor belt lasts for large distance around (8-10) kms, so damage in coal conveyor belt leads to high economical loss to change. Henceforth to overcome that we have introduced a new idea of fire extinguishing by implanting CO₂ gas in coal conveyor belt. The existing method of controlling fire in coal conveyor belt is water sprinklers. But water cannot have the ability to control fire in coal conveyor belt since because it is made up of rubber, (i.e) type b class fire. So liquid medium does not overcome that fire instead Carbon dioxide can overcome type b class of fire. And in this process Carbon dioxide can be obtained from Flue gas stack, (i.e) from chimney. And also it slightly reduces emission of harmful gases to atmosphere. And this process is only applicable for thermal power plants. We have added impact of accidents and major accidents held below this.

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: www.ijirset.com

Vol. 6, Issue 3, March 2017

II. IMPACT OF ACCIDENT

- Loss of human life.
- Loss in Power generation.
- Loss of revenue to rebuild the plant.
- Difficult to replace conveyor.
- Unwanted plant shutdown is required.

III. EXISTING METHOD

Each closed-head sprinkler is held closed by either a heat-sensitive glass bulb (see below) or a two-part metal link held together with fusible alloy such as Wood's metal and other alloys with similar compositions. The glass bulb or link applies pressure to a pipe cap which acts as a plug which prevents water from flowing until the ambient temperature around the sprinkler reaches the design activation temperature of the individual sprinkler. Because each sprinkler activates independently when the predetermined heat level is reached, the number of sprinklers that operate is limited to only those near the fire, thereby maximizing the available water pressure over the point of fire origin.

The bulb breaks as a result of the thermal expansion of the liquid inside the bulb. The time it takes before a bulb breaks is dependent on the temperature. Below the design temperature, it does not break, and above the design temperature it breaks, taking less time to break as temperature increases above the design threshold. The response time is expressed as a response time index (RTI), which typically has values between 35 and 250 $m^{1/2}s^{1/2}$, where a low value indicates a fast response. Under standard testing procedures (135 °C air at a velocity of 2.5 m/s), a 68 °C sprinkler bulb will break within 7 to 33 seconds, depending on the RTI



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IV.MAJOR ACCIDENTS

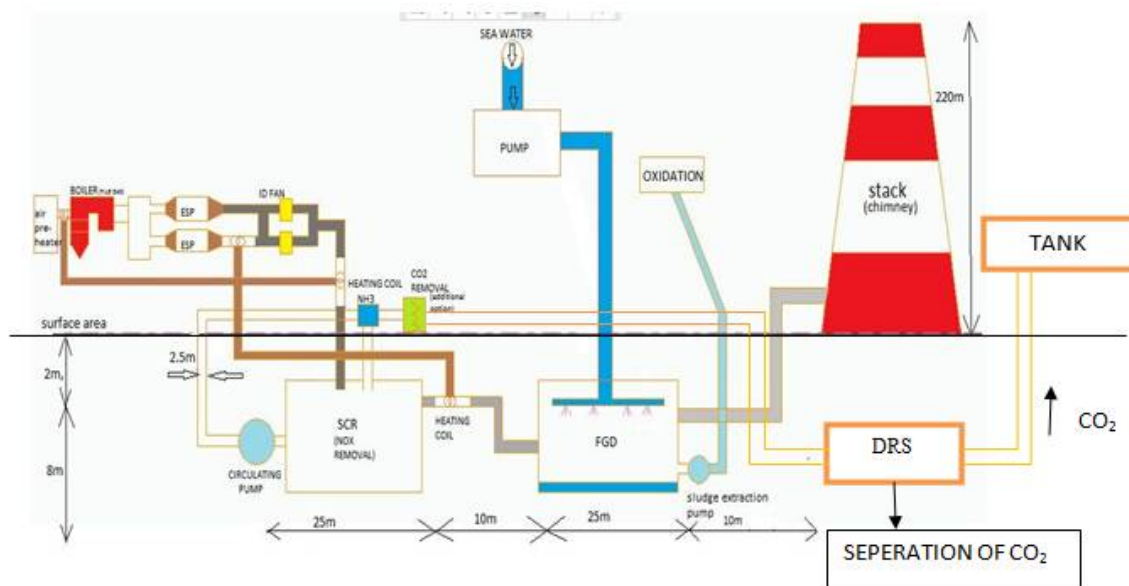
CHANDRAPUR: A massive fire destroyed the conveyor belt that carries coal from coal bunker to coal mill in Chandrapur Super Thermal Power Station (CSTPS). A primary estimate of damage to property has pegged the loss at about Rs 1.50 crore.



METTUR THERMAL STATION: The fire that destroyed the entire coal conveyor system. The fire killed a filed assistant and two other were injured heavily including an Assistant Engineer, who were on duty. The fire, noticed in the 400-metre long main coal carrying conveyor belt between Tower I and Tower II at 2 am, had spread to milling plant and later to Bunker Top. Fire tenders from Mettur, Omalur, Edapadi, Bhavani and neighbouring areas fought for five hours to bring the 20-feet high burning coal induced fire under control.



V. SOURCE OF CO₂



A flue-gas stack is a type of chimney, a vertical pipe, channel or similar structure through which combustion product gases called flue gases are exhausted to the outside air. Flue gases are produced when coal, oil, natural gas, wood or any other fuel is combusted in an industrial furnace, a power plant's steam-generating boiler, or other large combustion device. Flue gas is usually composed of carbon dioxide (CO₂) and water vapour as well as nitrogen and excess oxygen remaining from the intake combustion air. It also contains a small percentage of pollutants such as particulate matter, carbon monoxide, nitrogen oxides and sulphur oxides. The flue gas stacks are often quite tall, up to 400 metres (1300 feet) or more, so as to disperse the exhaust pollutants over a greater area and thereby reduce the concentration of the pollutants to the levels required by governmental environmental policy and environmental regulation.

V. QUENCHING PROCESS

CO₂ is taken from the flue gas stack with elimination of nitrous oxide and sulphur oxide gases and it is sent to reservoir (storage of CO₂). Here the reservoir is maintained at 55⁰ C to prevent CO₂ from bursting and the shortfall or excess of carbon dioxide level in reservoir is indicated by sensors. And the carbon dioxide is sent through pipeline. Pipeline lasts for 8.3 kms and the nozzle is situated diagonally at an interval of 30m/nozzle. Velocity and discharge of carbon dioxide from nozzle is calculated accordingly to the amount of fire. And the fire is detected by LINEAR HEAT SENSING CARD, it indicates via monitors by connected through wires. And also sensors are placed to open and close nozzle of CO₂ to quench fire. If heat detected in any area initially the movement of conveyor belt stops to control spreading of fire and the fire will be destroyed within fraction of minutes. Recovery of conveyor belt may take upto 10 crores and more. Henceforth this method of quenching fire will definitely save conveyor belt and will increase the life of conveyor belt.

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Vol. 6, Issue 3, March 2017

VI. CONCLUSION

Thus utilization of carbon dioxide is made useful in innovative method of destroying fire accidents in thermal power plants. This method is highly effective and safety to the current scenario. This technology is technically and economically proven to be a promising alternative to fire accidents in power plants. The emission of toxic gases is reduced, as a result atmospheric pollution can be controlled.

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