Qualitative risk assessment

1.1 BOILER HOUSE....1
1.1.1 Fire Prevention in Coal Storage....1
1.1.2 Risk Factors....1
1.1.3 Safeguards/Guidelines to ensure safety in Coal storage yard/shed:....2
1.1.4 Prevention of Spread of Coal Stock Fires....4
1.1.5 Fire Protection and Fire Fighting....4
1.2 MATERIAL SAFETY DATA SHEET....5
1.2.1 High Speed Diesel....5

Qualitative Risk Analysis

The following areas are covered under Qualitative Risk Analysis.

1.1 Boiler House

The main hazard in the boiler house would be storage and handling of coal, which is used as a fuel for the boiler. Some of the precautions to be taken while storage of coal, for prevention of fire etc. is given below:

1.1.1 Fire Prevention in Coal Storage

Coal is a potential fire hazard; coal storage requires careful study from the point of view of safety. Fire in coal stock is also a major source of environmental pollution. In order to avoid these hazards, coal storage facilities require careful evaluation in respect of fire safety, keeping in mind the characteristics of the different types of coal used in the industries.

1.1.2 Risk Factors

Self heating of coal to its ignition temperature, resulting in what is called spontaneous combustion, is a phenomenon identified with coal storage in industries. Virtually all grades of coal (except high grade anthracite) are vulnerable to spontaneous heating and ignition. Although the precise cause of the spontaneous combustion of coal is not well defined, it is believed that when coal is freshly mined, the fresh surface of coal pieces liberate absorbed hydro-carbons, chiefly methane (in varying amounts), After the escape of the absorbed gases, the exposed surface of coal particles get oxidized by the oxygen in the ambient air. The oxidation is very slow but heat is generated in the process. If the heat is not allowed to dissipate, the temperature of the coal may rise gradually but sufficiently enough to cause the mass to ignite. It is also believed that this self heating of coal usually occurs in about 90 to 120 days after the coal is extracted in mining operations.

Oxidation in coal stacks takes place mainly from loosely packed coal stacks and the consequent availability of oxygen in the voids of the stacks. The rate of oxidation is high at the outer surface of the stacks because of the availability of abundant oxygen there. The rise in temperature, however, cannot be detected due to the dissipation of heat by air movement. This zone extends roughly up to a depth of 0.5m. The situation beyond this zone, say up to a depth of 1.5m, is different. The coal in this zone also different. The coal in this zone also oxidizers fairly rapidly in the presence of adequate quantity of air entering the stack, but the heat generated in the course of this reaction is generally partially dissipated through convection and conduction. The heat transfer from this zone depends on factors like ambient temperature, rate of air movement around that zone, free moisture available in the material and thermal conductivity. The residual heat thus present in this zone further raises the temperature of the coal mass until it attains the critical (threshold) temperature i.e. the auto ignition temperature. Once it reaches critical temperature, the coal in the zone starts burning and smoking and eventually erupts in flames. Proneness to spontaneous combustion, therefore, can be determined by ascertaining the critical oxidation temperature or crossing point. The lower the crossing point, the more is the proneness to self heating.

All types of coal, when exposed to the atmosphere, are liable to suffer deterioration of quality through surface oxidation, but the extent of deterioration differs from type to type. Lignite is a type of brown coal containing a high percentage of volatiles. It is subject to weathering much more rapidly than bituminous coal. It contains a large percentage of moisture (as much as 40%) as mined, of which nearly 20% exists even before it is mined. Under dry hot ambient conditions, particularly in India where temperature in a shed could go up to 45^0C and humidity to less than 30%, lignite oxidation rate could be high. The rate of release of carbon monoxide which is indicative of the oxidation rate may be as high as 70 m^3 of CO per ton of lignite, which is about 100 times that of normal bituminous coal. It has also been observed that in large coal storage yards left undisturbed for long periods, smoldering takes place at the surface layers of the pile. In case of lignite, this phenomenon is more rapid. Highly volatile coal is particularly liable to spontaneous combustion.

1.1.3 Safeguards/Guidelines to ensure safety in Coal storage yard/shed:

Storage of large quantities of coal requires two conditions to be met viz. (i) avoidance of deterioration in quality and (ii) avoidance of heating in the pile. While neither of the conditions can be fulfilled completely, deterioration and risk of fire can be reduced to a minimum by careful manipulation of the conditions of storage.

As basic necessary steps to avoid spontaneous heating in coal storage, the following guidelines are recommended:

- The ground or floor where coal is to be stored should be thoroughly cleaned of leaves, grass, weds, pieces of wood, cotton waste or other organic waste and precautions taken to prevent such matter from getting under, into or on the coal pile.
- There should not be any steam or hot process pipelines or openings or sewers under, into, through or adjacent to coal piles.
- The floor and walls of coal storage bins should be of non-combustible material.
- The storage site should be provided with drainage facility to prevent accumulation of water on the ground.
- Special attention should be given to monitoring of the coal stack, floor or wall temperature in excess of 42^0C.
- The stack should be planned so as to facilitate dissipation of heat by wind from the surface of the stack. Any barrier / obstruction to wind should be removed.
- Newly broken fines of coal are more susceptible to spontaneous heating. Avoid dropping coal from heights while piling and keep watch on newly broken fines of coal.
- Avoid conical piles; this storage should be built up in layers by roll packing; this helps to exclude oxygen and thus prevents fires by discouraging spontaneous heating.
- Never allow coal piles from different sources to be stored together.
- Avoid alternative wetting and drying or keeping one part of the pile wet and another dry. If such a situation arises, look out especially for spots where spontaneous heating occurs to take proper corrective measures.
- Coal stock should be limited in height. Low grade coal should not be piled higher than 3 meters and best grade not higher than 4-5 meters unless it is piled by the roll packing method. Coal should be stored in mixed sizes as too many fines will be hazardous.
- Do not allow any standing timber or pipes, poles, etc. in the piles. These may give rise to formation of duct which allows sluggish air flow which may be sufficient for heating the coal but not sufficient to dissipate the heat.
- It is recommended to locate coal yards at least 6-7 meters away from any important buildings and other combustible storage areas.
- While selecting the site, it is to be kept in mind that all parts of the coal stock are accessible for regular inspection and monitoring.

A well designed and well maintained coal stack and a systematic consumption of coal from storage yard are fundamental to fire safety in the storage of coal in industries.

1.1.4 Prevention of Spread of Coal Stock Fires

During the period of low off take, coal stock generally tends to build up to alarming levels. Since most of the grades of coal are susceptible to spontaneous ignition if it is undisturbed for a certain period of time, risk of fire exists in coal stacks. Following are the recommended precautions for preventing spread of coal stock fire:

- Consumption of coal should be done on first in-first out basis.
- Some sealant and protective coatings are commercially available. The manufacturers claim that by spraying these chemicals over the coal heaps, the probability of spontaneous ignition of coal can be reduced. It is believed that these coatings form a film on the surface of the coal lumps which reduces the chances of oxidation.
- Check the temperature of the coal pile regularly if heating has been known to occur. Specific attention should be given to the sloped sides of the piles where vulnerable air pockets exist. If pile temperature exceeds 70^0C, open the pile and place the overheated material in a separate small pile or use it promptly.
- Inspection of stack is required to detect smoldering and organize removal / consumption of the smoldering coal on priority and to extinguish the flames in time. Such inspections are vital after the rains as water falling on the surface and penetrating the coal pile may aggravate and accelerate spontaneous heating by assisting oxidation.
- Coal having high moisture content should be stored separately, if possible, and used promptly.

1.1.5 Fire Protection and Fire Fighting

- During selection of storage sites, it is to be ascertained that all parts of the stack are accessible to mobile appliances for quenching fire in case of an emergency.
- The entire coal yard should be protected with a water hydrant system. Hydrant heads need not necessarily be equidistant from each other. They should be distributed in the stock yard in such a way as to provide protection on all sides. AT least one hydrant post should be provided for every 30 m. in the area.
- The capacity of the static water storage exclusively reserved for hydrant purpose should be done as per the Fire Protection Manual, part-I, issued by the Tariff Advisory Committee (TAC).

- The storage yard should also be provided with at least two hoses, each of 15 m. length and nozzles of not less than 16 mm. diameter and not more than 25 mm. diameter, kept in readiness for use during fire emergency. While selecting the place of installation of hose reels, it is to be seen that no part of the premises is more than 6m from a nozzle when the hoses are fully extended.
- During fire fighting, the fire fighters should dig out and remove the coal in the heated zone as promptly as possible and then sufficient water can be applied to chill the burning coal below its ignition point and thereby to extinguish the fire. During fire fighting operation, it is advisable to keep a safe distance from the coal stock. Sometimes the water that penetrates the stock may encounter a very hot spot and may be insufficient to quench the same. The water then turns into steam that bursts out of the pile with considerable force.
- The other recommended practice is to insert 50mm. pipes perforated with 9mm. holes into the stack of the affected zone. Water is then supplied through a hose attached to the upper end of the pipes. This method of fighting coal stack fire is preferred because water can quickly cool the affected burning coal to below its ignition temperature or cut off the air supply around the area due to formation of steam.

1.2 Material Safety data sheet

1.2.1 High Speed Diesel

MATERIAL SAFETY DATA SHEET : HIGH SPEED DIESEL

Section 1 – Chemical Product and Company Identification

Chemical Name : High Speed Diesel
Chemical Formula : Complex mixture of hydrocarbons
Synonyms : Diesel, Gas oil, High Flash HSD (HF HSD)
General Use : Motor Fuel and in Defence aircrafts
Manufacture's Name : Bharat Petroleum Corporation Limited
Address : Refinery, Mahul, Chembur, Mumbai 400074
Telephone Number for Info : 25533888 /25533999 / 25524888 / 25524999

Section 2 – Composition / Information on Ingredients

Composition: Complex mixture of hydrocarbons
ACIGH TLV TWA : Not listed
There are two basic types of HSD depending on the flash points - the Normal HSD and the High Flash HSD

Section 3 – Hazards Identification

Primary Entry Routes : Ingestion, inhalation, skin and eyes Acute Effects : Inhalation can cause dizziness, headache and nausea, depresses central nervous system and has an anesthetic effect. Breathing of liquid droplets may lead to chemical pneumonia.

Ingestion can lead to nausea, diarrhea and affect central nervous system. Skin irritant. Prolonged contact can result in skin drying and dermatitis. Eye irritant. Carcinogenicity : Not listed as carcinogenic Chronic Effects : No data available

Section 4 – First Aid Measures
Eyes : Flush with water for 15 min. Get medical attention.
Skin : Wash with warm water & soap.
Inhalation : Remove to fresh air. Consult a physician if irritation persists.
Ingestion : Do not induce vomiting. Do not give liquids. Get medical help at once.

Section 5 – Fire Fighting Measures
Flash Point : >35 oC and > 66 oC for HF HSD
Flash Point Method : Abel / Pensky Marten
Auto ignition Temperature : 230 oC to 250 oC (highly variable)
LEL : 0.5% UEL : 5.0%
Flammability Classification: Flammable
Extinguishing Media : Foam, Dry Chemical Powder, CO2
Unusual Fire or Explosion
Hazards :
Heat produces vapours and can cause violent rupture of containers.
Hazardous Combustion
Products : Carbon di oxide, carbon mono oxide, benzene
Fire-Fighting Instructions: Small fires can be extinguished by hand held extinguishers.
Major fires may require withdrawal and allowing the tank to burn.
Fire fighters should wear self breathing apparatus while fighting fire.

Section 6 – Accidental Release Measures
Small Spills : Shut off leaks without risk. Absorb on sand or earth.
Containment : Prevent spillage from entering drains or water sources
Cleanup : After spills wash area with soap and water preventing runoff from entering drains.

Section 7 – Handling and Storage
Handling Precautions: Do not use/store near heat/open flame. Use gumboots, gloves while handling the product. Do not inhale. Stay upwind while handling the product. Product should never be used to remove oil or grease from skin. It should not be siphoned by mouth. It should be stored in closed containers away from heat & source of ignition. Avoid contact with skin and eyes. Wash thoroughly after handling Storage Requirements : Do not use/store near heat/open flame/water/acids

Section 8 – Exposure Controls / Personal Protection
Engineering Controls : Provide proper ventilation for environment to be below TWA
Respiratory Protection : Use respiratory protection if ventilation is improper

Protective Equipment : Use face shield, PVC gloves, safety boots while handling. Contaminated clothing to be immediately removed.

Section 9 – Protection Physical and Chemical Properties
Physical State : Liquid
Appearance and Odour: Straw yellow or dark yellow liquid. Characteristic hydrocarbon like odour
Vapor Pressure : 0.5 mm of HG AT 38 OC (RVP)
Specific Gravity : 0.82 to 0.86 gm/ cc
Water Solubility : Insoluble
Boiling Point : 110 oC to 375 oC
Freezing Point : < 15 oC
Vapour Density : 3 to 5 (Air = 1)
Sulphur Content : 50 ppm(BS-IV) to 350(BS-III) ppm and < 0.2% for HF HSD

Section 10 – Stability and Reactivity
Stability : Chemically stable.
Chemical Incompatibilities : Incompatible with oxidizing agents & chlorine. Reacts vigorously with oxidising materials.
Conditions to Avoid : Hazardous Decomposition Carbon di oxide, carbon mono oxide Products

Section 11 – Toxicological Information
ACIGH TLV TWA : Data not available
Toxicity Data : Data not available
Acute Inhalation Effects :

Section 12 – Ecological Information
Prevent spillage from entering drains or water sources. After spills wash area with soap and water preventing runoff from entering drains. Can burn with lot of heat producing CO2 and CO.

Section 13 – Disposal Considerations
Disposal : Seal all the waste in vapour tight plastic bags for eventual disposal or incineration.

Section 14 – Transport Information
Shipping Name : High Speed Diesel, High Flash Diesel

Section 15 – Regulatory Information
Non - Toxic/Flammable Substance