Special considerations for high sulfur bituminous coals

The design features of the PRB coal firing unit as described above are general design features for sliding-pressure, high temperature supercritical Benson boilers which burn coals relatively low in sulfur such as PRB coals.

However, special design considerations for boilers that will fire high sulfur bituminous coals are necessary.

Sulfidation

For high sulfur coal firing where higher potentials for sulfidation are expected, protective coatings of metal or ceramic-metal composite containing high chromium should be applied to the walls in the combustion zone of furnace by thermal spraying or weld overlay processes.

Liquid phase corrosion

There is always potential for liquid phase corrosion to occur on tube surfaces where ash deposits, primarily in the highest temperature superheater and reheater tube banks.

In addition to Figure in the previous section, another laboratory test results of liquid phase corrosion are shown in Figure

To evaluate the corrosion rate in more severe conditions, this testing was done with an atmosphere containing 1% SO2. The curves in the figure show the influence of chromium content in the tested tube materials on the corrosion rate at each test temperature.

The results revealed that tube materials with chromium content of 25% and higher are effective for management of corrosion rates for high sulfur fuels and high steam temperatures.

An advanced high strength austenitic stainless steel with nominal chromium content of 25%, of composition 25Cr20NiCbV (A213TP310HCbN), has been employed since 1990 in various types of plants including utility boilers.

By using this material in new coal-fired boilers to be designed for high sulfur coals, the tube life of high temperature superheaters and reheaters can be well managed even for boilers with steam temperatures of over 1100ºF (593ºC).

Countermeasures for circumferential cracking

There have been cases of waterwall tube failures caused by circumferential cracking in older coal-fired boilers

. It is believed that this cracking is caused by the combination of a number of phenomena, including the metal temperature rise due to inner scale deposits, the thermal fatigue shocks caused by sudden waterwall de-slagging, and the tube wastage or deep penetration caused by sulfidation.

Metal temperature rise due to inner scale deposits can be prevented by the application of an OWT water chemistry regime. In high sulfur coal firing boilers, the tube wastage from sulfidation can be controlled by applying protective coatings in appropriate areas of the furnace, as well as by the selection of optimum burner stoichiometry.

The sudden metal temperature change due to periodic de-slagging can be minimized by optimized operation of wall blowers or high-pressure water cleaning systems.

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SELECTION OF SITE FOR HYDRO ELECTRIC POWER PLANT

1. **Water Available.**

To know the available energy from a given stream or river, the discharge flowing and its variation with time over a number of years must be known. Preferably, the estimates of the average quantity of water available should be prepared on the basis of actual measurements of stream or river flow. The recorded observation should be taken over a number of years to know within reasonable, limits the maximum and minimum variations from the average discharge. The river flow data should be based on daily, weekly,

monthly and yearly flow ever a number of years. Then the curves or graphs can be plotted between tile river flow and time. These are known as hygrographs and flow duration curves.

The plant capacity and the estimated output as well as the need for storage will be governed by the average flow.

The primary or dependable power which is available at all times when energy is needed will depend upon the minimum flow. Such conditions may also fix the capacity of the standby plant. The, maximum of flood flow governs the size of the headwords

and dam to be built with adequate spillway.

2. Water-Storage.

As already discussed, the output of a hydropower plant is not uniform due to wide variations of rain fall. To have a uniform power output, a water storage is needed so that excess flow at certain times may be stored to make it available at the times of low flow.

To select the site of the dam ; careful study should be made of the geology and topography of the catchment area to see if the natural foundations could be found and put to the best use.

3. Head of Water.

The level of water in the reservoir for a proposed plant should always be within limits throughout the year.

4. Distance from Load Center.

Most of the time the electric power generated in a hydroelectric power plant has to be used some considerable distance from the site of plant. For this reason, to be economical on transmission of electric power, the routes and the distances should be carefully considered since the cost of erection of transmission lines and their maintenance will depend upon the route selected

5. Access to Site.

It is always a desirable factor to have a good access to the site of the plant.

This factor is very important if the electric power generated is to be utilized at or near the plant site. The transport facilities must also be given due consideration.