HAZARDS IDENTIFICATION IN SODA RECOVERY BOILER

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Abstract - *This project presents hazard analysis in soda recovery boiler to improve the safety performance. In a paper industry all paper is created from one raw material: pulp. One of the most widely recognized techniques used to deliver pulp is the Kraft procedure, which comprises of two related forms, one is a pulping procedure and other is a chemical process. It fills two fundamental needs. The first is to recover chemicals in the black liquor through the combustion process (reduction) to be reused to the pulping process. The identification and understanding of hazards and the assessment of risk in boiler is a fundamental requirement for all organization deals with the safety of people. A few upset and spills are found at the mill due to old production procedures, however new interventions are made. The main aim of the present work is to evaluate the safety and health hazards in soda recovery plant and mitigating the potential for loss by the identification and assessment of potential threats.*

Key Words: *BOILER, BLACK LIQUOR, HAZARDS, SAFETY.*

1. INTRODUCTION

For all industries associated with the processing of raw wood, the most important factor is the cost of raw wood material, including the cost of its transportation to consumers and the costs of fuel and energy. In the pulp's price structure, 50 % of costs belong to initial raw materials and approximately 40 % to energy. Consequently, in order to increase the efficiency of pulp mills, the priority is to reduce the consumption of raw wood material and energy. The works directed to the essential decrease of wood consumption during pulp production are unknown. In these circumstances, the only way to significantly improve the profitability of pulp manufacture is to reduce its energy costs.

One of the opportunities for reducing costs associated with the consumption of energy at the pulp mills is the use of renewable energy sources such as black liquor, which are by-products of the pulp production. Indeed, modern pulp mills are energy self-sufficient due to using recovery systems in which black liquor combustion is carried out with the regeneration of chemicals and energy. Normally within the Kraft pulping industry efficiency based on the Gross Calorific Value (GCV) value is used. The efficiency of recovery boiler is quoted as the percentage of useful heat available, expressed as a percentage of the total energy potentially available by burning the fuel. This is expressed on the basis of gross calorific value of fuel.

The recovery boiler is an integral part of the pulp mill. It is used for two purposes one is to recovery the pulping chemicals from the black liquor and other is to produce thermal energy in the form of high pressure steam. This steam is used both for process and electrical power production. Chemicals are recovered in the form of smelt from the bottom of the furnace. Smelt is comprised of molten sodium salts, mostly in the form of sodium sulphide (Na_2S) and sodium carbonate (Na_2CO_3) with a smaller amount of sodium sulphate (Na_2SO_4). It is critical in a recovery boiler to prevent contact between water and molten smelt as this can lead to a violent physical reaction better described as an explosion. In addition to the risk of explosion, combustion in the recovery boiler creates very hot gases and highly corrosive molten ash in the lower furnace. The black liquor that fuels the recovery boiler also hot and highly caustic. Generally, administrators have played out various physical assignments around the recovery boiler that possibly may have them come into contact with smelt, black liquor, hot gases and debris during furnace pressure excursion (positive furnace pressure) and process upsets (smelt surges, substantial dissolving tank action). These tasks incorporate rodding and cleaning the smelt spouts and air ports just as embedding, evacuating and cleaning liquor guns.

2. SODA RECOVERY BOILER

The recovery boiler is the important component of the Kraft recovery process and a major recovery boiler explosion is probably the most catastrophic event that can occur at a Kraft pulp mill. is a risk of fatalities or serious injuries and the economic consequences of lost production and repair ca There n be severe, even with insurance. In a few cases, a significant recovery boiler explosion has brought about the perpetual conclusion of the mill. Accordingly it is imperative to take compelling measures to limit the probability of encountering a recovery boiler explosion.

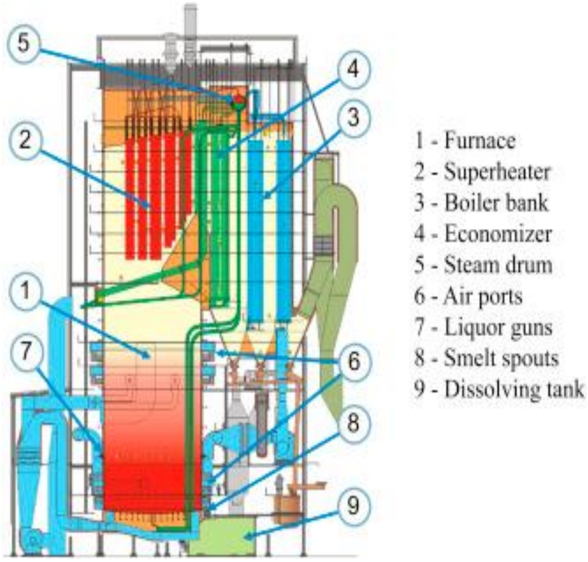

Fig-1: Recovery Boiler

Recovery Boiler operation of firing Heavy Black Liquor (HBL) is to produce steam for power generation and Green liquor. In the recovery boiler heat is utilized to produce high pressure steam, which is utilized to generate power in a turbine. The turbine exhaust, low pressure steam is utilized for process heating. Several processes occur in the recovery boiler that is combustion of organic material in black liquor to generate heat.

PERFORMANCE OPTIMIZATION OF SODA RECOVERY BOILER

Optimized operation of the chemical recovery boiler implies more steam and chemical recovery. Energy savings of major proportions can be realized in recovery boiler operation by focusing attention to the following.

- Develop and maintain a properly tuned process control system.
- Better control on input streams such as dry solids concentration, excess air, and salt cake makeup.
- Optimize the boiler cleaning system steam utilization.
- Maximum concentration of black liquor reduces the moisture loss.
- The firing pressure and temperature are to be optimized to minimum.
- The next very important parameter to be optimized is the total air flow, meaning the air flow proportion between primary and secondary, and air temperature. Expanding essential air quality will in general increment char bed temperature, increment the consuming rate and lower the reduce efficiency.
- Black liquor dry solids, higher dry solids content to the boiler gives a higher efficiency but also a somewhat higher heat consumption in the evaporation plant.
- Black liquor sulphur content, ah higher sulphur content gives a lower efficiency at constant green liquor reduction degree.

3. METHODOLOGY

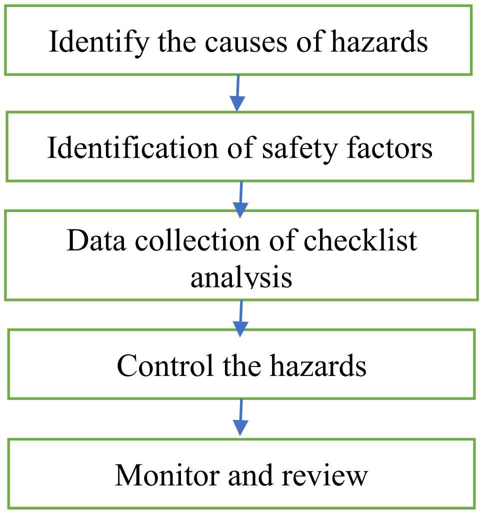

Fig.2 Methodology

CHECKLIST ANALYSIS

1. Characterize the activity or system of interest.
2. Characterize the issues of interest for the analysis.
3. Partition the activity or system for analysis.
4. Gather or create relevant checklists for the problem of interest.
5. Respond to the checklist questions.
6. Further subdivide the elements of activity or system.
7. Use the results in decision making.

4. RESULTS AND DISCUSSION

The personnel safety guidelines contain ideas for procedures and system modifications that have been, or are currently in practice on operating recovery boilers to take precautions from hazards in recovery boiler. This chapter also is used to illustrate practices that have found to be unsafe. It represents a compilation of operating ideas and practices drawn from experiences of operating companies, boiler manufactures, insurance carriers and consultants. It is not intended to be a standard for operations and does not contain every possible operating scenario, standard or emergency.

TABLE-1: Hazards in Soda Recovery Boiler

S. No.	Hazards Description	Condition	Safety Precaution
1	Hot flue gas, ash, char and/or smelt resulting in burns.	Blowback during typical operation when the boiler goes positive pressure.	Proper PPE when around a working recovery boiler, keep a safe distance from openings (liquor ports).
2	Hot flue gas blowback onto the operator as port is opened.	Opening a perception port to view the fireside during operation.	Stand on the hinge side of the port as it is opened. The entry way will help divert blowback should it happen. Wear proper PPE.

3	Hot flue gas blowback onto the operator while changing gun.	Changing or cleaning liquor gun.	Consider ceasing soot blowing when changing liquor guns to minimize the chance of blowback. Consider ramping up ID fan. Wear proper PPE.
4	Smelt blowback caused by moisture accumulation in or on smelt rod.	Moisture in or on smelt rod.	Use solid or "capped" rod.
5	Heavy solid rods are difficult to handle.	Minimizing smelt rod weight.	Construct smelt rods with solid tips yet the rods themselves are hollow. This example with a tapered edge is often used in the soda process. Generally, do not sharpen ends of lancing rods.
6	Char or smelt hitting spout rod. Rod gets knocked out of hand and swings upward quickly.	Rodding port or spout.	Hold rod out to side of body. Be cautious how far you go into the boiler past the spout or port with the rod.
7	Controlling liquor to boiler through ports/blowback.	Mounting liquor guns to ports.	Appropriate design and implementation of liquor and steam out systems.
8	Water inadvertently entering the furnace.	Ensuring liquor guns are out of ports when cleansing liquor ring header.	Proper purge of liquor header downstream of density measurement interlock.
9	Controlling liquor to boiler through ports/blowback.	Mounting liquor guns to ports.	Appropriate design and execution of liquor and steam out systems.
10	Hot flue gas, hot char and hot smelt blowback.	Rodding liquor gun ports, changing liquor guns.	Limits operator exposure by utilizing an automatic rodding system at the liquor ports, this system withdraws liquor gun away from port opening.
11	Hot flue gas, hot char and hot smelt blowback.	Liquor gun ports.	Install movable or fixed shields.
12	Chemical and temperature burns caused by splashing out of spout.	Smelt splatter from spouts.	Install a system/method to distantly adjust the angle of the shatter splash jet.

These all are the hazards analysed in soda recovery boiler. Also, we should take some precautions to eliminate the hazards for safety procedure. It presents peer reviewed practices that have been as supportive in ensuring personnel when they are in close proximity to an operating recovery boiler performing operating and/or maintenance functions.

5. CONCLUSION

Significant strides have been made to improve the safety of personnel during recovery boiler operation lately. Innovative products have been developed that offer more reliable automated features, based on modern recovery boiler arrangements, significantly reducing hazardous exposure of operators in areas such as the smelt spout and liquor firing decks and the combustion air system. In combination with upgrades to the spouts arrangement, a robot can be used to automate cleaning of the spouts along with several other tasks on the spout deck where operators are required to use extensive and cumbersome PPE to perform these tasks. Liquor stations can also reduce operator exposure to the dangerous environment of the furnace, reduce muscle strain associated with handling cumbersome equipment and improve boiler operation. Lastly, air port rodders have improved in both reliability and maintainability, and are available for all elevations of the combustion air system. Automation of air port cleaning helps both reduce exposure just as potentially physical strain for the operators. In summary, the focus in development of these automated products help by providing the tools essential for mills to improve operating efficiencies and sustain more consistent performance through outage cycles while creating a safer workplace environment for personnel.

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