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Study on Construction Safety in Thermal Power Plant

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Abstract

Safety first, Quality next is a normal think in a construction site. Worker working in construction site always fear of accident and the injuries that occur in construction site and is always in there mind at work. Worker is unaware of the work in parallel to their work at site.Saftey officer periodically reminder the works of their danger in construction site and warn then to use safety gadget while working. Work ignores the safety instruction given by Safety Steward at the time of construction work. Any construction activity has safe working procedure which has to be followed by worker during working at site. Before start of the any construction work, we have to look in to the different way in which accident may occur and how to prevent then. We should have good emergency preparedness and response and First in Hand. In Thermal Power Station Concrete work below the ground at foundation level and steel structure above the ground at superstructure and construction of chimney 235mt. The structure Height to maximum up to 41mt above the ground. As the Height increase safety also increase.Similary as the depth increase safety increase. Feasibility report was prepared and final conclusions was that high standard of safety is required to execute the thermal power project. Only by safety, only by quality project can be completed.

Keywords: *Commissioning, Erection, Injuries, Safety, Quality, unsafe condition and Hazards.*

1. Introduction

The thermal power generation 2x250 MW Korba involves the generation of electricity from the burning of fossil fuel in a large industry furnace. In simple terms, in a coal fired station, the coal is pulverized and blown into the furnace where it burns, much like a gas flame, to heat water and generate steam, which moves at high speed to turbine. The turbine spins and drives a rotor attached to a magnet in a generator. The rotating magnetic fields moving across coils in the generator produce electric current. The thermal machines used to convert the stored energy in the fuels to the kinetic energy of the rotor are complex units. Each consists of two principal parts: boilers and turbines. They also include variety of auxiliary equipment to provide fuel and water to the unit and to eliminate waste gases and products of combustion. The basic operation are highly automated. In a coal-fired power station, where boilers and turbines are combined, there is automatic control of coal pulverization, of supplied water fuel, of combustion, and of superheating. The elimination of ash in the auxiliary processes is also automated. Coal consumption per day19200.00 Mt/day, water consumption per hr required by plant 850.00 Lit/hr.It required 38.40 (Mt/day)/MW to produce current. Most construction of thermal power plant, repair and maintenance work done during unit shutdowns or period of extensive rehabilitation. This could involve working on one of the following components are steam drum, primary steam piping, boiler feedwater,superheater, reheater, economizer, down comers, feeder and riser tubes,waterwalls,boiler hangher rods, mud drum, boiler casing, condensate system, electrostatic precipitators, sulphur dioxide scrubbers, stacks. Construction and erection of all the components and assembling is a great challenge. The workforce require great skills with safety in erecting .Around 6.5 million people work at approximately 252000 construction sites across the nation on any given day. The fatal injury rate for the construction industry is higher than the national average in this category for all industries. Most accidents can be prevented by taking simple measures or adopting proper working procedures. If we work carefully and take appropriate safety measures, there will definitely be fewer work related injury cases and our sites will become a safe and secure place to work in. The potential hazards for workers in construction include, fall (from height), trenches collapse scaffold collapse, electric shock and arc flash/arc blast, failure to use proper personal protective equipment and repetitive motion injuries. The construction of thermal power plant starts with commencement of piling and foundation. Commencement of SG Erection ,Drum lifting,Hydo test, Boiler light up, Commencement power plant ward of condensor,TG Erection Comenecement,TG Box up, Completion of oil Flushing ,Stream to TG,Synchronisation of unit on coal and Successful completion of trail operation. The entire project duration 18month to 24 month.

2. Common Hazards of shutdown and Rehabilitation Work.

The conventional construction hazards in thermal power plant are workforce falls, either falling or things falling on workforce. The reason is that height of

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bunker and boiler which around 41mtr from the ground level. The crushed coal lifted to maximum height and burned to heat the water boiler. Workforce has to erect steel column, cast slab at each level, lift the drum, conveyor to this height requires safety. When the scaffolds are not erected or used properly. About 2.3million construction workers frequently work on scaffolds. Protecting these workers from scaffold-related accidents would prevent an estimated 4500 injuries and 50 fatalities each year.Scafflod must be sound, rigid and sufficient to carry its own weight plus four times maximum intended load without settling or displacement. It must be erected on solid footing. Each year, falls consistently account for the greatest numbers of fatalities in the construction industry. A number of factors are often involved in falls, including unstable working spaces, misuse or failure to use fall protection equipment and human error. Studies have shown that using guardrails, fall arrest system, safety nets, covers and restraint system can prevent many deaths and injuries. From falls. For solution consider using aerial lifts or elevated platforms to provide safer elevated working surfaces, Erect guardrail system with toe boards and warning lines or install control line systems to protect workers near the edges of floors and roofs, cover floor holes, use safety net. Ladder and stairways are another source of injuries and fatalities it's estimated that there are 24882 injuries and as many as 36 fatalities per year due to fall on stairways and ladders used in construction. Use the correct ladder for the task. Slips, trips and falls on stairways are a major source of injuries and fatalities among the construction workers. Stairways tread and walkways must be free of dangerous objects, debris and materials. Slippery condition on stairways and walkway must be corrected immediately. Another hazard that is trench collapses causes dozens of fatalities and hunders of injuries each year. Always use protective system for trenches 5feet deep or greater. Cranes used in erecting steel column, beam, mechanical components are significant and serious injuries may occur, if cranes are not inspected before use and if they are not used properly. Common problem in cranes is mechanical fatigue occurs while working due improper maintained, overloading, malfunction etc.Often these injuries occur when a worker is struck by an overhead load or caught within the crane's swing radius. Many crane fatalities occur when the boom of a crane or its load line contact an overhead power line. Head protection, serious head injuries can result from blow to the head. Be sure that workers wear hard hats where there is a potential for objects falling from above, bumps to their heads from fixed objects and accidental head contact with electrical hazards. The Industrial hygiene hazards before work begins, workforce should receive training in the hazards existing in the work area and obtain and review the Material Safety Datasheets for any hazards for any hazardous materials to which they may be exposed. These should be readily available from the facility and in fact, should be obtained by contractors and subcontractors at the time of bidding to facilitate job planning. Any protective equipment used should at least equal that worn by plant personnel in the area.

2.1 Reported Health Problem

Some workforce in boiler rooms may suffer from diseases of the upper respiratory tract such as bronchitis and from conjunctivitis caused by vanadium compounds (dust given off by oil combustion) and SO_2 .Flue cleaners and cinder removers may, after some years. Suffers from chronic bronchitis and rhinopharyngitis as well as pneumosclerosis caused by cinder dust and sulphurdioxide and trioxide.

2.2 Safety During Testing and Commissioning

The planning, Sequence is from whole to part. The testing sequence is from part to whole, give important to the 1st two point in commissioning the thermal power plant. Tests must not be avoided any circumstance. Putting the equipment into operation, without testing is a very unsafe practice and serious lapses of construction management. During testing and commissioning, each protective zone is tested independently. The general employees at construction site may inadvertently get exposed to danger during working in the plant i.e., during commissioning.

2.3 Safety Precautions during plant Energizing

First and foremost requirement during energizing of electric plant or its subsystem is to ensure that unauthorized person do not come to close proximity of the plant /subsystem. Display signboard "**DANGER COMMISSIONING IN PROGRESS ENRTY IS PROHIBITED".** Only authorized person with the gate pass should be permitted to enter control room and equipment zone. Follow procedure (protocall) for subsystem tests should be written down in advance and signed by contractor, owner, commissioning manager. Follow step by step, part to whole sequence. The total plant must be subdivided into sub-system and further small sections. The small section must be tested and proved first, then subsystem, finally plant. While energizing the subsystem, visual observations should stand at an appropriated safety distance from the subsystem for sparks/flash-over /abnormal sound if any. They should communicate with the control engineer.

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Safety precaution like Danger notice, First aid, provisions fire fighting facility, communication facilities etc.should be avaible during commissioning. Combustible material should be removed from the sub-system under commissioning in advance. Fire protection system must be commissioning in advance and must be ready to operate during commissioning. All interlocks and frequencies should be checked. Protective system and relays must be commissioned in advance before energizing the sub-system/total plant. It is hazardous to energize the electrical plant without adequate protective system and correct relays setting. Operation of relays during sub-system test must be investigatecarefully.Plant must be energized only after confirming that there are no faults /abnormal conditions in the plant be energized. Zone of energization should be identified in advance. The circuit breakers and isolators at the boundaries should be opened and locked open so that electricity do not flow beyond the predetermined zone to be energized. Approval of safety inspector must be obtained before final energized.Erection tool, tackles, equipment, ladder, temporary earth, crane, etc should be removed from the zone to be energized. Following sequence must be followed during commissioning are Equipment tests, Sub-system, System test, System energization, System loading, observation and trail. This step should not be bypasses under political or administrative pressure on commissioning staff. Safety documentation for commissioning must be followed. While switching on the circuits for the first time keep a close watch on the components for any abnormal sound, smoke, and flash and energize the circuit for only a few tens of seconds. Observer the measuring instrument and protective relays. If everything is normal energize the circuit once again and for longer time under close observation.

2.4 Safety During Operational and Maintenance of Electrical Plant and Equipment

Essentials of plants safety and personnel safety during O&M are lack of maintenance results in unsafe conditions. Protection system and control system should be healthy and well-set. Operation must alert. Maintenance work should be coordinated with work. Boundary between operations made maintenances mode must be well defined and understood. Electrical plants can be made 100%safe by systematic follow of operation and maintenance procedures and safety rules and procedures. During operating mode automatic switching, protection, regulating device play vital role in plant safety.

3. Tables, Figures and Equations

3.1 Tables and Figures

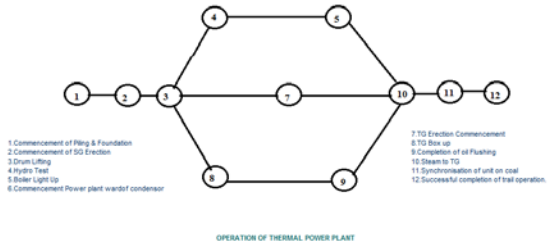

Fig. 1 Operational Thermal power plant PERT Network

Fig.2 Safety Report Fatal and Non-Fatal- 2006.

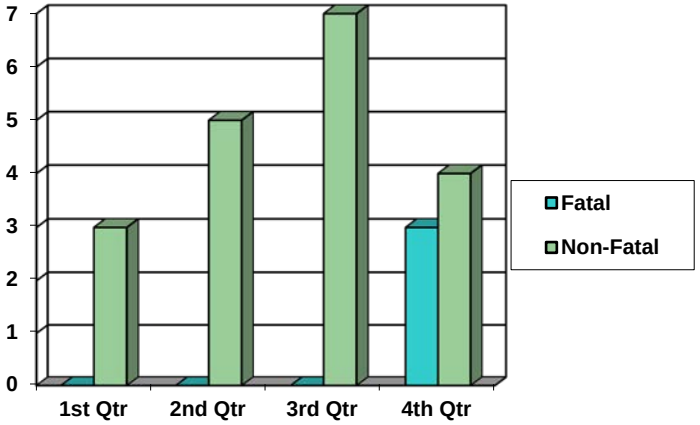

Table 1: Shows Severity Rate in Thermal power Plant

Year	Exposure (Man-Hours spent)	Fatality	Lost Time (over 4days)	Lost Time (less 4 days)	Total	Lost Days	Injury frequency Rate	Injury Severity Rate
2006	2880.0	Neck injury	-	1.0	1.0	0.986	2738.88	2.74
2006	480.0	Cut mark in leg	-	1.0	1.0	0.986	16433.33	16.43
2006	720.0	Leg fracture	60.0	-	60.0	59.17	657444.44	657.44
2007	320.0	Leg injury	-	1.0	1.0	0.986	25000.00	24.65
2007	520.0	Back injury	-	2.0	2.0	1.97	30769.23	30.30
2007	240.0	Pelvis	-	3.0	3.0	2.95	98333.66	98.33

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Table2: Hazards Substance

Substance	Characteristics and Dominant Hazards
Asbestos	Designated substance under construction regulation Diseases include asbestosis and cancer
Lead	Designated substance under industrial regulations Can cause kidney and drain damage
Fly Ash	Coal ash contains oxides of silica, aluminum and Iron with traces of manganese, lime, sodium and un burnt fuel (carbon) Also identified are trace elements such as arsenic and selenium. Oil ash can contain pentoxide, other vanadium oxides and soluble nickel compounds.
Silica	Designated substance under industrial regulation. Can cause silicosis
Carbon monoxide(CO)	Clear,colourless,odourless,tasteless toxic gas Cause drowsiness leading to death
Sulphur dioxide(S_{o_2})	From sulphur content in oil Very irrigating and corrosive gas,sulphur-like odour,forms an acid on contact with moisture.
Coal dust	In fuel supply and transport areas.
Welding fumes	Hazards vary depending on type of metal, type of welding and coatings. Health effects can include metal fume fever and respiratory irritation.

3.2 FATAL ACCIDENT RATE

For the entire project fatal accident rate is calculated. Based on the FAR report compensation may be granted to the affected workforce.

$$\mathbf{F.A.R} = \frac{\mathbf{N}}{\mathbf{M}} * \mathbf{100}$$

FAR=Fatal Accident Rate
N= No. of fatal accident during the year.
M=Average daily employment during the year 2006.
F.A.R=0.33%

Days lost=Number of days absent from work *360/365
Frequency Rate= (Number of Disability Injuries/Total hours worked)*1000000
Severity Rate=Days Lost/Total Hours Worked*100
By knowing the severity rate we can prevent the occurrence of accidents normal occurring in the thermal power station.

4. Conclusions

Construction of thermal power station has many challenges in safety implementation and overcoming the entire difficultly in executing project as per plan with workforce and minimum loss of life and injuries. Power shortage is increasing day to day, to overcome power shortage. We require to construction many thermal power stations to cope with current scenario. In constructing the thermal power project safety and quality are key for success in completing the project in given duration and also identifying unsafe condition in the project which can be made safe for workforce to work in ease without any difficultly. Giving high priority to safety is must for entire project. This project is related to many construction hazards related to constructing concrete structure below the foundation and erection of steel structure above the ground, chimney and erecting machine. High risk of safety for the workforce. Informing workforce about the unsafe condition and usage of personnel protective equipment can reduce the injuries to the workforce. Main aim of the study is to reduce accident in construction site and all contractors, engineer should obey the safety rules and guideline properly. Safety are neglected in construction is to given more importance and due consideration in thermal power project. Only Construction equipment should be inspected periodical for smooth running of project without delay. Safety 1st and Quality next.

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