Shut down management
For
Coal handling plant of thermal power station –A New Approach

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1.0 Abstract: -

Shut down can be defined as scheduled down period for a plant for scheduled maintenance for an extended period of time. Shutdowns provide unique opportunities to a maintenance department not normally available during standard operation or even during short shutdown periods. A large work is required to schedule into a relatively short period of time.

The process of project management is generally applied to a maintenance shutdown in coal handling plant of thermal power stations. The critical path method (CPM) or sometimes a Gantt charts is used for planning shut down. But it is observed that existing method is not sufficient and foolproof for such type of work. This paper covers a new method (MUC), which is developed for shut down management of coal handling plant of thermal power stations.

2.0 Introduction: -

In a coal handling plant of thermal power stations there are different streams for transporting of coal up to bunker. Generally shut down is planed for a stream. Major equipment overhauls are performed during shut downs to prevent future breakdowns. Work schedules may have to be modified. Special equipment may have to be rented. Contractors may have to be hired to fill additional labor requirements and special needs.

An effective system for the shut down maintenance should meet the following objectives.

- Manage and prioritize all the work initiated.
- Able to achieve the schedules
- Manage site/plant access for resources, vehicles, equipment, and tools.
- Manage indirect hire, contractor, subcontractor, and service personnel at the site/plant.

An effective method is developed for shut down management of coal handling plant of thermal power stations.

3. Maintenance Shutdown Management: -

It is the activity that most determines the success. It is only when it can forecast with some degree of certainty. It can able to achieve the schedules that are planed. This, in turn, has a direct impact on equipment availability, utilization, and operating and maintenance costs. Maintenance planners need enhanced skills in job planning (as distinct from job scheduling), and Maintenance Supervisors need enhanced skills in Leadership and Management, and that all Maintenance personnel need enhanced skills in Failure Investigation and Analysis. In general terms, Shutdown Maintenance management process can be considered as having eight phases, as shown in Figure No1.

This can be recognized as being similar to the familiar control loops, where plans are put in place, actions take place, and then the outputs are compared with the original plan and appropriate action taken. At most sites shutdown management become difficult, the prime reason is that these feedback and control loops are either missing, or ineffective.

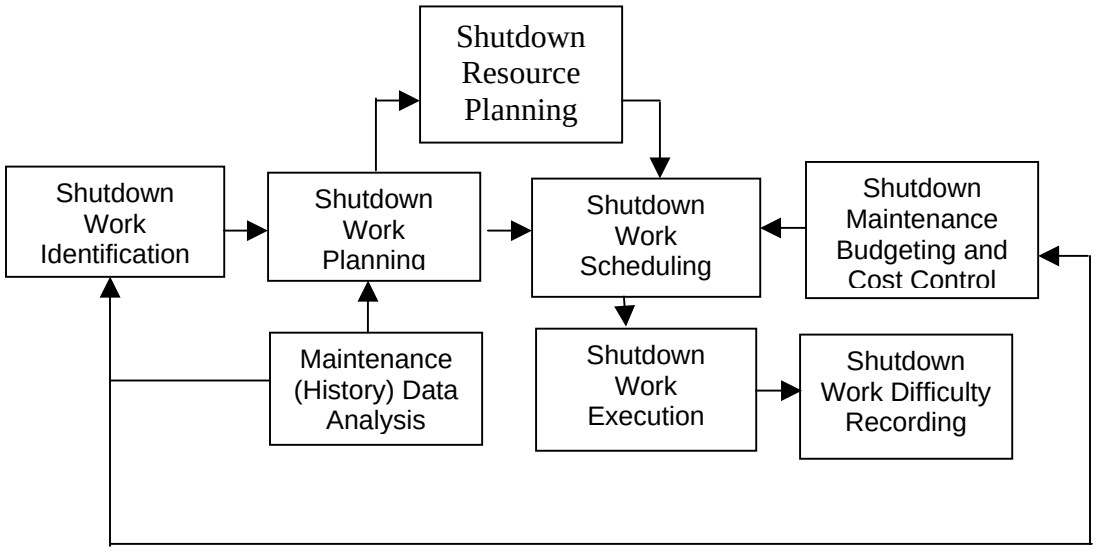


Figure No 1

3.1 <u>Shutdown Work Identification</u>: -

The work, which is to be carried, should be clearly identified. The work identification depends upon following points.

- The number of failures
- The root causes of those failures
- The Maintenance costs associated with those failures
- The Production costs associated with those failures - note that these may incorporate more than just downtime costs.
- Any Safety or Environmental implications associated with those failures.

3.2 <u>Shutdown Work Planning</u>: -

The quality of the planning varies enormously. Planning is little more than scheduling - a task is allocated to a specific time period, job procedure, the labour requirements (by trade type), any parts or special resource requirements (such as cranes, tools etc.). Furthermore compare actual labour hours or costs incurred with those that were initially estimated for the jobs, either on an aggregate basis, or on a job-by-job basis. The formal processes disciplines and allocated responsibilities to make this a Shut down Maintenance Management task.

3.3 <u>Shutdown Work Scheduling</u>: -

This incorporates the development of a Schedule, but more importantly, also includes control loops that ensure that the Schedule is realistic and achievable. An effective Scheduling system permits the allocation of jobs to specific time, so that parts can be delivered to the job site "just in time", and so that maintenance crew can complete maintenance task. It also compares the labour requirements of the schedule with the labour available from the work crew for each day of the schedule, and allows effective decision-making regarding the need for supplementary labour or the need to reschedule work before the schedule is finalized. Finally, it also permits the collection of data on a timely basis to permit effective comparison of "actual" with "schedule" in terms of job timing and duration.

3.4 Resource Planning: -

Generally the resource are consider, as the technical labor required, such as mechanics and electricians. Inspectors, safety personnel, engineers, and operations personnel should also be included as a resource on jobs. Non human resources in short supply, such as cranes, tools, and laser alignment instruments, should be considered as well. The process of load leveling will reveal any conflicts with these resources so the shutdown coordinator can deal with them ahead of time.

3.5 Shutdown Maintenance Budgeting and Cost Control: -

Shut down Maintenance costs are generated by Maintenance Activities. Shut down Maintenance budgets that are based on a bottom-up assessment of the Maintenance activities that they expect to perform. It is required to compare actual costs against those budgeted f cost.

3.6 Maintenance (History) Data Analysis: -

The equipment history includes the date of purchase, executed maintenance, history of usage etc. this data is required to analysis for critical works. The critical problem, which are occurred, and solution for them is required to properly analysis for further planning. This record also shows the spares quality which are supplied. Due to this the policy for purchase for spares can be decide.

3.7 Shutdown Work Execution: -

The project status should be updated continuously during the execution phase of a shutdown. The work exestuation is totally depending upon the supervisor's skills.

3.8 Shutdown Work Difficulty Recording: -

While executing the work the difficulties should be recorded. These records are useful for planning the next shut down.

4.0 Method using charts (MUC): -

The method, which is, develops for coal-handling plant is given with a model example. The method is spilt in four parts. These are as follows.

1. Planing with machine.
2. Sequencing machines with eight-hour shift.
3. Critical activity planning.
4. Combination of activities of machines

4.1 Planing with machine: -

Decide the machines or a stream, which are to be overhauled.

A model plant, which is consider is shown in figure. The stream is selected known as 'C' stream. The machine which are decided for overhaul are Wagon Tippler No1, Feeder No 1, Conveyor C_1 (between feeder no 1 and transfer house no1), Conveyor C_2 (between transfer house no1 and Vibrating Screen No 1), Vibrating Screen No 1, Crusher No1, Conveyor C_3 (between Crusher No1and transfer house no2). These machines are denoted as M_1, M_2, M_3, M_4, M_5, M_6 and M_7. See Figure No 2

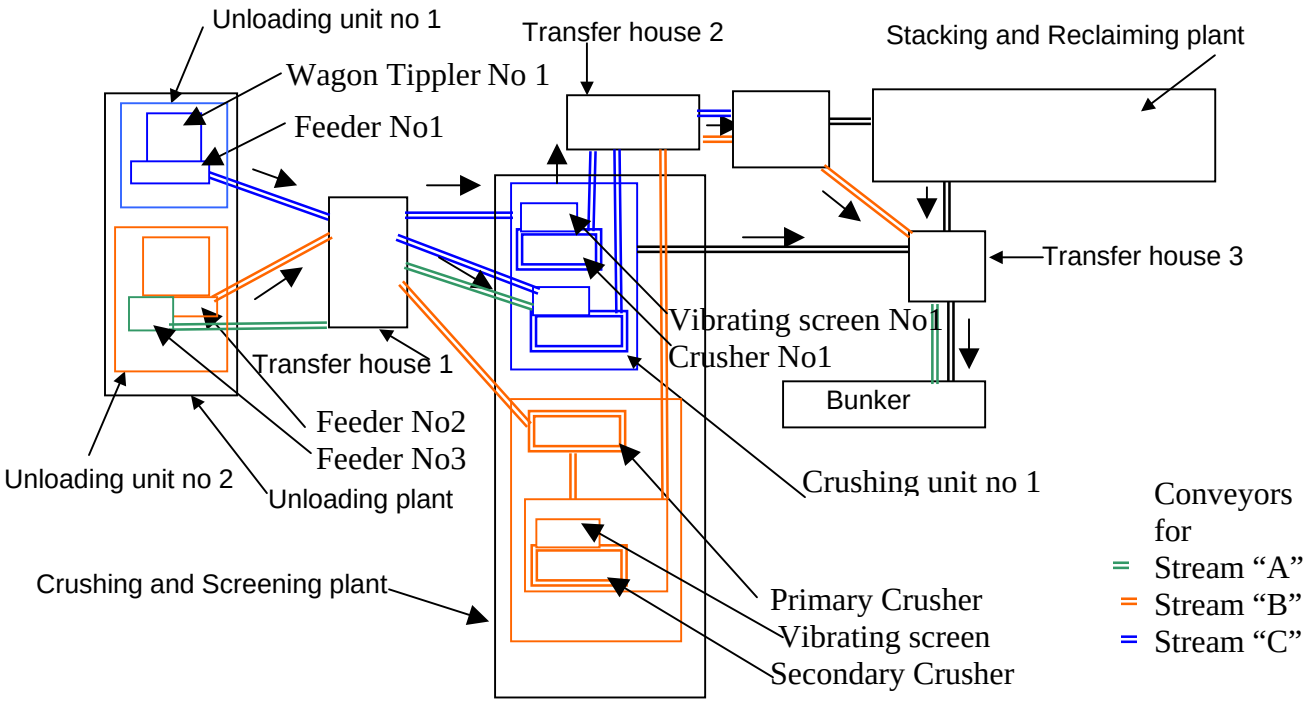


Figure No 2

4.2 <u>Sequencing machines with eight-hour shift</u>: -

List out the critical defects of each machine.

Spilt up the maintenance work or activity of each machine in smallest part.

List the resources required for each work.

Calculate time period for each activity for each machine. This time period should calculated as per " PERT ".

Make sequence of activity for each machine. And group these activities in eight-hour shift with consideration of shift normal allowances.

For machine M_1 the activities are A1, A2, A3, A4, A5, A6, A7, A8, A9, A10, A11 time required for each activity are 3,2,5,4,2,1,2,2,4,5,1 and sequence of activity are A2, A5, A7, A10, A11, A9, A6, A3 and parallel activities are A1& A5, A4&A7, A8&A10.

Shift allowance is 1 hour for 8 hours shift.

For grouping the activities prepare the table, as follows (Table No 1)

Group No 1		Group No2		Combination as per shift		Combination as per shift	
Activity	hrs	Activity	hrs	Activity	hrs	Activity	hrs
		A2	2				
A1	3	A5	2				
A4	4	A7	2	A2,A5,A7	6	A1,A4	7
A8	2	A10	5				
		A11	1	A10,A11	6	A8	2
		A9	4				
		A6	1	A9,A6	5		
		A3	5	A3	5		

Table No 1

Now the activitiesA2, A5 & A7 are combined. Let it denote by A_7. For activities A1, A_4 are combined and known as A_4. Other activities will be denoted as follows.
A10, A11 as A_{11}.
A9, A6 as A_9
Now new chart will be as follows. (Table No 2)

Activity	hours	Activity	hours
A_7	6	A_4	7
A_{11}	6	A_8	2
A_6	5		
A_3	5		

Table No 2

Each activity is combined in the group nearer to shift hours. Shift allowance is 1 hour for 8 hours shift is required to add in activity. Then each activity will convert into a shift i.e. it is an 8 hours job. Now make next chart as per "CPM". This is given below.
See Figure No 3

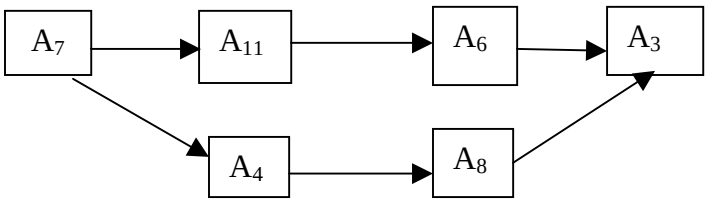


Figure No 3

Calculate the required time. Now for each machine this method should be applied.

4.3 <u>Critical activity planning</u>: -

Critical activity is the activity of a one machine, which makes a problem for the activity of other machine. There are some of activities for each machine which cannot be carried out in parallel with other machine activity. The reason is safe working, special resources. The special resources are cranes; special tools (special lifting trickles like hydraulic jacks, alignment instruments etc.). These activities should be listed. These activities should not foul each other.
These activities given in following table. (Table No 3)

Machine	Foul 1	Foul 2	Foul 3	Foul 4	Foul 5	Foul 6
M_1	A11					
M_2	B2		B4			
M_3			C7		C36	C9
M_4		D5		D9		
M_5		F5				
M_6						G6
M_7				H5	H1	

Table No 3

List the machines in descending order as per time required for the overhaul work. This time is calculated as per “CPM”.
See Table No 4

Machine	Hours
M_3	280
M_5	184
M_2	120
M_4	72
M_6	56
M_1	32
M_7	24

Table No 4

4.4 <u>Combination of activities of machines</u>: -

Select the machine, which required maximum period. This will define your shut down period. Select other machine, which required second highest period. Also select machine which required time less or equal to the difference first and second highest period machine. Then combine the group of these two machines. This will be second group. Further same procedure should be applied for other machine.

M_3 required maximum period.

$M_3 \geq M_5 + M_4 \geq M_2 + M_6 + M_1 + M_7$

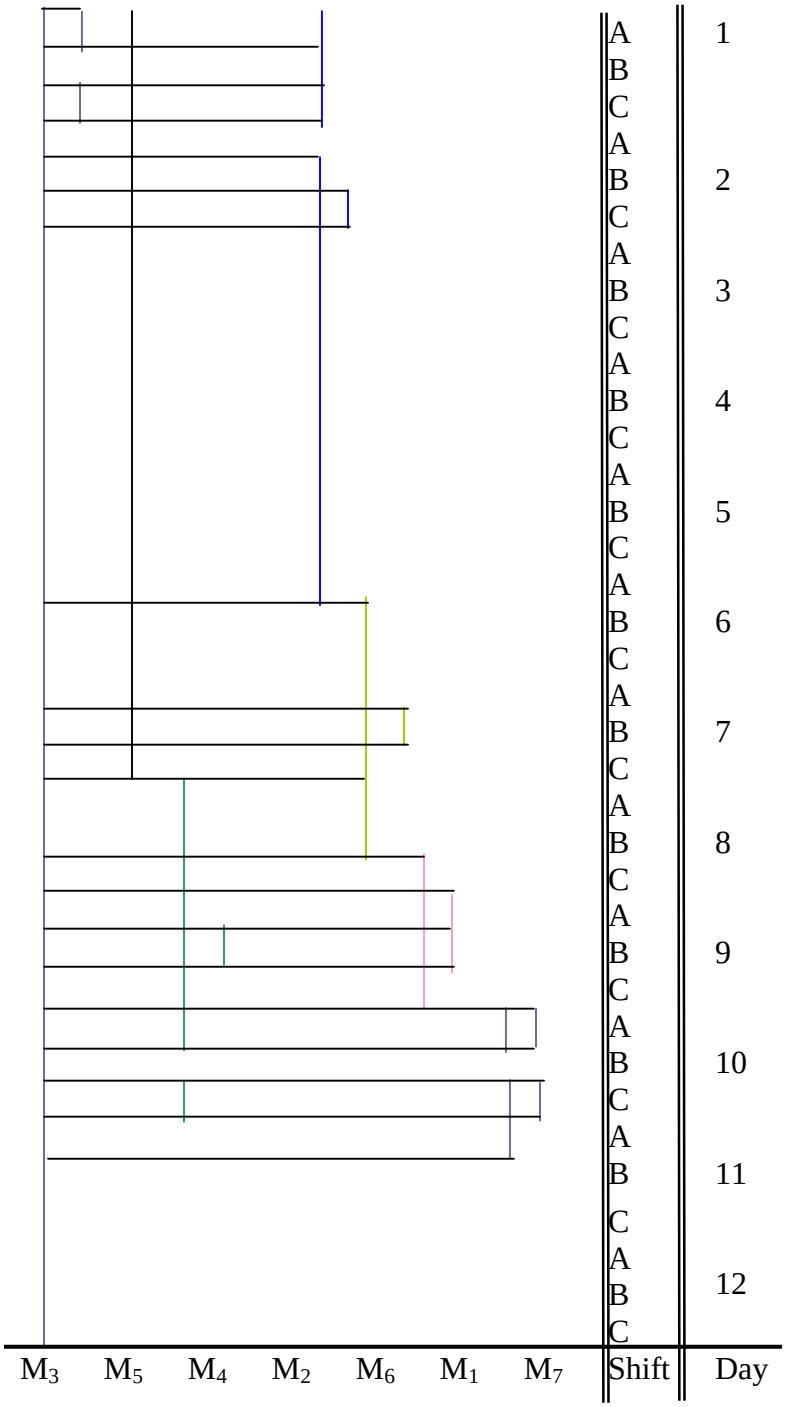
First enter the activity of a machine which required maximum time as per sequence. Then place other dissenting order machine or group. If the activity is foul then place in other column. B4 fouls C7 hence placed in next shift. See Table below.

Day	SHIFT A							SHIFT B							SHIFT C						
	M 1	M 2	M 3	M 4	M 5	M 6	M 7	M 1	M 2	M 3	M 4	M 5	M 6	M 7	M 1	M 2	M 3	M 4	M 5	M 6	M 7
1		B1	C3		F1				B2	C5 C1		F2				B3	C2		F3		
2		-	C7 C8		F4				B4	C 9		F5				B5 B 10	C 10		F6 F7		
3		B6	C 15		F8				B7	C 17		F 10				B8	C 20		F 11		
4		B 9	C 19		F 10				B 11	C 21		F 13				B 12	C 21		F 14		
5		B 14	C 22		F 15				B 15	C 22		F 16				B 16	C 22		F 17		
6		B 17	C 25		F 19					C 26		F 22	G1				C 26		F 23	G3	
7			C 29		F 25	G2				C 29		F 26	G5 G9				C 29	D1		G6	
8			C 31	D2		G7				C 32	D3		G8		A7		C 33	D4			
9	A 11 A4		C 34	D5				A6 A8		C 35	D6 D 10				A3		C 36	D7			-
10			C 38	D8			H1 H4			C 39	D9			-			C 39				H 5
11			C 41				H6 H7			C 42							C 43				
12			C 44							C 45											

Now the chart for activities for each machine with combination of other machine is developed. This chart is combination of “CPM” Chart and Gantt chart. First the machine having maximum period is plotted with the help of two lines. See Figure No 4.
Then the other group of machines is plotted. Then a chart is prepared for required manpower and spares required.

5.0 Conclusion: -

As this method is developed for the fouling activity, execution of work is carried timely.
Because of chart wise planning the requirement of manpower is smooth throughout the shut down period.
As the system is developed on basis of close loop, the feedback received give knowledge for further improvements.
This method is useful where machines are erected very closely like coal handling plants.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Day

Figure No 4