

Planning a Start - up  
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EAM – 2006  
12/15/05

The objective of a reliability program is to maximize availability, performance and output of the existing assets. This objective is not met when the equipment is down and not producing. During a planned shutdown, Maintenance planning and scheduling is responsible to script and choreograph activities so that downtime is minimized. A planned shutdown is not one simple task but a combination of tasks involving the whole organization. Working together the organization will restore the equipment to a reliable operating condition while ensuring the work is completed safely and efficiently.

This short course will discuss organizing, planning, and executing shutdown work to ensure a reliable start up. Topics include organizing for a successful start up, managing the five phases of a shutdown project and how the commissioning phase is the heart of the start up.

A successful shutdown and start up begins with organizing and planning of the project. The entire site will be affected by a major shutdown. Shutdown project activities will require resources. These resources must be balanced with maintaining plant operation and executing the shutdown project. Selecting the proper personnel to manage the project is one of the first decisions which has to be made. In many organizations, a Project manager will be appointed to define, manage and execute a scope, budget and timeline. This Project manager position is critical in managing the technical aspects of the project. What is often missed is the amount of change occurring during the shutdown and how this change will impact operations at start up. In order for operations be ready at start up, work instructions, preventive maintenance procedures, maintenance spares and regulatory documents need to be changed and training completed. This leads to the second appointed position which is the Start-up manager. This person will be responsible for coordinating the proper operating personnel for design review, developing commissioning procedures, updating TPM program and regulatory documents and managing training activities. In summary the Start up manager is the internal customer responsible for managing change to the operational level. The Project manager is responsible for developing and executing the technical part of the project. These two positions must have the same objective which is a vertical start up of the factory.

A shutdown project has five phases.

- Phase 1- Preliminary Work and Business Requirements
- Phase 2- Final planning, design and engineering phase
- Phase 3- Execution, Maintenance and Construction Phase
- Phase 4- Commissioning and Validation- Operation ownership
- Phase 5- Continuous Improvement

In phase 1, the first objective is to evaluate the need for a shutdown. If the need exists, different alternatives will be analyzed. All of the proposed work will be prioritized and the final justification determined. Once this is completed, the preliminary scope, cost and timeline are established.

What are some of the typical questions which need to be answered in phase 1?

- Is the shutdown truly needed? What is the business risk to perform or not to perform the shutdown? Can it be delayed?
- Are there ways to complete the critical work without shutting down? At what cost?
- How will this effect quality, customer service and product cost?
- What is the current capacity plan and next scheduled outage? How will this shutdown change the plan?
- Can we get the proper resources to maximize the effectiveness of the shutdown?
- What is the current backlog?
- Are there any other business activities which can take advantage of this downtime?
- How are you prioritizing the work?
- What is the cost? What has been budgeted? What is the timeline?
- What are the project and resource requirement?
- Are the start up cost in the project?
- Who is championing this effort?
- What are the top ten reasons for doing the shutdown?
- What are the top ten reasons for not doing the shutdown?
- Who is the Project Manager?
- Who is the Start-up Manager?
- Will this distract from other currently approved activity? How will this be managed?
- Are those items being changed following the proper change management process?

Once the decision has been made to schedule a shutdown, the next major milestone is to create the scope. The scope of the will be managed by the Project manager. The project scope will be made up of a group of subprojects. The smallest sub-project is a work order and the largest sub-project is a major capital installation. The project scope is the sum of the sub-projects scopes which are developed by reviewing available information.

- Maintenance Backlog
- PM Procedures and Records
- Input from operators, technicians and others
- Capital project installation and tie-ins
- Walk around yourself
- Review Shutdown Files
- Diagnostic work to scope future work
- Predictive Records
- Equipment History
- Operator TPM activities
- Jobs not requiring a shutdown
- Change management

Each of the sub-projects should be broken down into work breakdown structures to develop the cost and timeline. . Each sub-project should be reviewed by operation, maintenance, management and project team members before finalizing the scope.

Phase	Description of Phase	Deliverables
Phase 1	Ample time required to discuss and develop Preliminary Project Plan, Business Proposition and obtain approvals.	<ul style="list-style-type: none"> <li>●Project approval</li> <li>●Approved customer service and finish goods inventory plan.</li> <li>●Preliminary scope of work, approved budget and timeline.</li> <li>●Assigned Project and Start-up manager,</li> <li>●Project and start up teams staffing requirements.</li> </ul>

Phase 2 is the detailed planning and design phase of the project. The project team will detail work breakdown structures and job plans. Engineering drawings, material requirement, special tools, specifications, bid packages, procurement, contractor selection are defined, finalized and executed in this phase. Good project management competencies are a must during this phase.

The Start-up manager will focus on managing those items changing the process or product. They will develop a start-up plan which is integrated with the project plan. This plan will define the development or modifications of standard work instructions, training requirements, regulatory documentation, maintenance PM's, critical spares list and commissioning documentation.

Issues to be addressed in Phase 2 include:

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|-----------------------------------------------------------------------------|--------------------------------|
| Administration support                                                      | Staging Areas                  |
| Execution of communication plan                                             | Documentation management       |
| Procurement resources                                                       | Procurement plans              |
| Effective Change Management by work order                                   | Budget Control                 |
| Evaluation of alternatives                                                  | Sequencing jobs and jobs tasks |
| How to coordinate Crafts and Contractors                                    | Resource leveling              |
| Training required                                                           | Temporary Facilities           |
| PM's which are going to be performed                                        | Phase 2, 3 and 4 organizations |
| Rental Equipment                                                            | Rental Equipment leveling      |
| Detail Job plans (material, labor by craft, time, estimate, tools, permits) |                                |

Phase 2 begins by adding the details around the activities and managing the critical path of the project. The Project manager has the accountability to manage this phase of the project for technical activities and to coordinate with the Start-up manager on commissioning and validation activities. Planning and scheduling competencies are critical in this phase of the project. These skills need to be balanced across engineering, maintenance and start up requirements.

Phase	Phase Description	Phase Deliverables
Phase 2 – Final planning, design and engineering.	Detail planning, design, engineering, and procurement for the project’s technical and start up activities.	<ul style="list-style-type: none"> <li>● Each job listed has a detailed job plan and a detailed commissioning procedure.</li> <li>● Complete job list, engineering drawings, bid packages and labor estimates.</li> <li>● All contractors selected and contracted.</li> <li>● A project schedule detailing the sequence of work breakdown structures.</li> <li>● Schedule is integrated with start up activities.</li> <li>● Contingency planning is complete.</li> </ul>

Phase 3 can be a breeze if Phases 1 and 2 are done well. Take the time to plan and enjoy the fruits of this labor in phase 3 and 4. . With the plan in place and proper resources allocated and good supervision available, excellence in execution is the result. Phase 3 is where the execution of the sub-projects or job plans takes place. The key to execution is a good communication structure, organization, supervision and contingency plan. Communication is vital because things are changing everyday and the team must ensure that the right people receive the required information to execute their work. This does not just happen but takes planning and effort. Organization is important because roles and responsibilities must be met or the plan will not work. Supervision is critical to ensure daily and weekly schedules are executed. Good supervision is getting harder to secure because of the growing craft gap. Finally contingency planning is important because even with a great plan and crew, unforeseen issues will occur. The team’s ability to deal with these issues will determine their impact on the project and business.

Phase	Phase Description	Phase Deliverables
Phase 3 - Construction	Managing the execution of the schedule, resources and work activities.	<ul style="list-style-type: none"> <li>•Complete the shutdown job list or note exceptions and provide a plan to complete the work.</li> <li>•Track cost</li> <li>•Manage field changes.</li> <li>•Manage a punch list</li> <li>•Mechanical and Electrical checkout is complete.</li> <li>•All commissioning procedures and standard work instructions are complete.</li> </ul>

Phase 4 – Commissioning and Validation is the heart of the start up because this is where the transition of ownership of the equipment is turned over from the Project manager to Start-up manager. This is where the baton is passed and just like a winning relay team the critical moment is when one hand lets go and other closes. The functionality of good shutdown management is good start-up management with both being dependent on experience, organization, focus and leadership.

Commissioning is where the operation partner executes their start up plan to ensure the equipment is capable of producing product. During this phase all subsystems will be exercised moving low cost materials, tuning control loops and exercising equipment to certify operators on the process changes. Validation is the final phase of the testing to ensure the process is capable of meeting the minimum standards to produce the products. The purpose of validation is not to make salable product but to ensure all systems can work together to meet the customer’s expectation of the product.

Phase	Phase Description	Phase Outcome
Phase 4- Commission and Validation	Operation has the keys to the plant and is in charge of ensuring the plant can produce products safely, reliably, and efficiently.	<ul style="list-style-type: none"> <li>•Operation ownership,</li> <li>•Punch lists are completed as agreed.</li> <li>•Plant and facility are being restored to normal operating mode.</li> <li>•Vendor invoices are being processed.</li> <li>•All starts up activities are complete.</li> <li>•Operation PM’s and inspections are active.</li> <li>•TPM culture is built during a shutdown not destroyed.</li> </ul>

Phase 5 is the continuous improvement phase. The plant is producing salable product. Business practices are returned to normal state. Review meetings are held to determine what went right and what went wrong and shutdown preparation best practice and job plans are modified. Operation documents are being managed through the normal change management system. Everyone takes time to celebrate before closing the project.

Phase	Phase Description	Phase Outcome
Phase 5- Continuous Improvement	Completion of project documentation and reliable production of products.	<ul style="list-style-type: none"> <li>●Updated drawings, job plans, operator standard work instructions, and shutdown preparation document.</li> <li>●Normal staffing in the plant for operation.</li> <li>●Remaining punch list items are converted to maintenance backlog.</li> <li>●Celebration</li> </ul>

The key measure to determine how successful a shutdown project was managed is how well the equipment performs after the work is completed. This is not just the responsibility of maintenance, operation, commercial or engineering but the entire organization. A properly structured shutdown project should demonstrate a Total Productive Maintenance approach. This is accomplished by organizing the site team in sharing a common vision and goal, managing through the five phases of the project and ensuring ownership by effective start up management.

References:

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