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Outage Management Guidelines for Fossil-Fueled Power Plants

Technical Report

Outage Management Guidelines for Fossil-Fueled Power Plants

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EPRI Project Manager
R. Chambers

ELECTRIC POWER RESEARCH INSTITUTE
3420 Hillview Avenue, Palo Alto, California 94304-1338 • PO Box 10412, Palo Alto, California 94303-0813 • USA
800.313.3774 • 650.855.2121 • askepri@epri.com • www.epri.com

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ORGANIZATION(S) THAT PREPARED THIS DOCUMENT

AREVA NP, Inc.

NOTE

CITATIONS

This report was prepared by

AREVA NP Inc.
An AREVA and Siemens Company
7207 IBM Drive
Charlotte, NC 28262

Principal Investigators
K. Barker
M. Kelly

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PRODUCT DESCRIPTION

The efficiency of an outage program and the correctness of the outage process are important to the continuous improvement and the long-term success of a utility and plant. This report, based on collective industry experience, Electric Power Research Institute (EPRI) publications, and outage conference, meeting, and workshop data, provides guidance for utility/plant management and staff involved in outage planning, execution, and post-outage operations and in restarting the planning cycle in preparation for the next outage.

The current business environment challenges plants to minimize the cost and duration of planned outages. As a result, it is necessary to optimize work task identification, prioritization, planning, scheduling, and resource usage. A significant effort is usually expended in preparing for a planned outage. Effectively planned outages minimize the risks of shortcomings and failures and result in a measurable success. It is not sufficient for tasks to be completed on time and on budget. The right tasks must be executed at the proper time, in the proper manner, and on budget.

Results and Findings

This report is an accumulation of information and combined experiences from EPRI-member fossil plant outage managers, planners, schedulers, and those who execute outages. This comprehensive report provides the steps necessary to successfully plan, execute, and recover from outages. It also provides beneficial information about refining and repeating the processes for future outages.

Challenges and Objectives

- To develop a useful, logically sequenced guide for planning plant outages
- To define outage terminology
- To describe the budgeting and planning processes required to achieve a long-term approach to outage management
- To describe outage team roles and responsibilities
- To describe the steps to be included for critical path analysis to ensure successful outage planning, milestone establishment, execution, and recovery
- To discuss outage execution for a well-planned project
- To define steps for outage completion, unit recovery, and post-outage activities
- To provide examples of planning tools, schedules, reports, forms, and other documentation

Applications, Value, and Use

Continued outage improvement and long-term success are driven by a comprehensive, but project-appropriate, planning and preparation process. This report provides a framework that utility/plant management and staff can follow in order to gain an understanding of the methodologies used in planning and conducting a plant outage.

The approach presented in this report is applicable to scheduled outages at any type of power plant and allows the user the flexibility to select the methodologies and steps applicable to their needs. This report can also be used in conjunction with *Guidelines for Performance-Based Contracts* (EPRI report 1004829) and *Outage Effectiveness Measurement Methodology* (EPRI report 1004830) for a complete framework and guide to the planning and execution of plant outages.

EPRI Perspective

EPRI seeks to develop a standardized methodology for planning outages that will improve the execution of future plant outages.

This report is part of EPRI's development efforts under Maintenance Management & Technology (Program 69 – Outage Management project set). This project set is focused on providing the necessary tools to assist plants with lowering outage costs, reducing outage duration, extending outage frequency, improving safety, and increasing plant operational flexibility.

Approach

EPRI outage workshops and several technical advisory group meetings were conducted from 2003 through 2006 in order to identify the areas of planned outages that program members considered important and, by consensus, felt should be covered in this EPRI report. Drawing on the collective experience of program members, previous EPRI work on maintenance management, and other published industry knowledge, the project team developed this report which includes all of the previously listed objectives.

Keywords

Outage
Outage management
Outage planning
Outage cost
Critical path
Outage execution

ABSTRACT

This report is an accumulation of information and combined experiences from EPRI-member fossil plant outage managers, planners, schedulers, and those who execute outages. This comprehensive report provides the steps necessary to successfully plan, execute, and recover from outages. It also provides beneficial information about refining and repeating the processes for future outages.

Outage terminology used in this report is defined so that it will be clear for the user. It is recognized that different terms may be in use within different organizations, but alternate terminology can still be associated with the definitions provided here.

Successful and cost-effective outage planning and execution requires a long-term approach. However, no specific lead times or intervals are assigned to most tasks and milestones since they will vary due to the type of outage and depend on the maturity of the outage processes. These processes vary among utilities and even from plant to plant within the same utility.

The outage personnel, roles, responsibilities, and organization suggested in this report are generic in nature. The selection, training, and experience of key personnel are fundamental to the success of the outage process. The establishment of an effective outage organization requires the buy-in and support of management. Success depends not only on this support, but also on active and enthusiastic participation by all of the stakeholders. The size of an organization may vary, and multiple tasks may fall to the personnel involved. In general, all the responsibilities included in this report must be addressed to some degree during the planning and execution of every outage.

This report is intended to be as all-inclusive as possible and includes many specifics of the outage preparation processes. Therefore, some steps in the outage processes may not apply to every outage. However, the user should be able to use the report to build an outline of an effective outage plan and then add details as required for specific outage requirements. Key human performance points, technical aspects, schedule factors, operations and maintenance (O&M) concerns, and cost control issues are identified. All of the factors represented in this report should be carefully considered before any are eliminated from an outage plan.

If the pre-outage planning process has been completed correctly, the outage execution should be able to be completed on time and under budget. Of course, any outage will have a few glitches, so management techniques that emphasize good communications and the full participation of the stakeholders are required.

Post-outage unit recovery and the follow-up processes, including the discussion of feedback, capturing lessons learned, self-assessment, and vendor critiques, are covered in this report. Metrics are covered in *Outage Effectiveness Measurement Methodology* (EPRI report 1004830).

Finally, the attachments provide examples of documents that may be used as templates for the development of versions that will support the needs for a specific plant or a specific type of outage. These are examples only and should be carefully examined and modified as required to suit the needs of the plant owner. These documents and the processes they support should always be considered as "living"—they should be subject to changes and improvements in order to fit particular requirements and circumstances and as new techniques evolve.

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INTRODUCTION

The successful implementation and continued improvement of outage processes are desirable goals for several reasons. The economic impact of poorly planned and executed outages can be significant. The losses of availability or capacity due to outage extensions or later reworks due to maintenance error must be avoided. Avoidance of these negatives requires the proper planning and execution of every outage. Continued improvement requires the evaluation of outage performance effectiveness (not addressed in this report).

The planning process begins far in advance of the outage and includes all of the budget and resource planning. It anticipates all work activities, inspections, testing and operating data collection, monitoring of equipment performance, corrective actions, cost reports, follow-up reports, retaining and accessing historical data, and the initial planning steps for the next outage. A great deal of attention is paid to the manner and timeliness of achieving goals and objectives so that needed improvements can be identified and implemented. This report provides guidelines that can be used as the methodology and key parameters for planning and implementing a fossil power plant planned outage. In addition, an attachment includes supplementary guidance for planning forced outages.

Metrics are addressed in detail in *Outage Effectiveness Measurement Methodology* (EPRI report 1004830).

Purpose

The purpose of this report is to provide comprehensive guidelines containing the essential elements of outage planning and execution. It provides a basis for a standardized approach to conducting maintenance outages.

This report describes the key program elements, organization, responsibilities, and interfaces required to prepare for and to execute a scheduled plant outage. These guidelines are applicable for planned outages at any type of fossil-fueled power plant and should be followed by any group or individual that may be involved in the outage process.

It is recognized that because of the great diversity of power plant generating missions, varying capacities, availability requirements, staffing levels of site and corporate resources, the levels of reliance on original equipment manufacturers (OEMs) and contractors, the purpose of a particular outage, and a number of other factors, not all of the steps in these guidelines will have equal weight for all users.

However, it is recommended that this report be thoroughly understood before attempting to eliminate activities or to jump to activities not in the logical sequence for most planned outages.

An attachment offers planning guidance to prepare for forced outages and includes information related to risk mitigation for natural and man-made forced outage causes.

These guidelines:

- Establish the organizational structure recommended to manage pre-outage, execution, and post-outage responsibilities
- Assign responsibilities for actions
- Establish pre-outage milestones
- Provide a method of evaluating outage readiness
- Define the baseline requirements for:
  - Identification of scope
  - Work prioritization
  - Management involvement
  - Milestone commitments
  - Execution of major plant projects
  - Execution of major outage corrective tasks
  - Execution of preventive maintenance tasks
- Define the timetable and transition process for the plant and outage organization as the plant begins, executes, and completes the outage
- Define the process for scope development and scope change control
- Define the steps required to close outage tasks and return to service from the outage
- Define the steps required to roll the lessons learned into planning and preparation for the next outage

Successful outages require support from the individual corporate organizations and managers and the participation and commitment of numerous site and off-site organizations through all phases including planning, implementation, and closeout.

The execution of plant outages using high standards is essential for a company to stay competitive and ensures:

- High personnel safety performance
- Improved equipment performance
- Improved operational reliability

- Improved schedule performance
- More efficient outages
- Cost improvements
- Focused teams
- Development of common goals
- Improved sense of ownership

General

Outages require planning and preparation to ensure that activities can be executed in a successful manner. All plant employees and individuals from other organizations, including contractors and vendors, must support and contribute to outage preparations and implementation activities.

Outage planning consists of six phases:

1. Conceptual. This includes any planning that occurs (18 to 30 months before the outage).
2. Preliminary. Refinement of the conceptual plan and the addition of details to projects, work lists, and so on (12 to 18 months prior to the outage).
3. Detailed. Finished activities including the awarding of project contracts with vendors (6 months before the outage).
4. Pre-outage work. This includes the completion of materials requisitions, outage schedules, safety and contingency plans, and other detailed components of the overall execution plan.
5. Outage execution. This involves the actual execution of the work, progress reporting to management, and the preparation needed to return the unit to service.
6. Post-outage. These activities include the final payment of invoices, final reporting to management, and the completion of as-built drawings (normally extending up to 4 months after completion of the outage).

The float in the timing of these phases depend on the nature and complexity of the outage work to be performed.

Because outages are human endeavors, close attention must be paid to proper management techniques for human-behavior-driven *soft skills.* Some soft skills examples are pre-outage milestone adherence, gap analysis (where we are versus where we want to be, and how to get there), scope control, and readiness reviews. Many problems associated with these skills can be overcome through effective communication.

Effective communication is essential for generating the trust, respect, understanding, and teamwork needed to achieve consistently high levels of outage performance. Pre-outage orientations and briefings cover important areas of the outage, particularly the critical path, safety, and environmental issues.

Because the critical path sets the length of the outage, critical path work should always be the top priority. Everyone involved in the outage should know which activities make up the critical path. Periodically, the outage manager will provide an overview of outage planning, scheduling, and monitoring techniques to explain the benefits of and to promote the use of schedules and performance indicators. Personnel at all levels will be involved with job planning and duration estimates to foster schedule ownership. As the trend toward outsourcing outage work continues, it is important to build relationships with contractors that support the development of a sense of job ownership.

Successful outages require the participation and commitment of numerous site and off-site managers and organizations to all phases of outage management including planning, implementation, and closeout. Managers responsible for providing outage support are accountable for meeting their commitments. Dates for specific actions must be set, performance against commitments must be monitored, and progress must be reported to senior management on a regular basis.

Performance monitoring and control is the fact-finding and remedial action process used to facilitate meeting outage plans and goals. Its primary purpose is not to determine what has happened, but rather to predict what may happen if present conditions continue and there are no changes in the progression of the outage. The basis of effective performance monitoring and control is timely and accurate reporting of work progress by the people responsible, as well as the early recognition and reporting of problems or potential problems. It is essential for everyone to recognize that accurate and timely progress reporting is an integral part of successful work performance.

It is also important to recognize that performance monitoring and control should be designed to discover, capture, and measure both qualitatively and quantitatively:

- What things are **going right** and to provide methods for repetition in the future
- What is **going wrong** and to provide methods to avoid those factors and move toward improvement

The planning, scheduling, and execution of work activities before and during outages can have a significant impact on overall risk to generation when the plant is returned to service. As outage processes are optimized and outage durations become shorter, the risks that maintenance and modification work will be done incorrectly or inadequately increases. Controls must be in place to effectively check for and correct these risk factors in order to achieve cost-effective outage success that carries over to the recovery and the smooth operation of the plant when it is returned to service. Outage optimization techniques that help to ensure risk reduction are the subject of continuing research by EPRI.

Key Points

Throughout this guide, key points are summarized in bold lettered boxes that succinctly restate information covered in detail in the surrounding text, making the information easier to locate.

The primary intent of key points is to emphasize information that will allow individuals to take action for the benefit of their plant. The information included in these key points was selected by the EPRI Project Manager, TAG members, and the consultant that prepared this guide.

The key points are organized according to three categories: Operation and Maintenance (O&M) Cost, Technical, and Human Performance. Each category has an identifying icon, as shown below, to draw attention to it when quickly reviewing the guide.

Section 8 contains a listing of all of the key points in each category. The listing restates each key point and provides reference to its location in the body of the report. By reviewing this listing, users of this guide can determine whether they have taken advantage of key information that the writers of the guide believe would benefit their plants.

Key O&M Cost Point

Emphasizes information that will result in reduced purchase, operating, or maintenance costs.

Key Technical Point

Targets information that will lead to improved equipment reliability.

Key Human Performance Point

Denotes information that requires personnel action or consideration in order to prevent injury or damage or ease completion of the task.

These points emphasize the need for special attention that may be required in order to make the outage and the implementation of projects run as smoothly as possible.

2
TERMS AND DEFINITIONS

Activity. A major or significant work item made up of one or more tasks. Activities are identified by predecessors, durations, and successors within a scheduled network.

Communication plan. A plan that sets forth the parameters such as intended audience, subject or topic, planned frequency, and responsible individual for the various types of meetings that will be held during an outage. (See example in Attachment 7)

Computerized maintenance management system (CMMS). A computer software program that has the capability to track work orders for routine, preventive maintenance (PM), and outage maintenance. It will also have the database for planning tasks for weekly and outage schedules. Tasks for tracking time and material also need to be included.

Condition assessments. Documents generated as a result of inspections, testing, and review of previous reports used to determine the required maintenance for a piece of equipment that will ensure continued reliable operation.

Condition-based maintenance (CBM). The set of maintenance tasks performed as a result of evaluation of machine condition, as opposed to PM tasks, which are generally time-based.

Contingency planning. A process whereby potential problems are systematically identified, assessed, and provided for by responsible planning or mitigating actions. The necessity for a contingency plan is based on the impact and probability of a problem occurring.

Critical path. The sequence of activities upon which the overall completion date of the outage is dependent. Delay in the critical path has a direct impact on the schedule of the entire outage.

Emergent outage work. A work item which was unknown prior to the outage, occurs after the outage has commenced, and meets one or more of the following conditions:

- Prevents returning the unit to service if not completed
- Requires a shutdown to perform and is a significant threat to plant availability or capacity factor
- Corrects a condition that violates a regulatory or permitting requirement and for which compensatory action cannot be provided
- Corrects a significant personnel or plant safety concern
- Results in a significant environmental event and/or notice of violation (NOV)

At least one of these bulleted conditions should be included as part of the justification for adding emergent scope to the outage.

Environmental assessment. A review of a project or task that documents any conditions, equipment, or materials that will be used that may have an environmental concern that needs to be addressed prior to any work being started. This will be developed by the implementation manager and outage project leads (OPLs) with input from craft and its management. The assessment will be reviewed and approved by the site environmental manager (see environmental checklist example in Attachment 4).

Execution. Implementation and controlling work during an outage in accordance with the outage schedule.

Fitness for duty (FFD). The ability of a person to perform the task that he or she will be assigned.

Float. Represents the units of time available to an activity before it impacts the critical path. The sequence of activities with the least amount of float (= 0) is the critical path.

Forced outage. An outage that reduces capacity or takes a generating unit or station off-line due to an unexpected event. Pre-planning should be done to respond to this type of outage (see Attachment 13).

Foreign materials exclusion (FME). A plan that addresses the tasks and actions needed to be necessary to ensure that any tools, consumable supplies, debris, junk, trash, or any other foreign material that is used in, generated in, or taken in and out of a piece of equipment is accounted for and removed before the component/unit is placed back in service. It will also include the actions needed to cover or close any openings in equipment so nothing enters that is not accounted for.

Generation Availability Data System (GADS). A database that must be continuously updated by the plants and system operator that tracks the units that are available for generation on an as needed basis. This includes nuclear, fossil, combustion turbine, and hydro units in the system.

Implementation manager (IM). First line supervision on the job that has the direct responsibility for the supervision of the craft assigned to the work that has been scheduled. The implementation manager is often referred to as the craft supervisor.

Initial outage scope. The scope of work that is the base line for the outage. It consists of the basic requirements for the type of outage planned. This may also include the work orders that have been identified and coded for outage required in the CMMS.

Integrated outage schedule (IOS). The overall schedule that includes all aspects of the outage (see Level 3 Plan/Schedule).

Job order (JO). See work order.

Job safety analysis (JSA). A safety plan that includes the identification of all safety hazards that may be encountered on the job and the actions that must be taken in order to prevent injury to workers or equipment. This document must be reviewed and approved by the on-site safety representative.

Laydown plan. The plan that sets forth the steps and locations for the placement, staging, storing, and protecting components and materials that are to be removed, installed, or replaced during outage project work (see example in Attachment 6).

Lessons learned. Information that is reviewed to identify and summarize areas of potential improvement for site management disposition. During the outage, lessons learned can be submitted via hardcopy or by other means deemed appropriate by the outage manager. All valid lessons learned should ultimately be submitted to a point of contact who can enter all information into a lessons learned database so that the information can be retrieved in the future and so that future outage stakeholders and other plants can review the database for information applicable to their outage conduct (see example in Attachment 11).

Level 1 plan/schedule. An overall view of the outage plan, schedule, and key milestones, including shutdown and startup. This schedule provides baseline versus current projection capability and serves as the basis for periodic management reviews. This schedule will show start dates and ending dates for major activities planned for the outage (see example in Attachment 2).

Level 2 plan/schedule. A summarization of outage work activities with sufficient detail to define the critical path and to provide a basis for monitoring and controlling actual versus planned work performance (see example in Attachment 2).

Level 3 plan/schedule. Detailed, logic-based schedules developed for projects or other complex work evolutions in support of summary work activities in the Level 2 schedule. Their purpose is to provide the outage manager, outage project leads and the implementation manager with sufficient understanding of job interrelationships, the requirements of day-to-day management, and the ability to anticipate and avoid potential problems. Detailed schedules are generally developed independently and later merged to form the integrated outage schedule (see example in Attachment 2).

Major outage activities. Activities on the schedule that are the largest in terms of establishing or affecting the critical path, scope, budget, and time required.

Major project. An outage should be considered a major project. It will consist of or include other projects that are defined as major projects, such as any projects that require funding outside the normal outage base. Some of these project examples are fan replacement, boiler replacement, heat exchanger replacement, or other major component replacement, or overhauls such as economizers, reheaters, and air heaters.

Manager outages and projects. A corporate management position with overall responsibility for all outages and projects at fossil fueled plants.

Matrix outage organization. A group of people from several different departments and organizations that work together to accomplish an outage, project, or task.

Milestone. A significant or important event of zero duration that summarizes the start or completion of one or several related activities or decisions (see example list in Attachment 3).

Near critical path. An activity, that if not worked on schedule and within the scheduled duration, has the potential to affect critical path or become critical path itself.

Notice of violation (NOV). A formal document that is issued to a facility when an adverse environmental or safety event has occurred or an issue has been raised or overlooked and not resolved in a timely manner.

Occupational Safety and Health Administration (OSHA). Federal government department tasked with the enforcement of health and safety standards for workers on the job.

Outage backlog. A list of work orders and tasks in CMMS that has been coded for outage and will be included in the scope development.

Outage budget. The amount of money that upper management has approved for the outage based on the approved scope.

Outage challenge meeting. A meeting or series of meetings chaired by the manager of outages and projects that consists of members from different plants and departments that review the outage plan and question the outage team members about the plan to confirm that the outage plan is ready for implementation.

Outage goals. Targets that are established in order to measure outage planning and outage completion successes.

Outage implementers. Members of the outage planning team and others that will implement the outage on the outage start date.

Outage incentive plan. A plan to outline the use of incentives during the planning and execution phases of the outage. The outage manager should work with the plant manager to develop this plan.

Outage manager. The single point of contact (SPOC) for the outage and the person who has overall responsibility.

Outage meeting reports. Summaries of the activities, discussions, issues, and action items from various types of outage meetings. These reports are issued as soon as possible to attendees and other stakeholders to inform everyone about meeting content and outage status (see rules for meetings in Attachment 8 and report example in Attachment 9).

Outage performance monitoring. The continuous interactive appraisal of all phases of an outage. Goals for each planned outage are defined in advance. Performance indicators are established for the purpose of monitoring progress toward meeting these goals and identifying potential problem areas.

Outage project lead (OPL). The single point of accountability or point of contact that represents a specific project or work assignment that is scheduled to be performed during an outage. The outage purpose and the projects involved will dictate the list of OPLs to be assigned. Depending on resource constraints, one person may be assigned as the OPL for several projects.

Outage-/project-/task-specific safety plan. A plan developed for each outage, project, or task which will include and coordinate in-house and contractor safety plans, address the conditions and hazards related to the work with plans to reduce or eliminate hazards, and protect personnel through engineering controls, administrative controls, and/or personal protective equipment.

Outage readiness checklist. The list of all activities that must be completed before commencement of the outage begins to ensure success. This list should be generated for each outage to reflect project work specifically related to a particular outage (see example in Attachment 5).

Outage schedule. A time line showing the tasks, duration, resources required, and other information that are necessary to complete the outage.

Outage scheduler. The point of contact for the outage schedules. Right-hand person to the outage manager for the outage schedules that are developed for.

Outage scope freeze. An action taken at a point determined by the outage manager when the scope of work for the outage is closed. Any additional work that is identified from this point on must go through the scope control measures.

Outage team. A matrix group brought together to plan, execute, implement, and complete an outage.

Performance indicators. Items identified that will be tracked in order to confirm the work is being completed as required. (See milestone and status template examples in Attachment 10).

Performance monitoring and control. The fact-finding and remedial action process used to facilitate meeting outage plans and goals.

Planner. The individual responsible for taking a work order and identifying the tasks, materials, resources, time, and budget required to complete the work order.

Planning. The breakdown of an activity into individual specific tasks. Planning is identifying activities to be completed prior to and during the outage and assigning responsibility for each activity. Planning begins with long-range plans and is defined in greater detail as outage schedules are developed.

Preventive maintenance (PM). Time-based tasks needed to keep a piece of equipment in operating condition. Preventive maintenance also includes higher level tasks such as vibration data collection or other predictive maintenance (PdM) tasks.

Preliminary Level 3 schedule. A draft of the final schedule that shows tasks, resources required, and details of interaction with all other projects. This schedule also includes the schedules from contractors that have been included in the outage plan.

Pre-job briefing. A safety briefing with the work supervisor, crafts, and all other personnel on a particular job or task. Pre-job safety briefings should be held at the beginning of each shift, anytime the scope changes, before any work is done, and anytime something changes from the original scope or schedule for that specific work area or any other project that may have an impact.

Pre-kitting. The identification, collection, and placement of parts, materials, tools, and equipment needed to complete a task. These necessary parts can be placed in the store room, in the warehouse, or on the job site as identified in the laydown plan.

Pre-outage milestone schedule. A schedule developed and used during outage planning to define start dates, activities, and completion dates that are necessary in order to properly prepare for an upcoming outage.

Pre-outage milestones. A list of milestones that is developed for the pre-outage activities. The list is used to ensure progress is tracked during the planning stage of the outage.

Pre-outage plan. A plan developed at the beginning of the planning process that shows the elements needed to complete the outage plan. It includes milestone schedules, meeting schedules, and other information that describes the outage planning process from the assignment of the outage manager to the outage start date.

Pre-outage report. A report issued by the outage manager on the status of the pre-outage plan process (see milestone number 54).

Ready-to-work. An activity status indicating that when work packages are prepared, parts are verified, special permits and clearances are generated, and all other restraints are cleared.

Scheduling. A management tool to direct and control pre-outage and outage activities, workforce, other resources, materials, and outage duration. Accurately prepared schedules communicate management decisions on the scope of work to be performed, acceptable durations for accomplishing scoped activities, and the resources to be applied to accomplish the activities. Schedules also provide management with a means to assess progress by comparing actual performance with planned performance. Scheduling is the positioning of an activity with a specified duration into a time network showing the relationship of that activity to other activities.

Safety assessment. A review of the safety plan developed for a project or outage by someone other than a member of the team that will be performing the work.

Safety guide. A booklet or pamphlet given to outage personnel that recaps safety principles and expectations. This guide may include contact names, numbers, and other emergency information (see example in Attachment 12).

Safety tailgate meeting. A short safety meeting that addresses a specific issue that has been identified and needs to be addressed before work continues.

Scope. The work that has been identified as needing to be done. Additional tasks or rework results in added scope.

Scope control measures. Processes developed by the outage team in order to identify, prioritize, approve, and schedule additional emergent work that is identified during the planning process or while the outage is in progress that may need to be added to the outage plan.

Scope review committee. A committee chaired by the outage manager that reviews the scope as it is developed to ensure that all needed projects are included. As a minimum, the committee will have each OPL as its members.

Shift outage manager (SOM). The outage manager on any particular shift.

Single point of contact (SPOC). A person who is assigned all coordination and execution control responsibilities for a task, group of tasks, or a project. The outage manager is the highest level SPOC for the overall outage.

Task list. The most detailed level of information and work breakdown structure for a project. This is a logically sequenced list of the tools and tasks necessary to actually perform work in a correct and efficient manner.

Shutdown. The task of taking a unit off generation and making it available for maintenance.

Walkdown. The actual physical inspection of a system or component in order to identify all possible work associated with an activity. Walkdowns are necessary to properly plan work.

Work breakdown structure (WBS). A chart used to list tasks for each project that separates tasks and shows the time and resources required to complete. This chart is then used to develop the schedule (see example in Attachment 1).

Work management. A department within the maintenance organization that has the overall responsibility for planning, scheduling, and tracking maintenance activities.

Work order (WO). A document used to identify work that needs to be completed. It is also used as the basis for planning and scheduling.

Work package. The file that contains all the documents including the work order, task list, safety plan, environmental plan, material list, schedule, budget, and resources required to complete the work.

Work request (WR). Also known as a job order (JO) or work order (WO). A document from the work planning and control system or CMMS that tracks work that needs to be completed during the outage.

3
OUTAGE ORGANIZATION

General

A typical pre-outage planning organization chart and an outage implementation organization chart may have the following positions or groups represented. (Note: Depending on the size and purpose of the outage, some organizational charts may have additional or fewer positions.)

- Corporate management
- Plant manager
- Unit manager
- Outages and projects manager
- Outage manager
- Shift outage managers
- Work management manager
- Outage scheduler
- Work management (work orders)
- Work management (planners)
- Safety
- Outage project lead (for each major project):
  - Insulation
  - Scaffolds
  - Cranes and materials handling
  - Turbine
  - Boiler
  - Heat exchangers
  - BOP
  - Others (as required)

- Implementation managers
- Matrixed organizations
  - Training
  - Environmental
  - Cost control/Budget support
  - Administrative support
  - Operations manager
  - Maintenance superintendent
  - Engineering
  - Equipment/System owners
  - IT support
  - Craft
  - Stores
  - Facilities
  - Vendors
- Contractors

The outage organization is staffed by individuals who are matrixed to the outage manager and individuals who serve as organizational representatives (see Figure 3-1).

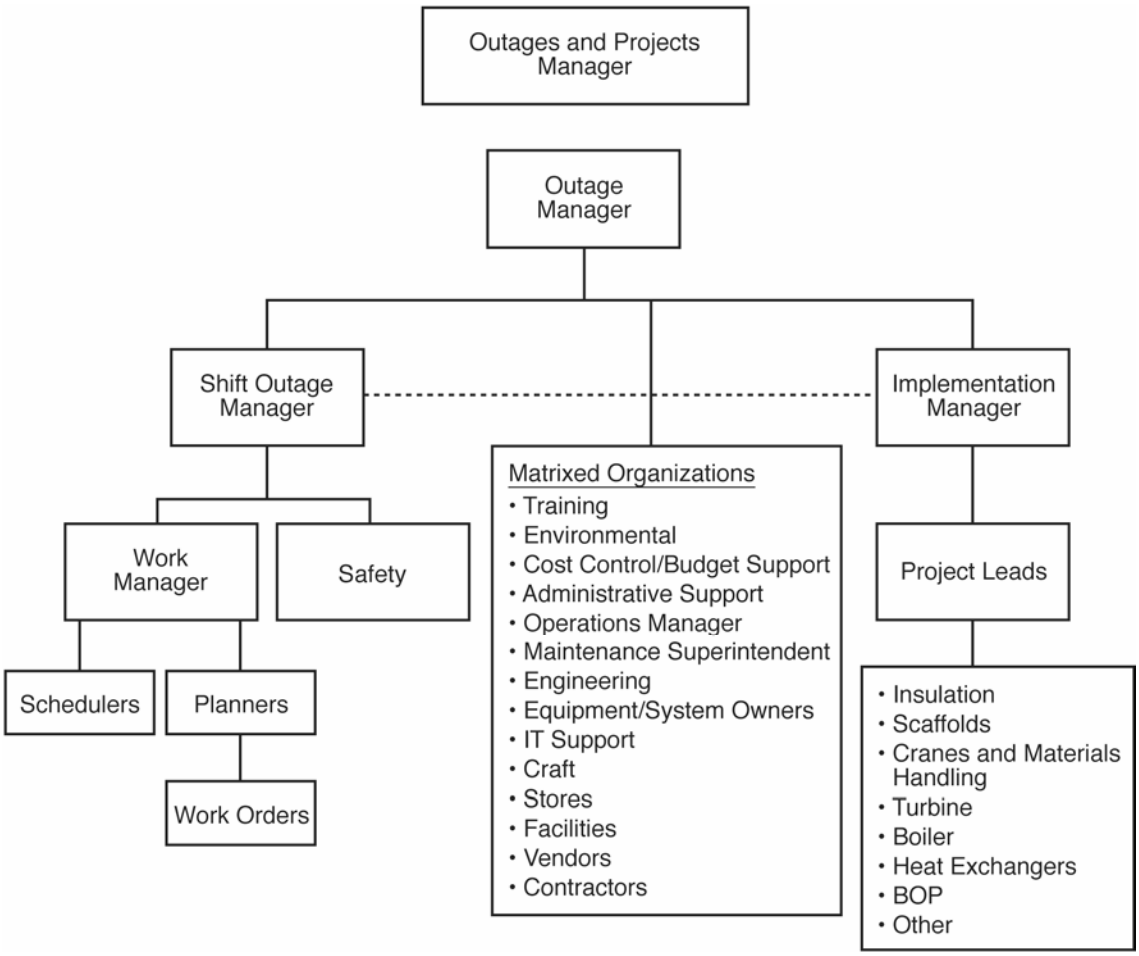


Figure 3-1
Example Outage Organization

4
ROLES AND RESPONSIBILITIES

Common Responsibilities

The common responsibilities for all outage participants are:

- To work safely and ensure that others work safely
- To do the right things, the right way, at the right time
- To perform on time and within budget
- To give feedback and share lessons learned

Corporate Management

The corporate management responsibilities are:

- To provide funding for outages and projects
- To support the outages and projects manager, plant manager, and outage manager
- To develop a company-wide outage schedule and keep it updated.
  - This outage schedule lists the large base load units, the as-needed load units, and the units primarily used for high demand (peaking units). This schedule also shows outage dates through an eight-to-ten-year period. Each year when outages are completed, a new year is added so that all units have rotation of outage dates as required. This schedule must be coordinated with the system dispatcher or system operator so that the needed generation to supply the grid is available. A lack of coordination may have significant economic impact, especially for independent operators, co-generators, and peaking units.

Plant Manager

The plant manager's responsibilities are:

- To approve the outage scope, including the emergent scope, which will increase outage duration or will have a significant budget impact.
- To approve pre-outage milestones and the pre-outage schedule
- To approve outage goals
- To approve the final outage schedule
- To approve the final outage budget

Unit Manager

The unit manager's responsibilities are:

- To remain responsible for the performance of the respective unit
- To ensure that the outage planning activities are top priority
- To ensure that the outage planning commitments are satisfied

Outages and Projects Manager

The outages and projects manager's responsibilities are:

- To ensure that guidelines are followed for applicable outages
- To assign outage managers to outages
- To assign project managers and implementation managers for major project work
- To partner with plant managers as necessary to support an aligned matrix outage organization
- To chair the outage challenge meetings
- To review and concur with outage goals, schedules, and budgets
- To maintain outage guidelines based on management expectations, previous experience, lessons learned, self-assessments, and other changing requirements
- To periodically meet with the plant manager to ensure consistency concerning the usage of outage guidelines and incentives

Outage Manager

The outage manager responsibilities are:

- To establish an outage organization structure to meet the specific needs of the outage
  - Individuals reporting to the outage manager will staff the matrix outage organization.
- To hold the decision-making authority to control all outage activities including planning, execution, and closeout
- To resolve individual priorities relative to outage work, except for questions of plant or personnel safety
- To establish specific responsibilities and expectations for each outage team member on the outage organization chart

The following items may need to be supplemented or reduced depending on the outage scope and schedule.

Pre-Outage Responsibilities

An outage manager's pre-outage responsibilities are:

- To prepare the pre-outage plan, including specific pre-outage milestones
- To conduct pre-outage planning meetings
- To maintain and revise outage procedures based on management expectations, previous experience, lessons learned, self assessments, and other changing requirements
- To monitor milestone progress
- To coordinate with the outage scheduler to ensure that the schedule is developed to support other planning activities
- To prepare and present outage goals
- To develop the matrix outage organization consisting of assigned matrix resources from appropriate organizations
- To coordinate the identification of the initial outage scope and scope control measures once the outage scope freeze is in place
- To review lessons learned and self-assessment items for incorporation into outage plans
- To establish meeting schedules and conduct routine schedule performance reviews
- To manage overall preparation activities and performance concerning the pre-outage plan and to initiate corrective actions
- To provide management with periodic reports/briefings on the outage preparation progress
- To prepare the pre-outage report
- To assign additional pre-outage activities to the responsible organizations as required
- To evaluate overall resource requirements and individual organization, including staffing plans for shift coverage
- To validate that all necessary budgets, contracts, and other supporting functions are available
- To conduct formal schedule reviews, both horizontal (start to finish) and vertical (daily/hourly) for possible conflicts during a specific time frame or for resources
- To review and revise contingency plans

During Outage Responsibilities

An outage manager's responsibilities during an outage are:

- To direct the outage on a day-to-day basis
- To review the status of major outage activities, including critical path jobs

- To assist with notification/communications between work groups in order to facilitate progress
- To resolve outage conflicts and priority questions
- To anticipate problems and take actions in order to keep the outage on or ahead of schedule and within budget limitations
- To review and approve schedule changes and contingency plan revisions
- To review and approve outage status and financial reports
- To recommend outage major scope changes to the plant manager for approval
- To provide briefings on the outage status to management

Post-Outage Responsibilities

An outage manager's post-outage responsibilities are:

- To accumulate, organize, disseminate and prepare archives for retention of information on lessons learned in the lessons learned database
- To verify the completeness and retention of all as-found/as-built/as-left information
- To prepare a final outage report

Shift Outage Manager

The shift manager's responsibilities are:

- To be organizationally subordinate and accountable to the outage manager
- To assume all duties of the outage manager on night shift, back shift, or other time periods as required
- To be responsible for completion of all tasks and administrative details during his period of duty

Work Management Manager

- To ensure that adequate planning and scheduling resources are available to support the outage
- To ensure that continuing work on operating units is adequately supported
- To ensure that all feedback and lessons learned are loaded into the appropriate work management archives, communicated to plant personnel, and disseminated to others in the company

Outage Scheduler

The outage scheduler's responsibilities are:

- To interface with outage implementers in the development and analysis of the outage schedule
- To identify and include clearance, post-maintenance testing, and startup testing into the outage schedule
- To manage and update the following schedule information:
  - Critical path
  - Integrated project schedules
  - Resource loaded schedules
- To establish baseline data and processes in order to track the trending and performance monitoring information
- To ensure that all special testing and inspections are reviewed and incorporated into the outage sequence

Work Management – Planners

This position's responsibilities are:

- To plan work orders and ensure that the appropriate safety information is included along with other technical information needed to perform the task
- To identify the parts needed and to reserve a work order

Work Management – Work Orders

This position's responsibilities are:

- To provide information to each planner and OPL on preventive maintenance activities in the work order system that need to be included in the outage or project scope
- To provide information on all work orders coded for outage required in the work order system
- To coordinate all emergent work orders that are requested during the outage planning process and during the outage that may need to be added to the outage plan
- To work closely with OPLs to ensure that all work orders are properly closed after the work is completed

Outage Project Lead

Pre-Outage Responsibilities

The outage project lead's pre-outage responsibilities are:

- To attend pre-outage meetings or designates a representative to attend
- To ensure that all work orders are planned for the scope of work by the specified due date or schedule milestone and that health, safety, training, and environmental issues are addressed in each work request or job order
- To identify all support services required and to initiate a work request to support the activity
- To obtain all contracts and purchase orders or authorizations associated with the assigned work
- To recommend and order all spare parts, supplies, and expendables required for the assigned work
- To review schedules in order to ensure accuracy, efficiency, and commitment
- To develop contingency plans for potential problems having a 25% or greater probability of occurring and to indicate the cost and schedule impact to the overall outage
- To determine and/or co-ordinate material or contract contingencies to support contingency plan if justified and approved by the plant and/or outage manager

During Outage Responsibilities

The outage project lead's responsibilities during an outage are:

- To maintain overall responsibility for the daily management of assigned work activities
- To ensure that the schedule is maintained on a daily basis and that the schedule is adhered to:
  - Schedule adherence means that deviations from the schedule are communicated daily to the scheduling personnel and that schedule logic or other appropriate modifications are made accordingly
- To communicate job/schedule status and critical issues to the outage manager and shift outage manager(s) on a daily basis
- To report progress to the outage scheduler
- To provide a plan of the day/week to appropriate levels of outage management and the project lead for the assigned project
- To serve as the designated representative for all contracts associated with an assigned block of work

- To ensure that all personnel have an awareness for compliance with FME, FFD, OSHA, safety, and environmental issues for their assigned work
- To monitor cost versus budget (on a weekly basis) using a spreadsheet or other appropriate cost tracking tools
- To ensure that shift turnover lists are developed jointly by the appropriate lead personnel or supervisors and that they support the outage plan for their assigned work
- To be responsible for the disposition of technical recommendations from plant or vendor technical personnel for their assigned work
- To coordinate field and/or shop repairs of equipment required to support work scope in order to maintain the schedule for assigned work
- To provide support to the project manager or outage management in providing recommendations concerning emergent work scope, cost, and schedule impact for their assigned work
- To provide daily on-site direction of assigned work in order to achieve milestone activities
- To ensure that work released to a repair vendor/contractor has a well-defined scope document along with acceptance criteria prior to the release of work
  - Any detailed specification referenced in the work scope should be attached to the release, delivered in hard copy, or communicated in a mutually agreed upon manner to the vendor/contractor.
- To ensure that the repair vendor cost and schedule are monitored while the work is being performed
- To ensure that work orders are closed out as the work is completed

Post-Outage Responsibilities

The outage project lead's post-outage responsibilities are:

- To ensure that demobilization and job site cleanup are performed as planned and within schedule and budget
- To provide a report summary and recommendations to the outage manager within a specified time period (no more than two weeks is suggested) after unit startup
- To perform outage critique within a specified time period (no more than three weeks is suggested) after startup to ensure strengths, opportunities, and lessons learned are captured
- To attend a post-outage meeting with the plant within a specified time period (30 days is suggested) after unit startup
- To transmit a final report to the outage manager or project manager within a specified time period (no more than six weeks is suggested) after unit startup. This report should include the appropriate information in detail regarding work performed, vendor reports, a summary, a

detailed cost report, recommendations, and any other information required by management or that would result in improvements to future outages

  - The final outage cost report should include:
    - Cost summary as previously shown in the weekly reports
    - Work-hours and cost report for each component/equipment overhauled

- To ensure that there is appropriate technical justification (words, photos, and sketches) for all recommendations in the report

Implementation Manager

The implementation manager's responsibilities are:

- To attend pre-outage planning meetings as required by the OPL
- To review schedules in order to ensure accuracy, efficiency, and commitments
- To have overall responsibility for the daily supervision of assigned work crews
- To communicate job/schedule status and critical issues to the OPL on a daily basis
- To lead job safety briefings as required
- To report resources and time on a daily basis to the OPL for tracking project cost

Safety

This position's responsibilities are:

- To review work scope and safety assessments and to work with the OPLs in order to identify potential safety issues
- To participate in schedule reviews in order to identify activities that pose safety hazards
- To mobilize sufficient personnel in order to provide safety oversight during the outage execution by working with the outage manager to determine the level of technical safety support, funding for needed support, and if needed, the identification of external resources that may provide this support
- To provide assistance in reviewing contractor safety programs or procedures
- To provide assistance in completing requisite reports for accidents, injuries, investigations, and so on
- To provide input to outage lessons learned and self assessments in order to ensure that best practices regarding safety issues are identified for future outages
- To resolve questions and concerns related to safety in the performance of outage tasks
- To provide topics of special interest for pre-job briefings and safety tailgate meetings

Training Coordinator

The training coordinator's responsibilities are:

- To review training records of in-house and contractor personnel for the current status of safety and task performance training and qualifications required, including legally mandated and corporate requirements
- To develop a training required list, including a skills test and verification
- To coordinate with the safety coordinator, engineering, plant operations and maintenance management, contractor and vendor representatives, and outage planners and schedulers in order to deliver required training in a timely manner
- To obtain training materials required
- To review training materials as required
- To assess the quality of training as delivered
- To assess the skills of trainees
- To arrange for supplemental training if required for emergent work
- To document training and to maintain training records
- To participate in outage critiques and feedback processes

Environmental

This position's responsibilities are:

- To review the work scope, environmental assessments, and to identify environmental issues with individual OPLs
- To participate in schedule reviews to identify activities which pose environmental hazards
- To mobilize sufficient personnel in order to provide environmental oversight during outage execution
- To provide assistance in reviewing contractor environmental programs or procedures
- To provide assistance in completing requisite reports for environmental events
- To provide input to outage lessons learned and self assessments in order to ensure best practices regarding environmental issues are identified for future outages

Cost Control/Budget Support

Cost control/budget support's responsibilities are:

- To assist the outage manager and OPLs with budget development
- To assist the outage manager and OPLs with cash flow projections
- To provide cost reports to the outage team as directed by outage manager

Administrative Support

Administrative support's responsibilities are:

- To assist the outage manager with scheduling meetings
- To maintain action items and minutes for pre-outage meetings
- To assist the outage manager during the outage with other administrative needs

Operations Manager

The operations manager's responsibilities include:

- To provide support for the development of the outage schedule
- To develop a staffing plan and a strategy for the preparation of clearances and the development of a clearance plan to facilitate the orderly issuing and releasing of clearances during outage execution
- To provide adequate manpower in order to meet operations outage commitments
- To develop outage clearances
- To prepare unit shutdown and startup plans
- To review the integrated outage schedule to ensure the inclusion of:
  - Specific operational evolutions
  - Special testing and inspections
  - Systems to service sequence return

Maintenance Superintendent

The maintenance superintendent's responsibilities include:

- To identify the potential outage scope to the outage manager for review
- To develop a laydown map and a plan to reserve space for outage activities
- To coordinate with plant maintenance planners in order to ensure that outage work orders are planned to support pre-outage milestones
- To ensure that maintenance personnel reviews work orders to support pre-outage milestones
- To review the outage schedules in order to identify activities that need to be resequenced or have high risk based on equipment history, performance, or other industry data
- To assign individuals for outage positions and provide adequate support and manpower in order to meet maintenance's outage commitments

Engineering

Support from engineering may be needed for several individual tasks and/or projects during the planning of the outage and during the outage. These include mechanical, electrical, instrumentation and control, civil, and others such as environmental. Some organizations have engineers assigned at each plant while others have a central engineering department or contract the work. To supply the support needed for the outage planning process and the outage and without having to assign several engineers to the outage team, a single engineer may be assigned to the outage team to act as a single point of contact for all engineering concerns before, during, and for a short period after the outage. This engineer should have the authority to contact any other engineers, either in-house or contract, who have the expertise that is needed at the time.

Engineering's responsibilities are:

- To attend all outage planning meetings
- To be the single point of contact for all engineering request from outage team members
- To track the resources needed and to budget for engineering support

IT Support

IT support's responsibilities are:

- To provide support for network, computer, and software applications as required during all stages of the outage planning, execution, and recovery
- To support the planning process

Craft

Craft's responsibilities are:

- To provide input during the planning stage on job scope, skills required, training required, resource issues, potential conflicts, and improved methods for task performance
- To provide trained and skilled personnel with the appropriate qualifications for the tasks required
- To provide input to planners on parts, equipment, tools, and consumables required for tasks
- To prepare bundled work materials (pre-kitting)
- To keep accurate records of as-found and as-left component conditions
- To make appropriate entries into the outage management tracking and CMMS systems in a timely manner as required
- To provide useful critiques, lessons learned, feedback, and follow-up reports in a timely manner

Stores

This position's responsibilities are:

- To ensure that the appropriate reserved material is ordered and received in order to meet milestones
- To stock pre-kits material identified by the OPL or implementers
- To provide the status of contracts to the outage manager and to ensure pre-outage milestones are met

Facilities

- One of the OPLs should be designated to be responsible for the following facilities concerns:
  - Area management
  - Housekeeping
  - Sanitation
  - Aid with FME
  - Storage and retrieval of tools, parts, and supplies

Vendors

Vendor's responsibilities are:

- To participate in all phases of the outage planning, execution, and recovery
- To provide input on component maintenance and modifications during the planning process
- To complete the required training
- To provide trained resources for tasks as required
- To provide parts, equipment, and supplies including consumables and specialty items as required
- To work to achieve task completion on time and within budget
- To provide feedback and lessons learned as required

Contractors

Contractors' responsibilities include:

- To participate in all phases of the outage planning, execution and recovery
- To submit information for background checks, if required

- To accomplish required training
- To provide trained resources for tasks as required
- To work to achieve task completion on time and within budget
- To provide feedback and lessons learned as required

Key Human Performance Point

The security of company facilities needs to be considered as part of routine outage preparations. There is always some risk that inadequate screening would allow persons with ill intent to enter the site and commit acts of sabotage that would delay plant restart, cause plant shutdown later on, or put plant or public safety at risk.

To reduce these risks, a personnel screening process should be developed and implemented.

There are also risks from natural disasters or unforeseen accidents that need to be considered in a risk mitigation plan.

5
OUTAGE PREPARATION

Pre-Outage Planning

"Plan the work, then work the plan."

Every outage plan and schedule should be developed in accordance with the objectives established by work management.

The following are standing objectives which may be amended for specific outages.

- As much work as possible should be performed while the plant is on line to help limit planned outage duration
- Outages will be performed in as short a time as possible without sacrificing environmental or personnel safety
- Outages will be performed in as short a time as possible without sacrificing equipment availability and reliability
- Lessons learned from outage critiques and a thorough review of industry experience should be incorporated into future outage plans
- Emergent work must be carefully screened to ensure it should be started during the outage. Otherwise, the work should be delayed until after the outage

Pre-outage planning activities must be completed in order to be properly prepared to enter an outage. The plan identifies milestone activities and detailed sequences that allow individual organizations to understand plant management's expectations. These plans also provide a base line to measure the timely completion of these activities. The plan is developed and planned around milestone completion dates.

Outage planning is a continual evolution involving not only the next scheduled outage but all scheduled future outages as well. Long-range planning often begins as much as 36 months before the planned start of the outage and is a process of increasingly detailed scope definition, work planning, estimating, and scheduling driven by the pre-outage milestone schedule.

The pre-outage planning process establishes the planning milestones and the responsibilities required to accomplish these milestones. In order to ensure that planning is progressing as required, the status of all milestone activities is monitored and evaluated by outage management. Outage management then compiles the status updates and prepares periodic reports for corporate and plant management.

The outage manager will review the status of milestone completion and approve milestone closure when satisfactory progress toward the milestone activity is adequate in order to meet the intent of the milestone (he may elect to close the milestone and track any remaining activities through other means).

The outage manager approves all milestone due date changes (the entire outage team will be made aware of the due date change and its potential impact prior to making the change).

The outage manager also provides final approval on all decisions and questions involving pre-outage milestones, documents milestone closures, and retains these documents for reference.

Meetings are held in order to brief management on overall outage preparation, identify potential problems, and identify the appropriate corrective action. The frequency and duration of these meetings are determined by the outage manager.

The following sections list the pre-outage milestones for a typical outage. The outage manager, in preparing a specific plan for an assigned outage, uses these milestones as a reference. This plan includes those items needed to prepare for the outage and ensures that the milestones are appropriate for the specific scope of work for the current outage. The following sections also cover the outage and outage closeout. Additional milestones are listed that must be included in the overall outage plan.

Pre-Outage Milestones

NOTE: The time preceding the outage and the exact sequence necessary for effective implementation of the following steps will vary depending on the type of outage and the needs of the plant and are therefore left to the discretion and best judgment of the user. Many of these steps require only a brief action to complete. Many of these steps may seem intuitive or unnecessary; however, it is recommended that the user fully consider and comprehend the possible implications of eliminating or ignoring steps when setting up an outage plan.

Key Human Performance Point

Steps related to safety, environmental, or regulatory requirements must never be eliminated or ignored.

1. **Assign outage manager.** The outages and projects manager assigns an outage manager to an outage and notifies the plant manager.
   - Approximate due date: As far in advance as required, generally 18 to 60 months prior to outage start
   - Responsibility: Outages and projects manager
   - Satisfied by: This milestone has been met when the plant manager and the outage manager have been notified, via memo, by the outages and projects manager.
   - Allowed lead time depends on outage scope

2. **Cost information.** The outage manager confirms the amount that has been budgeted for the outage.
   - Approximate due date: 16 months prior to outage start
   - Responsibility: Outages and projects manager
   - Satisfied by: This milestone has been met when the outage manager has been notified, via memo, by cost control/budget support.
3. **Assign outage scheduler.** The outages and projects manager assigns a scheduler to the outage. Input from the outage manager on this selection is recommended.
   - Approximate due date: 14–16 months prior to outage start
   - Responsibility: Outages and projects manager
   - Satisfied by: This milestone has been met when the outage manager has been notified, via memo, by the outages and projects manager.
4. **Review previous outage reports/assessments.** The outage manager reviews previous outage reports and assessments and determines if action is needed to modify or add additional scope to outage. This item requires a review of the budget limitations.
   - Approximate due date: 14–16 months prior to outage start
   - Responsibility: Outage manager
   - Satisfied by: This milestone has been met when a list of scope to be included in the outage plan has been created.
5. **Issue draft pre-outage milestone schedule.** The pre-outage milestone schedule is issued for comment. The schedule implementation is a site-wide endeavor, and each work group will review the schedule and resolve any concerns.
   - Approximate due date: 14–16 months prior to outage start
   - Responsibility: Outage manager
   - Satisfied by: This milestone has been met when the outage manager issues the preliminary pre-outage milestone schedule for review.
6. **Issue outage improvement plan.** The outage manager issues the outage improvement plan, noting the specific action needed.
   - Approximate due date: 14 months prior to outage start
   - Responsibility: Outage manager
   - Satisfied by: This milestone has been met when the outage manager distributes a memo to outage team members.

7. **Issue approved pre-outage milestone schedule.** Comments from the review of the pre-outage milestone schedule have been resolved. The schedule has been approved by the work management manager.
   - Approximate due date: 14 months prior to outage start
   - Responsibility: Outage manager
   - Satisfied by: This milestone has been met when the outage manager distributes the approved schedule to plant management.
8. **Begin pre-outage meetings and establish meeting schedule.** Outage planning meetings, which are attended by organizational outage representatives, begin and a meeting schedule is distributed.

   The outage manager will establish meeting times, locations, and durations. Pre-outage meetings are intended to provide a status of overall planning activities, to communicate needs, and to solicit input from others. Typical outage meetings last 1 hour or less. As problem areas are identified, individuals are assigned to resolve each item. An action item list is maintained for tracking unresolved items. If necessary, additional meetings may be required with individual project teams or groups of teams in order to resolve issues that may not require the whole outage planning team to attend.
   - Approximate due date: 14 months prior to outage start
   - Responsibility: Outage manager
   - Satisfied by: This milestone has been met when the first outage meeting is completed and a meeting schedule listing the time and location for future meetings has been distributed to the outage core team members by the outage manager.

Key Human Performance Point

As the meeting progresses, action items should be identified and assigned for action, and an expected completion date and time should be defined. The action items should be reviewed at the end of the meeting. Each person assigned an action item is held accountable to ensure that the action item is accomplished correctly and in a timely manner (see Rules for Meetings, Attachment 8).

9. **Pre-outage planning organization.** The outage core team members are identified early in the planning process. The plant manager, the manager – outages and projects, and the outage manager jointly identify these team members. These assignments should include the OPLs, operations, support organizations, safety, and environmental representatives.
   - Approximate due date: 14 months prior to outage start
   - Responsibility: Outage manager
   - Satisfied by: This milestone has been met when a memo identifying the outage core team members has been distributed from the outage manager to the work management manager.

Key Human Performance Point

The core team must consist of people who:

- Have knowledge and experience relevant to the outage projects
- Are fully engaged in the processes of the outage and the projects
- Are able to meet expectations for accomplishing the task delegated to them

10. **Issue preliminary list of projects for the outage.** All major projects for the outage have been identified. This list is composed of items from a prioritized list and from emergent work items that have been recently identified. The projects have been approved by the plant manager.
    - Approximate due date: 12 months prior to outage start
    - Responsibility: Outage manager
    - Satisfied by: This milestone has been met when the outage manager distributes a list of approved modifications and projects.
11. **Shared resource requirements.** These requirements are communicated to peer groups/providing organizations. Outage Project Leads (OPLs) provide information on shared resources that may be needed for outage.
    - Approximate due date: 12 months prior to outage start
    - Responsibility: OPLs
    - Satisfied by: This milestone has been met when the OPLs distribute a memo to the shared resources manager and the outage manager.
12. **Long lead time parts.** OPLs issue a list of parts needed for the outage that have long lead times to stores.
    - Approximate due date: 12 months prior to outage start
    - Responsibility: OPLs
    - Satisfied by: This milestone has been met when the OPLs distribute a memo to the stores and the outage manager identifying the parts needed.

    Qualified suppliers and shops are becoming harder to find, and those that remain are often overwhelmed with orders. In addition, materials are often difficult to obtain. As a result of these and other factors, lead times are increasing.
13. **Initial work scope identified.** A key element to completing a successful outage is to identify scope to accomplish the objectives of ensuring the right work is completed for ensuring the safety and the reliability of the unit while maintaining outage durations in accordance with the business plan. Maintaining plant safety and reliability should always be the primary objective.

The following steps should be followed for the scope identification process:

- Ensure completion of all work orders from the last outage
- Generate work orders for all outage PM tasks
- Review master work orders for applicability and completeness
- Collect input on required work from managers, engineering, operations, maintenance, and other stakeholders
- Identify required versus elective tasks
- Review the scope list with the outage team and stakeholders and refine as necessary
- Have a scope control process
- Enforce the scope control process and measure the effectiveness of scope control (include late additions, emergent work, and missed items)

The outage manager will request at least one representative from plant operations, plant mechanical maintenance, plant electrical maintenance, major projects, technical support services (client manager), turbine generator services, and environmental performance to be named to assist in reviewing various documents and reports including condition assessments, outage backlog, outage related preventive maintenance, component testing, and others as required.

- Approximate due date: 10 months prior to outage
- Responsibility: Outage manager
- Satisfied by: This milestone is met when a memo identifying the members of the scope committee is distributed to the plant manager from the outage manager.

14. **Outside services with designated representative identified to contract services.** Identify contractor needs to contract services for the evaluation of contract status and/or contract development. The intent is that all outage needs that involve contractual activities be identified to the contract services group in order to allow adequate time for contract development.
    - Approximate due date: 10 months prior to outage start
    - Responsibility: OPLs
    - Satisfied by: This milestone has been met when the OPLs have distributed a memo to contract services and the outage manager identifying the contract needs.
15. **Firm price contracting.** Projects that are to be firm (or fixed) in price are identified and communicated to contract services.
    - Approximate due date: 9 months prior to outage start
    - Responsibility: OPLs
    - Satisfied by: This milestone has been met when the OPLs distribute a memo to contract services and the outage manager.

16. **Issue summary schedule (Level 1).** This schedule will define the outage duration, anticipated critical path sequence, and maximum availability of plant systems for outage work.
    - Approximate due date: 8 months prior to outage start
    - Responsibility: Planning and scheduling supervisor
    - Satisfied by: The milestone has been met when the planning and scheduling supervisor distributes the Level 1 outage schedule to plant management.

Key Technical Point

Outage work is scheduled through a hierarchical system of interrelated schedules starting with the outage Level 1 schedule down through to the detailed daily work schedule. The different schedule levels are provided in order to accommodate the varying needs of users and management through a hierarchical system of reports. Strict linkage is maintained between all schedule levels to ensure accuracy and consistency.

17. **Outage goals identified [10].** Define potential outage goals and distribute to site. Outage goals will not be quantified until later in the planning process.
    - Approximate due date: 6 months prior to outage start
    - Responsibility: Work management manager
    - Satisfied by: This milestone has been met when the work management manager distributes a memo describing the plant distribution and the transmission of potential outage goals to the outage manager.
    - Areas of consideration:
        - Specific goals and objectives should be established for planned outages to ensure outage management effectiveness.
        - The following areas will be considered when developing outage goals:
            - Outage duration
            - Schedule adherence
            - Safety significant events
            - Percentage completion of planned activities
            - Percentage emergent work
            - Reportable injuries
            - Solid waste volume generated
            - Plant systems/equipment performance (post-outage)
            - Budget

Goal Development

The outage manager has the overall responsibility for the development and maintenance of outage goals and objectives for the plant. The following guidance should be considered when developing outage goals.

- Company goals and objectives for planned outages will be incorporated when developing plant-specific outage goals.
- Input on goal development, along with required actions, will be obtained from responsible managers that support outage execution.
- Goals should be developed that are achievable and controllable, can be supported by affected organizations, and can be monitored effectively.
- The approval of outage goals and objectives will be obtained from the work management manager.
- Outage goals will be communicated to appropriate site and support personnel. Communication methods may include posting, written memoranda, email, a web site, distributed telephone messages, distributed hard copies of special notices, instructions or forms, and briefings.

Key Human Performance Point

A universally accessible outage web site on the plant's local network is helpful for updating outage participants and management on status and to allow active feedback on outage issues and lessons learned.

18. **Issue final list of projects for the outage.** All major projects for the outage have been identified. This list is composed of items from a prioritized list and from emergent work items recently identified. The projects have been approved by the plant manager. Any changes to the list after the freeze date will require approval through the outage scope change process.
    - Approximate due date: 8 months prior to outage start
    - Responsibility: Outage manager
    - Satisfied by: This milestone has been met when the outage manager distributes a list of approved modifications and projects.

Key Technical Point

A work breakdown structure (WBS) is the best way to develop the list of projects for the outage. Using task identification, requirements for each step can be identified, resources can be estimated, and the time required can be listed. See Attachment 1.

19. **Begin scope review.** The scope review committee starts the scope review process and develops a scope document that will serve as the basis for detailed planning and scheduling.

- Each member will ensure that a complete and accurate scope for their area of responsibility, based upon condition assessments and reviews of outage backlog, is in the scope document.
- Considerations in developing task lists include the following:
  - Identification of additional support needs, conflicting activities, and overall resource requirements
  - Identification of high-risk evolutions and their associated safety/environmental impact
  - When overall resource requirements are identified (including physical resources, such as cranes and test equipment), the schedule is optimized in order to obtain the shortest duration with the most efficient and effective use of available resources
- Approximate due date: 8 months prior to outage start
- Responsibility: Outage manager
- Satisfied by: This milestone has been met when the first scope review meeting has been completed and a schedule has been distributed to the scope committee to enable the completion of the scope review.

Key Technical Point

Task lists are an effective means of developing and monitoring detailed work plans at the functional (or performing organization) level without overloading the outage schedule with excessive detail. Task lists have two basic uses:

- They provide a list of work items or specific actions to be performed within a given period of time.
- They provide a list of work items or specific actions that are not constrained to performance within a given window of opportunity, but are prerequisites to key events in the schedule.

20. **Begin schedule development meetings.** Meetings to develop the outage schedule, on a project and/or block basis, have started. Initial reviews of outage plans and schedules occur during the schedule development meetings. Each preliminary plan is jointly reviewed by supervision/management of the functional areas responsible for accomplishing the work. The intent of this review is to:
    - Ensure that supervision/management is aware of the scope of work and any potential problem areas
    - Ensure that work of appropriate priority is included in the plan and schedule

- Obtain commitment of resources to accomplish the planned work
- Obtain agreement/commitment for the execution of assigned work in accordance with the plan and schedule

The integrated outage schedule is reviewed, agreed on, and committed to by the functional area managers responsible for the physical accomplishment prior to its submittal to plant management for approval. This includes on-site and off-site utility organizations, as well as contractors.

- Approximate due date: 8 months prior to outage start
- Responsibility: Outage scheduler
- Satisfied by: This milestone has been met when the first schedule development meeting has been completed, a meeting schedule has been distributed to the appropriate participants, and the outage manager is satisfied that the meeting objectives will be met.

21. **Freeze on program revisions that may affect outage planning and completion.** Outage manager and plant manager agree to the freeze to any revisions in procedures or schedules that may affect the outage schedule or budget.
    - Approximate due date: 6 months prior to outage start
    - Responsibility: Outage manager
    - Satisfied by: This milestone has been met when the outage manager informs the outage team of the freeze.
22. **Begin clearance preparation.** The preparation of outage clearances has started. This plan will include the following elements:
    - Identifying all clearances required
    - Placing operations staffing for clearance
    - Planning and scheduling for placing clearances
    - Considering any requirements for testing during outage
    - Approximate due date: 6 months prior to outage start
    - Responsibility: Operations superintendent
    - Satisfied by: This milestone has been met by the actual start of outage clearance preparation. The operations superintendent will notify the outage manager that the milestone has been met.

Key Human Performance Point

Clearances must be prepared, reviewed, and put in place far enough in advance in order to ensure that the appropriate paperwork can be completed in advance and any licenses or inspections can be planned and arranged. This may be particularly important for environmental issues such as asbestos, PCB, and waste disposal.

23. **Outage lessons learned reviewed.** Outage lessons learned from previous outages have been reviewed and incorporated into the current outage plans as deemed appropriate. Applicable lessons learned requiring further investigation or analysis will be tracked as an action item requiring resolution prior to outage commencement.
    - Approximate due date: 6 months prior to outage start
    - Responsibility: Outage manager
    - Satisfied by: This milestone has been met when the outage manager completes a review of the lessons learned with the outage team and has assigned the action items as needed.
24. **Scope control process in effect.** All aspects of the corrective and preventive outage scope have been identified. The scope has been approved by the plant manager. Any change in the outage scope after the scope freeze date requires approval through the post-freeze date scope control process as directed by the outage manager.
    - Approximate due date: 6 months prior to outage start
    - Responsibility: Outage manager
    - Satisfied by: This milestone has been met when the outage manager and the scope review committee have completed the scope review process and the scope document has been made available to the plant for review and comment.
25. **Input for lay down plan.** OPLs provide the support of any laydown and temporary storage and retrieval areas needed for material, and equipment needed for the outage. This includes ground level and deck areas. Planning for this also needs to include materials handling requirements for lifts, moves, interference removal, and safety.
    - Approximate due date: 6 months prior to outage start
    - Responsibility: OPLs
    - Satisfied by: This milestone has been met when the OPLs distributes a memo to OPL support and the outage manager.
26. **Input for pre-outage schedule.** OPLs inform outage scheduler of any work that needs to be completed before the outage starts.
    - Approximate due date: 6 months prior to outage start
    - Responsibility: OPLs
    - Satisfied by: This milestone has been met when the OPLs distribute a memo to the outage manager and the scheduler
27. **Contract requisitions submitted.** The contracts needed for the outage work have been identified to contract services. The requisitions (fully developed scope with contract requisition) have been prepared and are in the queue for approval.
    - Approximate due date: 8–16 months prior to outage start
    - Responsibility: OPLs
    - Satisfied by: This milestone has been met when the OPLs distribute a memo to the outage manager.

28. **Issue initial laydown plan.** OPL support issues a copy of the laydown plan for review by project teams.
    - Approximate due date: 5 months prior to outage start
    - Responsibility: OPLs
    - Satisfied by: This milestone has been met when the OPLs distribute a memo to the outage manager stating that plan has been issued.
29. **Contract requisitions approved.** Contract requisitions have been approved by on-site management.
    - Approximate due date: 5 months prior to outage start
    - Responsibility: OPLs
    - Satisfied by: This milestone has been met when the OPLs notify the outage manager, via memo, when the contract requisitions submitted for approval in response to the contract requisitions submitted activity have been approved by on-site management.
30. **Issue preliminary outage Level 2 schedule.** The outage scheduler issues the outage Level 2 schedule for review with project teams.
    - Level 2 schedule components include the following:
        - All hard-logic activities required for plant and system condition changes, including shutdown, startup and performance testing.
        - One or more summary work activities for projects that are supported by detailed schedules. The duration of summary work activities is calculated from the overall duration of the supporting schedules.
        - Consideration in developing detailed schedules should include the following:
            - Schedules should be developed under the direction of the project manager or the OPL and should include input from the performing organization.
            - The level of activity detail is determined by the requirements of the project manager or the OPL in conjunction with good schedule control practices.
            - Detailed schedules use only true logical relationships unless otherwise required by the project manager or work sponsor.
    - Approximate due date: 4 months prior to outage start
    - Responsibility: Outage Scheduler
    - Satisfied by: This milestone has been met when the outage scheduler distributes a memo to the outage manager stating that schedule has been issued.

Key Technical Point

The outage Level 2 schedule is a summarization of the outage work activities with sufficient detail to define the critical path and to provide a basis for monitoring and controlling actual versus planned work performance.

31. **Issue unit shutdown plan.** The plan has been developed providing specific direction for unit shut down to start the outage. The plan is developed by operations with input from maintenance and engineering and should take into consideration the following items:
    - Current equipment problems – get input from operations and the condition-based maintenance (CBM) or predictive maintenance (PdM) team
    - Scheduled maintenance and testing evolutions during the shutdown
    - Lessons learned and operating experience feedback
    - Expected and possible plant responses due to shutdown
    - Environmental considerations
    - Contingency plans for undesirable plant responses

    – Approximate due date: 4 months prior to outage start

    – Responsibility: Operations manager

    – Satisfied by: This milestone has been met when the operations manager provides a copy of the approved shutdown plan to the outage manager.

Key Human Performance Point

This plan should be completed three months prior to the outage in order to allow sufficient time for training and the completion of subsequent action items.

32. **Issue unit startup plan.** A plan has been developed to return the unit to service following the outage. This plan will incorporate required testing, precautions, and contingencies resulting from outage modification work and will define any special considerations or controls that are required as a result of the outage activities. The plan will be developed by operations with input from engineering, outage, and maintenance teams.

    – Approximate due date: 4 month prior to outage start

    – Responsibility: Operations manager

    – Satisfied by: This milestone has been met when the operations manager delivers an approved copy of the startup plan to the outage manager.

33. **Weekly or bi-weekly outage meetings begin.** Outage teams begin meeting once a week or at an appropriate interval based on needs of outage. The outage manger should determine the schedule as required.
    - Approximate due date: 4 months prior to outage start
    - Responsibility: OPLs
    - Satisfied by: This milestone has been met when the OPLs issue the outage planning meeting schedule to the outage manager.
34. **Lessons learned resolution.** The lessons learned from previous outages have been reviewed. The action items resulting from the lessons learned review have been resolved adequately to support the activities of the current outage.
    - Approximate due date: 4 months prior to outage start
    - Responsibility: Outage manager
    - Satisfied by: The outage manager closes the milestone when the intent of the milestone has been met. He approves exceptions to the milestone completion date and negotiates acceptable completion dates or alternative actions such that the intent of the milestone is met.
35. **Temporary power plan complete.** A plan has been generated to provide the temporary power needs to support the outage scope.
    - Approximate due date: 4 months prior to outage start
    - Responsibility: Plant maintenance manager
    - Satisfied by: This milestone has been met when the support OPL distributes a memo to the outage manager stating that the temporary power plan is complete and ready to support the outage.
36. **Temporary air plan complete.** A plan has been generated to provide the temporary air needs to support the outage scope.
    - Approximate due date: 4 months prior to outage start
    - Responsibility: Support OPL
    - Satisfied by: This milestone has been met when the support OPL distributes a memo to the outage manager stating that the temporary air plan is complete and ready to support the outage.

37. **Special equipment needs identified and arranged.** Facilities needed for the outage have been identified, and arrangements have been made to provide the needed services/facilities. This milestone monitors the identification of outage-related facilities needed, such as mobile offices, break areas, shower trailers, and seating space in plant buildings. It also includes the identification of other outage needs, such as computers, fax machines, telephones, file cabinets, printers, and so on. Approval by the outage manager is required for facilities requests submitted after the milestone completion date.
    - Approximate due date: 4 months prior to outage start
    - Responsibility: OPLs
    - Satisfied by: This milestone has been met when the operations manager, maintenance manager, training manager, technical support services manager, and OPLs each distribute memos to the outage manager stating that their temporary facilities needed to support the outage have been identified and that these needs have been communicated to the support OPL.
38. **Scaffold plan complete.** A plan has been generated to install scaffolding in order to support the outage schedule. This plan will be detailed sufficiently to support planning for a Level 3 schedule.
    - Approximate due date: 4 months prior to outage start
    - Responsibility: Support OPL
    - Satisfied by: This milestone has been met when the support OPL distributes a memo to the outage manager stating that the scaffold plan is complete.

Key Technical Point

The scaffold plan should include as many tasks in parallel as possible for erection, teardown, and moving activities. It also needs to be coordinated with plans for lay-downs, lifts and moves, temporary power, temporary air, insulation removal, painting, and post-maintenance testing. Do as much work as possible prior to the start of the outage.

39. **Insulation plan complete.** A plan has been generated to remove, store, and install insulation in order to support the outage schedule. The plan includes the ordering and storage of replacement insulation materials and assemblies. This plan will be detailed sufficiently to support planning for a level 3 schedule.
    - Approximate due date: 4 months prior to outage start
    - Responsibility: Support OPL
    - Satisfied by: This milestone has been met when the support OPL distributes a memo to the outage manager stating that the insulation plan is complete.

40. **Self-assessment of outage preparations.** The outage manager will perform a self assessment of progress on outage planning and present the results to the plant manager.
    - Approximate due date: 3 months prior to outage start
    - Responsibility: Outage manager
    - Satisfied by: This milestone has been met when the outage manager distributes a copy of the report to the plant manager.
41. **Identify outage worker/resource needs.** The workers needed to supplement the plant staff during the outage are identified by the OPLs. The outage manager will use this information to match the available resources to the outage worker requirements. Contractor needs will be determined after the available internal resources have been identified. The number of people and the required skills must be conveyed to the outage manager. Possible sources for workers include in-house workers at the plant site, other plants that do not have an outage at the same time, traveling maintenance crews, and contractors. The workers dedicated to fixed cost projects should not be included in this milestone.
    - Approximate due date: 4 months prior to outage start
    - Responsibility: OPLs
    - Satisfied by: This milestone has been met when the OPLs have provided their worker needs to the outage manager.
42. **Asbestos abatement plan complete.** Any asbestos abatement that needs to be addressed for or during the outage has been identified and a plan for abatement has been developed.
    - Approximate due date: 4 months prior to outage start
    - Responsibility: OPL
    - Satisfied by: This milestone has been met when the OPL has distributed a copy of the asbestos abatement plan to the outage manager.
43. **On-line PM and routine tasks.** The balance-of-plant (BOP) OPL notifies the outage manager that tasks that are planned and scheduled for when the unit is online have been identified and included in the scope of work and the schedule for the outage.
    - Approximate due date: 4 months prior to outage start
    - Responsibility: BOP OPL
    - Satisfied by: This milestone has been met when the BOP OPL distributes a memo to the outage manager.
44. **On-line schedule transition plan.** The plant scheduler provides the outage scheduler with information about the on-line schedule to be included in the outage schedule.
    - Approximate due date: 4 months prior to outage start
    - Responsibility: Outage scheduler
    - Satisfied by: This milestone has been met when the outage scheduler distributes a memo to the outage manager.

45. **Identify training needs.** After the supplemental resources identified milestone is completed, the job supervisors must confirm the training requests and in-processing information for their allocated personnel with the training coordinator. The training coordinator will provide a single point of contact to bring personnel on site and provide the training and testing necessary to have them ready to perform their outage functions. Other outage job-related needs, such as lead abatement physicals, respirator, forklift, confined space, asbestos handling, rigging permits, welding certifications, and so on must be identified. The job supervisors must ensure that the training coordinator has been provided with all of the information needed to bring the personnel on site and prepare them to perform their outage role. The training coordinator will determine what training is required for the outage staff and when to schedule this training in order to efficiently meet the outage needs.
    - Approximate due date: 4 months prior to outage start
    - Responsibility: Training coordinator
    - Satisfied by: This milestone have been met when the OPLs have each distributed a memo to the training coordinator stating that the identification of supplemental resource personnel training and in-processing needs have been completed for the respective work group. The training coordinator then notifies the outage manager that the needs have been identified.
46. **Contracts awarded/work authorizations issued.** All contracts supporting outage work have been awarded, approved, and delivered to the contractors.
    - Approximate due date: 4 months prior to outage start
    - Responsibility: OPL
    - Satisfied by: This milestone has been met when the OPLs notify the outage manager. Contracts resulting from scope additions will not prevent the milestone from being met.
47. **Work order task planning complete.** The planning for all outage work orders has been completed. Exceptions to this milestone will require approval by the outage manager.
    - Approximate due date: 3 months prior to outage start
    - Responsibility: Assigned OPL
    - Satisfied by: This milestone has been met when the assigned OPL distributes a memo to the outage manager stating that planning has been completed and that any exceptions have been approved by the outage manager.
48. **Issue pre-outage implementation schedule.** The pre-outage implementation schedule has been developed and issued. The pre-outage schedule will contain those activities that are planned to be completed prior to outage commencement, such as pre-fabrication activities, crane erection, equipment staging, temporary facilities and services installations, and others.
    - Approximate due date: 3 months prior to outage start
    - Responsibility: Outage scheduler
    - Satisfied by: This milestone has been met when the outage scheduler has distributed the approved pre-outage schedule to the outage manager.

49. **Complete contract designated representative refresher training.** All outage team members that will be coordinating contractor activities during the outage have completed training if required.
    - Approximate due date: 3 months prior to outage start
    - Responsibility: Training coordinator
    - Satisfied by: This milestone has been met when the training coordinator distributes a memo to the outage manager.
50. **Information plan.** An information plan is developed that provides communication information needed during the outage. This plan includes the names, location, and phone numbers of all outage team members.
    - Approximate due date: 3 months prior to outage start
    - Responsibility: Outage manager
    - Satisfied by: This milestone has been met when the outage manager issues a copy of the plan to the outage team.
51. **Cost tracking reports.** The budgeting process has been completed in order to identify funds approved for the outage. The budget plan is detailed enough to show weekly cash flows for the outage.
    - Approximate due date: 3 months prior to outage start
    - Responsibility: OPLs
    - Satisfied by: This milestone will be declared complete at the direction of the outage manager.
52. **Pre-kitting of outage material.** All material for outage has been pre-kitted (bundled and staged) and is ready to support the outage.
    - Approximate due date: 3 months prior to outage start
    - Responsibility: OPLs
    - Satisfied by: This milestone has been met when the OPLs distribute a memo to the outage manager,
53. **Issue preliminary outage schedule – Level 3.** The preliminary Level 3 schedule has been released to the site for review and comment.

    This is a detailed, logic-based schedule developed for projects or other complex work evolutions in support of summary work activities in the Level 2 schedule. The purpose of this schedule is to provide the project manager or OPL with a sufficient understanding of job interrelationships and requirements of day-to-day management in order to anticipate and avoid potential problems. Detailed schedules are generally developed independently and later merged to form the integrated outage schedule.
    - Approximate due date: 3 months prior to outage start
    - Responsibility: Outage manager
    - Satisfied by: This milestone has been met when the outage manager releases the preliminary Level 3 schedule to the site for review.

54. **Pre-outage report issued.** The pre-outage report, summarizing the outage statistics, has been written, approved by the outage manager, and released for distribution.
    - Approximate due date: 3 months prior to outage start
    - Responsibility: Outage manager
    - Satisfied by: This milestone has been met when the outage manager releases the pre-outage report for distribution.

Key Technical Point

The pre-outage report should include, but not be limited to, the following:

- Executive summary
- Organization
- Outage organization
- Communication plan
- Routine meetings
- Planning
- Pre-outage milestone schedule
- Plans
- Safety assessment
- Environmental assessment
- Scope and schedule
- Level 1 schedule (with critical path defined)
- Level 2 schedule
- Level 3 schedule (with critical path details)
- Work scope summary (scope document)
- Budget (with projected cash flows)
- Outage goals
- Pre-outage photos

55. **Senior management review/approval of outage plan.** The final outage schedule and associated plans have been reviewed by the outage team, and a presentation has been prepared for senior management.
    - Approximate due date: 3 months prior to outage start
    - Responsibility: Outage manager
    - Satisfied by: This milestone has been met when the schedule has been revised to incorporate changes resulting from the safety assessment and action items have been assigned to resolve any outstanding issues, if required. The outage manager will confirm the presentation date with the plant manager.

56. **Establish outage implementation organization.** The outage manager has requested and received a matrix organization for outage implementation.
    - Approximate due date: 3 months prior to outage start
    - Responsibility: Outage manager
    - Satisfied by: This milestone has been met when the outage manager distributes a memo identifying the outage implementation organization, which indicates the names of individuals filling the shift outage manager position, OPLS, safety, and others, as appropriate.
57. **Contracts executed.** The contracts for the outage have been approved by the vendors. The contracts are now ready to be implemented as scheduled. For some jobs there may be a need for contingency contracts in case there is an unanticipated need for additional support or a failure of performance by the primary contractor.
    - Approximate due date: 3 months prior to outage start
    - Responsibility: OPLs
    - Satisfied by: This milestone has been met when the OPLs each distribute a memo to the outage manager. Contracts that are a result of scope additions are exempt from this milestone.
58. **Budget outage cash flows complete.** The budgeting process has been completed to identify funds approved for the outage. The budget plan is detailed enough to show weekly cash flows for the outage and for each project
    - Approximate due date: 3 months prior to outage start
    - Responsibility: OPL
    - Satisfied by: This milestone will be declared complete at the direction of the outage manager.
59. **Issue final laydown plan.** A plan allocating outage storage and laydown areas has been completed and is available for review. Laydown areas need to be identified after the milestone completion date and must be approved by the outage manager or as part of a scope change request.
    - Approximate due date: 3 months prior to outage start
    - Responsibility: Plant maintenance manager
    - Satisfied by: This milestone has been met when the laydown plan has been reviewed and accepted by the outage manager.
60. **Clearances approved – clearance plan issued.** The outage clearances have been prepared and have been approved by operations. The clearances are ready to support the outage schedule. Clearances are detailed in the outage schedule, logically grouped by priority and workgroups, and communicated to the site.
    - Approximate due date: Not later than 2 month prior to outage start
    - Responsibility: Operations manager
    - Satisfied by: This milestone has been met when the operations manager distributes a memo to the outage manager.

61. **Contractor mobilization plan.** Specific plans for contractor mobilization have been developed. These plans should include the material and workers for each day of pre-outage and outage work.
    - Approximate due date: 2 months prior to outage start
    - Responsibility: OPLs
    - Satisfied by: This milestone has been met when the OPLs distribute a memo to the outage manager.
62. **Contractor orientation meetings.** A meeting has been held with each contractor, first-line supervision, and two levels above in order to convey the company's, plant's, and outage team's expectations during the outage.
    - Approximate due date: 2 months prior to outage start
    - Responsibility: OPLs
    - Satisfied by: This milestone has been met when the OPLs distribute a memo to the outage manager stating that the meeting is scheduled and the contractors have been notified.
63. **Complete work order implementer reviews.** All corrective and preventive work orders, including support work orders, are flagged as having been reviewed by the implementer (person responsible for doing the work). Any exceptions to this milestone will require approval by the outage manager.
    - Approximate due date: 2 months prior to outage start
    - Responsibility: BOP OPL
    - Satisfied by: This milestone has been met when the BOP OPL distributes a memo to the outage manager stating that the planning is complete.
64. **Special lifting/rigging fixtures or points.** Any cranes or lifting devices that are on site and may be used during the outage have been tested and are ready to support the outage. This needs to be coordinated with facilities for equipment availability on site or within the company, and with procurement, if equipment must be purchased or leased.
    - Approximate due date: 2 months prior to outage start
    - Responsibility: Support OPL
    - Satisfied by: This milestone has been met when the support OPL distributes a memo to the outage manager and the OPLs.
65. **Issue outage goals.** The outage goals have been established, quantified, and the value for each has been verified and approved through the plant manager.
    - Approximate due date: 2 months prior to outage start
    - Responsibility: Outage manager
    - Satisfied by: This milestone has been met when the outage manager distributes a memo identifying the outage goals.

66. **Complete job safety analysis.** A job safety analysis (JSA) has been performed for each outage job or task. The sequential steps required to perform the task will be examined for injury potential, and compensatory measures will be identified along with the responsibility for implementing the compensatory measures. The site safety representative will have final decision-making authority in approving the JSA. The completed JSA forms will be made available to the site safety inspectors during the outage. They will monitor work activities for compliance to the JSA requirements.

    A contractor safety information checklist should be developed for all project contractors and subcontractors. This checklist will be used to confirm that each contractor that will be doing work during the outage has the required training in order to perform the work. This same checklist will be used for in-house resources and should be developed with the training coordinator.

Key Human Performance Point

A job safety analysis (JSA) should be conducted for all project tasks. This analysis will be completed as part of the project development plan. The analysis will:

- Identify all project tasks
- Identify hazards to be expected
- Identify compensatory actions to be taken to mitigate hazards
- Identify training that will be required to execute each project task
- Identify the competent person where required by OSHA

When completed and approved, JSAs will be considered part of the outage safety plan.

The outage manager develops a specific safety plan for each outage with the assistance of the safety representative. This plan should include:

- Designated individuals responsible and accountable for the development and implementation of the safety plan. This should include a specific plan for each contractor unless the activities are covered by the outage safety plan. The contractor plans should address the same items as the overall plan.
- The verification of safety rating for each contractor and a method for evaluating the performance of the contractor at the end of the outage.
- A project-specific plan for off-site medical treatment and designated individuals responsible for injury case management.
- A project-specific JSA and the designated individuals responsible for conducting and updating JSAs. Once completed, copies of the JSAs should be a part of the outage safety plan. Safety assessment/pre-job briefing forms may be included as appropriate.

- A plan that addresses minimizing personnel hazards by the use of engineering controls, administrative controls, and personal protective equipment.
- A plan for safety compliance inspections. This plan should include a list of who will perform these inspections, schedules, and how items found will be handled.
- A plan for correcting hazards and the non-compliance of safety issues. This should include criteria for safety stand-downs to discuss these issues.
- A plan for exposure monitoring.
- A plan for safety training requirements, including the means to ensure that initial training is accomplished, to address the deficiencies that are identified, and the actions necessary to correct them, concerning supervisors and employee qualifications. Pre-outage milestones address when training should be identified and completed.
- A plan for communicating safety information and incidents internally, to other sites, and to other employers. This reporting method should include close calls, first aid cases, and OSHA recordable injuries.
- A plan that addresses the necessary actions to achieve safety goals for the outage and how these actions will be communicated. The plan should address specific housekeeping standards for the outage and other standards that may improve safety performance during the outage.

– Approximate due date: 2 months prior to outage start

– Responsibility: Project manager and safety

– Satisfied by: This milestone has been met when the project manager distributes a memo to the outage manager.

67. **Environmental review/checklist.** An environmental checklist should be created and used by a person designated as the environmental OPL.

    This checklist is intended to assist individuals who are developing and managing projects that will be completed during the applicable unit outage in order to ensure that all environmental issues are identified and addressed in accordance with the regulatory requirements and company policy. This checklist will provide the basis for the plant environmental department to review the project or work scope and to develop any additional contingencies and/or action plans that are necessary to address all identified environmental issues/concerns in order to ensure full environmental regulatory compliance.

    Instructions: The outage manager (or OPL responsible for the block of work) should complete Attachment 4 and return it to the plant environmental department. If the project manager or person responsible for the work answers “Yes" or "Uncertain" to any question, the responsible person should contact the plant environmental department in order to provide details of the scope of work. The plant environmental department will work with the responsible person to ensure that appropriate action planning is provided to meet full regulatory compliance for the item.

The OPL, project implementation manager, or work block leader will be responsible to for the identification of all chemicals that are to be used on their respective job scope, and they must also obtain appropriate material safety data sheet (MSDS) information for each chemical. A copy of the MSDS must be obtained and forwarded to the plant environmental department for review and approval prior to bringing any chemicals on the plant site. No chemicals will be allowed on site without prior approval.

- Approximate due date: 2 months prior to outage start
- Responsibility: Outage manager, OPLs, implementation managers, environmental OPL
- Satisfied by: This milestone has been met when the environmental department distributes a memo to the outage manager stating that review has been completed.

68. **Challenge meetings begin.** These meetings challenge projects in order to review the adequacy of contingency plans and the state of preparation for outage implementation of the project or system window. At this time, there should be a thorough effort to finally eliminate schedule overloading and to discover any last minute needs that were withheld or overlooked.
    - Approximate due date: 2 months prior to outage start
    - Responsibility: Outage manager
    - Satisfied by: This milestone has been met when the first challenge meeting has been completed and a schedule has been generated for the remaining meetings.
69. **Perform outage readiness assessment.** A common pitfall is to rely on the completion of pre-outage milestones and performance metrics as the sole indication of readiness to implement the outage plan. An essential element necessary to validate the readiness of the organization and the outage plan is to have a robust readiness review process.

    The readiness review process consists of the following elements:

    - Outage issues meetings
    - Review meetings – input from peers as well as up and down the management chain and other stakeholders
        - Pre-outage assessments
        - Risk assessments
    - Meetings that may be combined with regular outage meetings
    - Contingency planning
    - Return to service planning as steps in the outage planning process

In some cases, it may be desirable to perform a more rigorous assessment of the plant's readiness to implement a major outage. This assessment may be a hired audit service assessment, an in-house self-assessment, an assistance visit, contact with past outage managers, or any combination of assessment methods. The intent is to determine if weaknesses exist in the pre-outage preparations that may impact the outage implementation.

- Approximate due date: 2 months prior to outage start
- Responsibility: Outage manager
- Satisfied by: This milestone has been met when the outage manager distributes a memo to the plant manager that the assessment has been completed and corrective measures, if required, have been assigned/initiated.

70. **Management final scope and budget review.** Management concurs with the scope identified for the outage.
    - Approximate due date: 2 months prior to outage start
    - Responsibility: Outage manager
    - Satisfied by: This milestone has been met when the outage manager is satisfied that management concurs with the scope that is identified for the outage.
71. **Plant cranes and hoists ready to support outage.** The cranes and hoists needed to support the outage work have been verified to be capable of providing the type of support needed for the outage. The preventive maintenance and corrective maintenance on all cranes and hoists have been completed.
    - Approximate due date: 2 months prior to outage start
    - Responsibility: Maintenance manager
    - Satisfied by: This milestone has been met when the maintenance manager distributes a memo to the outage manager.
72. **Material on site.** Material required for the outage is on site and ready for issue. Exceptions will be approved by the outage manager.

    Procurement commitments are in place for delivery no later than 60 days before the outage.

    All applicable materials for the outage should be received, released, and staged at least 30 days prior to the early start date of the outage.

    If materials are not available 21 days prior to the outage start, the work item should be re-evaluated for inclusion in the outage by the outage manager. The outage manager will also evaluate assurances that material will be available to support the outage schedule.

    - Approximate due date: 1 month prior to outage start
    - Responsibility: OPL
    - Satisfied by: This milestone has been met when the OPL has distributed a memo to the outage manager stating that all material needed for the outage is available to support the outage schedule.

73. **Approved outage schedule.** The Level 3 schedule has been issued for site review. The intent is to resolve schedule conflicts and concerns prior to commencement of the outage.

    Initial reviews of outage plans and schedules occur during the schedule development meetings. Each preliminary plan is jointly reviewed by supervision/management of the functional areas responsible for accomplishing the work. The intent of this review is to:

    - Ensure that management and supervision are aware of the scope of work and any potential problem areas
    - Obtain commitment of resources in order to accomplish the planned work
    - Obtain agreements/commitments for the execution of assigned work in accordance with the plan and schedule

    The integrated outage schedule is reviewed, agreed on, and committed to by the functional area managers responsible for the physical accomplishment prior to its submittal to plant management for approval. This includes on-site and off-site utility organizations, as well as contractors.

    – Approximate due date: 1 month prior to outage start
    – Responsibility: Outage manager
    – Satisfied by: This milestone has been met when the outage manager releases the Level 3 schedule for review.

74. **Pre-outage training plan complete.** The intent of this milestone is to identify the training, testing, and so on that will be provided for the outage support staff. It will identify the scheduled classes; the date, time, and location of the class; and who is scheduled to attend the class. The plan will show all of the scheduled activities supporting the qualifying, training, and in-processing of the outage support staff. This training plan will allow an individual to know which classes he/she is scheduled for and when and where the classes will be held.

    – Approximate due date: 2 months prior to outage start
    – Responsibility: Training coordinator
    – Satisfied by: This milestone has been met when a pre-outage training schedule is published by the training coordinator.

Key Technical Point

Training Verification

Contractors should submit a completed contractor review/training checklist no later than 15 days prior to contractor mobilization.

This document will be updated as new contractor employees arrive on site.

Contractor team leaders and supervisors have the responsibility for ensuring that all of their employees attend and satisfactorily complete all required training.

All contract employees should attend a site-specific plant orientation and safety training class prior to performing work. Orientation training will be conducted on-site by the company will be scheduled by outage management. The implementation manager will coordinate the scheduling of contract employees in these sessions.

Training materials may be provided to the contractor. Contractors will conduct orientation training off site and will certify the completion of their training.

The training coordinator will develop the same checklist for in-house resources and well as shared resources from other plants within the company. The verification of training should be an ongoing process as new technologies are introduced to maintenance requirements.

It may also fall to the training coordinator to work with the human resource department in order to verify that background checks, drug and alcohol screens, and other fitness for duty records are documented.

75. **Outage facilities mobilized.** All outage facilities are installed and ready for use.
    - Approximate due date: 1 month prior to outage start
    - Responsibility: Support OPL
    - Satisfied by: This milestone has been met when the support OPL distributes a memo to the outage manager stating that all facility installations and modifications have been completed in order to support the outage schedule.

Possible Temporary Outage Facilities

- Portable toilets
- Eyewash stations
- First aid kit
- Defibrillator stations
- Showers and lockers
- Parking areas

- Break areas with vending machines, refrigerators, and microwaves
- On-site food services
- Temporary offices (or trailers) for outage personnel or team meeting space
- Temporary power – including regulated for computers
- Tool room issue counter and storage
- Gang boxes outfitted with tools and supplies
- Chemical storage
- Welding supply storage and heaters
- Consumables storage
- Waste disposal facilities and dumpsters
- Telephones
- Shared computers and network access locations – for CMMS outage entries/status
- Smoking areas

6
OUTAGE EXECUTION

A great deal of emphasis is always placed on planning and pre-outage work. If the pre-outage plan and milestones are completed and followed as required, the outage implementation becomes an easier part of the whole process. Everything that needs to be done should be completely identified in the pre-outage plan and milestones. The work necessary during the outage will have been repeatedly reviewed during preceding preparatory period. Preparing and following a detailed plan will alleviate many concerns about how the actual conduct of the outage will proceed.

Milestones

Outage Begins

The outage starts on (outage date).

This is the point in time that shows the benefits of many months of planning. All of the pre-outage plans and activities are now ready to be implemented. From this point on, the outage plan is the guide for the outage. At the moment the operations department is given the unit from the system operator (sometimes called the dispatcher or grid manager), the outage schedule is followed starting with the shutdown plan.

- Responsibility: Outage manager
- Satisfied by: This milestone has been met when the outage manager notifies the site of the outage start date.

Additional outage execution milestones are defined by the scope of the outage and the projects involved.

In general, the plant manger is responsible for the success of the outage, and the outage manager is the person who ensures that the outage implementation meets the goals for success. The goals for success are:

- Safety
- Quality
- Schedule adherence
- Cost control

- Scope control
- Milestone completion
- Resource management – project mangers, area and team coordinators, supervisors, shift personnel, and vendor and contractor resources
- Timely and accurate reporting to management about the outage progress and any issues

Work Hours

The work hours for the outage will have already been scheduled on the outage schedule. Critical path activities often work 7 days a week, 24 hours per day, or as economic conditions dictate. Near critical path activities, as determined by the outage manager, often work on a minimum of two 10-hour shifts per day, 7 days a week. Deviations from this minimum work schedule requires prior approval by the outage manager. Individual project or work group work hours may be adjusted in order to reduce the congestion at shift change. These changes are individually evaluated and approved by the outage manager.

Key Human Performance Point

Work schedules are dictated by the needs of a particular outage, defined by the work breakdown structure, and cast into the schedule. It is vital that all outage participants buy into and work in accordance with the outage plan; otherwise, outage costs can become unpredictable and out of control.

Daily Sequence of Events up to the Daily Outage Meeting

At the beginning of each shift, a process starts that should be repeated at the beginning of every shift until the outage is completed. These events are required for the success of each shift to complete the scheduled work, resolve any issues, and complete a shift turnover to the incoming shift with no interruptions in the schedule. A day shift time of 7 am to 7 pm and a nightshift time of 7 pm to 7 am will be used for the examples in this report.

The shift outage manager (SOM) maintains a chronological record of the outage-related events occurring during his shift. The log may be hardbound with sequentially numbered pages or maintained on the computer network as a file. It should be in a format that is easily archivable and retrievable because this log will serve as a source document for preparing the post outage report and will be used in analyzing outage performance. The log should address all critical path significant events, document causes for schedule deviation during the shift, and also be written with enough detail in order to allow it to be used as the primary source of information for the SOM shift turnover briefing.

1. **Pre-job briefings.** A pre-job briefing serves the purpose of communicating any information needed to complete what is on the schedule for that day along with any changes that have taken place during the previous shift that may have an effect on the task at hand. The briefings, attended by the project team members, are lead by each OPL. This includes in-

house resources, shared resources, and all vendors and contractors. Pre-job briefings are conducted on each shift prior to commencing work at 7 am and 7 pm and as often as changing conditions warrant. Pre-job briefings should always be documented.

Topics that need to be addressed are:

- The tasks scheduled for that day and who is assigned each task. This information has been on the schedule for several months, and this is only a reminder of that information unless that individual is not at work that day and his assignment needs to be covered by someone else.
- Any safety issues that need to be addressed including personal protective equipment needed for that day, any safety issues that were identified from the previous shift, and the safety topic for the day.
- The status of schedule compliance from the previous shift and any changes in resources that may be needed in order to make sure the schedule is followed.
- Any issues that have been brought to the attention of the OPL from the crafts and that need to be addressed by the project team, discussed during the outage meeting, and resolved by the outage team.

2. **Project schedule update by OPL.** After the pre-job briefing, the OPL reviews the project schedule from the previous shift and the schedule for the current shift. He then provides the updated information to the scheduler either through the preferred method of a computer-generated report or by a handwritten update. This information will include comments on tasks started on time, started late, completed, and any other comments the scheduler may need to know in order to update the integrated outage schedule. This should be completed by 8:30 am in order to allow the scheduler sufficient time to update the outage schedule prior to the daily outage meeting.
3. **Outage schedule updated by outage scheduler.** Starting at 8:30 am, the outage scheduler will take each project update and enter the new information into the integrated outage schedule. This will show completed tasks and new tasks started along with any delays that need to be discussed at the outage meeting. The scheduler will also update the schedule for the next 24 hours based on the new data. The scheduler will print out copies of the updated schedule, tasks scheduled for the next 24 hours, and a list of exceptions with the comments entered by the OPL that will be discussed at the outage meeting. The copies will be distributed to each of the OPLs for review prior to the outage meeting. The outage scheduler will meet with the outage manager and review the schedules prior to the outage meeting.
4. **Outage meetings.** The outage manager has already established meeting times, locations, and durations prior to the start of the outage. The outage meetings are not intended to serve as a status meeting for those in attendance. The purpose of the meeting is to provide a communication and decision-making forum for the outage team in order to effectively manage the outage. A typical outage meeting length is 30 minutes or less. As problem areas are identified, individuals are assigned to carry out a plan of action to resolve each situation quickly. An action item list is maintained for tracking unresolved items.

Key Human Performance Point

Action items are expected to be completed by the person assigned or by an appropriate designee. Uncompleted action items are always carried over until completed.

Always ensure that shift manager leadership is equally effective and craft skill levels are similar on all shifts in order to avoid any perception that more work gets done or with a different level of quality on one shift versus another.

Those that are required to attend the outage meetings during the outage are different from those that attended the pre-outage planning meetings. The outage manager, scheduler and each OPL should attend the daily outage meeting. Daily outage meetings should normally start at 11 am in order to allow for the review of the updated schedules by all attendees before the meeting.

The agenda for the meeting should be brief and stay on target. It should include:

- Safety issues for the day and any safety issues that need to be addressed by the outage management team
- Status of critical path
- Schedule for the shift
- Any exceptions that have been noted on the schedule
- A schedule for next 24 hours including any issues that may keep schedule from being met
- Outage goals and status including those that may be in jeopardy and actions necessary in order to keep on track
- Any other issues that the outage management team needs to address

– After the outage meeting, the outage manager will complete a daily report on the outage progress for the past 24 hours and what is planned for the next 24 hours. The outage manager should meet with the plant manager by 2 pm and provide a copy and a verbal summary of the outage report.

– After the plant manager has reviewed the outage report, the outage manager posts or otherwise distributes the report to all outage team members and the plant manager can report the same to upper management.

– All of the above items should be listed in the communication plan that was developed for the outage so that all those involved in the outage are aware of the information required and the timeframe for reporting.

5. **During each shift.**

Due diligence responsibilities.

– The implementation manager or designee must exercise due diligence during the execution of a project scope by conducting routine walkdowns and inspections. The implementation manager observes work in progress to ensure that safety, environmental, housekeeping, and quality standards are acceptable. Non-compliance issues are identified to the appropriate contractor by the implementation manager and should be corrected immediately.

Outage safety and environmental expectations.

– Personnel safety and environmental performance are not only just key parts of a successful outage, they are often legal requirements as well. Keeping personnel safety in perspective is accomplished through regular safety meetings, supervisory presence at the job site, and safety-conscious attitudes in the work force. Safety must not be compromised for any reason.

– Environmental compliance is generally mandated by statute and rigorous compliance is expected.

Safety stand-downs

– If work force personnel or contractors are repeatedly advised to correct a particular non-compliance issue or if any other adverse safety trends are observed, the implementation manager may direct the responsible manager, supervisor, vendor, or contractor to conduct a safety stand-down. The implementation manager will dictate the minimum communications content of the stand-down. Vendors and contractors will participate in any site-wide safety stand-downs scheduled by outage management.

Accidents/injuries

– An objective of the project is to execute the scope with zero safety events. It is expected that all tasks will be executed in accordance with the JSA.

First Aid

– First aid events should be recorded and maintained on site in order to allow for periodic review by the implementation manager. The purpose of this record is to facilitate the identification of minor injury trends that could lead to a more significant event. This will create an opportunity for the project team to implement additional compensatory measures in order to prevent the trend from escalating and culminating in a serious accident or injury.

Accidents

- If any direct or contract employee experiences an accident, the manager, supervisor, vendor, or contractor representative must notify the implementation manger or designee immediately. The implementation manager contacts and notifies the outage manager and other personnel as appropriate.
- If the accident is serious, the manager, supervisor, vendor, or contractor will immediately contact and notify the plant control room via the plant communication system. This information should be included in the outage communication plan. Seriously injured employees should be transported to the local emergency care facility normally used by the plant. Investigations of accidents should be initiated and led by the work group(s) involved.

Housekeeping

- Housekeeping standards/expectations:
  - Work areas must be kept clean and free of debris at all times.
  - All tools are stored in appropriate areas when not in use.
  - Work areas are kept free of trip hazards.
  - Foreign matter should be kept out of open equipment, vessels, and pipes.
  - Implementation managers survey work areas routinely for compliance.

6. **Scope control**

Outage scope freeze dates are established in accordance with the provisions of the pre-outage planning milestones. Revisions to the outage scope following the scope freeze date impact the ability to prepare for and implement outages. Revisions to the outage scope must be processed promptly to facilitate preparation and implementation activities.

Necessary scope changes should be scheduled as follows:

- Submit a hardcopy of the work order to scheduling.
- Schedule the evaluation of approved scope changes (outage scheduler).
- Management approval. The outage manager is designated to approve scope additions so that scheduling can be completed promptly. The outage manager is contacted for scope changes that impact the critical path of the outage. The plant manager will be contacted for his approval if the outage length is extended or if significant budget impact results.
- Following approval, the scheduler then ensures that schedule changes (clearances, startup testing, logistics, and so on) are made in order to incorporate the scope change.

Key Human Performance Point
Key Cost Control Point

Schedule adherence is probably the most important aspect for scope and cost control.

Do the right task, the right way, at the right time.

One idea that will help to control scope additions is the use of one or more “fix-it-now” teams, especially during major outages. These teams are created in order to provide resources to perform small tasks that might otherwise add to scope or cause delays to the critical path. Safety and qualification concerns still need to be addressed, but these teams can generally be designed to perform tasks such as removing insulation, erecting scaffolds, providing temporary power, operating hoists and cranes or forklifts, obtaining tools, and so forth.

7
OUTAGE COMPLETION AND UNIT RECOVERY

Post-Outage Activities

Complete Major Contractor Critiques

The team critiques for the outage teams have been completed. This process is the first step in self-evaluation of the outage team performance. The critiques are completed within a short time after the outage to improve the quality of the information and to support the final outage report.

- Approximate due date: 30 days after the outage ends
- Responsibility: OPLs
- Satisfied by: This milestone has been met when the outage manager has received copies of the team critiques from all organizations and groups who were involved in the outage.

Post-Outage Critique

The elements of a successful post-outage critique include the following:

- Management analysis of outage information
- The identification of changes to improve outage performance
- The assignment of responsibility for implementing changes
- Management follow up in order to verify that changes are effectively applied to future outages

Selective Critiques

Selected outage activities may be designated as requiring a post-outage critique. Guidelines for determining which activities require a critique include the following:

- Major work performed by contractors
- Work not completed as scheduled with a major impact on the outage schedule
- Work that resulted in significantly higher work hours or cost than originally planned
- Rework items

- Test problems and unexpected test results
- Problem areas identified in previous outage critiques
- Complex work activities involving multiple crafts and support groups
- Management-significant emergent work items
- Major work items completed in significantly less time than scheduled

Lessons Learned

The documentation of outage lessons learned is a critical task during the performance of any outage, planned or forced. Management and plant staff are not aware of the many opportunities for improvement that occur during the performance of a task in the field unless they are notified. Therefore, every individual should take the time to ensure these opportunities are properly documented.

The following expectations should be followed for the documentation of outage lessons learned:

- Document any event that causes the critical path to slip by more than one hour.
- Document anything that would improve the critical path.
- Recommend improvements to task sequences, even for routine tasks.
- Document tool unavailability.
- Document anything that was missed in pre-outage planning.
- Document anything that would have improved resource usage and sharing.
- Identify support resources that were needed but not available.
- Recommend improvements to laydown plans.
- Recommend outage organization improvements.
- Identify work that could be done on-line instead of during the outage.

The lessons learned form (Attachment 11) or its electronic equivalent is made available to all personnel on site throughout the outage to gather and document information about specific outage problems and successes, including impact. An electronic database should be used to administer the lessons learned program and the data from the lessons learned form should be added to the database. The database should have search features allowing sorting and querying to extract data from the database. The outage-related lessons learned can be reviewed during the outage planning process to ensure that the experiences gained in previous outages are used in the planning and preparation phase.

Perform Self-Assessment of Outage Performance

- Approximate due date: One month after the outage ends
- Responsibility: Outage supervisor and manager, OPLs
- Satisfied by: This milestone has been met with the completion of the self-assessment.

The post-outage assessment is the single most important activity to ensure continuous improvement in outage planning and execution. Broad site involvement is essential, with the focus and leadership being provided by the outage group, which is led by the outage supervisor.

A self-assessment of performance, problems, and areas for improvement should be conducted by each work group at the completion of the outage. This information will be used in order to improve the outage implementation process for future outages.

A self-assessment of overall outage performance should be performed under the direction of the outage manager. This self-assessment should include a review of the performance of the outage preparation activities, pre-outage milestone completion effectiveness, and outage implementation. The intent is to understand the strengths and weaknesses in the processes and performance and to incorporate this information into the planning for the current outage.

The post-outage assessment is a three stage process:

1. The outage supervisor reviews and issues the lessons learned accumulated in the database over the outage period.
2. The individual units complete their post-outage assessments and provide the results as input to the site post-outage assessment. The units have designated a lead for their assessment input. The site team lead meets with the unit leads together and reviews each of the units' assessments. Issues, weaknesses, and improvement items are identified during this review. The team lead prepares a draft report and issues it for comment.
   - Team members may include the following:
     - Operations
     - Training
     - Chemistry
     - Maintenance
     - Maintenance facilities and planning
     - Engineering
     - Site support services
     - Project leads
     - Craft
     - Others as required

It is often useful to refer to information in work package close-outs and to interview craft and other personnel to ensure that lessons learned are complete and correct. These interviews often serve as testimonials that new or different techniques are effective and may help overcome resistance to change.

3. The site post-outage assessment is issued.

Issue Post-Outage Report

The post-outage report summarizes the outage performance and statistics. The report is prepared by the outage team with input from all involved groups

- Approximate due date: Two months after the outage ends
- Responsibility: Outage manager
- Satisfied by: This milestone has been met when the report has been approved by the work management manager.

A typical outage report outline should include but not be limited to the following:

- Executive summary
- Assessment objectives and scope
- Outage goals – Comparison of planned goals/objectives with accomplishments
- Outage performance standards and criteria
- Safety performance – Measured against safety goals
- Scope – Outage scope changes (additions and deletions)
- Work completed – Summary of work accomplished and deviations from plan
- Schedule – Baseline versus actual summary schedule and milestone comparisons
- Emergent work – Major problems encountered
- Budget
- Performance indicators (see next section)
- Lessons learned – Critiques with analysis and specific action item responsibilities and dates and other feedback
- Outage photos

Performance Indicators

As pointed out previously, outage success metrics are addressed in other documents. However, part of the post-outage process is to critically evaluate the overall cost effectiveness and impact of outage conduct. Not all of the evaluation needs to be quantitative; some qualitative measures are also good indicators. Some areas that could be evaluated are:

- Procedure adequacy and revisions required
- Engineering changes issued and subsequent revisions
- Work order planning effectiveness
- Walkdown effectiveness
- Clearances added during outage
- Scope additions, changes, and deletions
- Tasks completed/not completed
- Resource usage measures
- Milestones met and schedule adherence
- Changes in turbine efficiency (post-outage)
- Coal fineness
- Emissions and opacity

Planning the Next Outage

The entire process repeats again prior to the next planned outage. Often, this restart occurs immediately and with the same personnel involved for the next outage cycle. The outage planning process must be continuous in order to ensure long-term cost reduction and improved reliability.

The experienced personnel who can be made available for future outage planning and execution should be used; however, care must be taken not to burn out the experienced staff. A training and turnover plan is needed to ensure that resources will be available for the long term.

One of the most important aspects of planning is the outage budget planning process. The responsibilities for this process fall to several individuals. The processes and the standards to be met must fit with the goals of the corporation.

Responsibilities

- The outage management supervisor takes responsibility for identifying and accumulating the individual financial estimates that make up the outage budget in much the same manner and timing as the development of the outage schedule.
- The financial services supervisor retains responsibility for the total outage budget as a portion of that year's total site operations, maintenance, and capital budgets.
- Plant managers retain responsibility for ensuring that sufficient funds are budgeted for the work scope execution for which they are responsible. Their responsibilities for maintaining expenditures at or below budget amounts for the year are unchanged whether the expenditure is during an outage or on-line.
- Project managers and individual contributors are responsible for providing effective estimates of funds required for their work scope and maintaining expenditures below the budgeted amounts.

Process

- Development of the budget estimate proceeds in parallel with the development of the outage schedule.
- The previous budget estimate spreadsheet is used as a starting point to ensure standard costs are captured and to use previous outage actual costs as a baseline.
- The outage management supervisor makes initial changes to the estimate ensuring line items are added to represent outage-specific work scope and deletions are made from the previous outage baseline.
- This initial estimate should be posted to a location on a shared computer drive to ensure broad access.
- At some point prior to the outage, financial services takes control of the spreadsheet and posts or disseminates it. Subsequent changes would be made through the designated analyst.
- Pre-outage planning requires confirmation of budget estimate line items.
- Financial services develops a set of metrics that monitors costs accumulated versus the plan through the outage and a reporting schedule for this information to be communicated back to outage managers and planners.

Standards

- The objective is to couple as closely as feasible outage work scope and cost.
- The estimate is reviewed to ensure that line items exist for the following:
  - Individual contracts
  - Major material requirements
  - Individual work orders to support specific work scopes
  - Material required to be refurbished prior to, during, and after the outage.

- Line items that are expensed the previous year should be noted, but not added to the total. This is to ensure that the history is captured.
- Line items that are capital (versus O&M) should be accumulated in a separate worksheet. The budget estimate is primarily for O&M expenses.
- For each line item, an individual's name should be listed. This individual is responsible for the estimate of that line item.
- A basis or other information should be provided to explain or justify the budget line item.
- Site overtime and shared resource estimates should be based on specific estimates, by name, or by hours per week.

These budget spreadsheets are normally maintained by the financial analysts.

8
SUMMARY OF KEY POINTS

The following lists provide the location of Key Points information in this report.

Key Technical Point

Targets information that will lead to improved equipment reliability.

Page	Key Technical Point
5-7	Outage work is scheduled through a hierarchical system of interrelated schedules starting with the outage Level 1 schedule down through to the detailed daily work schedule. The different schedule levels are provided in order to accommodate the varying needs of users and management through a hierarchical system of reports. Strict linkage is maintained between all schedule levels to ensure accuracy and consistency.
5-8	A work breakdown structure (WBS) is the best way to develop the list of projects for the outage. Using task identification requirements for each step can be identified, resources can be estimated, and the time required can be listed. See Attachment 1.
5-9	Task lists are an effective means of developing and monitoring detailed work plans at the functional (or performing organization) level without overloading the outage schedule with excessive detail. Task lists have two basic uses: • They provide a list of work items or specific actions to be performed within a given period of time. • They provide a list of work items or specific actions that are not constrained to performance within a given window of opportunity, but are prerequisites to key events in the schedule.
5-13	The outage Level 2 schedule is a summarization of the outage work activities with sufficient detail to define the critical path and to provide a basis for monitoring and controlling actual versus planned work performance.
5-15	The scaffold plan should include as many tasks in parallel as possible for erection, teardown, and moving activities. It also needs to be coordinated with plans for lay-downs, lifts and moves, temporary power, temporary air, insulation removal, painting, and post-maintenance testing. Do as much work as possible prior to the start of the outage.

Page	Key Technical Point
5-19	The pre-outage report should include, but not be limited to, the following: • Executive summary • Organization • Outage organization • Communication plan • Routine meetings • Planning • Pre-outage milestone schedule • Plans • Safety assessment • Environmental assessment • Scope and schedule • Level 1 schedule (with critical path defined) • Level 2 schedule • Level 3 schedule (with critical path details) • Work scope summary (scope document) • Budget (with projected cash flows) • Outage goals • Pre-outage photos

Page	Key Technical Point
5-27	**Training Verification** Contractors should submit a completed contractor review/training checklist no later than 15 days prior to contractor mobilization. This document will be updated as new contractor employees arrive on site. Contractor team leaders and supervisors have the responsibility for ensuring that all of their employees attend and satisfactorily complete all required training. All contract employees should attend a site-specific plant orientation and safety training class prior to performing work. Orientation training will be conducted on-site by the company will be scheduled by outage management. The implementation manager will coordinate the scheduling of contract employees in these sessions. Training materials may be provided to the contractor. Contractors will conduct orientation training off site and will certify the completion of their training. The training coordinator will develop the same checklist for in-house resources and well as shared resources from other plants within the company. The verification of training should be an ongoing process as new technologies are introduced to maintenance requirements. It may also fall to the training coordinator to work with the human resource department in order to verify that background checks, drug and alcohol screens, and other fitness for duty records are documented.

Key Human Performance Point

Denotes information that requires personnel action or consideration in order to prevent injury or damage or ease completion of the task.

Page	Key Human Performance Point
4-13	The security of company facilities needs to be considered as part of routine outage preparations. There is always some risk that inadequate screening would allow persons with ill intent to enter the site and commit acts of sabotage that would delay plant restart, cause plant shutdown later on, or put plant or public safety at risk. To reduce these risks, a personnel screening process should be developed and implemented. There are also risks from natural disasters or unforeseen accidents that need to be considered in a risk mitigation plan.
5-2	Steps related to safety, environmental or regulatory requirements must never be eliminated or ignored.

Page	Key Human Performance Point
5-4	As the meeting progresses, action items should be identified, assigned for action, and an expected completion date and time should be defined. The action items should be reviewed at the end of the meeting. Each person assigned an action item(s) is held accountable to ensure that the action items are accomplished correctly and in a timely manner (see Rules for Meetings, Attachment 8).
5-5	The core team must consist of people who: • Have knowledge and experience relevant to the outage projects • Are fully engaged in the processes of the outage and the projects • Are able to meet expectations for accomplishing the task delegated to them
5-8	A universally accessible outage web site on the plant's local network is helpful for updating outage participants and management on status and to allow active feedback on outage issues and lessons learned.
5-10	Clearances must be prepared, reviewed, and put in place far enough in advance in order to ensure that the appropriate paperwork can be completed in advance and any licenses or inspections can be planned and arranged. This may be particularly important for environmental issues such as asbestos, PCB, and waste disposal.
5-13	This plan should be completed three months prior to the outage in order to allow sufficient time for training and the completion of subsequent action items.
5-22	A job safety analysis (JSA) should be conducted for all project tasks. This analysis will be completed as part of the project development plan. The analysis will: • Identify all project tasks • Identify hazards to be expected • Identify compensatory actions to be taken to mitigate hazards • Identify training that will be required to execute each project task • Identify the competent person where required by OSHA
6-2	Work schedules are dictated by the needs of a particular outage, defined by the work breakdown structure, and cast into the schedule. It is vital that all outage participants buy into and work in accordance with the outage plan; otherwise, outage costs can become unpredictable and out of control.
6-4	Action items are expected to be completed by the person assigned or by an appropriate designee. Uncompleted action items are always carried over until completed. Always ensure that shift manager leadership is equally effective and craft skill levels are similar on all shifts in order to avoid any perception that more work gets done or with a different level of quality on one shift versus another.
6-6	Schedule adherence is probably the most important aspect for scope and cost control. Do the right task, the right way, at the right time.

Key Cost Control Point

Emphasizes information that will result in reduced purchase, operating, or maintenance costs.

Page	Key Cost Control Point
6-6	Schedule adherence is probably the most important aspect for scope and cost control. Do the right task, the right way, at the right time.

A
ATTACHMENTS

List of Attachments:

1. Example Work Breakdown Structure
2. Schedule Examples
3. Example Simplified Pre-outage Milestone Schedule and Checklist
4. Example Environmental Review Checklist
5. Example Outage Readiness Checklist
6. Example Laydown Plan
7. Example Outage Communication Plan
8. Rules for Meetings
9. Example Daily Outage Meeting Report
10. Example Daily and Weekly Outage Milestone and Status Templates
11. Lessons Learned Form
12. Outline for Contractor Safety Guide
13. Forced Outages

ATTACHMENT 1
EXAMPLE WORK BREAKDOWN STRUCTURE

A properly structured project:

- Provides a clear and common understanding of scope for all team members

  "If it's not in the WBS, it's not in the scope of the project."

- Provides the most accurate method to develop cost estimates during the proposal phase
- Facilitates tracking of costs and progress
- Facilitates tracking the schedule and milestones
- Facilitates assignments of resources to clearly defined tasks
- Allows automatic production of burn curves and daily cost updates

The Work Breakdown Structure (WBS) is best developed during the proposal phase of a project. It should be the basis for developing the cost estimates.

The WBS is a breakdown of the scope of a project into logical organization. The WBS is hierarchical, with each descending level providing more detail. The WBS in its entirety should define the entire scope of a project.

Typically, a project scheduling software (Microsoft Project, Primavera, etc.) is used to schedule the project to follow and expand on the WBS.

Possible WBS Structure

Level 00 Project identifier – name and/or number

Level 01 Major deliverables – list by name and/or number

Level 02 – Project phase – list by name and/or number under appropriate deliverable – may replicate deliverable list in part or all

Level 03 – Tasks – name and/or number and general task description for each project phase

Level 04 – Work packages required to accomplish tasks, listed under appropriate tasks

ATTACHMENT 2
SCHEDULE EXAMPLES

The examples below are for successful outages for a major southern utility.

The first example of a Level 1 schedule was the working schedule for the first few meetings of the feedwater heater replacement outage planning team of the owner until the Level 2 requirements could be fleshed out.

The second Level 1 example, for a condenser re-tubing outage, is slightly more definitive about outage work to be performed.

The Level 2 schedule is from the primary contractor for the feedwater heater replacement work from the first Level 1 example, setting forth the major milestones and project phases required for the project from the contractor's side. Both the owner and the contractors need to be able to use appropriate planning tools to achieve success in the most effective manner.

The Level 3 schedule is for several phases of a boiler project.

The task/work package example is for crane modifications and other work associated with a feedwater heater replacement.

First Example of Level 1 Schedule

Planning Activities	Plan Finish Dates	Status
Plan Document for Major Projects	07/26/02	In progress
Workforce Requirements Identified	07/26/02	In progress
Major Contracts Bid & Long lead Material	06/28/02	In progress
Plan Document for Minor Projects	09/20/02	Open
Material Requests for Medium Lead Items	09/20/02	Open
Minor Contracts Bid	10/18/02	Open
Major Contracts Awarded	N/A	N/A
Outage Scope Finalized	11/15/02	Open
Minor Contracts Awarded	11/15/02	Open
Station Base Maintenance Work List Finalized	11/15/02	Open
Final Schedule Inputs Due	12/06/02	Open
Remaining Material Ordered	12/20/02	Open
Facilities Plan Complete	12/06/02	Open

ATTACHMENT 2 (Continued)

Second Example of Level 1 Schedule

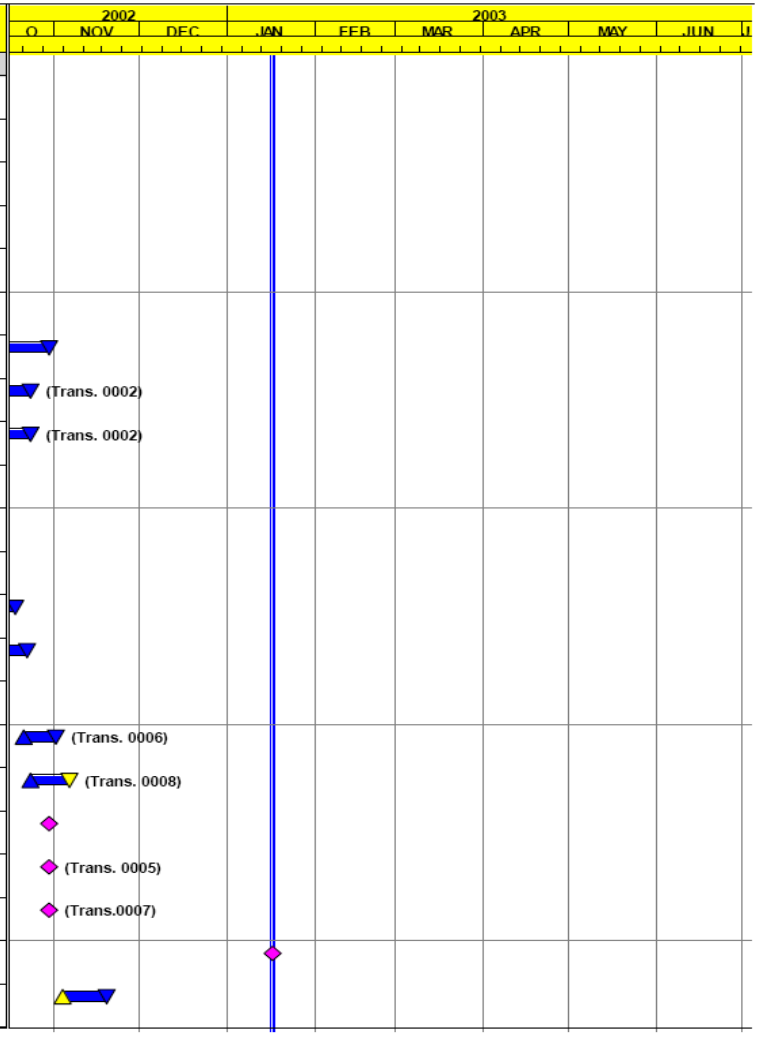
Condenser Retubing Project
Project ID: C271

Draft Schedule

Activity Description	By	Start	Finish
Requisition and Spec Mat'l		4/10/2001	4/13/2001
PO Mat'ls, Tubing, Packing, Gaskets		5/7/2001	5/11/2001
Labor Spec		5/23/2001	5/29/2001
Pre Bid Meeting		6/7/2001	6/7/2001
Bids to Purchasing		6/8/2001	6/13/2001
Labor Bid Evaluation / Award Order		6/14/2001	6/27/2001
Outage		9/29/2001	12/31/2001
Remove Waterbox Cover		9/29/2001	10/3/2001
Remove Packing, run taps into holes & clean		10/4/2001	10/14/2001
Ball burr support plate holes		10/15/2001	10/25/2001
Install New Tubes		10/19/2001	10/31/2001
Roll Inlet ends and bell - install package		10/30/2001	11/6/2001
Install Waterbox covers		11/7/2001	11/10/2001
Perform Standing Water Hydrotest		11/11/2001	11/11/2001

Example of Level 2 Schedule

Activity ID	Activity Description	Orig Dur	Rem Dur	%	Early Start	Early Finish	OUTG	PROJ
FRAM - Framatome Engineering FWH MS3								
AM010	Receive Preliminary Funding	0	0	100	23JUL02 07:00A		MS03B018	FRAM
AM020	Vendor Engr 3A1 FWH	450	0	100	23JUL02 07:00A		MS03B018	FRAM
AM110	FWH Lift Plan Development	400	0	100	23JUL02 07:00A		MS03B018	FRAM
AM120	Review Openings in Operating Floor for Clearance	400	0	100	23JUL02 07:00A	30SEP02 13:59A	MS03B018	FRAM
AM130	Review Mez. Floor Support Steel	400	0	100	23JUL02 07:00A	30SEP02 13:59A	MS03B018	FRAM
AM200	Walkdown Piping for Piping Layout Design	30	0	100	23JUL02 07:00A	25JUL02 12:59A	MS03B018	FRAM
AM140	Id Lifting Lugs Placement to Vendor 3a1, 3a2	151	0	100	03SEP02 12:00A	30OCT02 12:59A	MS03B018	FRAM
AM150	Provide Support FWH Legs Design	151	0	100	03SEP02 12:00A	23OCT02 13:59A	MS03B018	FRAM
AM270	Provide Structural Design for Htr Support Steel	151	0	100	03SEP02 12:00A	23OCT02 13:59A	MS03B018	FRAM
AM205	Issue Prelim P&IDs	120	0	100	11SEP02 07:00A	04OCT02 12:59A	MS03B018	FRAM
AM040	Receive Final Heater Outline Drawing	88	0	100	16SEP02 07:00A	30SEP02 14:59A	MS03B018	FRAM
AM280	Preliminary BOM for Structural Steel Mod	1	0	100	26SEP02 07:00A	26SEP02 07:59A	MS03B018	FRAM
AM145	Receive Whiting Crane Report	88	0	100	01OCT02 13:00A	18OCT02 13:59A	MS03B018	FRAM
AM206	Client P&ID Review	80	0	100	04OCT02 07:00A	22OCT02 13:59A		
AM201	Release Project Funding	0	0	100	07OCT02 07:00A		MS03B018	FRAM
AM210	Issue Preliminary Piping Layout Design	120	0	100	21OCT02 14:00A	01NOV02 14:59A	MS03B018	FRAM
AM225	Issue Datasheets	80	0	100	23OCT02 14:00A		MS03B018	FRAM
AM100	3A1 & 3A2 FDW Htr Floor Mod Complete	0	0	100		30OCT02 14:59A	MS03B018	FRAM
AM400	3A1 & 3A2 FDW Htr Floor Mod BOM Delivered To Duk	0	0	100		30OCT02 14:59A	MS03B018	FRAM
AM600	3A1 & 3A2 FDW Htr Transp Plan Delv to Duk	0	0	100		30OCT02 14:59A	MS03B018	FRAM
AM800	3A1 & 3A2 FDW Htr Interference Dbase Delv to Duk	0	0	100			MS03B018	FRAM
AM041	Revise Final Heater Outline Drawing	96	0	100		19NOV02 14:59A	MS03B018	FRAM



Start Date 25FEB02 07:00
Finish Date 11JUN03 14:59
Data Date 16JAN03 16:00

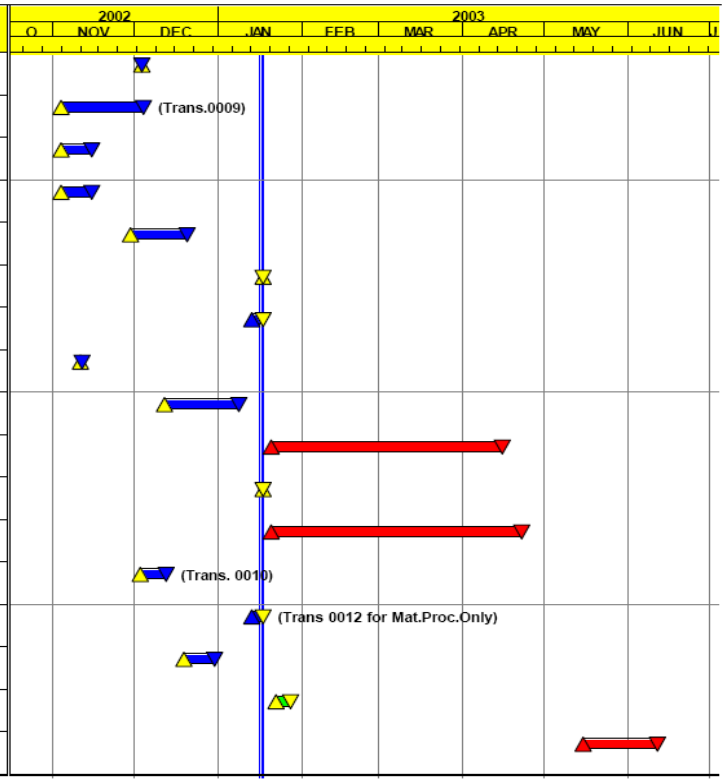
M318 - FRAM Sheet 1 of 2

FRAM - Framatome Engineering FWH MS3 specific info

ATTACHMENT 2 (Continued)

Example Level 2 Schedule (Continued)

Activity ID	Activity Description	Orig Dur	Rem Dur	%	Early Start	Early Finish	OUTG	PROJ
AM160	Crane Mod Interface/Procedure	0	0	100		03DEC02 14:59A	MS03B018	FRAM
AM215	Issue Final P&IDs	184	0	100		04DEC02 14:59A	MS03B018	FRAM
AM220	Civil Review Preliminary Piping Layout Dwgs	80	0	100		15NOV02 14:59A	MS03B018	FRAM
AM230	Mech Review Preliminary Piping Layout Dwgs	80	0	100		15NOV02 14:59A	MS03B018	M3A2
AM240	Provide Cold Pull Restraint Details	120	0	100		20DEC02 10:59A	MS03B018	FRAM
AM250	Perform Stress Analysis on Pipe	120	0	100			MS03B018	FRAM
AM255	Perform Hanger Design	60	1	98	13JAN03 07:00A	17JAN03 07:59	MS03B018	FRAM
AM300	Release Vendor for Fabrication	8	0	100		11NOV02 14:59A	MS03B018	FRAM
AM305	Release PO for Crane Mod	160	0	100		08JAN03 14:59A	MS03B018	FRAM
AM310	Fabrication of 3A1 FWH	500	500	0	20JAN03 07:00	15APR03 16:59	MS03B018	FRAM
AM315	Issue Crane Mod pkg for Review	8	8	0	17JAN03 07:00*	17JAN03 14:59	MS03B018	FRAM
AM320	Fabrication of 3A2 FWH	535	535	0	20JAN03 07:00	22APR03 11:59	MS03B018	FRAM
AM330	Release Phase 2 Cost Est Package - 80%	60	0	100		12DEC02 23:59A	MS03B018	FRAM
AM260	Issue Final Piping Layout Design	70	4	95	13JAN03 08:00A	17JAN03 11:59	MS03B018	FRAM
AM325	Review comments to Whiting	64	0	100		30DEC02 14:59A	MS03B018	FRAM
AM290	Issue Engineering Instructions	120	24	80	22JAN03 11:00	27JAN03 10:59	MS03B018	FRAM
AM285	Provide As-Built Drawings	160	160	0	15MAY03 07:00*	11JUN03 14:59	MS02B018	FRAM



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Finish Date 11JUN03 14:59
Data Date 16JAN03 16:00

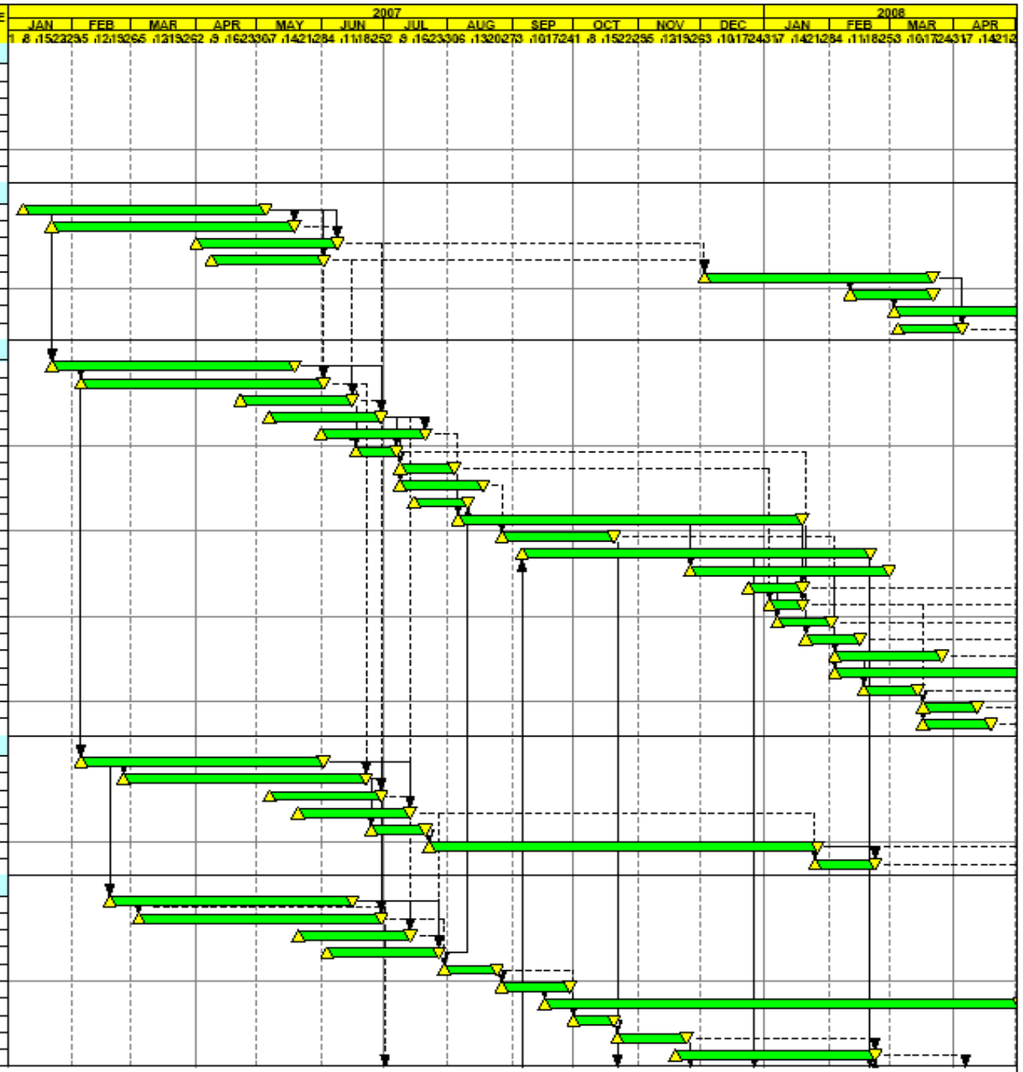
M318 - FRAM Sheet 2 of 2

FRAM - Framatome Engineering FWH MS3 specific info

ATTACHMENT 2 (Continued)

Example Level 3 Schedule

Activity ID	Activity Description	Cal ID	Orig Dur	Early Start	Early Finish	Total Float	PHAS	BOLI	GROU	RESP	AREA	MILE
11 - Milestones												
0NS000	NTP	2	0	01FEB06*		1	C		11			
0NS001	Hydro Unit 1	2	0	18AUG06*		0	C		11			
0NS031	Hydro Unit 2	2	0	22SEP08*		0	C		11			
0NS011	Unit 1 Chemical Cleaning	2	0	13OCT06*		0	C		11			
0NS041	Unit 2 Chemical Cleaning	2	0	27OCT06*		0	C		11			
0NS021	Unit 1 First Fire (Gas)	2	0	10NOV06*		0	C		11			
0NS051	Unit 2 First Fire (Gas)	2	0	10DEC06*		-12	C		11			
12 - Silo Area Unit 1												
1NS-1880	COLUMNS / HEAVY	2	85	08JAN07*	04MAY07	10	C		12			
1NS-1930	VERTICAL BRACINGS	2	85	22JAN07	18MAY07	35	C		12			
1NS-1860	RAILINGS / LADDERS / STAIRS	2	50	02APR07	08JUN07	30	C		12			
1NS-1870	GRATINGS	2	40	09APR07	01JUN07	25	C		12			
1NS-1210	FUEL DISTRIBUTION EQUIPMENT (FEEDERS)-Install	2	80	03DEC07*	21MAR08	24	C		12			
1NS-1750	LIMESTONE CRUSHING / FEED EQUIP (MILLS & FEED SY	2	30	11FEB08	21MAR08	24	C		12			
1NS-2240	Limestone Piping - Install	2	56	03MAR08	19MAY08	24	C		12			
1NS-2210	Fuel Feed Spout Air Ducting	2	23	05MAR08	04APR08	45	C		12			
13 - Furnace Unit 1												
1NS-1890	COLUMNS / HEAVY	2	85	22JAN07	18MAY07	10	C		13			
1NS-1940	VERTICAL BRACINGS	2	85	05FEB07	01JUN07	30	C		13			
1NS-2100	GRATINGS	2	40	23APR07	15JUN07	20	C		13			
1NS-2060	RAILINGS / LADDERS / STAIRS	2	40	07MAY07	29JUN07	20	C		13			
1NS-1060	BOILER HANGERS-Install	2	36	01JUN07	20JUL07	21	C		13			
1NS-0000	STEAM DRUM w/HANGERS & INTERNALS-Install	2	15	18JUN07	05JUL07	20	C		13			
1NS-1780	STRIPPER COOLERs - Install	2	20	09JUL07	03AUG07	20	C		13			
1NS-1620	Furnace raise/set walls/wingwalls/panels	2	30	09JUL07	17AUG07	20	C		13			
1NS-2140	MEDIUM / LIGHT STEEL	2	20	16JUL07	10AUG07	20	C		13			
1NS-1530	Furnace area fit & weld	2	120	06AUG07	16JAN08	20	C		13			
1NS-2300	Furnace raise/set piping	2	40	27AUG07*	19OCT07	15	C		13			
2NS-1630	Furnace area fit & weld	2	120	06SEP07	20FEB08	22	C		13			
1NS-1350	BUCKSTAY SYSTEM-Install	2	70	26NOV07	29FEB08	20	C		13			
1NS-1790	Sand Feed Equipment/Pipe - Install	2	20	24DEC07	16JAN08	90	C		13			
1NS-2180	Stripper Air Cooler Ducting	2	12	03JAN08	16JAN08	100	C		13			
1NS-1830	Drag Chains - Install	2	20	07JAN08	01FEB08	105	C		13			
1NS-1310	STEAM DRUM LEVEL INDICATING SYSTEM-Install	2	20	21JAN08	15FEB08	90	C		13			
1NS-1220	Sootblower - Install	2	37	04FEB08	25MAR08	105	C		13			
1NS-2000	BOILER VENT & DRAIN PIPING - Install	2	70	04FEB08	09MAY08	20	C		13			
1NS-1810	Air Cannons - Install	2	20	18FEB08	14MAR08	105	C		13			
1NS-2190	Air Piping to Stripper Cooler	2	20	17MAR08	11APR08	110	C		13			
1NS-1230	Start-Up Burners - Install	2	25	17MAR08	18APR08	105	C		13			
14 - Cyclone Unit 1												
1NS-1900	COLUMNS / HEAVY	2	85	05FEB07	01JUN07	10	C		14			
1NS-1950	VERTICAL BRACINGS	2	85	26FEB07	22JUN07	30	C		14			
1NS-2110	GRATINGS	2	40	07MAY07	29JUN07	25	C		14			
1NS-2070	RAILINGS / LADDERS / STAIRS	2	40	21MAY07	13JUL07	15	C		14			
1NS-2020	WATER COOLED CYCLONES - pre-assemble	2	20	25JUN07*	20JUL07	75	C		14			
1NS-2330	Water Cooled Cyclones raise/set/fit/weld	2	135	23JUL07	25JAN08	75	C		14			
1NS-1760	LOOPSEAL-Install	2	21	25JAN08*	22FEB08	125	C		14			
15 - HRA Unit 1												
1NS-1910	COLUMNS / HEAVY	2	85	19FEB07	15JUN07*	10	C		15			
1NS-1960	VERTICAL BRACINGS	2	85	05MAR07	29JUN07	30	C		15			
1NS-2120	GRATINGS	2	40	21MAY07	13JUL07	20	C		15			
1NS-2080	RAILINGS / LADDERS / STAIRS	2	40	04JUN07	27JUL07	10	C		15			
1NS-1660	HRA pre-assembly	2	20	30JUL07*	24AUG07	10	C		15			
1NS-1670	HRA raise/set reheaters	2	25	27AUG07	28SEP07	10	C		15			
1NS-2310	HRA fit & weld	2	165	17SEP07	02MAY08	10	C		15			
1NS-1700	HRA raise/set superheaters	2	15	01OCT07	19OCT07	25	C		15			
1NS-1710	HRA raise/set economizers	2	25	22OCT07*	23NOV07	25	C		15			
1NS-2320	Remove temp steel from modules	2	70	19NOV07	22FEB08	40	C		15			



Start Date 03OCT06
Finish Date 09DEC08
Data Date 03OCT06
Run Date 07AUG06 14:31

Early Bar
Progress Bar
Critical Activity

CLEC

Example of Level 3 Boiler Erection Schedule

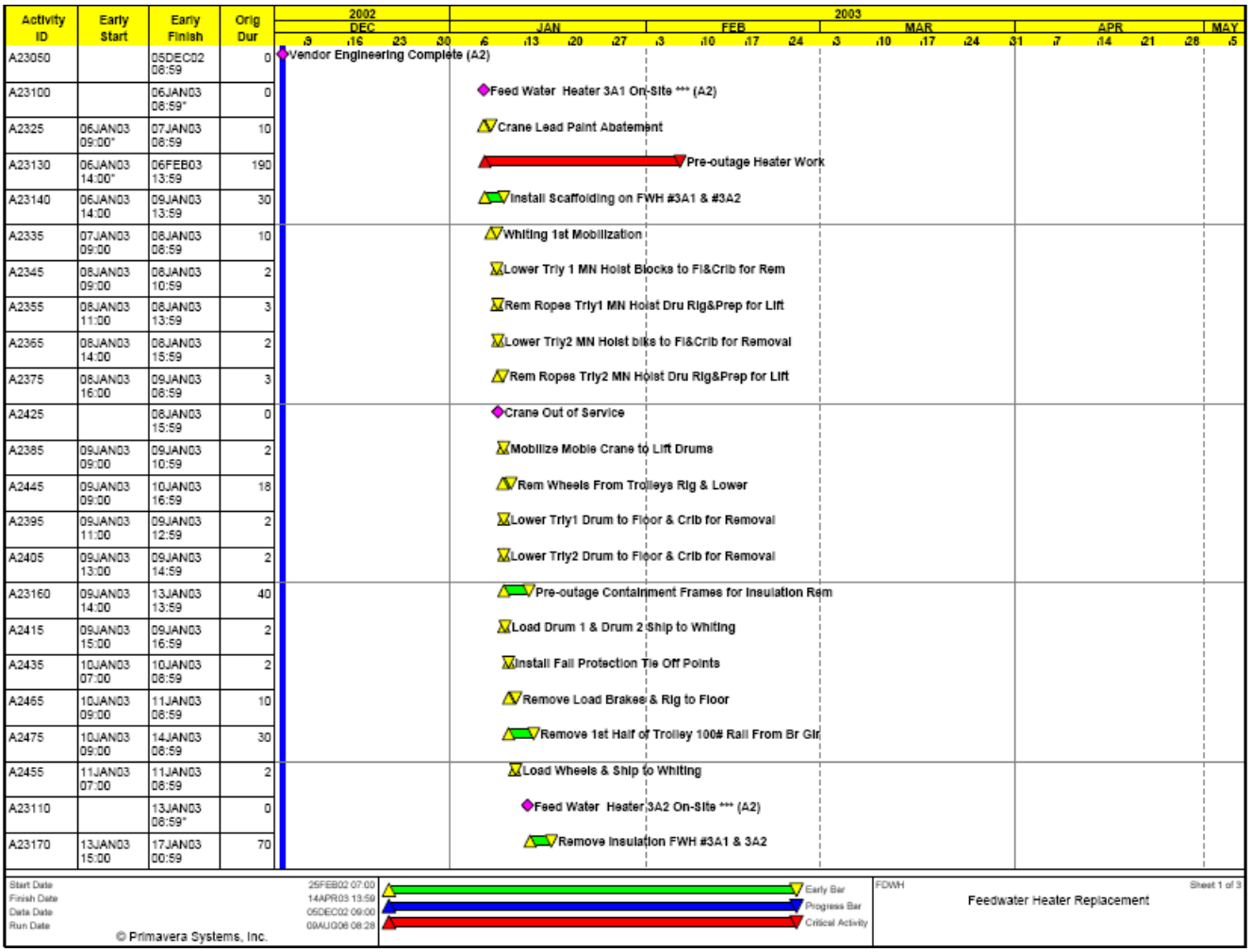
Classic Schedule Layout

Sheet 1 of 3

Date	Revision	Checked	Approved

ATTACHMENT 2 (Continued)

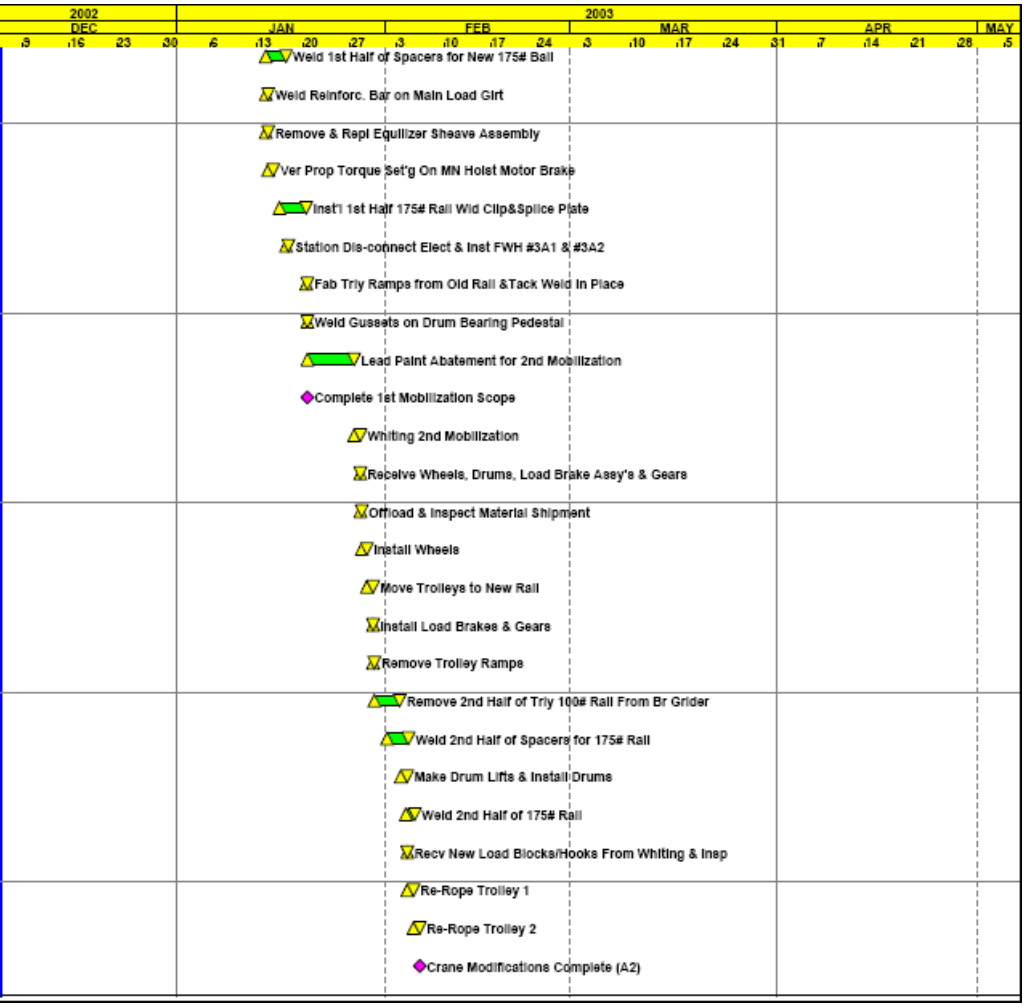
Example Task/Work Package Schedule



ATTACHMENT 2 (Continued)

Example Task/Work Package Schedule (Continued)

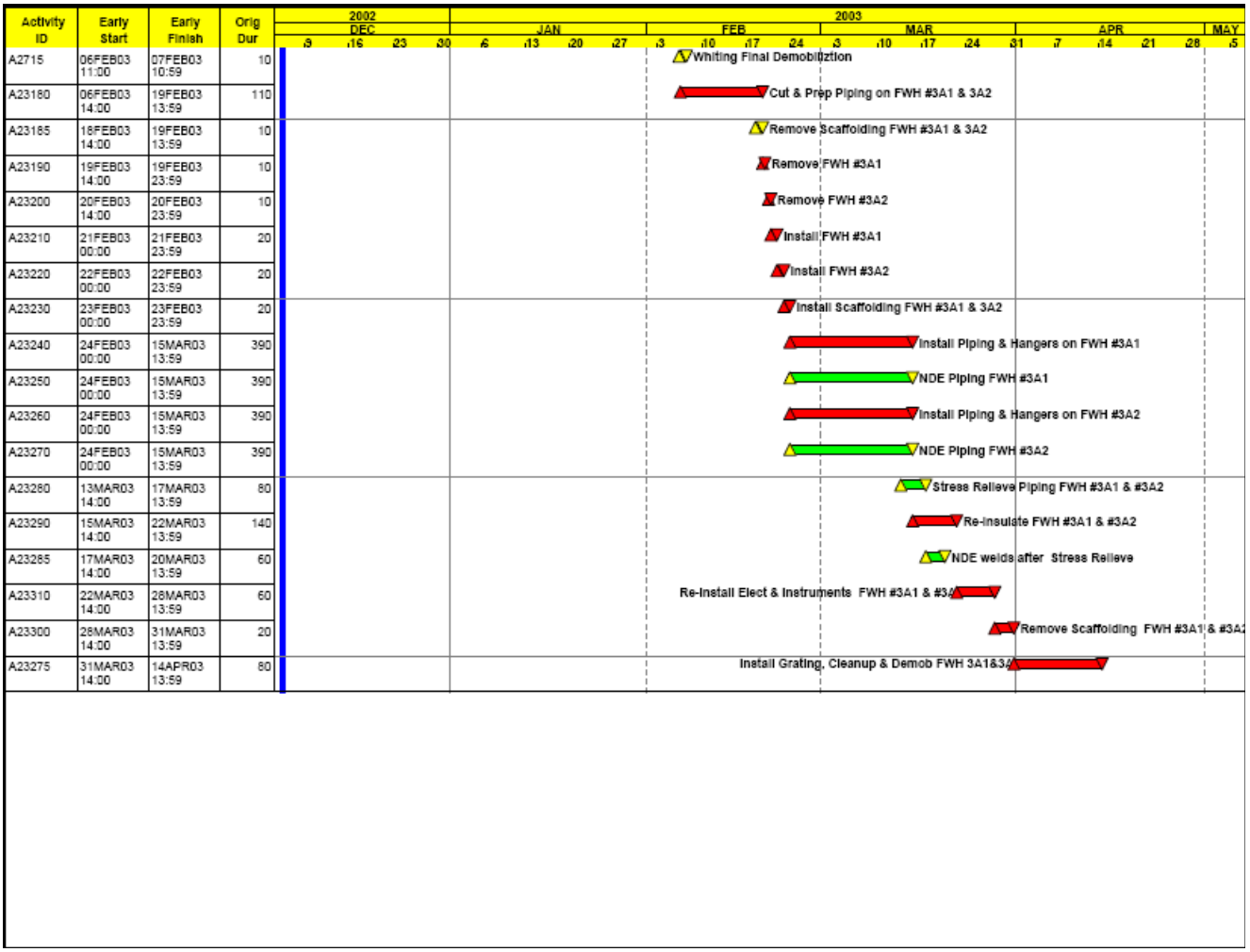
Activity ID	Early Start	Early Finish	Orig Dur
A2485	14JAN03 09:00	17JAN03 08:59	30
A2525	14JAN03 09:00	14JAN03 13:59	5
A2545	14JAN03 09:00	14JAN03 13:59	5
A2555	14JAN03 14:00	15JAN03 08:59	5
A2495	16JAN03 09:00	20JAN03 08:59	30
A23150	17JAN03 07:00	17JAN03 16:59	10
A2505	20JAN03 09:00	20JAN03 11:59	3
A2515	20JAN03 12:00	20JAN03 14:59	3
A2535	20JAN03 15:00	27JAN03 10:59	36
A2565		20JAN03 14:59	0
A2575	27JAN03 11:00	28JAN03 10:59	10
A2585	28JAN03 11:00	28JAN03 12:59	2
A2595	28JAN03 13:00	28JAN03 15:59	3
A2605	28JAN03 16:00	29JAN03 10:59	5
A2615	29JAN03 11:00	30JAN03 07:59	7
A2625	30JAN03 08:00	30JAN03 10:59	3
A2635	30JAN03 09:00	30JAN03 11:59	3
A2645	30JAN03 12:00	03FEB03 08:59	27
A2655	01FEB03 09:00	04FEB03 16:59	28
A2675	03FEB03 12:00	04FEB03 10:59	9
A2665	04FEB03 07:00	05FEB03 16:59	20
A2685	04FEB03 11:00	04FEB03 11:59	1
A2695	04FEB03 12:00	05FEB03 10:59	9
A2705	05FEB03 11:00	06FEB03 10:59	10
A23096		06FEB03 10:59	0



ATTACHMENT 2 (Continued)

Example Task/Work Package Schedule (Continued)

Activity ID	Early Start	Early Finish	Orig Dur
A2715	06FEB03 11:00	07FEB03 10:59	10
A23180	06FEB03 14:00	19FEB03 13:59	110
A23185	18FEB03 14:00	19FEB03 13:59	10
A23190	19FEB03 14:00	19FEB03 23:59	10
A23200	20FEB03 14:00	20FEB03 23:59	10
A23210	21FEB03 00:00	21FEB03 23:59	20
A23220	22FEB03 00:00	22FEB03 23:59	20
A23230	23FEB03 00:00	23FEB03 23:59	20
A23240	24FEB03 00:00	15MAR03 13:59	390
A23250	24FEB03 00:00	15MAR03 13:59	390
A23260	24FEB03 00:00	15MAR03 13:59	390
A23270	24FEB03 00:00	15MAR03 13:59	390
A23280	13MAR03 14:00	17MAR03 13:59	60
A23290	15MAR03 14:00	22MAR03 13:59	140
A23285	17MAR03 14:00	20MAR03 13:59	60
A23310	22MAR03 14:00	28MAR03 13:59	60
A23300	28MAR03 14:00	31MAR03 13:59	20
A23275	31MAR03 14:00	14APR03 13:59	80



ATTACHMENT 3
Simplified Pre-Outage Milestone Schedule and Checklist

Example Simplified Pre-Outage Milestone Schedule and Checklist

NUMBER OF WEEKS OUT	MILESTONE	RESPONSIBLE PERSON	DATE COMPLETE	COMMENTS
36	Define outage organization	Plant manager		
34	Issue pre-outage milestone schedule	Outage manager		
32	Identify major work scope	Equip. owners, planners		
30	Develop firm price projects and vendor list	Outage manager, equip. owners		
26	Complete inquiry for major activities	Outage manager		
24	Pre-bid meetings with contractors	Out. mgr., owners		
24	ID and order long-lead materials	Owners, planners		
19	Review work order tasks	Owners, planners		
19	ID modification training needs	Operations mgr.		
19	Condition reports to equip. owners	CBM group		
18	All bids returned and evaluated	Equip. owners		
18	Equip. owners select outage tasks	Owners, planners		
17	Assign craft est. hours to w/o tasks	Equip. owners		
17	Review w/o support needs	Equip. owners		
17	ID pre-outage fabrication, prep. Work	Owners, planners		
17	Receive outage cost data sheets	Equip. owners		
16	Award bids for contract work	Management		
15	Work force size and schedule set	Planners		

NUMBER OF WEEKS OUT	MILESTONE	RESPONSIBLE PERSON	DATE COMPLETE	COMMENTS
12	ID 90% of all outage work	Owners, ops.		
9	Conduct pre-job mtgs. W. contractors	Outage mgr.		
8	Deliver w/o info to contractors	Planners		
8	Start building critical path schedule	Owners, planners		
7	Finalize facility, laydown, temporary power, other plans	Outage mgr., equip. owners		
6	Complete all w/o materials planning	Owners, planners		
6	Scope freeze in effect	Outage manager		
4	Deliver w/o info to all work groups	Planners		
4	Publish outage goals	Outage manager		
4	Verify outage materials on-site	Equip. owners		
3	Review off-line event sequences and clearances	All		
2	Feedback to planners on work packages	Equip. owners		
2	Finalize operations plans for shut-down and re-start	Ops. Mgr., planners		
2	Begin weekly outage meetings	Outage manager		
0	Outage begins	All		

ATTACHMENT 4
EXAMPLE ENVIRONMENTAL REVIEW CHECKLIST

Note: The environmental activities listings are intended to include those items which either trigger a new or an existing Regulatory Permit requirement or a notification to applicable Regulatory Agencies to gain approvals for the activities to be performed.

The Environmental Review Checklist should address each of the following as it applies to each task on the job plan. This list is not all inclusive and more or less may be needed depending on the scope of work.

___ Accident prevention
___ Accident reporting
___ Aerosol cans
___ Alarms and emergency evacuation
___ Aluminum cans
___ Arsenic
___ Asbestos
___ Barricades and barriers
___ Batteries
___ Blood-borne pathogens
___ Boiler cleaning waste (citric acid cleaning)
___ Chemicals
___ Chemical spills
___ Clearance procedures
___ Clothing
___ Coal dust
___ Compressed gas cylinders
___ Confined spaces
___ Contractor chemicals
___ Demolition
___ Demolition debris
___ Digging and digging permits
___ Dirty/used/oily rags
___ Electrical
___ Fall protection
___ First aid
___ Fire protection
___ Fly ash disposal
___ Fly ash exposure
___ Foreign matter exclusion
___ Forklifts
___ Grinding dust
___ Hazard communication
___ Hearing protection
___ Heat-related hazards
___ Housekeeping
___ Insulation
___ Ladders
___ Lead acid batteries
___ Lead paint
___ Licenses
___ Lock-out/Tag-out
___ Materials Handling/Storage
___ Materials Safety Data Sheets (MSDS)
___ Mercury
___ Mineral wool
___ Oil spills
___ Opacity
___ Overhead work
___ Paint
___ PCBs
___ Personal Protective Equipment (PPE)
___ Permits
___ Power tools
___ Radiography
___ Recycling
___ Respiratory protection
___ Rigging, cranes, hoists
___ Sandblasting/paint removal
___ Scaffolds
___ Scrap metal
___ Silica exposure
___ Sanitary waste
___ Solid waste
___ Spill clean-up
___ Spill protection
___ Underground hazards and interferences
___ Used oil
___ Wash stations
___ Waste oil disposal
___ Water quality
___ Welding (hot work)

ATTACHMENT 4 (Continued)

Example Environmental Review Checklist (Continued)

ENVIRONMENTAL REVIEW CHECKLIST		
Project Identification		**Date:**
Project Manager/Block Leader Name		
Project or Work Scope Name		
Project/Work Scope Description		
Does the Project or Work Scope include or result in any of the following activities? Circle Yes (Y), No (N), or Uncertain (U), for each activity:		
AIR QUALITY & OTHER PERMIT REQUIRED NOTIFICATION ACTIVITES		
Construction of a new source of air emissions at an existing plant: i.e., fossil fuel combustion component/system change out (including Pulverizer upgrades/replacements, Fans replacements, feed water system modifications, changes in steam production, upgrades and change-out or modification of burners and air registers); modifications to turbine generators that increase power output and/or that have an adverse impact on efficiency.		Y N U
Addition of or any change (physical or operational addition or removal) to a piece of air pollution control equipment (for example, electrostatic precipitators, flue gas conditioning systems, low NOx burners, etc).		Y N U
Changes to generating units that are intended to increase efficiency, reliability, or megawatt output of the unit, which results in an increase in Heat Inputs and/or increase in generating capability of the unit.		Y N U
Any physical or operational change which can cause a release or increase in fugitive emissions		Y N U
Storage and use of lubricating oils and or greases on job site that result in a potential oil spill or release		Y N U

ATTACHMENT 4 (Continued)

Example Environmental Review Checklist (Continued)

Sand blasting/Chemical Cleaning of components and/or equipment	Y N U
Burning of supplemental fuels (such as waste solvents, or used oils) and the use of an alternative or secondary fuels	Y N U
Installation of any type of storage tank (to store petroleum or chemical products or any volatile organic compounds)	Y N U
Replacement/repair /demolition of stacks or stack liners	Y N U
Operation of stationary (that is, immobile) emergency diesel generators or diesel engines (for example, supporting fire protection) Open burning of any kind Changes in cooling water treatment chemicals Use of Paints, Spray Booths, and or Paint removal activities Use of Solvents for cleaning Storage & use of chemicals in quantities above specified thresholds	Y N U
WATER & NATURAL RESOURCES QUALITY ACTIVITIES	
Discharge of any material wetlands or navigable waters	Y N U
Land clearing and/or land disturbance of one or more acres	Y N U
Construction of main sewers, wastewater collection and transmission systems, pump stations and force mains, waste water treatment facilities, and components.	Y N U
New discharges of waste water to surface waters	Y N U
Construction and/or modification of sewer system or sewer treatment facility	Y N U
New discharges or modified discharges into existing sewer/septic system	Y N U

ATTACHMENT 4 (Continued)

Example Environmental Review Checklist (Continued)

Potential obstruction to navigable waters	Y N U
Modification or changes to existing potable water system or water treatment works	Y N U
Any land or water disturbance which may impact endangered or threatened species, and/or impact to any Migratory birds.	Y N U
Activity may create a potential oil spill to surface waters and/or soil.	Y N U
SOLID AND HAZARDOUS WASTE ACTIVITIES	
Addition of any petroleum storage tanks (above ground or under ground).	Y N U
Excavation activities	Y N U
Construction activities requiring material/debris disposal options	Y N U
Disturbing oily/contaminated soil	Y N U
Chemical releases and/or exposure	Y N U
Demolition/Maintenance repair activities that may disturb asbestos (insulation and/or piping)	Y N U
Chemical Usage, (for example, cleaning solvents, painting,) (Note: All chemicals must be pre-approved prior to being used on site)	Y N U
Activity resulting in discarded scrap metal on site	Y N U
Activity which requires radiological (x-ray) on site	Y N U
Activity may result in the disturbance of lead (removal of paint, burning, chipping, cutting/welding).	Y N U
Activity will generate on site “used oil”	Y N U
Activity will generate a “universal waste,” (used batteries, used florescent bulbs, etc.)	Y N U

ATTACHMENT 5
OUTAGE READINESS CHECKLIST

Example Outage Readiness Checklist

Plant _____ Outage Start Date _____
Unit _____ Outage End Date _____
Date _____ Days Until Start _____
Outage/Project Manager _____
Plant Management Contact

No.	Description	Date Implemented
1	O&M scope frozen	
2	Capital projects identified	
3	Outage manager assigned	
4	Cost information	
5	Outage budget set and approved	
6	Cost control system in place	
7	Assign outage scheduler	
8	Review previous outage reports	
9	Issue draft pre-outage milestone schedule	
10	Issue outage improvement plan	
11	Issue approved pre-outage milestone schedule	
12	Establish pre-outage meeting schedule	
13	Pre-outage planning organization	
14	Issue preliminary list of projects for the outage	
15	Shared resource requirements communicated to peer groups providing	
16	Long lead time parts	
17	Initial work scope identified	
18	Outside services with DR identified to contract services	
19	Firm price contracting	
20	Issue summary schedule Level 1	
21	Outage goals identified	
22	Issue final list of projects for the outage	
23	Begin scope review	
24	Begin schedule development meetings	
25	Engineering drawings received and issued	
26	Engineering materials ordered	
27	Freeze on program revisions that may affect outage planning	
28	Begin clearance preparation	
29	Outage lessons learned reviewed	
30	Scope control process in effect	
31	Input for lay down plan	
32	Input for pre-outage schedule	
33	Contract requisitions submitted	
34	Issue initial lay down plan	
35	Contracts requisitions approved	
36	Issue preliminary outage schedule Level 2	
37	Issue unit shutdown plan	
38	Issue unit startup plan	
39	Weekly or biweekly outage planning meetings begin	
40	Lessons learned resolution	

ATTACHMENT 5 (Continued)

Outage Readiness Checklist (Continued)

41	Temporary power plan complete	
42	Temporary air plan complete	
43	Special equipment needs	
44	Scaffold plan complete	
45	Insulation plan complete	
46	Non-destructive test plan in place	
47	Non-engineered materials and consumable ordered	
48	Self-assessment of outage preparations	
49	Identify outage manpower/resource needs	
50	Asbestos abatement plan complete	
51	Plant work requests written for on-line PMs and routine tasks	
52	Review of maintenance backlog to be addressed	
53	On-line schedule transition plan	
54	Identify training needs	
55	Contracts awarded/work authorizations issued	
56	Work order task planning complete	
57	Issue pre-outage implementation schedule	
58	Complete contract Designated rep refresher training	
59	Planned inspection hold points identified	
60	Information plan	
61	Cost tracking reports	
62	Outage and project related equipment ordered	
63	Outage and project tools ordered	
64	Pre-kitting of outage material	
65	Issue integrated outage schedule Level 3	
66	Critical path identified	
67	Pre-outage report issued – all milestones identified and communicated	
68	Work hours established	
69	Senior management review/approval of outage plan	
70	Issue outage implementation staffing plan and organization chart	
71	Report templates built	
72	Contracts executed	
72	Budget outage cash flows complete	
74	Issue final laydown plan	
75	Clearances approved – clearance plan issued	
76	Contractor mobilization plan	
77	Contractor orientation meetings	
78	Complete work order implementer reviews	
79	Special lifting/rigging points or fixtures	
80	Issue outage goals	
81	Complete job safety analysis	
82	Emergency contact list issued	
83	Complete environmental review /check list	
84	Challenge meetings begin	
85	Perform outage readiness assessment	
86	Document control plan in place	
87	Contingency plans in place	
88	Management final scope and budget review	
89	Plant cranes and hoist ready to support outage	

ATTACHMENT 5 (Continued)

Outage Readiness Checklist (Continued)

90	Material on site	
91	Outage authorization and approved outage schedule in place	
92	Pre-outage training plan complete	
93	Safety training completed	
94	Outage facilities mobilized and in place, including tool rooms	
95	Parking, access and security plans in place	
96	Walkdown for adequacy of lighting, power and housekeeping	
97	All-shift materials and tools issuance plan in place	
98	Work staging areas established	
99	Lay down areas established	
100	Engineered and non-engineered materials and consumables received	
101	Outage and project equipment and tools received and set up	
102	Inventory control plan in place	
103	Cost tracking system activated	
104	Lock out/tag out plan in place	
105	All pre-outage tasks complete	
106	Outage begins	
107	Complete major contractor critiques	
108	Perform self assessment of outage performance	
109	Issue final outage report	

Milestones will vary depending on the projects in an outage, but certain key milestones will recur in every outage plan. The items in bold type above are key milestone events.

ATTACHMENT 6
EXAMPLE LAYDOWN PLAN

This laydown plan was used by a major southern utility during a feedwater heater replacement outage. The level of detail needs to be expanded if the laydown requires special considerations for safety, cleanliness and foreign materials exclusion, hazardous waste control or other reasons.

1. Feedwater Heater Cribbing (Laydown Areas)

1.1 Each of the two new feedwater heaters will be delivered sitting on two stacks of timbers or cribbing. These timbers will be reused and, therefore, must be taken off the railcar; however, the feedwater heater restraints are welded to the rail car and must be torched off before offloading the heater. In addition, the cribbing is also encased with steel on each end, which is also welded to the railcar and must also be torched off also. The feedwater heater cannot be lifted off the rail car until all the restraints are removed.

1.2 The two heaters will be set on the railroad track on the south end of the building, with two stacks of cribbing supporting each of the new heaters.

1.3 Once the restraint system has been removed, the feedwater heater will be lifted a few inches above the rail car to load test the crane brakes.

1.4 When the load brakes have been successfully tested, the feedwater heater will be lifted further to allow for the cribbing to be removed from the rail car and placed on the floor over the railroad track. The space between the two stacks of timbers should remain the same after being relocated. In addition, the center of gravity of the heater should also not change relative to the cribbing after they are moved.

1.5 In addition, cribbing will be required to lay down the old heaters before loading them on the rail car for disposal. The cribbing will be made of timbers 10' long x 10' wide (minimum) x 2' tall with a saddle to prevent the feedwater from rolling.

1.6 The owner will provide 8" x 8' x 10' cross ties and 6" x 8 " x 8' timbers for cribbing of the feedwater heaters.

1.7 The owner will identify a suitable location on the turbine room floor that is rated for the load of the new feedwater heater. This location will be identified in the final lifting plan, which the owner will provide to the contractor for review.

1.8 The new laydown area will also be required to up-right the new heaters before they are set into place. This is because the West hook will not reach the center of the feedwater heaters where they are going to be installed, and the East hook will not reach the center of the railroad track to lift the feedwater heaters. Therefore, the new heater must be move to the laydown area where the rigging will be changed, and a different hook will be used to complete the lift.

1.9 After the old heaters are lifted onto the railcars and the new heaters have been up-righted, the cribbing will not be needed any longer. The owner may require the cribbing to be removed at this time in order to create more useable laydown space for other projects.

ATTACHMENT 7
Outage Communication Plan

Example Outage Communication Plan

Audience	Message	Vehicle	Target	Assignee
• Outage Team	• Status update onproject/outage schedule and plan • Understand what resources, help the team needs to stay on schedule/plan	Daily Outage Status meetings	Daily	OM
• Outage Team • Plant Management	• Status update on project/outage schedule and plan	Daily Outage Status meetings	Daily	OM
• Outage Team • Plant Management • Senior Management	• Status update on outage budget • Overall weekly update	Written report	Weekly	OM
• Outage Team	• Safety Priorities • Environmental goals	Safety/Environmental Goals Kickoff event	15-20 days before outage	OM
• Plant Employees	• Measures taken to prep for outage • Goals of projects/outage	Kickoff event	15-30 days before outage	OM
• Plant Employees	• Status of outage	Written report — email and posted in visible areas	Weekly	Plant Manager

ATTACHMENT 7 (Continued)

Example Outage Communication Plan (Continued)

Audience	Message	Vehicle	Target	Assignee
• Senior Management	• Outage status, opportunities, barriers	Conference call	Weekly	Plant Manager Outage Manager
• Plant Operations • Plant Management • Outage Management organization	• Outage history	Turnover report	In compliance with procedure	OM and OPLs
• Outage Workers	Rationale for schedule compliance	Shift Turnover sessions	On a weekly basis, beginning 30 days prior to outage	OPLs
• Outage Workers	Outage schedule status	Shift Turnover sessions	Daily throughout outage	OPLs
• Plant Employees	Countdown to outage	Signs and posters	Daily beginning 3 months before outage start date	OM

As part of the outage communication plan, it may be useful to designate a convenient location in the plant as “outage central.” This location would be staffed continuously by planners and could also have one or two “runners” who could carry messages to the field or other offices.

This could also be the main contact point for the fix-it-now team that could perform simple support tasks safely, quickly and effectively.

ATTACHMENT 8
RULES FOR MEETINGS

1. Don't let the rules get you down. Many meetings run smoothly with informal use of rules.
2. The outage manager runs the meeting. However, run your meetings as you would have others run the meetings that you attend.
3. Be clear about the meeting's objectives. Don't hold unnecessary meetings.
4. Create a solid agenda. If there is nothing to put on the agenda, do not waste time having a meeting.
5. Prepare in advance and give others enough time to do the same. No one should ever wonder what the meeting is about or why they are there.
6. Know the process. It is every individual's responsibility to know, understand, and participate in the organizational documents, procedures, and rules.
7. Discussion-management process:
    a. Every meeting is a partnership between the leader and the participants.
    b. All the meeting's participants are the meeting's facilitators.
    c. Conduct meetings in the spirit of open and honest communications.
    d. Disagree without being disagreeable. Conflict is desirable and resolving conflicts, disagreements, and concerns will improve the outage process and help reach goals.
    e. Assume good faith in actions on the part of others.
    f. Stay on topic. Finish one topic before moving to another.
    g. Speak in turn. Do not interrupt unless it is to get back on topic.
    h. Speak only for yourself.
    i. No sidebar discussions. Involve everyone or have additional conversations after the scheduled meeting.
    j. Question assumptions and ask clarifying questions.
    k. Relinquish ownership of ideas. Present ideas to the team and the team will address, challenge, and improve them.
    l. The meeting should enforce the will of the majority while protecting the rights of all members. Each individual should be able to live and cooperate with the group's decision.
8. Use of time. Plan an appropriate and convenient time for routine meetings, arrive on time, start on time, stick to the meeting schedule, end on time or early.
    a. For emergency meetings, try to manage time in the same way.
9. Plan, discuss and assign roles. Wrap up meetings with a clear statement of action items, the next steps to be taken to accomplish the actions, who is to take them and when results are due.
10. Pre- and post-meeting communication:
    a. Emphasize open, honest and continual communication.
    b. If something is not right, report it and start to fix it as soon as you can.
11. The safe conduct of work and success of the outage are paramount.

ATTACHMENT 9
EXAMPLE DAILY OUTAGE MEETING REPORT

Outage Update
Day 24 -1800
00/00/0000

Human Performance/Safety Tip

Eye Protection
We experienced our first OSHA recordable injury today. A contract employee felt something in his eye and instinctively rubbed it. There was an object in his eye and, by rubbing it, probably pushed it further into his eye. Trying to wash his eye was unsuccessful, and he was taken to the doctor to have the metal removed.

Eye protection is important. Do not take shortcuts; wear the proper personal protective equipment. When removing your safety glasses or face shield, ensure that items will not fall into your face or eyes.

Major Activities Completed Last Shift
- Install Extension shaft
- Stress relief completed on header
- BFP & Condensate Pump Inst. Cal/Inspection/test
- Completed welding BFP discharge valve
- Finished installing "B" Air Heater Hot & Cold Rotor Post Seals

Schedule Variance
- 18 hours behind (Additional repair time needed due to cracks found on HP heater

Critical Path Activities Next 24 Hours
- Generator Re-wedge
- Sand Blast HP Rotor
- Balance LP Rotor

Next Major Milestones
- All Boiler Tubes Welded
- Air Heater Turnover to Operations for testing

Issues/Hard Spots
- Feed Water Header repairs starting today. This work will take 2 days but will not impact outage end date.
- Water wall project slipping behind schedule. Reviewing/revising plan to improve progress.

ATTACHMENT 10
EXAMPLE DAILY AND WEEKLY OUTAGE MILESTONE AND STATUS TEMPLATES

Project	**Priority**	**Day/Hour**			**Look Ahead Daily/Weekly Schedule Example**	
Milestone	**CP**	**Window**	**Scheduled Duration (hrs)**	**Template (hrs)**	**Schedule Variance (hrs)**	**Assumptions**
Description of milestones to be met in next 24 hours	Yes, if item is critical path	Name planned work window	Scheduled window duration	Work time scheduled for task	Difference: + is added time, - is reduced time	List assumptions that must be met to support schedule
Concerns and issues						
Summary of last 24 hours						
48 hour look ahead						
Safety items						

A simple template like the one above can be used and posted or distributed to each work team to let all stakeholders know what the daily plan is. Issue weekly for simple outages, daily for more complex outages and jobs.

OUTAGE STATUS UPDATE – Outage name/number:				**Week Ending: mm/dd/yyyy**	
OUTAGE PROJECT/ACTIVITIES	**PROJECT MGR.**	**ORIG. TARGET DATE**	**REV. TARGET DATE**	**ACTUAL COMP. DATE**	**COMMENTS**
Auxiliaries					
Project 1					
Project 2					
Etc.					
Boiler					
Project 1					
Project 2					
Turbine/Generator					
Project 1					
Project 2					

A weekly update, like the one above, can be very general and still give all outage participants an update on outage status.

ATTACHMENT 11
LESSONS LEARNED FORM

REQUESTED INFORMATION

The "Lessons Learned" input allows the outage manager to document what went well or where problems occurred during each phase and project during the outage and to identify the improvement opportunities for the future. Please respond openly to each question and then return this document to the Project Manager so that the findings can be compiled.

1. Which factors within and external to the team contributed to the success of the project?
2. What did the project team do well?
3. What are the three top strengths of the project team?
4. How can we capitalize on our successes?
5. What did we not do well?
6. What factors detracted our team from doing well?
7. What did you personally do well?
8. What are you proud of?
9. What could you have done differently or better?
10. What do you want:
    1. More of
    2. Less of
    3. The same

Add any additional comments, attaching additional sheets as necessary.

ATTACHMENT 11 (Continued)

Lessons Learned Form

To be completed by initiator:

Plant: Outage: Observation/Statement describing issue:

Recommended actions:

Submitted By: Date:

To be completed by Outage Manager: Lessons Learned Number:

Category:

Disposition:

Outage Manager: Date:

Lessons Learned – add sheets as required.

ATTACHMENT 12
OUTLINE FOR CONTRACTOR SAFETY GUIDE

The following items apply to all personnel working on the outage, not solely to contractors. However, many sites provide contractors with abbreviated guides to safety information and expectations, along with contact information that can be used if necessary to report a safety concern or incident during an outage.

The information below is presented partially in outline form because a typical pocket-sized guide may contain several dozens of pages and a full version is outside the scope of this report. Also, individual plants will have corporate and local regulations, rules and policies that will need to be included for many sections, and there may be special instructions for specific outages. The safety department should use this outline as a starting point for development of the utility, plant specific or outage specific contractor safety guide.

Safety Guiding Principles
(The rationale and foundation of the overall safety program)

- Everyone is responsible for safety.
- We look out for each other.
- Safety will be planned into our work.
- All injuries are preventable.
- Management is accountable for preventing injuries.
- Employees must be trained to work safely.
- Working safely is a condition of employment.
- Safety performance will be measured.
- All deficiencies must be resolved.
- React to incidents, not just to injuries.
- Off-the-job safety is as important as on-the-job safety.
- It's good business to prevent injuries.
- We will comply with applicable occupational health and safety regulations.

Level 1 Safety Assessment
(To be performed by teams and individuals before and during the conduct of every job)

1. Do I understand and use the Safety Guiding Principles?
2. Do I understand the task and how to perform it safely?
3. Do I understand how my actions affect the safety of others?
4. Am I trained and qualified to perform the task safely?
5. Am I complying with company methods and procedures?
6. Am I working safely?
7. Am I communicating for safety?
8. Do I refuse to accept unsafe work practices by others?
9. Do I share lessons learned for the benefit of others?
10. Do I report all safety problems?

ATTACHMENT 12 (Continued)

Example of Booklet Content
Health and Safety Program

1.0 Applicability

This Health and Safety Program is applicable to all personnel, including company personnel, vendors and contractors during the execution of their daily occupational tasks. It is also applicable to all visitors and guests during the time they occupy the various facilities administratively controlled by management. Personnel escorting visitors and guests are responsible for ensuring all individuals comply with all applicable safety procedures and policies.

2.0 Purpose

The purpose of this program is to define the actions required to provide a clean, safe work environment for all company personnel, vendors, contractors, and visitors. In accordance with this program, the safety and training departments will ensure that personnel are trained to work safely. This program defines the elements for achieving a safety conscious culture. In doing so, it defines the following:

- The roles and responsibilities for all levels of personnel involvement
- Guidance for performing work assignments and associated activities in a safe manner
- The mechanisms for responding to, tracking, and trending safety issues that arise
- The disciplinary actions for safety violations

3.0 References – Place company-specific reference information here.

4.0 Safety Program Contacts – Contact information for the company, the plant and for the outage

5.0 Roles and Responsibilities – Company-specific information regarding the following:

- Program responsibilities
- Manager and supervisor responsibilities
- Individual responsibilities

6.0 Program Tools

6.1 Implementation Tools

6.1.1 The following are tools utilized in the implementation of this program to create and maintain a safety conscious culture.

6.1.1.1 Corporate Policies and Procedures
6.1.1.2 Working Instructions
6.1.1.3 Corporate Safe Work Practices Manual
6.1.1.4 Facility or Project Safety Procedures
6.1.1.5 Safety Steering Committee
6.1.1.6 Training
6.1.1.7 Job Hazard Analyses
6.1.1.8 Audits, Inspections and Metrics
6.1.1.9 Goals
6.1.1.10 Employee Discipline Policy

ATTACHMENT 12 (Continued)

7.0 **Safety Committee** – Brief description of the committee organization, its charter, goals, tracking of safety requirements and compliance, trending of safety reports and records, metrics used to assess effectiveness, safety event review, reporting of near misses and incidents

8.0 **General Safety Components**

8.1 Job Hazard Assessments – Explain when and how they are to be performed

8.2 Housekeeping

8.2.1 Each work crew member should be responsible for maintaining their work areas in accordance with housekeeping rules.

8.2.2 The following housekeeping criteria must be met:

8.2.2.1 All work and training areas should be kept clean, with trash, debris, and tools picked up, and cans and bottles thrown in trash.

8.2.2.2 Laydown areas should have tools and equipment stored neatly.

8.2.2.3 Aisles and walkways should be kept clear of cables, hoses, tools, trash, equipment, and materials.

8.2.2.4 Tools in work areas and on working platforms should be picked up and stored in toolboxes.

8.2.2.5 Trash should be disposed of and materials and equipment should be neatly stored out of the way.

8.2.2.6 Spills of oils, grease, hydraulic fluid, etc. should be cleaned up immediately. Oily rags should not be placed in the regular trash, but put in metal containers designated for oil soaked rags. These containers must be emptied nightly.

8.2.2.7 Cables, hoses, video, and electrical lines should be run overhead; when placed on the floor, appropriate covers and signage must be used to prevent trips, falls, and damage.

8.2.2.8 Unsafe conditions should be corrected immediately.

8.2.2.9 Sharp objects (broken glass, etc.) should not be thrown in trash unless they are wrapped or boxed to protect others.

8.2.2.10 Flammable and combustible materials must be kept in approved containers. The containers must be stored in an ANSI, NFPA or OSHA consensus standard approved flammable liquid storage cabinet. If these materials are transferred to a secondary container this container must be labeled the same as the original container.

8.2.2.11 First aid equipment should always be accessible and never blocked by equipment

8.2.2.12 Fire fighting equipment (extinguishers, hose reels and emergency exits) should always be accessible and never blocked by equipment.

8.2.2.13 Electrical panel boxes and valves should always be accessible and never be blocked by equipment

ATTACHMENT 12 (Continued)

8.3 Personal Protective Equipment (PPE)

8.3.1 It is the responsibility of each individual to utilize the appropriate level of personal protective equipment (PPE), consistent with the guidance of this document, and in accordance with local safety postings, job hazard assessments, and applicable work permits.

8.3.2 PPE requirements will be based on anticipated job hazards within given work areas as defined by the safety supervisor; facility manager; task manager; Manager, Support Services; or their designees.

8.3.3 In the absence of specific requirements, personnel should use sound safety judgment and common sense when selecting PPE for a given work activity or environment. The following is a list of standard safety equipment requirements while at company facilities:

8.3.3.1 Safety glasses with side-shields are required in all shop and training center areas except where otherwise posted.

8.3.3.2 Hardhats are required when overhead work is performed, if bump hazards exist, when operating cranes, within 25' of operating cranes, and when performing rigging.

8.3.3.3 Appropriate gloves should be used for all hands-on work activities with the potential for hand injuries including, but not limited to, burns, splinters, cuts, punctures, pinching, or chemical exposures.

8.3.3.4 Work shoes with leather uppers and slip-proof soles are required in all shop and training center facilities.

8.3.3.5 Safety shoes are required when operating or in proximity to (25') forklifts, cranes, heavy loads, rigging and materials in transit and whenever the potential exist for falling objects, rolling objects, punctures and electrical hazards. (Safety shoes must meet ANSI or ASTM standards.)

8.3.3.6 Hearing protection should be utilized in areas posted as hearing protection required and as required by environmental health and safety or local safety rules.

8.3.3.7 Fall protection and/or fall arrest devices should be utilized when working at heights 6' or more above a lower level.

8.3.4 In order to ensure the continued reliability of PPE, it must be inspected prior to use. PPE that fails an inspection, or is otherwise found to be defective and cannot be repaired, will be removed from service and discarded.

ATTACHMENT 12 (Continued)

8.3.5 An exemption from the use of PPE required by a safety policy or job hazard assessment is justifiable only when creating an increased hazard to the worker. When an increased hazard is present, exemptions from the use of PPE should be documented and approved by the project or facility environmental health and safety person or project manager.

8.4 Operation and Maintenance of Cranes and Bridges

8.4.1 Operators and riggers must receive training and pass equipment specific test(s) prior to the operation of cranes and bridges or the utilization of rigging. Training may be in the form of classroom presentation or computer based modules. Both written and practical examinations may be included as a pre-requisite for certification to operate these devices.

8.4.2 Movements of large equipment, equipment of an awkward configuration, or with a non-typical center of gravity, should be pre-planned. A documented an approved lift plan should be completed and present for the lift. A pre-job briefing should be documented as part of the lift plan.

8.4.3 For all lifts, the travel path must be verified to be cleared of personnel and physical obstacles. Personnel not associated with the movement should be cleared from the area.

8.5 Pre-Operational Procedures

8.5.1 Prior to operation, all devices should be inspected to ensure they are in good working order. If deficiencies are noted, the equipment should be de-energized and/or tagged out of service. Equipment that is non-repairable should be discarded.

8.6 Maintenance Procedures

8.6.1 Maintenance of facility components and equipment should be conducted by authorized personnel. Only personnel qualified to perform work in the required mechanical, electrical, HVAC, or other area of specialization, should be permitted to perform maintenance activities.

8.7 Burn Permits

8.7.1 All activities utilizing flames for the purpose of welding, grinding, cutting, or brazing should be governed by the appropriate manual and require the use of “burn permits.”

8.8 Emergency Response

8.8.1 Emergency response actions should be implemented in accordance with the facility Emergency and Evacuation Plan.

ATTACHMENT 12 (Continued)

8.9 Near Miss, Injury, and Illness Reporting

8.9.1 Each individual worker is responsible for immediately notifying their supervision/management of conditions adverse to safety, near miss events, and accidents.

8.9.2 Supervisors and managers should complete the first report for all injuries and illnesses, and a near miss form for near miss events. Completed document the incident and distribute forms to the following within 24 hours:

8.9.2.1 Email or fax a completed and signed copy to the appropriate safety coordinator.

8.9.3 If a worker is sent to the Doctor, Hospital or has lost time from work, management must also complete the accident investigation form.

8.9.4 All reports are maintained by the Safety Department.

8.10 Chemical Controls

8.10.1 Chemicals should be controlled in accordance hazard communication program.

8.10.2 All chemicals should be in a clearly identified, sealed container, of adequate design and construction.

8.10.3 When not in use combustible and flammable chemicals should be stored in a storage container designed for this purpose.

8.10.4 Questions concerning chemical identification, storage, and use should be directed to the Safety Supervisor.

8.11 Spill Response

8.11.1 Response actions for chemical spills are managed in accordance with the facility emergency and evacuation plan.

8.11.2 Trained responders will be maintained to respond to spills and determine if spills can be cleaned up by our employees, or if outside assistance is needed.

8.12 Fire Protection and Prevention

8.12.1 Fire Protection requirements are defined in the safe work practices manual.

8.12.2 All personnel must be familiar with their responsibilities and duties in the facility emergency and evacuation plan.

8.12.3 In the event of a fire, personnel are to immediately exit the facility by means of the nearest, unobstructed exit.

8.12.4 Personnel should offer assistance to those with special needs.

ATTACHMENT 12 (Continued)

8.12.5 Personnel should assemble within the designated muster areas for the facility.

8.12.6 Management will announce when it is safe to return to work or any further evacuation plans.

8.12.7 The corporate Safe Work Practices Manual defines the control, maintenance, and use of fire extinguishers.

8.13 Smoking

8.13.1 Smoking is restricted to designated areas of the facility only and is not allowed in company buildings or company vehicles.

8.13.2 Smoking is not allowed within 25' of any flammable material.

8.13.3 Cigar and cigarette butts must be placed in the proper containers.

8.13.4 Violations of the smoking policy will result in disciplinary action.

8.14 Lock out/Tagout

8.14.1 The Safe Work Practices Manual defines the actions required before working on powered equipment driven by hazardous energy sources such as electrical, mechanical, hydraulic, pneumatic, and thermal.

8.14.2 Supervisors or training must provide effective Lockout/Tagout initial training, retraining as needed, and certification of training. The certification should include each employee’s name and dates of training.

8.14.3 The training program must cover the following:

8.14.3.1 Review of Safe Work Practices Manual, Lockout/Tagout, including the sequence of events.

8.14.3.2 Elements of Safe Work Practices Manual, which are relevant to each employee.

8.14.3.3 Training may be accomplished through classroom or CBT.

8.15 Forklift Operation and Maintenance

8.15.1 The Safe Work Practices Manual defines the pre-requisite and operational requirements for forklifts.

8.15.2 The essential elements are:

8.15.2.1 Forklift operators should be qualified by successful completion of classroom or CBT and practical training prior to operating a forklift.

ATTACHMENT 12 (Continued)

8.15.2.2 Hands-on training should be conducted on the specific forklift to be operated.

8.15.2.3 Operating characteristics of individual forklift(s) must be reviewed with all new operators.

8.15.2.4 A documented, pre-operational inspection of the forklift is required on a daily basis.

8.15.2.5 After the initial daily documented pre-operation inspection, each operator should inspect the lift prior to use.

8.15.2.6 Equipment found in need of repair or replacement, affecting the safe operation of the forklift, should not be used.

8.15.2.7 Free-rigging from a forklift is not permitted. Rigging from a forklift is only permitted in conjunction with the use of a boom or other device specifically manufactured for this use.

8.15.2.8 Forklifts may be utilized as a personnel lift only when fitted with an approved man-lift device. Personnel using these devices should be equipped with approved fall protection gear.

8.16 Scaffolding

8.16.1 The Safe Work Practices Manual sets forth the requirements for safe erection and use of scaffolds

8.16.2 Only individuals trained and certified in accordance with OSHA requirements (“competent person”) can construct and inspect scaffolding.

8.16.3 Employees and contractors should be trained on the safe use of scaffolds (scaffold user training).

8.16.4 Prior to the use of any scaffold, a “competent person” should inspect it and approve it for use. Scaffold approved for use should be tagged accordingly.

8.17 Rigging

8.17.1 Personnel performing rigging must complete rigging training, or receive a waiver from the training department for past training/experience.

8.17.2 Competent personnel should inspect rigging and lift equipment prior to use.

8.17.3 Only approved rigging techniques and equipment should be utilized.

8.17.4 Damaged or inoperable rigging equipment should be tagged out of service or discarded.

8.18 Noise and Hearing Conservation

8.18.1 Hearing protection is required whenever sound levels exceed OSHA limits. In general, hearing protection will be used when sound levels are at, or above, 85 dBA.

ATTACHMENT 12 (Continued)

8.18.2 The requirements for hearing protection should be evaluated through a job hazard assessment for the work activity.

8.18.3 Areas requiring hearing protection should be posted as necessary.

8.18.4 Ear plugs or other hearing protection devices should be available as required by local supervision or the safety department.

8.19 Office Safety

8.19.1 The Safe Work Practices Manual describes the general guidelines for safety in office areas.

8.19.2 Office safety activities will parallel those found in the field and operating plant areas.

8.19.3 A fundamental aspect of office safety is house-keeping.

8.19.4 Keep office areas free of clutter and obstructions.

8.20 Travel Safety

8.20.1 Travel safety tips and instructions may be obtained from the safety department.

8.21 Inspections

8.21.1 Routine and impromptu inspections will be performed by the Safety Department, other designated company and plant stakeholders and outside agencies.

8.21.2 These inspections will serve multiple purposes.

8.21.2.1 Inspections will serve to ensure compliance with OSHA standards, procedures, and policies.

8.21.2.2 Weaknesses or non-compliant issues will be recognized, documented via the corrective action program, and corrected.

8.21.2.3 Condition Reports should be utilized to document violations and the subsequent corrective actions.

8.21.2.4 Inspections also allow good practices and extraordinary efforts to be recognized.

8.22 Evacuation

8.22.1 Evacuations and emergencies should be managed in accordance with the facility emergency and evacuation plan.

ATTACHMENT 12 (Continued)

8.22.2 In the event evacuation is required, the evacuation alarm (fire alarm) or public address system will be utilized to notify occupants.

8.22.3 Should the evacuation alarm (fire alarm) or the public address system be inoperable, volunteers will be utilized to order the evacuation in person.

8.22.4 Muster and assembly instructions will be provided as required.

8.22.5 Assembly should be in the designated muster areas.

8.22.6 Air monitoring should be in accordance with corporate procedures.

8.23 Air Handling Systems

8.23.1 Air handling system maintenance is the responsibility of Facilities Management.

8.23.2 Two classifications of systems are utilized. The normal heating, ventilation, and air conditioning system (HVAC) is utilized to maintain a comfortable work environment. Process or area ventilation, such as welding or chemical work hoods, are essential to the health of the occupants.

8.23.3 Facilities will ensure the regulated, minimum flow rates are maintained for HVAC systems.

8.23.4 The local environmental health and safety department will monitor flow rates for welding and chemical ventilation systems.

8.24 Safety Meetings

8.24.1 Employees and contractors at the time of scheduled safety meetings are expected to attend. Supervisors and managers of employees not able to attend are responsible for ensuring the information covered in the safety meeting is disseminated to their employees.

8.25 Training

8.25.1 Indoctrination Training

8.25.1.1 All employees should receive training in regard to this safety program and the related procedures, policies, and documents.

8.25.2 Task Specific Training

8.25.2.1 Training specific to the operation of tools and equipment is the responsibility of the supervisor/manager of the person performing the task. Task-specific training should consist of a combination of formal classroom and hands-on coursework.

8.25.2.2 Training should be performed with lesson plans.

ATTACHMENT 12 (Continued)

8.25.2.3 Job hazard assessments and pre-job briefings are required for all task-specific training activities utilizing tools and equipment.

8.25.2.4 Performance criteria should be clearly defined.

8.25.3 Documentation

8.25.3.1 Training classes should be documented and stored for retention.

8.25.3.2 Certifications of personnel to perform a given task should be issued only when adequate documentation exists to validate the ability of the individual to conduct the task in a safe manner.

9.0 Safety Program Compliance

9.1 Accountability

9.1.1 All personnel are accountable for complying with the health and safety program.

9.1.2 It is the responsibility of all personnel to comply with local and procedural safety measures.

9.1.3 Individuals are expected to inform others observed to be working in an unsafe manner or unsafe conditions. If the situation cannot be corrected on the spot, work is to be stopped, placed in a safe condition, and supervision notified.

9.2 Disciplinary Policy

9.2.1 Failure to comply with the safety program will result in disciplinary action.

9.2.2 Possible reactions to violations include verbal warning, written warning to file, suspension without pay, denied facility access, and termination.

9.2.3 Repeat offenders and willful and deliberate violations will not be tolerated and are clear grounds for termination.

9.3 Record Keeping

9.3.1 All records associated with safety training provided will be maintained.

ATTACHMENT 12 (Continued)

9.4 Program Maintenance

9.4.1 It is inherent that problems will occasionally arise through the introduction of new equipment, processes, and procedures. It is our goal to identify and eliminate as many potential problems as possible to improve employee protection and encourage employee safe practices.

9.4.2 The following methods should be utilized to review the effectiveness of this program:

9.4.2.1 Self-assessment
9.4.2.2 Independent review
9.4.2.3 External authority review

9.4.3 Reviews will be conducted in accord with safety committee initiatives, procedures, and policies.

9.4.4 Revisions will be made to improve the program after thorough review by stakeholders, safety professionals and approval by management.

Other topics that may need to be addressed in the completed handbook are:

- Outage-specific safety requirements
- Abrasive blasting and coatings
- Climate
- Coal handling
- Confined spaces
- Electrical safety – for the plant and for transmission and distribution areas, as required
- First aid
- Hazardous chemicals and waste
- Use of equipment – heavy and light categories
- Motor vehicles
- Personal security
- Pesticides
- Physical and mental preparedness – fitness for duty
- Safety signs, markers, ribbons, tapes, tags
- Tools
- Trenching and excavation
- Water safety
- Welding, cutting, brazing, grinding
- Expanded information on any or all of the above topics or addition of other topics not listed here.

ATTACHMENT 13
Forced Outages

The purpose of this attachment is to provide general guidelines and discussion of issues that need to be addressed for a forced outage for a fossil-fueled power plant. An example based on previous experiences is used to provoke a thought process to develop discussion and plans for individual plants. Since each plant and unit has different requirements, each plan for forced outages will be different.

The same planning techniques may be applied to a "unit not needed" or opportunistic maintenance outage such as a weekend or period of time when weather conditions do not require the load. This enables the plant to take the best advantage of unanticipated downtime and generally reap some economic benefit from it.

A forced outage is not something a plant wants or needs but that does happen. It can be planned for and anticipated to shorten the outage time. One advantage to a forced outage is the ability to complete some of the work that has been planned for a scheduled major outage in the period of time the unit is forced down. This being accomplished, the planned scheduled major outage time can be reduced.

A forced outage plan and schedule is not something that is thrown together as the unit is coming down. Advance planning should be done to ease the transition from normal operation to forced outage implementation. Specific plans need to be in place, and several steps and processes must be done as the unit is coming down and cooling off in order to complete a successful forced outage in the least amount of time. Forced outage plans should be "living" plans and should be disseminated as often as necessary to keep personnel informed about what actions are necessary to deal expeditiously with a forced outage.

These include but are not limited to the following considerations:

- Pre-planning
- Short notice planning requirements
- Schedule for forced outage
- Spare parts availability
- Resources required
- Contractors required
- Root cause evaluation of reason(s) for outage
- Testing and results
- Additional work completed
- Equipment status after startup
- Safety goals
- Post-startup requirements
- Work order close out
- Major outage plan changes

ATTACHMENT 13 (Continued)

Forced Outages (Continued)

Designate in advance individuals as the forced outage manager and members of the forced outage team. These designations could be flexible and specific for certain known likely or possible types of forced outage.

Use site generation availability data system (GADS) info to help establish an "off-the-shelf" plan based on historical failure/availability data – what do you most likely need to plan for? An example of tube leaks is included below. There are several "common" forced outages depending on unit type and age. The following is a sample list.

Boiler tube leak
- Water wall
- Super heater
- Reheat
- Economizer

Turbine condenser tube leak
Feed water heater tube leak

Use condition assessments (predictive maintenance and other condition-based maintenance techniques) linked to GADS and other operational data along with risk evaluation and mitigation techniques applied to planning.

Have a "hit list" of what needs to be done to start rolling on the work for known types of forced outages and the requirements to meet them if they may occur again (part of the above plan that could be used immediately without any meeting or time delay to get started). The list that should be followed is the schedule and plan that should be in the system as described below. In addition a general check list is included below.

If a plant has a system in place for work orders being coded for outage required and if these work orders are planned, reviewed and scheduled for a planned major outage, work orders can be sorted by duration and pulled for use during a forced outage.

EXAMPLE

As an example for the purpose of discussion consider a unit that is due for a scheduled major outage in four months. One of the major projects for the major outage is the replacement of the front water wall tubes. This replacement is necessary because of increased number of tube leaks due to water chemistry problems and heat distribution changes. The project for the tube replacement and the milestones for the project and outage are on schedule.

Several assumptions are made for this example.

1. The plant has a maintenance work order system that has PMs, work orders, and an outage plan in place.
2. The system allows four to six weeks advance planning for routine maintenance scheduling

ATTACHMENT 13 (Continued)

Forced Outages (Continued)

3. Plans and schedules are already in place for predicted forced outages such as tube leaks. These plans should address:
    - Requirements for clearances
    - Resources required
    - Tools and materials needed for repairs
    - Work break down structures for work identification
    - Startup plan and schedule
    - Close out requirements
4. The plant has a "Forced Outage Team" in place. This team is made up of a representative from each of the following areas and is on call at a moment's notice to put a forced outage plan into action.
    a. Maintenance
        i. Mechanical
        ii. Electrical
        iii. Instrument and controls
    b. Work order planning
    c. Scheduling
    d. Operations
    e. Stores
    f. Engineering
    g. Environmental
    h. Safety

The following is a suggested process for this forced outage.

1. The members of the forced outage team are notified.
2. The forced outage plan for tubes leaks will be pulled from the system and reviewed.
3. The duration will be confirmed and the major outage plan will be searched for any tasks that have the same duration time on the schedule.
4. A review of the equipment that will have a clearance for the forced outage will be compared to the equipment on the major outage list for the same duration.
5. A review of the spare parts required for each task should be compared to the status of parts for the major outage. The ones that are on site will be pulled.
6. The plant manpower availability will be reviewed. Resources can be available from several sources. One would be in-house movement of needed crafts to complete the work. Another could be resources from another plant that like all plants would maintain a list by craft of available resources for sharing for forced outages. Another choice would be to form an alliance with different contractors in the immediate area that, on a moment's notice have a pool of crafts to draw from that have already had the necessary training for the type of work required and also the company and plant specific training that is required. If craft unions are available, this could be another source for labor.

ATTACHMENT 13 (Continued)

Forced Outages (Continued)

7. After resources that are available have been identified, the tasks for the major outage can be added to the forced outage schedule without increasing the duration required.
8. The engineer and planner should review the major outage plan to check if any inspections, testing, samples or measurements can be completed that would have been done during the major outage.
9. The engineer should be the lead during the forced outage work on the root cause investigation for the cause of the tube leak. This may be obvious, but it needs to be confirmed to make sure a new issue is not identified that may cause emergent work to be discovered during the major outage.
10. The safety and environmental representatives need to review plans for forced outage work and any task from the major outage to make sure they are complete.
11. The plant should have a standing set of goals for any forced outage, and make sure work is planned and scheduled to meet those goals.
12. During the forced outage, the forced outage team should conduct outage meeting updates the same as a major outage to track plan and schedule compliance. Any deviations from plan should be addressed to keep the outage on schedule.

Post-Outage Activities

1. The forced outage team will meet immediately after the unit is on-line to review the following

    a. Forced outage effectiveness
    b. Lessons learned
    c. Completed work
    d. Status of equipment after outage vs. prior to outage
    e. Plans if needed and action items to improve process
    f. Close out completed work orders
    g. Entry of new work orders into system for work identified for outage required

2. The information from the above post outage meeting needs to be presented to the major outage manager, planner, and scheduler so they can make necessary changes and updates to the major outage plan and schedule.

ATTACHMENT 13 (Continued)

Forced Outages (Continued)

Forced Outage Check List

1. Notify forced outage team.
2. Plan for type of forced outage is pulled from CMMS and reviewed.
3. Duration of forced outage plan is confirmed, and scheduled outage plan is searched for work orders and task with same duration.
4. Review of forced outage equipment and clearances required is reviewed and compared with what is required for additional.
5. Information for additional clearances required is communicated to operations.
6. Spare parts identified are communicated to stores for confirmation of availability.
7. Plant resources are reviewed and checked against resources needed and available from other sources.
8. Engineering will review list of scheduled outage inspections and/or test that could be completed during forced outage.
9. Start root cause investigation for forced outage.
10. Address safety and environmental concerns for forced outage.
11. Conduct outage status meetings.
12. Conduct post-outage meeting documenting the information listed under post-outage activities for forced outages.

B
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3420 Hillview Avenue, Palo Alto, California 94304-1338 • PO Box 10412, Palo Alto, California 94303-0813 USA

800.313.3774 • 650.855.2121 • askepri@epri.com • www.epri.com