

## **5.2. Start-up of the infrastructure operations**

### **STARTUP COMPONENTS**

Startup activities may include the activities discussed in the following sections.

#### **Startup Transition Plan**

The development of a startup transition plan for the conventional facility may be essential for smooth startup implementation. Typically, these plans will include test plan procedures, scheduling, security planning, and the associated documentation. A plan provides an excellent opportunity to think ahead to situations that may be encountered at the facility during startup.

#### **Startup Organization**

Development of a startup organization, including management, administrative, operations, maintenance, and technical support personnel, will be required prior to the actual startup. Employees may have to be relocated to staff the facility while it is being tested, so employee moving costs or employee living costs may also be included in the cost estimate for facility startup.

In a startup situation, the owner's startup manager is in full charge of the work. Experienced engineers, who are familiar with the facility whether from the owner's organization or the engineering firm should be present during the startup. However, those outside the owner's organization act only on a consulting basis to the startup manager and his staff.

#### **Operating and Maintenance Procedures**

Site-specific operating and maintenance procedures will have to be developed for a new facility with special attention paid to equipment startup or initiation procedures. In some cases, as with a nuclear facility, startup operations and their sequence will be strictly regulated. Some of the maintenance responsibilities are as follows:

- Publish work and safety procedures
- Specify maintenance activities
- Select and purchase maintenance supplies and spare parts
- Negotiate with vendors and contractors
- Keep up maintenance records
- Make detailed designs of any changes and additions made during commissioning

- Storage of spare parts and supplies
- Schedule routine daily work and that for planned shutdowns

### **Spare Parts Inventory and Training**

The startup cost estimate must include provisions for materials to be used during startup and spare parts for any maintenance that occurs during startup. Training for operations and maintenance personnel will also be required.

### **Testing**

Some facilities will require a safety / readiness review before they can be declared operational. Some scheduling may also be involved. For example, a facility may have to demonstrate successful operation at a certain capacity for a specified period of time before it is commissioned. The startup cost estimate must account for the testing schedule. Safety should continue being one of the most important considerations on turnover of the plant. Commissioning and startup represent a time in the project life cycle when accidents increase. The owner's representative is responsible for establishing and enforcing the safety program after turnover.

### **STARTUP COSTS**

Every business is different, and has its own specific cash needs at different stages of development, so there is no generic method for estimating the startup costs. Some businesses can be started on a shoestring budget, while others may require considerable investment in inventory or equipment. It is vitally important to know that there will be enough money to launch a business venture.

To determine the startup costs, all the expenses that a business will incur during its startup phase have to be identified. Some of these expenses will be one-time costs such as the fee for incorporating the business or price of a sign for the building. Some will be ongoing such as the cost of utilities, inventory, insurance, etc.

While identifying these costs, decide whether they are essential or optional. A realistic startup budget should only include those things that are necessary to start that business. These essential expenses can then be divided into two separate categories: fixed expenses (or overhead) and variable expenses (those related to producing sales for the business). Fixed expenses will include things like the monthly rent, utilities, administrative costs, and

insurance costs. Variable expenses include inventory, shipping and packaging costs, sales commissions, and other costs associated with the direct sale of a product or service.

The most effective way to calculate the startup costs is to use a worksheet that lists all the various categories of costs (both one-time and ongoing) that will be needed to estimate prior to starting the business.

'Facility management' is an evolving field whose nature is still somewhat fluid. It is the practice of coordinating the physical workplace with the people and work of the organization. It integrates the principles of business administration, architecture and the behavioral and engineering sciences. Thus it is the effective, efficient and integral management of all facilities.

As the economic situation is becoming more and more difficult, also construction enterprises need to increase the performance of their tasks with regards to facility management in order to stay competitive. Businesses have come to realize that maintaining a well-managed and highly efficient facility is critical to success. The positive effects of good maintenance have received increased attention, largely because corporations appreciate the strategic importance of real estate and facility to a company's financial structure. Facilities management recognizes that facilities consume large amounts of capital, but by themselves produce nothing. They must be combined to work with humans to produce output in support of an organization's goals and objectives. There has also been a reasonably successful attempt in demonstrating the significant relationship of maintenance and investment performance. New technologies, security issues and health concerns also have had a major impact on the importance of and need for facility professionals in organizations.

Facility maintenance must conform to two goals. The first one is both strategic and operational. It is to ensure that clients, customers, employees, and other constituencies are able to work in a specific type of environment. The environment should be safe and clean, and the maintenance and repair problems are attended to promptly. The second goal includes targeting financial performance for property in terms of costs per square foot, costs per employee etc.

There is a big misconception in facility management about giving more attention to one-time high items, while small recurring cost items are practically ignored. While a reduction on a one-time high item will result in a one time saving, a small decrease in recurring items can have a much more significant effect on cash flow and ultimately property and business value.

The recurring cost is called the “multiplier effect”. The greater the size of the property (in square footage or acres) the greater the impact of the multiplier effect.

Moreover the goal of Facility Management should be towards performing more ounces of prevention instead of pounds of cure. The maintenance staff and others should work towards more preventive and cyclic maintenance work orders that are tracked, instead of a myriad of means that are not tracked or measurable. What gets measured gets done.

## **MAINTENANCE**

Maintenance is defined as any activity, such as tests, measurements, replacements, adjustments and repairs, intended to restore or retain a functional unit or asset in a specified state in which the unit can perform its required functions.

It can be dissevered further into three phases. (1) Preventive Maintenance (2) Cyclic Maintenance (3) Deferred Maintenance.

### **Preventive Maintenance**

This is a planned activity performed annually or more often on the same asset, equipment, component, or location such as filter changes, lubrication, or inspections, and includes repairing all sub-standard conditions found while performing regular inspections in order to preserve the asset’s function and serviceability, and to ensure its maximum life cycle.

### **Cyclic Maintenance**

This is a planned programme of repairs and improvements. This type of maintenance not only aims to keep properties to a maintainable standard but also allows for minor improvements such as the installation of central heating or double glazing. It is an activity that can be performed every year and perhaps on the same asset; but not on the same component, wall, roof, or location worked on in the previous year.

### **Deferred Maintenance**

Maintenance that was not performed when it should have been or was scheduled to be and which, therefore, is put off or delayed for a future period. Deferred maintenance does not include alterations and modifications, expansion in size or capability, work to address major technical or functional obsolescence, or other types of “new work.”

Many agencies of federal, state and local governments desire to know the deferred maintenance as a benchmark to compare to other organizations or the previous year’s

maintenance. Nearly all of these organizations are realizing these requests are costly, time consuming, soon outdated, and because each new search for this data finds more that was not found in the previous exercise, the number of organisations continues to grow.

**UNDERSTANDING MAINTENANCE SPENDING**

Maintenance groups frequently are asked to perform numerous activities in addition to maintaining equipment and facilities. These activities are important to business functions, but often are not recognized by upper management as spending that is in addition to "maintenance spending."

It is important to identify these additional costs, and make management aware of their magnitude and impact on the maintenance function. According to David E. Liddle, president of Liddle & Associates, USA, maintenance group spending can be separated into three categories: maintenance, improvement efforts, and inefficiencies.

**Maintenance**

Reason for spending	Activities necessary to keep the asset running at its current capacity and quality level.
Required or optional	Required for continued operations.
Type of activities	Repair in kind, preventive tasks, predictive tasks, resolving safety issues, administrative needs (vacations, safety meetings, etc.)
Causes	Business needs.

**Improvement Efforts**

Reason for spending	Activities that provide increased capacity, capability, or quality, or reduce the cost of production.
Required or optional	Optional discretionary spending (ROI should be calculated)
Type of activities	Modifications, trials, upgrades and improvements, support for capital projects, expense portion of capital projects, cost-reduction projects, administrative choices (training, special projects).
Causes	Business choices.

## Inefficiencies

Reason for spending	Ineffective work practices and activities that have no payback.
Required or optional	Optional discretionary spending (no ROI)
Type of activities	Over maintaining, modifications and improvements with no payback, unanticipated spending on capital projects, poor planning, travel time and waiting, nonproductive meetings and events.
Causes	Poor work practices, lack of discipline to calculate ROI, too many maintenance or engineering resources.

## BEST MAINTENANCE PRACTICES

Best Maintenance practices includes methods, strategies, and actions that can make maintenance operations more efficient, reduce maintenance and operating costs, improve reliability, and increase morale. It had been proposed by Ricky Smith, executive director, maintenance solutions, at Life Cycle Engineering, Inc, a multi-disciplined engineering company, USA.

Strategic attributes of proactive maintenance includes:

Maintenance skills training

Performing a job task analysis (JTA) will help define the skill levels required of maintenance department employees. The JTA should be followed with a skills assessment of employee knowledge and skill levels. Analyze the gap between required skills and available skills to determine the amount and level of training necessary to close the gap.

Work Flow

One element of the transition planning process that can be a major stumbling block is analyzing existing work flow patterns and devising the necessary work flow and organizational changes required to make use of a computerized maintenance management system (CMMS). This process can be difficult for the employees involved. When work flow shifts from a reactive to a proactive posture, planned and scheduled maintenance will replace the corrective maintenance style. The CMMS will provide insights into organized, proactive work flow arrangements through its system modeling.

#### Work order system

There probably is an existing work order system that is at least loosely followed. Again, the CMMS will help in defining changes to, or complete restructuring of, any existing work order system. The work order will be the backbone of the new proactive maintenance organization's work execution, information input, and feedback from the CMMS. The types of work orders an organization needs will need to be defined. They will include categories such as planned/scheduled, corrective, emergency, etc. The work order will be the primary tool for managing labour resources and measuring department effectiveness.

#### Planned, preventive maintenance activities

Developing maintenance task documentation most likely will be one of the most time-consuming requirements of the proactive maintenance approach, unless the procedures are already written and in-place. Procedural documentation should include standardized listings of parts, materials, and consumable requirements; identification of the craft and skill level(s) required to perform the task; and stated frequencies (or operating time-based period) of performance. Categories of maintenance procedures that will be included in planned maintenance documentation include:

- Routine preventive maintenance (lubricate, clean, inspect, minor component replacement, etc.)
- Proactive replacements (entire equipment or major components, time-based or operating hours)
- Scheduled rebuilds or overhauls
- Predictive maintenance
- Condition monitoring/performance based maintenance

#### Maintenance engineering development

If your facility or plant does not have a Maintenance Engineering section, one should be established. The functions and responsibilities of new or existing maintenance engineering groups should be reviewed and revised to integrate and enhance the proactive maintenance organization. Finding the reasons for self-induced failures, and all failures, is a responsibility of maintenance engineering.

Reliability engineering is the primary role of a maintenance engineering group. Its responsibilities in this area should include evaluating preventive maintenance action effectiveness, developing predictive maintenance techniques and procedures, performing condition monitoring, providing planning and scheduling, conducting forensic investigations of failures including root cause analysis, and evaluating training effectiveness.

Establishment, assignment and training of maintenance planners

Whenever maintenance is performed, it is planned. It is a question of who is doing the planning, when he is doing it, to what degree, and how well. Separation of planning from execution is a general rule of good management and good organizational structure. The responsibilities of the planner-scheduler are diverse, and although he must be familiar with the maintenance process, he also must be a good administrator and have the appropriate level of authority to carry out his role as labour usage scheduler and interface between many departments within the organization. The following are typical responsibilities of the planner:

- Establish equipment numbering system and number all equipment
- Develop PM program for each piece of equipment
- Ensure accuracy of equipment bills of materials
- Maintain equipment history in the CMMS as detailed and complete as possible
- Review equipment history for trends and recommend improvements
- Provide detailed job plan instructions (PM procedures)
- Determine part requirements for planned jobs
- Provide necessary drawings for jobs
- Ensure drawings are revised and kept current
- Arrange for special tools and equipment
- Coordinate equipment downtime with production

- Inform production of job progress
- Provide cost information from equipment history
- Assist with development of annual overhaul schedule
- Publish negotiated weekly maintenance schedules

The function of the planner-scheduler is a pivotal position in a successful proactive maintenance approach and therefore vital to attaining the standards of best maintenance practices. The planner-scheduler assignment must be critically evaluated, and specialized in-depth training should be provided if required.

#### Maintenance inventory and purchasing integration

The cost of (parts) inventory is almost always an area where cost reduction can be substantial. With the help of suppliers and equipment vendors, purchasing usually can place contracts or basic order agreements (BOA) that guarantee delivery lead time for designated inventory items. It just makes sense that your facility should shift the bulk of the cost of maintaining inventory to the suppliers.

Begin by identifying your facility's parts, material, and consumable requirements. All the inventory requirements data should be entered into the CMMS. If you do not already have this data, equipment vendors can be very helpful because they usually maintain parts lists by equipment type and model. It may even be formatted such that it can be directly downloaded to your system.

The parts requirements of planned preventive maintenance tasks should then be used (your CMMS should perform this function) to generate a parts list for the planned preventive category of work order. These are items that do not need to be in your physical inventory through your use of just-in-time vendor-supplied BOAs.

Bar-coding, continuous inventory and demand and usage data can be integrated through the use of the CMMS to minimize on-hand inventory and still avoid stock-outs.

#### Management reporting and performance measurement and tracking

Hand-in-hand with the CMMS review (upgrade) is the "report generator" function. The CMMS output should be providing maintenance, engineering, operations or production, purchasing, and upper management with accurate and effective reports for evaluation and

management. The types of reports and data tracking that should be obtained from the CMMS include:

- Open work order report
- Closed work order report
- Mean time between failures
- "Cost per" reports
- Scheduled compliance report
- PM overdue report
- Labour allocation report
- Parts demand and usage report

#### Return on investment (ROI) analysis

Justification of anything in business today is based on cost. You will need to accumulate data on productivity (total plant costs per item produced), maintenance labour costs, maintenance material costs, inventory carrying costs, and reliability/availability data for at least 2 years prior to transition to the proactive maintenance organization. Once you begin the planning and implementation of the changes, upgrades, etc., you will need to separate the development costs from the routine and normal operating costs of your facility to determine the total cost of implementing best maintenance practices.

When transition has been completed, accumulate the same cost and performance data that you obtained for the period prior to implementation. Obtaining this information must be planned for ahead of time so you determine your real ROI.

#### Evaluate and integrate use of contractors

A final item to consider when incorporating best maintenance practices is integrating the use of contractors into your facility maintenance and maintenance engineering. Again it is necessary to determine costs for in-house performance and compare them to the costs of contracting out selected efforts. This likely will be a function of total facility size and operating costs.

Some of the maintenance or maintenance engineering efforts that may be considered as potential candidates for contractor performance includes performance of maintenance, capital improvements, expansion programs, predictive maintenance, and condition monitoring.

Any maintenance activities that do become a contractor function still must have relevant information and data collected and entered into the CMMS. All requirements that will be contracted to outside providers must be completely defined and should include a listing of the contractor's responsibilities and expectations prior to awarding any contracts. Formatting data for direct input to the CMMS is an example of a requirement that a contractor would not routinely provide services for.