A PRACTICAL GUIDE TO MAINTENANCE STRATEGY DESIGN FOR CAPITAL EXPANSIONS

A Practical Guide to Getting a “Ready for Implementation” Maintenance Strategy in Capital Equipment Projects
A PRACTICAL GUIDE TO GETTING A “READY FOR IMPLEMENTATION” MAINTENANCE STRATEGY IN CAPITAL EQUIPMENT PROJECTS

Whether it is a Greenfield capital project, existing plant expansion or the replacement of existing installed equipment, sooner rather than later, you will need an asset maintenance strategy to support your production uptime targets.

Have you heard this before?

“I have not failed. I’ve just found 10,000 ways that won’t work.”~ Thomas Alva Edison

Unless you are an inventor or researcher, you cannot afford to learn by failure. Get it right at the start of your project, or regret it for years to come.....

The longer you wait, the more expensive it becomes.

Narayan [1] has shown that adding to or changing the project scope after it has been contracted out, will not only be more expensive, but will also cause delays.

Ideally, the business objective should be to have a maintenance program uploaded into the organization’s CMMS by the time plant commissioning is complete. This means that the design of the maintenance strategy should not be an afterthought, but a milestone in the project schedule.

In the same way that the installation, testing and commissioning of a complex process is planned, budgeted and resourced; the design and implementation of the asset strategy must also be well planned out.

SAME OLD STORY

“This is my third plant expansion in 10 years. Next week we start with staged commissioning, but there is so much still to do. My Maintenance Planner and Team Leaders are breaking down my door, asking for resources to develop their maintenance strategies and populating our CMMS.

We have not even yet finished the previous expansions’ plans!

The design company is demobilizing, and the engineers will be occupied for months with process optimisation.

And I don’t have approval for my Reliability team yet!

It will take years to get the strategies done now that we’ve reached the end of our capital resources!”
The first important step is to recognize that designing and implementing an asset strategy program must be a formal part of your project process - in schedule, quality and budget. This needs to be considered in the early planning stages of the overall project and form part of the initial project budget presented for approval.

Obtaining this commitment will probably not be easy. Be ready for battle with the project accountants, but remember that maintenance is as much an investment in the lifecycle as the capital equipment itself!

Additionally, you should also evaluate manpower requirements to support the maintenance strategy once the project is operational.

Companies that specialize in asset management design and implementation would be able to provide justification for undertaking this effort by modeling the entire operational life cycle of the plant to achieve optimum availability and lowest cost to operate. Be prepared to budget between 2% and 5% of your installation cost towards preparing the asset strategy. The more complex the installation the more you will need up front. The upside is the more you put in now (in capital expenditure), the less you will spend during the lifecycle (operational expense and downtime losses).

Ok, so you have the commitment to include the asset maintenance strategy development into the project schedule and budget. Now you need to implement and manage the details of the project plan.

The following steps should form part of your project schedule:

**STEP 1. PRE-PROJECT CONTRACT AWARD**

**A. Conduct a kick-off meeting to form the asset management program**

i. Appoint a champion and a leader for this process - someone with passion, and an eye for detail.

ii. Define what you want from the Asset Management Design and Implementation program:
   - Basic strategies
   - Detailed strategies
   - CMMS populated
   - Maintenance plans and tasks with their associated labor, equipment and spares required
   - OEM maintenance manuals
   - When you want the CMMS populated
   - Mapping CMMS fields that should be translated into the strategy development process

iii. Determine what resources you will require to fulfill your requirements (in-house labour, consultants, OEM specialists etc.)

**B. Clarify the process to be used in developing the asset strategies to meet your production uptime targets. This process will form the basis of the project schedule milestones.**

i. Assign rankings to equipment groups, from statutory/regulatory, process critical to non-critical systems to ensure the crucial stuff gets done first.

ii. An operational and maintenance philosophy to provide guidance in developing the Asset Strategies.
STEP 2. PROJECT TENDER PROCESS

Build the following into the contract tender(s) before awarding them. If this forms part of the tender process, the vendor / OEM has no choice but to supply to your requirements. Yes, it might come at a cost now, but it will be even more expensive later.

A. Spares
   i. Capital spares list – in a format specified by you: Upload ready for your CMMS
   ii. Two year proposed consumption spares list - in a format specified by you: Upload ready for your CMMS
   iii. All other spares – what about all the other spares usually not listed to be required in the first few years, but you inevitably need? Again in a format specified by you: Upload ready for your CMMS
   iv. Determine what resources you will require to fulfill your requirements (in-house labour, consultants, OEM specialists etc.)

B. OEM Manuals – hardcopy and software. This includes component details, as well as any Recommended Maintenance Plans.

C. OEM failure data where available.

D. Project team to submit piping & instrumentation diagrams, electrical diagrams, civil drawings, system drawings and hazard and operability study (HAZOP) notes as they become available.
   i. If you wait for the finalised copies, then it will be too late to recommend changes and too much work all at once. Get involved in the design & draft stages. Resources and schedule to develop equipment maintenance strategies.

E. Ensure the project management company will allocate resources to this task as well as include this initiative as project milestones into the project schedule. Resources may be determined by either specifying your requirements, or by simply stating it as a cost.

F. Ensure that vendors have adequately estimated costs to support the development of strategies.

G. Ensure that the vendors understand the asset strategy deliverables.

C. Estimate cost of initiative. What are the alternatives? Which will provide you with the lowest life cycle cost?

D. Ensure everyone involved understands the asset strategy deliverables. Some of the small detail may not be available this early, but understanding the outcomes will start the process of detailing the requirements.
**STEP 3. PROJECT CONTRACT AWARDED – COMMENCE STRATEGY DEVELOPMENT**

Now it is time to sit down with the vendor(s), and start detailing the project schedule to support the asset strategy deliverables.

A. **Develop your asset strategy development project schedule to support the overall capital venture’s schedule.**

B. **Create detail maps of:**
   i. Which equipment will be evaluated?
   ii. Level of evaluation.
      a. Identify your critical equipment for detail review (once you have defined what is critical; a good guide is NORSOK A-008).
      b. Perform ranking of your equipment – this will ensure that critical items will be addressed first, while you still have funds available.
   iii. Method of evaluation:
      a. Detailed RCM for critical equipment.
      b. Other methods employed by your company, may be generic maintenance templates applied to medium criticality, or OEM recommendations to low criticality.
   iv. Resources utilized
      a. Criticality and project duration may define what kinds of resources are utilized to develop the maintenance strategy.
      b. Critical items may be done using expert consulting firms. These firms often possess RAMS tools to perform detailed reliability, availability, and maintainability studies, RCM studies, and produce not only a maintenance strategy, but also estimations of equipment availability, cost of maintenance and lifecycle impact on the plant, the plan optimized for efficiency, and work instructions documents for task execution.
   c. For less critical items, these same resources may be used to produce just a generic maintenance plan.
   d. For items in the lower ranking of impact, onsite resources and equipment vendors may offer adequate solutions under the leadership of personnel capable of conducting RCM-like studies.

C. **Mobilise resources**
   i. Start with the first sessions as soon as the first equipment details are made available.
      a. Draft your CMMS hierarchy
      b. Set up your required CMMS fields, with special focus on interaction with any software solutions employed by consultants or own staff.
      c. Ensure any software modeling is mapped to the structure of your CMMS equipment hierarchy, and associated fields. Sometimes the best structure of an RCM study may not match a geographical structure, or equipment class structure in the CMMS.

D. **Develop equipment maintenance strategies**
   i. Whatever choices made to develop targeted maintenance plans, ensure that the logic for task selection is preserved – focus on the details now, to avoid delays and inflated project and plant lifecycle costs later.
   ii. Maintenance strategies need to align to the business goals which may include safety, environmental, production and cost.
STEP 4. IMPLEMENT DEVELOPED MAINTENANCE STRATEGIES

By now months, or maybe years, have passed since the first capital proposal contained the inclusion of a maintenance strategy development plan as a project milestone. You may have reached practical completion by now, and be busy with commissioning activities. Whatever the case, the resources that will be maintaining the equipment once operational must understand the rationale as to why the maintenance plan contains the various tasks and what to do when things go wrong.

In the early phase of plant operation these resources are probably thinly spread, overworked and the schedule seems to be slipping. It is important that the maintenance department can understand the priorities and which critical equipment needs maintenance from the start. They should know which equipment requires daily inspections now to ensure that they don’t fail early on, before you understand how they behave.

With so many things to focus on, the need to have developed, detailed plans earlier in the project life becomes clear. If you do not have these in place before the pressures of commissioning or early operations start –up arrive, you will be too busy reacting to ever find the time to put preventative, predictive or proactive maintenance in place. It is very difficult to get out of this reactive cycle.

To ensure the maintenance plan remains optimal, the root cause of any unexpected failures should be investigated. Periodically, the failure data should be reassessed and compared to the original assumptions. Let’s face it, the early analysis done prior to commissioning is not a crystal ball, so changes and improvements are likely to be required if the maintenance plan is to continue to be optimal and proactive. When plans and priorities are not changed over time, that is when the plan can become high cost and ineffective.

In summary, the high level basic steps required to implement sustainable maintenance strategies are:

- Identify the need (evaluate the future requirements)
- Evaluate current situation
- Compare (gap analysis)
- Plan to fill the gap
- Act
- Implement
- Analyze the root cause of failures
- Monitor and improve

The fundamental ingredient to starting down the path to success is recognizing that developing maintenance strategies for capital ventures does not happen by accident – it is part of the project plan and costing from the start and it is as much a key deliverable as a fully commissioned, operational facility.
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References: