

Organising the Plan for Turnarounds

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In the preparations for any turnaround, a work process must be a part of the company's overall business plan, says the author, so that it takes into account the changing business environment as well as developments in the plan itself.

Most organisations recognise that a turnaround is no longer a single occurrence that is simply part of the maintenance function. It is readily accepted there is a need for multi-functional teams to be responsible for planning, and for a work process the organisation is able to follow throughout these high cost activities. However, definition of the work process can be a challenge. The solution for many organisations has been the adaptation of a generic process to their local environment. In theory, and fortunately in practice, a good generic process is capable of being applied to the overhaul of a multitude of different types of plant and equipment, irrespective of the nature of the industry. The 80/20 rule is well known; however, if a sound generic process is being applied then many are surprised to discover that the fit is more like 90/10.

A common mistake is simply to classify turnarounds as just "other projects". It is true that they have many things in common with all projects, but typically the nature of repair work sets it apart. Despite the considerable improvement in the techniques for predicting the condition of equipment, there remains that element of discovery when the equipment is opened and cleaned for inspection.

A further difference is that the execution of the turnaround tends to be more concentrated than for construction projects. It has its own challenges of having to make instant decisions based on the equipment condition as found, despite the increasing accuracy of predicted conditions and corrosion rates.

Therefore, the work process for planning the turnaround needs to address the specific needs and challenges that are part of repairing continuous process equipment.

The first step in defining a process is to recognise that it is in fact ongoing, with the completion of one turnaround being the starting point of the next cycle. Returning the plant to production with "on spec" products going to tankage is often seen as the point at which demobilisation of people and equipment takes place. While this is certainly true for the majority of the workforce, those who make up the planning team must remain in place to ensure that records are completed and that lessons learned are carried forward to the next turnaround.

Any work process must be a part of the overall company business plan, to ensure that it reflects the current needs of the constantly changing business environment. It should also recognise that the focus of planning activities will change depending upon the stage reached in the planning process.

The first reaction of many is that the work process, starting as it does immediately after completion of the last turnaround, will require considerably more effort and planning manpower than if planning did not start until nearer the actual turnaround dates. This is not necessarily the case. If we assume that a given number of activities need to be accomplished in the planning process, it is often more efficient to carry them out over a longer period of time rather than rushing to complete them in the few months immediately prior to the turnaround.

As previously mentioned, the need for multi-functional or disciplined teams (core team) to handle the diverse activities of the planning process is generally recognised as a practical means of ensuring that the disparate requirements of all those who contribute to the turnaround are reflected in the final plan. What is not always recognised is that such teams require both leadership and guidance and that working as a team raises its own challenges.

We should not be surprised that self directed teams often proceed in self directed directions and that these can be in conflict with corporate or plant requirements. Many organisations provide guidance to such teams through a steering committee to oversee their progress and to ensure that their efforts are channelled down

the right path. Additionally, they can easily be kept abreast of corporate, managerial and operational decisions that will influence specific turnarounds.

The core team

The appointment of a core team to handle the planning process is often considered as an end in itself, but really this is just the first step. Working as a member of a team does not always come naturally to individuals who traditionally have had roles and responsibilities that were based on functional and departmental requirements.

When naming members of a core team, an assessment of their ability to work as a team should be made and, where needed, appropriate training should be given. However, it should not be assumed that everyone can be taught the skills that are needed to be an effective team member. Simply put, not everyone is suited to being a team player. This should not imply that they are ineffective, but rather that their individual talents are best utilised outside a team environment

The challenge does not only lie with team members. Frequently, those who appoint individuals to the team have difficulty in delegating authority along with the responsibility. This "pass everything by me" symptom is often difficult to break, but it is essential to do so if the team is to be effective. Make certain that team members clearly understand that decisions are made by the team and not by individuals within it.

Frequently overlooked is the need to define the roles and responsibilities of the core team and its members. Roles will fall into two categories, those that are common to all members and those that are dependent on the individual functionality of the team member. The core team must have a functional leader or facilitator whose responsibility it is to assess timing for issues that need resolution, to ensure that meetings are scheduled, and that links with the steering committee are maintained. This assignment can vary with the type of turnaround being planned or on the basis of the stage of the process. In some organisations, operations department representatives will lead the team until the pre-shutdown work is started, whereupon the maintenance representative will take the lead.

Steering committee

The members of the turnaround steering committee team will be the facility's senior management. The obvious purpose of such a group is to provide direction and guidance to the core team and ensure that the turnaround meets the needs of the business. However, the more important function of the committee is to ensure that the scope and budget for the turnaround are in alignment.

How many times have we heard the comment that "they"(management) have set unrealistic budget expectations? Frequently, the reality is that what appears to be a poor decision is, in fact, the appropriate one, based on the information available when the decision was made. Therefore, the work process must ensure regular communication between the core team and the steering committee and that the latter is kept abreast of the work scope to be carried out and current estimated costs of execution.

If this can be achieved, then discussions and subsequent decisions will be enhanced by the improved quality of information. However, we should not be naïve enough to believe that this will solve all our budget problems; but without a regular review of alignment between scope and budget, there will be little opportunity for resolution of differences.

Reviews or audits

In order to ensure that the planning and execution process is receiving the appropriate priority and that progress is being maintained, a series of reviews or audits should be carried out at intervals throughout the process. Typically they will coincide with the completion of each specific stage.

The individuals who will undertake such audits will be appointed by the steering committee and will be knowledgeable in turnaround matters but should not have direct responsibilities in respect to the turnaround under review. It is desirable to include someone from outside the plant or organisation for some, if not all, of the audits.

The two most important audits are carried out at the completion of the conceptual development and detailed planning stages. The former reviews the setup of the turnaround strategy and the basic resources needed for success in meeting the turnaround objectives. In contrast, the audit following completion of detailed

planning has particular importance in that it is the final opportunity to estimate the preparedness of an organisation to undertake a specific turnaround, while also allowing some time for changes to be implemented if needed.

Audits will review team progress compared to the projected milestone schedule using group discussions, document reviews, site visits and meetings. A brief report should be published and discussed with the core team and steering committee. Each turnaround will have its own specific milestone schedule that will detail the timing of each stage and the individual tasks to be completed within each stage.

This is the tool used to secure commitments from individuals or functions for the completion of tasks or the supply of data and information, and is the primary means of measuring planning progress.

Long range business plan

The purpose of this ongoing activity is to establish the long range schedule and budgets for turnarounds and to integrate them into the overall corporate plan. The steering committee would be responsible for these activities.

During the process it would consider and review the following data and activities:

- Marketing strategy
- Plant or unit performance data (both present and anticipated)
- Inventory capacities
- Scheduled inspection compliance requirements
- New regulations and standards
- Improvement plans
- Benchmarking results and findings
- Market conditions
- Inter-plant or facility coordination
- Capital or investment planning
- Individual plant or unit mechanical performance
- Regulatory and legal requirements
- Turnaround timing to ensure minimal lost profit opportunities
- Value of downtime
- Evaluation of which plants or units to shutdown at the same time.

The long range business plan deliverables should include:

- A five-year rolling turnaround schedule
- An annual turnaround schedule
- Forecast turnaround budget for the next five years (both expense and capital)
- Long range improvement plans

The long range business plan is an ongoing process. The present day business environment, where raw material costs, product prices and demand can change rapidly, makes it inevitable that long term plans will change and that turnaround schedules will have to be flexible to respond to these changes.

Conceptual development

This stage should begin immediately following the completion of the post turnaround stage of the previous cycle and within the framework of the long-term business plan. Functional representatives should be assigned to each turnaround core team and a meeting should be scheduled between the team and the steering committee to clearly define the groundwork for the basic philosophy of the upcoming turnaround.

Consideration will be given to the type of turnaround, whether it is to be restricted to such activities as a catalyst change, significant capital items, time until the next turnaround and other factors affecting the work content.

This will allow the definition of the basic turnaround philosophy, which is the foundation for all that follows. The core team can now concentrate and work on the activities for this stage which include the following:

- Formation of core team and definition of responsibilities
- Definition of turnaround philosophy and goals
- Review previous turnaround history
- Review lessons learned from past turnarounds
- Identify sources of work input
- Establish major work items, both expense and capital
- Establish value of plant and/or unit lost production
- Develop work-list criteria based on the philosophy
- Ensure recognition of Hazop and reliability requirements
- Review process plant performance, past and present
- Contractor strategy
- Front-end loading strategy
- Cost control and tracking process.

Conceptual development deliverables will include the following:

- Turnaround philosophy
- Preliminary work list
- Basic cost estimates (± 30 per cent)
- Estimated duration
- Turnaround preparation milestone plan
- Manpower forecast for turnaround planning resources
- Organisation structure
- QA/QC requirements
- Stage report and the audit schedule
- The milestone plan.

At the end of this stage, the deliverables are presented to the steering committee for guidance and buy in. The philosophy should be formalised and signed off by all core team members and the preliminary work-list used to establish an order of magnitude cost estimate for the turnaround, usually in the region of ± 30 per cent.

Another critical deliverable is the turnaround preparation milestone plan. This lays out the key checkpoints and delivery dates for the planning cycle, and forms the basis for forecasting the planning resources. It will form the schedule of commitment for all functions.

The Audit schedule should be an integral part of the milestone plan and together with the work process, will provide the basis for measurement of progress.

It is essential to establish agreement between the steering committee and the core team before proceeding to the next stage of the process. This is the means by which the scope of the turnaround is kept in alignment with the budget. This is a critical aspect of turnaround success. If, initially, alignment cannot be reached, then exceptions should be noted, plans should be reworked and differences should be resolved prior to proceeding to the next stage.

Timing: this conceptual stage usually has a short duration in the region of two to three months and for major turnarounds should typically be completed some four to six months following completion of the previous turnaround. Even for smaller turnarounds with no major material lead times, the stage should start immediately following the previous turnaround, although completion of the stage can be some 12–15 months prior to commencement of the next turnaround.

Work development

During this stage, all work list inputs are gathered and assembled while the organisation and schedule continue to be developed. As the work list comes together, continuous maintainability, reliability and constructability input together with reviews of the work list criteria and philosophy ensure that the scope of work is kept in focus.

All work list proposals must come through the core team for review and assessment of impact. The team's activities should be focused on:

- Firming up all turnaround work inputs
- Risk based inspection and reliability items
- Capital works
- Compliance items
- Hazop study outputs
- Operational requirements
- Process engineering requirements
- Environmental, safety and health needs.
- Maintenance requirements
- Maintainability, reliability and constructability reviews
- Resolution of conflicting needs
- Long lead time material procurement
- The work development deliverables include:
 - An integrated plan (schedule, equipment and resources)
 - Preliminary critical path schedule
 - Refined budget estimate (± 20 per cent)
 - Updated preliminary and approved work list
 - Long lead materials ordered
 - Critical lift plans
 - An additional work approval process
 - Work scope closed
 - Stage report
 - Review or audit report.

As work is defined, the critical path schedules should be generated to allow evaluation of alternative methods of execution. This will ensure that the most cost effective approach to minimum downtime will be utilised.

As previously, at the end of this stage the deliverables are presented to the steering committee for guidance and buy-in, thus ensuring that the all-important alignment between scope and budget is maintained. Proceeding to the next stage is conditional on agreement being reached.

Timing: this stage should be complete 12–15 months prior to the shutdown of the plant or equipment.

Detailed planning

The point where the detailed planning of the work takes place (turnaround detailed planning) typically using such tools as Primavera, CASP or IBM P2, is an essential element to ensure that all work to be done during the turnaround is incorporated and integrated into the plan. This should include all capital work as well as operational shutting-down and startup sequences.

The need to integrate the work cannot be over-emphasised because failure to do so is one of the most common causes for turnarounds to overrun both budget and duration. However, this does not necessarily mean that responsibility for execution must be integrated. This will depend upon its complexity and nature.

Internal modifications to equipment and unit piping changes would be handled by the turnaround execution team. But major plant modifications, where the work can be easily separated, could be handled by a project organisation. Irrespective of who or what function is responsible for execution, the core team has the responsibility to ensure that the impact of all work is understood and fully integrated into the plan.

The work list should be finalised some four to six months prior to the shutdown date, and a key role of the core team is to ensure that this happens. Cutoff dates for turnover of capital items will have been

established and must be adhered to, thus ensuring that the opportunity exists to clearly establish what influence such work will have on the overall plan. This final work list is the basis for the final budget estimate that should now be in the region of ± 10 per cent. Onstream inspection activities should also be closing at this time to ensure that the results are interpreted and the appropriate action integrated into the plan. It is essential that a work process be in place that can control, review, and if appropriate, approve, additional work that arises after the work list is finalised, whether this is as an oversight or that which arises during execution.

During this stage the core team's activities should be focused on:

- Work list finalisation
- Finalisation of unit clean-up plan for equipment cleaning and personnel entry
- Contracting plan in place and all major contracts let
- Critical path schedule
- Detailed execution plans
- Detailed safety plan
- Additional work approval process
- All capital work turned over
- Complete materials procurement plan
- Final estimate
- Define format and frequency of performance and progress reports.

The detailed planning deliverables include:

- Integrated execution plan (finalised on critical and sub critical work)
- Final budget estimates (± 10 per cent)
- Final work list
- "What if" scenarios
- Lifting plans
- Mobile equipment requirements
- Detailed shop loading plans
- Review or audit report.

These deliverables, primarily the execution plan and the budget estimate, are presented to the steering committee. The budget should represent the best estimate available based on the finalised work list and the execution plan developed by the core team.

Sound estimating methodology for turnarounds should include a provision for contingency, which it is expected, will be expended. The objective of all estimates is to forecast expected costs, not to match a preset budget. If the budget and scope are still not in alignment then one or the other must be changed.

The audit function at the end of this stage is the most critical, because this is the last realistic opportunity to take action with a view to affecting the outcome of the turnaround. If possible, the audit team should include out-of-plant personnel, thus ensuring that a conflict of interest does not occur. The results of the audit should be presented to both the core team members and the steering committee. Any corrective action necessary should be jointly agreed upon.

Timing: it is essential that this detailed planning stage be completed four to six months prior to the turnaround.

Pre-turnaround work

This stage covers the period immediately before full-scale execution. The primary focus areas are training and orientation needs, mobilisation, final execution plans and pre-shutdown work.

The importance of total alignment between operations, maintenance and contractors cannot be over emphasised. This is the opportunity to ensure that all parties understand the work to be done and the sequence and details of the shutting-down process together with preparation for entry.

During this stage the core team's activities should be focused on:

- Implementation of the safety plan
- Training for operations personnel

Training and orientation for maintenance and contractor personnel
Team building
Environmental, safety and management of change requirements review
Pre-fabrication work commenced
Onsite pre-shutdown work started
Shutdown and unit clean out sequences detailed
Temporary connections prepared
Blind locations identified and blinds hung
Temporary offices, stores, tool houses installed.
Execution team mobilisation
Cost tracking and reporting begins
Detailed execution plan
Shutdown and clean out plan
Work performance
Turnovers
Start-up plan.
The pre-turnaround deliverables should include:
Execution plan finalised
Pre shutdown turnaround work completed
Execution team trained
Turnaround organisation charts
Reporting plan
Field mobilisation complete
Shutdown meeting procedures finalised
Communications/alignment meetings
Review or audit report (optional).

Mobilisation will include all aspects of the logistics involved in the temporary increase in the workforce. Training aspects to be covered should include ensuring that personnel are capable of operating and maintaining any new equipment or facilities that are to be installed.

Communication is an important part of administering the turnaround and is a factor that can influence success. As well as being a means of advising personnel on logistical matters, overall progress can also be communicated through such items as turnaround newsletters and flyers.

Timing: two weeks to three months prior to turnaround.

Turnaround execution

The focus of the core team moves from planning to execution. The leadership of the core team should move to that individual responsible for execution. The execution stage begins as feed is reduced and includes shutdown, preparation of plant for entry, work execution and start up. All these elements should be covered in the detailed plan.

During execution the core team's activities should be focused on:

Unit and equipment shutdown and preparation for entry
Daily turnaround meetings
Schedule reviews and update
Daily cost tracking and reporting
MOC requirements documented
Additional work review and processing
Track additional work and changes of scope
Ensure records reflect as found conditions
Documentation of all repairs
Documentation of all inspection
Pre-startup safety review.
Execution deliverables include:
Turnaround executed per the plan
Objectives met
Contingency plans reassessed as needed

Pre-startup safety review
Startup on schedule
Release to operations.

An important aspect of execution is control of scope and this consists of two elements: additional work requests and scope growth of identified work list items. Additional work requests covers obvious oversights from the work list and work which becomes apparent during execution, such as the unanticipated replacement of equipment internals. Such work must follow the additional work approval process, although resolution may be achieved at the daily shutdown meeting.

Scope growth of identified work list items

This category would include such items as "replace six trays in a vessel" becoming "replace nine trays". Although this represents additional work, it is not really outside the scope of the work list, and typically some allowance for such contingencies should have been made in the estimates. Scope growth should be documented for cost control purposes but does not necessarily have to pass through the additional work approval process.

A key aspect of execution is the conduct of daily shutdown meetings. It is essential that attendance at these meetings is limited; typically, only the core team should attend on a regular basis. The meetings should be brief and concentrate on resolving changes to the work scope. The stage deliverable is execution of the work per the plan, and this is only complete when the plant is started up and on-specification product is being produced.

Post turnaround

This stage covers de-mobilisation, documentation, cost reports and perhaps most importantly, lessons learned that can be carried forward to the next turnaround. The ability to execute this stage in a timely manner and to produce a quality result will largely depend on the effectiveness of the data collection during the execution stage.

Just as vital is that the core team be maintained and allowed the time to complete this aspect of their responsibilities. Successful completion of this stage can have a major impact on the next turnaround.

During this post turnaround stage the core team's activities should be focused on:

- Demobilisation of contractors
- Post-turnaround clean up of unit and laydown areas
- Resolution and disposal of excess material
- Repair and inspection history reports
- Updating of turnaround historical database
- Post turnaround MOC requirements
- Turnaround accounts frozen
- Final cost report issued
- Lessons learned and recommendations for future turnarounds
- Final turnaround report preparation.

The deliverables will include:

- Post-turnaround clean up of unit and lay down areas
- Planned run length
- Improvement opportunities
- Final reports
- Final audit report of both performance and adherence to the work process.

Timing: one to two months following completion of the turnaround.

Performance metrics

It is important to have an agreed set of metrics by which turnaround performance can be measured and trends can be observed. As with all measurements, a single indice can frequently be misleading and it is therefore necessary to design a basket of metrics to provide a balanced indication of performance.

Some suggested metrics include:

Duration: oil out to on-specification product in days. Also in days/year

Total costs: for both turnaround shutdown and routine maintenance

Turnaround costs: both actual and annualised by plant function

Frequency: run length in months

Predictability: actual versus planned work hours, duration and cost

Safety: accident numbers and rates

Startup incidents: days lost due rework

Unscheduled shutdown: days lost per year during the run

Mechanical availability: time available as a percentage

Additional work: actual versus contingency

Environmental incidents: impact of those attributable to the shutdown

Savings: money saved resulting from changes to these metrics.

Success

Having a work process does not in itself guarantee that the turnaround will be successful, but benchmarking has shown that it considerably reduces the likelihood of failure. Those who are completing turnarounds on time, on budget and without surprises, invariably have a work process defined and are adhering to it.

Following the process is the key, but today's technology provides tools that allow organisations to specify the process, define the tasks, and measure adherence. Web-based computer technology is the ideal medium to organise and control the multitude of tasks, information, and issues, that are critical to the successful completion of turnarounds.

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