Turnaround management methodology for fertilizer plants

Vol. 1 - Initiating the Turnaround

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1. SYNOPSIS

AmmoniaKnowHow.com and UreaKnowHow.com support fertilizer manufacturers by providing essential services to the industry, using our syngas technologies and scientific knowledge developed in multiple projects worldwide.

Together we initiate a program to enhance the guidelines and procedures for operation, engineering, maintenance and process safety in the fertilizer industry utilizing the best practices and standards available today.

Using knowledge gained from our industry, historic risk registers, lessons learned from projects and from FIORDA members we are committed to give proper advice to improve safety, reliability and projects performance of fertilizer plants.
2. WHY DEVELOP SPECIFIC GUIDELINES AND PROCEDURES

Guidelines and Procedures are developed to help staff and management teams run the organization. In the best use situations, procedures play a strategic role in an organization. They are developed in light of the mission and objectives of the company and they become the media by which management’s plans, rules, intents, and business and operation processes become documented and communicated to all staff.

Carefully drafted and standardized guidelines and procedures save the company countless hours of management time. Guidelines, procedures and employee handbook should be an important part of the operation. They should be the first thing given to a new employee (either in hard copy or an electronic version). They should also be easily accessible in their most up-to-date version. Hence it is extremely important that an organization’s procedures are a “living document” prepared and saved in Microsoft Word and easily exported into portable versions (like PDF) and made available over the company network.

3. PURPOSE OF THIS DOCUMENT

The purpose of this document is to detail the first process in a turnaround lifecycle. Similar with a kick off meeting, the initiation process requires several inputs:

- Important tasks
- Strategic plan
- Contractor selection criteria
- Historical information

The end document of this phase is the shutdown schedule. Properly planning the shutdown work upfront increases the project chances of success.

4. METHODOLOGY

Most organizations follow a formal procedure to select and prioritize shutdown time, duration, and major jobs to be carried out during the turnaround period. A steering committee is formed who is responsible for review, selection, and prioritization. A steering committee is a group of personnel comprised of senior managers and sometimes middle management who represent each of the functional area in the organization. They are responsible for the long-term strategy for turnarounds.

5. TURNAROUND FACTS

- Over 80% of turnarounds experience cost overruns
- 90% report scope growth from 10% to 50%
- Critical part method scheduling is implemented on less than 20% of all turnarounds
- Turnaround staff experiences minimal training in modern management concepts
- Approximately 50% of turnarounds suffer schedule slippages
- Unplanned additions cost 30% to 50% more than planned work
- Cost control and forecasting is implemented on less than 20% of all turnarounds
- Over 90% of critique recommendations are never implemented
- Most turnarounds fail to meet management expectations
6. WHY DO TURNAROUNDS FAIL?

- Failure to start early enough
- Failure to treat as projects
- Failure to apply Best Practices
- Failure to assign professional turnaround management team
- Failure to control scope

7. STRATEGIC CORE PLAN

A plant turnaround can come with a significant cost and hit to operating budgets. These extensive shutdowns come to the attention of an operation’s boards of directors and shareholders, as well as have an effect on inventory supply and client relationships. Therefore, it is essential that fertilizer plants manage shutdowns and turnarounds, as efficiently as possible.

A **core long-term plan** for turnaround management should be outlined in the budget forecast 3-5 years before execution. The long-term plan contains detailed lists of major works that must be performed during each scheduled major shutdown. The long-term plan is the backbone and the tool for controlling the scope of each outage. Without a long-term plan, there is a risk that major repairs and inspections will not get adequate attention until it is too late to properly prepare for their execution.

To accurately budget for a major shutdown, the scope, duration, and timing of the outage should be supplied before the operating budget is approved. This means that any major shutdown is scoped to an accuracy of +/- 10% at least 18 months before it is scheduled to take place in order for the budget process to proceed. **This is the short-term plan** for the shut-down management. The short-term plan is developed using the long-term plan as a starting point.

**Kickoff meeting**

The launch of shutdown begins with a kickoff meeting involving the major players responsible for planning, including the shutdown manager, ammonia, urea, nitric acid plants managers, technology experts and lead engineers for process, mechanical, instrumentation & control, electrical and civil engineering. The purpose is to recognize the “official” formation of the team and the initiation of shutdown.

The major players are usually authorized to make decisions concerning timing, costs, and resources required.

Some of the topics discussed in the initial kickoff meeting include:

- The scope of the shutdown, including both the technical objective and business objective.
- The assumptions and limitations
- The organizational chart (if known at that time)
- The participants roles and responsibilities

**Plants turnaround history**

An examination of past turnaround performance and of subsequent plant performance will indicate whether the turnarounds have provided the protection expected. If not, the situation must be reassessed to find out why and how a new rationale for turnarounds developed.

**Current plants performance**

Apart from the statutory plant inspection, the scope of work may be dictated by the operating performance of the plant and the level and effectiveness of preventive maintenance carried out in the period between turnarounds.
8. INITIATING THE TURNAROUND

The key to successful turnarounds lies in a clear scope of work, well organized and managed, locked-in early with a detailed planning.

Planning for a major turnaround begins immediately after the finalization of the last turnaround report and the cycle is as long as the longest lead time for any material and equipment. In some cases, the lead time can be as long as 24 months for specific items like rotors/stators for rotating equipment, reformer tubes, exchanger parts, and special alloys steel components. It is easy to see that beginning the turnaround planning cycle 6-12 months out can be, and often is, too late. The risk of late procurement effort may result in delaying the turnaround and increase the possibility of an unscheduled shutdown while at the same time incurring costly premium payments.

Factors impacting the decision for the best timing for the turnaround are:

- Market supply,
- Plant conditions,
- Material availability,
- Labor availability.

9. SCOPE STATEMENT

The purpose of the scope statement is to document the shutdown goals, deliverables, and requirements so that they can be used as a baseline for future decisions. The scope of work is the foundation upon which all other aspects of the turnaround rest and will have a major influence in determining the final cost. With a clear schedule is a matter of transferring the goals and deliverables information from the charter to the scope statement.

In the initial phase, answers to questions below will define the boundary of shut down.

- What are the goals and objectives?
- Who are the principal participants?
- When must it be finished?
- Why is the shutdown being launched?
- What are the constraints and limitations?
- Coordination requirements
- Level of support from participants
- Major assumptions
- Major responsibilities
- Milestone dates
- Quality criteria

Assumptions

This section lists any unknown factors about the project. Assumptions may, for example, relate to levels of external vendor support, progress of engineering activities or existing market conditions.

Constraints

Most probably a project will not have unlimited resource at its disposal. Money, time, people, equipment, supplies, and facilities are often limited in quantity and quality. Recognizing such limitations early on enables realistic planning.
10. APPOINTING SHUTDOWN TEAM

At this point, the scope of shutdown has been defined in detail and the shutdown team is ready to be appointed. A shutdown manager can be appointed prior to the establishment of the shutdown team. The maintenance and inspection department, which plays a key role in a turnaround, has that name for a reason that becomes crystal clear during the turnaround. It is common for a maintenance specialist to be a shutdown manager.

11. THE SHUTDOWN TEAM PURPOSE

The shutdown team purpose

Once appointed, the shutdown team assumes the responsibility of ensuring the success of turnaround, but they have six specific purposes to focus their activities and decisions on:

1. The provisions of funds for the turnaround

The shutdown team controls the budget and ultimately decides how much will be allocated to the turnaround. The actual cost estimate derived from the approved work scope will determine how much money is required. The group must also decide if a contingency fund is to be set aside for unscheduled work which may emerge during the turnaround and if so how much.

2. The balancing of turnaround constraints

The turnaround will take place within a business environment which includes, but is not limited to, business performance, market circumstances, customers, competitors, local community, available technology, legal requirements, health and safety at work, and even the weather. The constraints are often in conflict with each other and have to be balanced in order to reach optimal outcome.

3. The setting of objectives for the turnaround

Turnaround objectives must be measurable by quantity, quality, time, money and safety. These include, but are not limited to:

1. **Quantity**: how much work will be done or how many people will be employed?
2. **Quality**: what is the acceptable minimum level of workmanship?
3. **Time**: when will the event begin and how long will it take?
4. **Money**: what is the acceptable cost of the event?
5. **Safety**: what is the tolerable rate of accidents, incidents, emissions? Should be zero.

The safety of people, property and environment must not be compromised to achieve all other objectives.

4. The formulation of policy to meet the objectives set

Policy is the course of action which is taken to achieve the objectives, and is applied to the same element for example:

1. **Quantity**: a mixture of internal and external resources will be used because the former is insufficient to cover the event,
2. **Quality**: the ISO 9002 standard or company internal quality standard procedures will be adopted, including audits of all subcontractors to ensure the uniformity,
3. **Time**: because of market demands, the window of opportunity is limited to a certain number of days,
4. **Money**: a “X” % increase on the allocated budget will be borrowed from an external source to meet the increased work scope (assumption).

5. **Safety**: A professional safety manager may be engaged for the event in case that the company cannot find anyone with the appropriate experience.

5. **The monitoring of progress against objectives**

Objectives must be measurable so that the progress can be monitored and compared against some standards to ensure that all phases of the turnaround are kept on track. **The steering group must formulate a set of procedures to accomplish this.** Where a written set of procedures exists, formal audits may be used as a monitoring device.

6. **The modification of objectives or policy**

Because the turnaround is a complex process performed over a long period, the steering group needs to be flexible in its approach, able to modify its objectives or change its policies so that it can readily deal with changes which may be a radical in process of environmental constraints. The steering group needs to deal with the disturbances as they occur. The most acute disturbance is when a fault may be found in a critical piece of equipment and there might be no option but to carry out an expensive repair which will be costly and will increase the duration of the event.

**12. MAJOR TURNAROUND MILESTONES**

Major turnaround milestones are mentioned here in brief comprising all the phases of the turnaround. The turnaround outlook report should contain details about the jobs accomplished in the turnaround and all the previous outstanding jobs. Generally, the turnaround report along with the inspection outlook report should be released within 6 months of the completion of the turnaround.

1. **Preliminary turnaround job list** (at 24 months) is formed based on the turnaround outlook report. The preliminary job list should also comprise inspection reports released after the outlook report. The preliminary job list should be released at least 24 months ahead of the forthcoming turnaround. The preliminary job list once prepared should be released for inspection, operations, and field maintenance department reviews.

2. **Review meeting at 24 months ahead of the turnaround**

The agenda of the meeting should comprise the following points:

- Tentative date and duration of the next turn around
- Lock-in major replacement and modification jobs
- Identifying the major thrust area of the turnaround such as revamp jobs, reliability issues, maintenance / project-driven etc.
- Major turnaround philosophy for each plant or overall fertilizer complex
- Approval of turnaround milestone chart
- Review of the turnaround report and learning from the previous turnaround

3. **On-stream inspection** (at 15 months ahead of the turnaround) The on-stream inspection of all the units, their utilities, and their offsite facilities due for turnaround should be completed.

4. **Improvement modification jobs** (at 24 to 15 months ahead of the turnaround) major modification improvement jobs should be finalized along with the engineering drawings at least 24 months in advance. All major HAZOP actions that required significant engineering effort and are planned to be implement in the coming turnaround, shall be closed with engineering documentation attached and MOC closed and approved. However small modification jobs may be firmed up along with engineering drawing 15 months ahead of the turnaround.
5. **Review meeting at 12 months ahead of the turnaround**
   The agenda of the meeting should comprise the following points:
   - Review of the progress against action items of the last meeting and overall progress of turnaround planning,
   - Review of major jobs and readiness for the same,
   - Review of vendor philosophy,
   - Review major contracts,
   - Review the turnaround philosophy,
   - Review and approval of the turnaround schedule and cost,
   - Release of final frozen turnaround job list,
   - Finalize the exact date and duration of turnaround,
   - Finalize the action plan for material procurement and contracting.

6. **Review meeting at 6 months ahead of the turnaround**
   The agenda of the meeting should comprise the following points:
   - Review of the progress against action items of the last meeting and overall progress of turnaround planning,
   - Resolving any issues pertaining to turnaround,
   - Review of the timing of the proposed turnaround; situation of turnaround around of other companies in and around of country / region; its acceptability from the angles of religious functions, weather conditions, etc.
   - Review of major jobs and readiness for the same,
   - Approval of the allotment of the fabrication spaces to vendors.

7. **Handover of job list to execution teams** A formal presentation should be made by the respective planners to all the members of the execution teams covering the following aspects:
   - Responsibility chart of execution team members
   - Job list
   - Turn around schedule including prefabrication work schedule and the unit shutdown and start-up plan
   - Contracts
   - Details of parent philosophy, facilities, administrative requirements, housekeeping, scrap disposal plan, etc.
   - Expectations from the execution teams
   - Monitoring formats

8. **Prefabrication review meetings** These meetings should be chaired by Operation Manager and the main objective of these meetings shall be to take stock of the prefabrication work, performance of vendors, and to resolve any issues related to prefabrications.

9. **Review meeting at 8 weeks prior to turnaround**
   The main objective of this meeting will be to ensure:
   - Presentation of progress by the planner
   - Proper mobilization by all vendors
   - Review of material availability
   - Resolution of issues related to turn around
   - Review of shutdown and start-up plan
10. Review meeting at 4 weeks prior to turnaround.
The main objective of this meeting will be to ensure the following:

- Presentation of progress by the planner
- Review of prefabrication work progress, initiation of the turnaround site work like scaffolding erection, temporary lines erections, etc.
- Resolutions of issues related to turnaround

11. Review meeting 2 weeks prior to turnaround.
The main objective of this meeting will be to ensure the following:

- Presentation on progress by the planner
- Review of prefabrication work progress
- Review of progress of site activities
- Resolution of issues related to turnaround

13. PERFORMANCE CRITERIA
Cost, schedule, and quality. The project cannot, for example, cost more than a set amount; specific milestones must be met, service or product specification must be addressed. This information allows for meaningful planning and ensure that the project will address key concerns.

What are the shutdown turnaround performance criteria?

1. Shorter shutdown / turnaround duration to increase availability of fertilizer complex
2. Reducing scope by efficient Risk-Based Inspection RBI
3. Official shutdown / turnaround preparation through:
   a. Thorough scope identification to correct level of detail
   b. Realistic and workable shutdown / turnaround plan
   c. Risk analysis procedure executed on critical path activities
4. Efficient shutdown / turnaround budget control mechanism for planned and emergent works scope.
5. Incidents free startups.

14. RESPONSIBILITY

Turnaround Management procedure is a document owned in general by the Maintenance or Plant Inspection department within the organization. They are responsible to develop the specific procedures and guidelines for facilities turnaround to support the delivery of company turnaround strategy.

15. DEVELOP YOUR OWN ORGANIZATION PROCEDURES

Although templates can give you a head start on procedures development, other factors must be considered as you write your own internal documents.

One factor is your organization’s culture. Organizational attitudes toward procedures determine the spectrum. On one end of the scale are companies that have a procedure for everything. At the other end of the spectrum are companies that only have only a few guidelines (only those required by the laws that are relevant to that company). Most companies fall somewhere in between these two extremes. The manager writing any guideline needs to understand where on the spectrum the company it falls and how the policy can be made to fit the organization’s culture to enhance compliance.
Other two factors to be consider when developing guidelines and procedures are the fertilizer technology that company employs and local and international standards applicable to the industry. Internal standards and procedures must be developed in line with these factors, being applicable for your own plants and in line with regulatory requirements.

The last, but not least, factor when developing your own procedures is the best industry practice that you need to employ. Liaison with your fertilizer association, participation in industry meetings and conferences and using fertilizer industry consultants can bring a fresh eye, new ideas and enhance the quality of your own guidelines and procedures.

16. DEFINITIONS

HAZOP Hazard and Operability (study)
FIORDA Fertilizer Industry Operational Risks Database
R & M Reliability & Maintenance
RBI Risk Based Inspection

17. REFERENCES

3. David Mathews, TGE Industrial Services, Why Turnarounds Fail to meet management expectations – presentation.

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