Beyond turnaround planning

Utilising process- and unit-specific knowledge transfer to improve turnaround execution. A better approach is needed to ensure the transfer of critical event information to an experience- and discipline-diverse workforce

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How often is a plant's year spoilt by poor performance on a maintenance turnaround? Excellent safety and environmental performance, outstanding cost management and near perfect reliability — all hard earned through great effort — can be destroyed by poor performance during a single turnaround. Turnarounds are almost always well planned. The problem lies in executing that well-crafted plan.

Successful execution is dependent on communication and information transfer from the planners to the doers. Moving from a traditional informal and unstructured approach to a knowledge engineered communication and information exchange programme greatly decreases the risks, cost and duration of turnarounds. A structured approach and detailed agenda for turnaround information exchange that ensures success are imperative.

Maintenance turnarounds and process unit revamps are arguably the greatest points of exposure for refineries in terms of safety incidents, production delays and lost profits. These events require a tremendous amount of planning, awareness and motivation to ensure a safe and successful execution.

Turnarounds are a time when the unit is in a constant state of flux through shutdown, de-inventory, clearing and cleaning, mechanical work-over, inventory and startup. The number of personnel supporting these activities rises and falls in a typical bell curve-like fashion.

Planning and scheduling activities begin months or even years in advance. Plans and contingencies are revised again and again with the help of operations and maintenance staff, tenured personnel, outside supporting vendors and refining peers. Much time and effort is spent planning every conceivable detail, with the single-minded goal of performing the work safely and on schedule. The product of this effort is often a thick binder containing marked-up P&IDs, blind lists, expandable Gantt charts and pages of procedure check-off sheets. Now what?

Executable knowledge transfer

Herein lies the fundamental problem. Unfortunately, the same zeal applied to planning and scheduling is too often not paid to transferring those critical details to the minds of the personnel actually executing the work. Many work groups (including operations, technicians, contractors and vendors) are given a one- or two-day overview of big picture concepts such as critical path, a shutdown/de-inventory strategy and a general timeline of execution. This type of training is usually given in a group classroom setting about four to six weeks prior to oil out, but regrettably provides no verification that the necessary knowledge has been successfully transferred and can be applied when executing the work list tasks.

While the variability and lack of detail provided in such traditional training sessions have long been a concern, the skilled workforce attrition that the industry faces today magnifies the risks, increases the need for best practices and calls for a new paradigm: process- and unit-specific knowledge transfer.

Skilled workforce attrition

Senior plant operators are retiring in unprecedented numbers, and with them goes invaluable best practices, process knowledge and expertise. They are being replaced with new hires, each with a unique background and varying degrees of expertise and knowledge. Many have never been through a unit turnaround before. Detailed process- and unit-specific knowledge transfer is needed to close the knowledge gap and reduce risk.

Operations staff are becoming leaner because of this demographic change, and time is often not available to operators for training activities outside of their daily operating tasks. Maintenance resources are stretched too thin to take time away from repairing process equipment. Event-specific training and awareness for contractors, who will be brought in by the hundreds to support the field work, is often limited to general refinery safety training and tailgate job safety analyses (JSAs) during shift change.

Yet, the probability of safely meeting the turnaround event's goals and objectives so heavily depends on these groups working closely and effectively together. How can your refinery ensure this complex co-ordination has the best chance of happening and certify that everyone has the knowledge they require, both by craft and individual, to work safely and productively to meet your turnaround schedule?

Communication is key

The success of any turnaround can be greatly improved, while reducing the associated risks, simply by implementing a rigorous, well-structured knowledge transfer system that communicates the proper process- and unit-specific information, specifications and procedures to all those involved. This means that all of the tasks, schedules, priorities, contingencies and perceived risks that should or might occur to a group of workers, who range widely in terms of craft, experience and responsibility, need to be documented, structured and delivered to the appropriate audience through a validated process.

Conversely, miscommunication and misinformation typically lead to poor decision-making, which creates misdirection and ultimately results in confusion and potentially hazardous situations. That confusion becomes contagious as shift changes take place across all disciplines and can easily cause a schedule delay of one or two days before everyone can realign as a team and regain momentum.

The other vital part of a successful turnaround is the agreement on common goals and objectives by all the

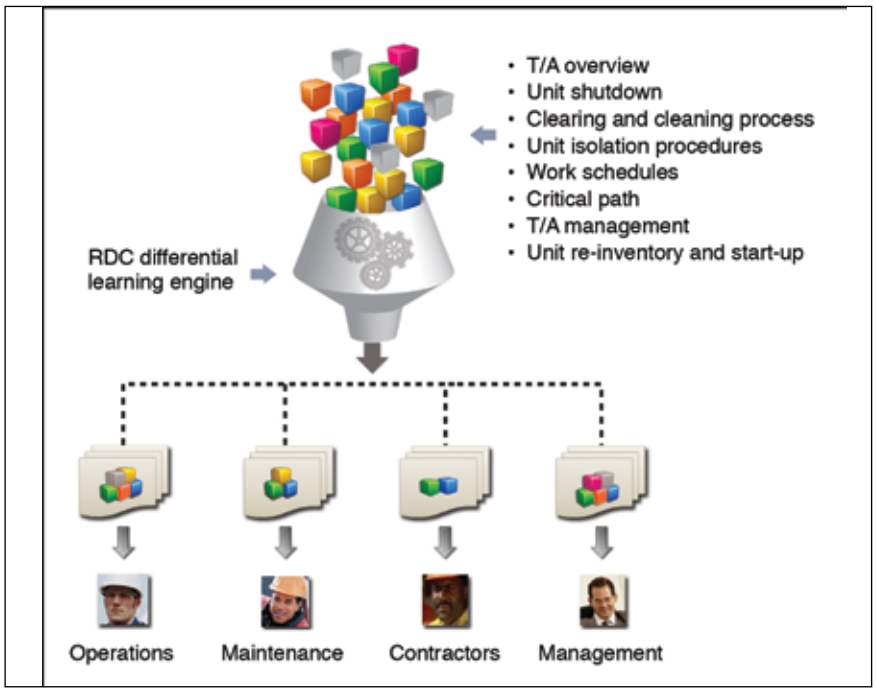

Figure 1 *??*

departments involved. Nothing will kill a turnaround faster than departments working independently toward their own objectives. It takes many disciplines working as a team to achieve a successful turnaround, and only one group or department from the usual sectors of management, process engineers, maintenance, operators, turnaround co-ordinators and contractors with misaligned priorities can cause large amounts of discourse, delays and costly setbacks. For this reason, everyone must agree on the primary target and process of the turnaround to improve the chances of success and reduce risks. This can also best be achieved by transferring and certifying the understanding of the goals, assignments and work details in order to create a cohesive, efficient and unidirectional team. Communication is the key. But with so many diverse groups and talents, dissemination of information must be done in a way that is efficient and effective.

Refining companies would be prudent to take a much closer look at how they are effectively transferring that valuable knowledge across this spectrum of workers. Successful companies will ensure that a well-engineered, formal knowledge transfer process is in place that certifies critical turnaround information is documented, organised and communicated in the right quantity, to the right individual and craft, and in the context that is relevant to their role and responsibility.

Consistency

Without a rigorous process and system for knowledge transfer, there is no best practice and each turnaround will differ based on the backgrounds, expertise and biases of the key players. More often than not, planning styles will vary from one planner to another and from one turnaround to the next; formal communication of the plan to all parties involved tends to relax as the event draws closer; and training is general in nature, casual in format and varies based upon the experience of the trainer. So, you may have a good turnaround if you have the right people in leadership positions, or you may have a disastrous turnaround without an established knowledge transfer process in place.

In order to be effective, a turnaround training knowledge base should cover the major strategic initiatives, from which a consistent set of learning objectives can be created and assigned. It should be dynamic in design, with the capability to deliver a personalised learning path, tailoring the knowledge transferred based upon the individual's role as a contractor, new hire operator or experienced maintenance craftsman. In other words, you need to get the right information to the right people — not all of the information to all of the people — and then you need to deliver the knowledge in a consistent and efficient process that certifies full knowledge transfer to 100% proficiency.

Structuring the knowledge base in a modular fashion offers flexibility in delivery of the information. The following are the recommended key modules and associated learning objectives:

1. Turnaround basics:

— General overview of a turnaround: key objectives are duration and typical scope

— Training on turnaround management tools: this is training on the tools used for managing the turnaround. For example, training on how the blind list is provided and how to use it

— Information on the specific upcoming turnaround:

– Work schedule

– Organisational structure, such as how the turnaround is going to be staffed, work schedules and work assignments

– Turnaround activities, such as critical path and heavy lifts.

2. Project task tracking — critical path schedule:

— Use of typical project task tracking with the inclusion of anticipation of discoveries and changes that may be necessary during the actual shutdown.

3. Shutdown of the unit:

— General step-wise overview of how this unit is shut down

— More detailed procedure review of unit shutdown by process system (ie, preheat train and pumparounds)

4. De-inventory and cleaning of process piping/vessels:

De-inventory:

— Understanding the difference in clearing process liquids vs gases

— What utilities are available to facilitate the clearing process (ie, flare and oil recovery system) and what are their operating capacities?

— How dead legs and trapped liquids should be handled. What lessons have been learned from previous turnarounds?

— Lessons learned might include:

– A little bit of liquid hydrocarbon left in a low spot can really slow down a turnaround while shift after shift is spent trying to pass the explosivity or hydrocarbon content test on a vent

– Drain and purge lines are usually small compared to normal process lines. It is frequently difficult to get enough flow through the gas purge inlet and outlet piping to carry liquid down a line and impossible to carry liquid up a vertical pipe run

– Installation and use of big-bore steam lines at the discharge of product draw and pumparound pumps can help to significantly reduce de-inventory times of those circuits and have the two-fold effect of enhancing the cleaning process.

Cleaning:

— Use of the best-in-class cleaning technology. Liquid circulation can be costly in terms of waste effluent processing and the equipment and real estate to facilitate the process. Vapour-phase technology is proving to be more effective in terms of cleanliness and can be coupled with the unit steam-out process

— Illustration and proper

documentation of isolation, blinding and cleaning of specific vessels and equipment.

5. Safety, work permits, tagging and blinding:
— Appropriate training for employees and contractors of permitting process
— Review of hot work and vessel entry permits
— Review of tagging and blinding system.

6. Work list execution:
— Proper material, crafts and access to complete specific turnaround tasks
— Teams for inspection, verification and sign-off of completion of each task
— Documentation and tracking system to ensure managers know of work status and can quickly update any critical path assessments based upon discovery work.

7. Unit start-up:
— Review of overall start-up process
— Step-wise review of start-up by process system.

8. MOC process:
— Proper orientation of management of change (MOC) process for change and approval of work plan, documentation and equipment repairs
— Beneficial for documenting actual turnaround events and updating information for use after turnaround.

Keep best practices evergreen

The adage that, if we do not learn from the past, history is bound to repeat itself rings especially true for turnarounds given the typical five- to seven-year interval between events and the continued loss of experienced refining personnel to retirement.

Any turnaround training knowledge base must be kept evergreen. Most refineries conduct post-event reviews to identify and document lessons learnt and areas for improvement. Those enhancements are often made to the planning book, only to be shelved for the next turnaround and forgotten or overlooked in the next turnaround cycle. That valuable information came at a significant price, be it sweat equity or otherwise, so make the effort to build it into additional learning objectives.

Knowledge engineering solution

The good news is that refineries do not want for information. Volumes of P&IDs, procedures, Gantt charts and blind lists reside in binders created for previous turnarounds. On the surface, it seems an almost impossible task to take this enormous pile of relevant data and organise it into a useful knowledge base.

A well-structured turnaround knowledgebase template is now available that is modularised in the format previously referenced and through a proprietary Knowledge Engineering process, made site-, unit- and event-specific for each unique plant. Throughout the instructional design process, RDC works in partnership with refining companies to blend information from existing turnaround plans into this learning tool. In addition, interviews are conducted with the most experienced planners, operators and maintenance personnel to gather best practices information that can be cultivated into knowledge, tied to learning objectives and overlaid in a craft- and unit-specific manner.

It is important to clarify that the instructional design focus should be on adult learning and conveying technical process knowledge. As adults, we absorb knowledge differently than we did in our younger years. Adults require participation throughout the learning process and the information that is being presented must be relevant to the learner's specific job responsibilities and, to a greater extent, be information that fills gaps in their knowledge. One-size-fits-all training in a classroom setting largely has proved ineffective at efficiently transferring such detailed technical knowledge.

Differential learning

Crafting a complete and customised knowledge base is only half of the total solution. Automated delivery of this information to the learner and an assessment process that validates the learner has absorbed and comprehends the information completes the closed-loop solution.

The learning environment is capable of handling the flux of hundreds of workers that will support a given turnaround event. Access to the turnaround knowledge base content is personalised, based on the role(s) an individual is assigned. The scope and depth of a curriculum assigned to a contractor supporting the turnaround will differ from that of a unit operator, because the learning environment personalises each individual's learning path, based upon their role and the prior level of knowledge they exhibit. Training on the unit's permitting process, as well as who is qualified to sign a work permit, can easily be applied to the learner's knowledge requirements by assigning a permit-qualified role to a maintenance contractor, cleaning vendor or operator.

Knowledge gaps = risk

Accidents and safety impacts associated with turnarounds in recent years have heightened awareness and culpability, dictating that refining companies can no longer continue to use a broad-stroke approach to training and knowledge certification. Group training in a classroom setting for contractors, especially when they are talked through the training, watch a video or two and then complete a paper test, can leave a refinery exposed in the wake of a deadly accident or explosion.

Workers must be remediated and certified to prove 100% competency across all knowledge requirements to perform a job safely. The technology is available to pre-assess a worker's existing knowledge gaps with respect to a group of learning objectives, automatically deliver a personalised learning path, and post-assess and validate proficiency until all knowledge gaps are remediated.

Conclusion

Successful and lower risk turnarounds can be achieved by establishing a best practice for documenting, organising and disseminating information. Skilled workforce attrition is a subject that is tirelessly discussed in the energy industry, as well as much of manufacturing. Every refining company invests a hefty sum in the professional development of its workforce. An operator, through training efforts and on-the-job experience, develops a wealth of best practices knowledge over a 25-year career.

We encourage you to retain your company's investment by proactively capturing that knowledge and imparting that wisdom to the incoming generation of operators. Work with an instructional design leader in the industry who provides the knowledge engineering and differential learning tools to cost-effectively capture, retain, access and transfer the process-, job-, event- and unit-specific knowledge needed to improve ongoing operating margins.

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