KBC WHITE PAPER

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WHAT HAPPENS WHEN 25% OF YOUR WORKFORCE RETIRES IN 5 YEARS?

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Competitive pressure from mega sites especially intense in APAC region

The orange dots on the map show how the mega sites are spread out across the world. The competition is particularly intense in the APAC region. These mega sites have competitive advantages in the form of economy of scale due to their high throughputs. They often have relatively complex process units that translates to enhanced upgrading capacity. This also translates into increased processing flexibility to capture market opportunities.

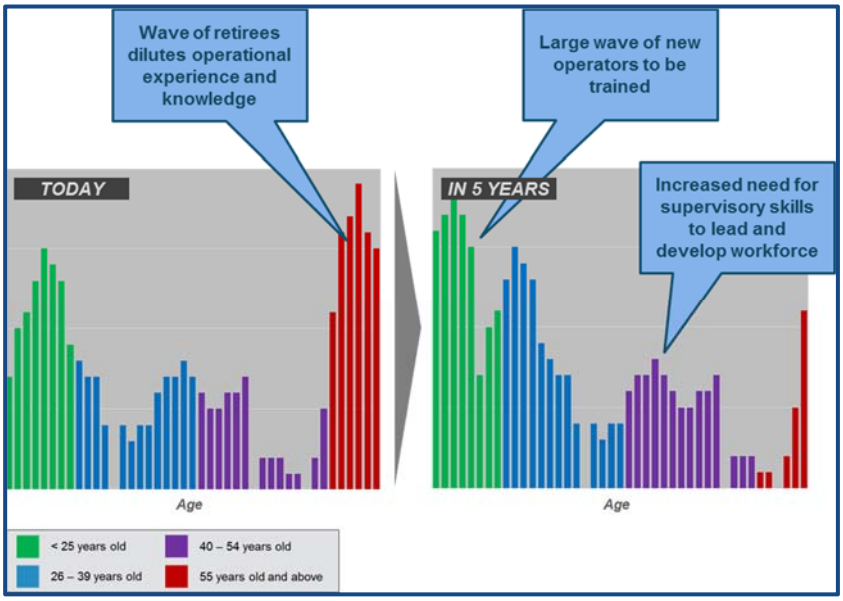
To survive and thrive in this hyper-competitive environment, plants in the APAC region need to satisfy two performance imperatives:

- ***Secure base plant operation*** – Plant operations need to be able to effectively identify and manage abnormal situations to ensure that months of consistent hard work are not jeopardised by preventable plant incidents. The occurrence of plant incidences often lead to a reduced focus and energy on plant improvement activities. A safe and reliable operation represents the foundation on which plants can compete with their regional competitors.

- ***Continuous improvement and optimisation mindset*** – To ensure that both on-shift and off-shift optimisation activities are carried out and followed through to realise production benefits. Plants cannot rest on their past laurels and will need to constantly learn, innovate and improve.

A skilled and experienced workforce represents a critical component to address these competitive imperatives.

Plant demographic trends indicate increased operational risk exposure if not handled well



In the demographic charts shown above, the horizontal axis indicates the age, while the height of the bars represent the proportion of the operators that are of a particular age. A typical chart for today is shown on the left. Looking at the red bars, many of the organisations in the APAC region are facing a wave of retirees that will be retiring in the near future. This represents ~25% of the current workforce. The impact of the associated dilution in operational experience and knowledge must be factored in the forthcoming operational strategy.

The projected demographic chart in five years shown on the right. Zooming in on the green bars, a large influx of new operators will be required to replace the capacity lost due to retirements. With a large wave of new operators to be trained, it is critical that a robust new hire training programme is in place that will be able to handle the extra training load. Thus it is important to consider the effectiveness of your new-hire competency and development assurance process.

From a career development stand point, a portion of operators will switch role from being an individual contributor to become a supervisor or manager. With a crew that consists of a large proportion of less experienced operators, there is an increased need for supervisory skills to lead and develop the workforce. A supervisor's ability to coach and develop his/her team members is critical to accelerate workforce development.

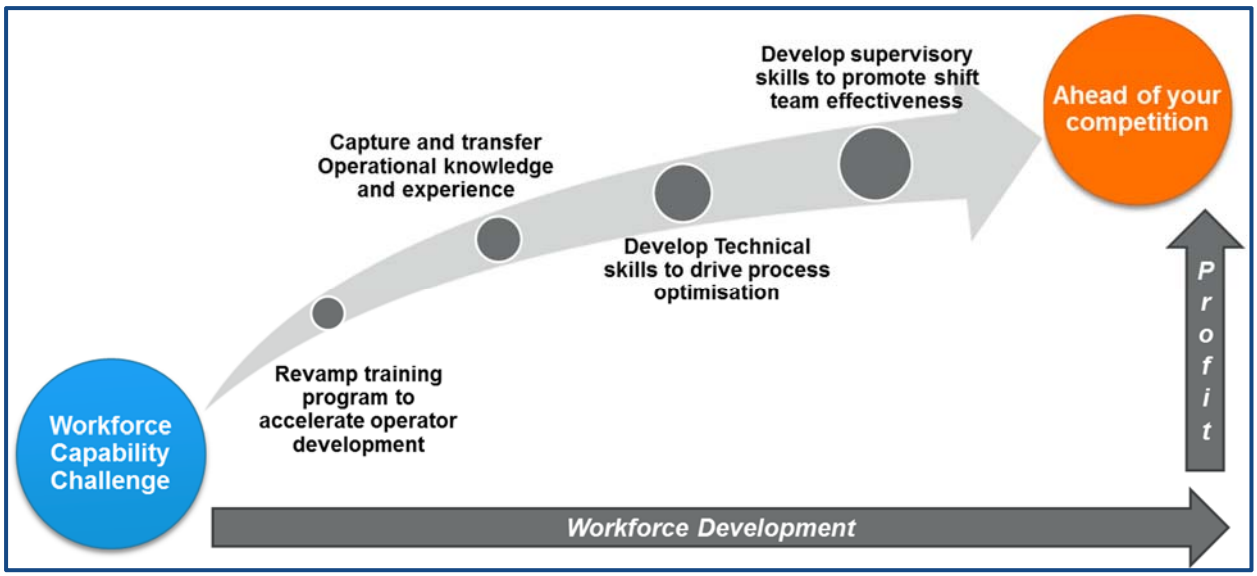
The demographic trends indicate several issues and risks. Is your plant at risk?

- Are you effectively retaining and transferring operational knowledge from these experienced operators?
- How robust is your new hire competency development and assurance process?
- Are your supervisors competent to lead and develop a less experienced workforce?

- To some extent, the lack of operator experience could be mitigated by a strong process engineering team. Does the technical department in your plant have the right level of expertise and the capacity to support plant optimisation efforts?

The odds are stacked against plants with similar demographic profiles to maintain the current level of performance, let alone improving performance to compete with the mega sites.

What can we do about this? As shown in the following roadmap, a multi-pronged approach is required. In the following sections, we will discuss elements of the roadmap.



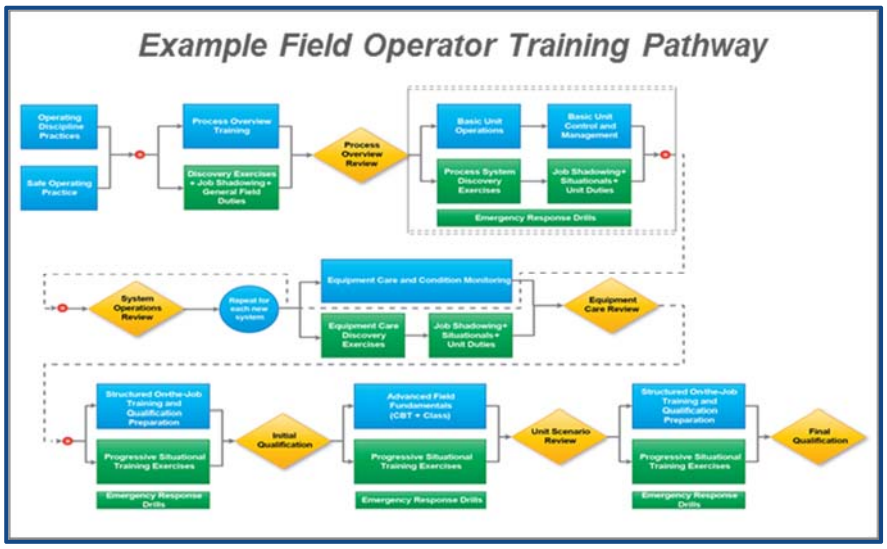
Accelerated Operator Development

One implication of the demographic trend we saw earlier is that many plants are facing a large influx of new operators that need to be trained. Many organisations have found that traditional training programmes that rely heavily on classroom training are not very effective in imparting skills and knowledge to the operators.

KBC's Accelerated Operator Development approach to training is driven by design principles derived from adult learning preferences.

Trainee Driven Active Learning & Development	Structured Approach to Experiential Knowledge Transfer	Career Progression Paths
• Blended, interactive approach to training • Staged, guided learning paths • Structured coaching/mentoring program	• Experiential knowledge transfer must include "why," not just "what" and "how" • Experience must be built on a developed predisposition to think; not react • Structured developmental projects designed to promote experience transfer	• Well defined career maps • Progression paths designed to promote competency development • Focused developmental assignments

The field operator training pathway below illustrates how these design principles are applied.

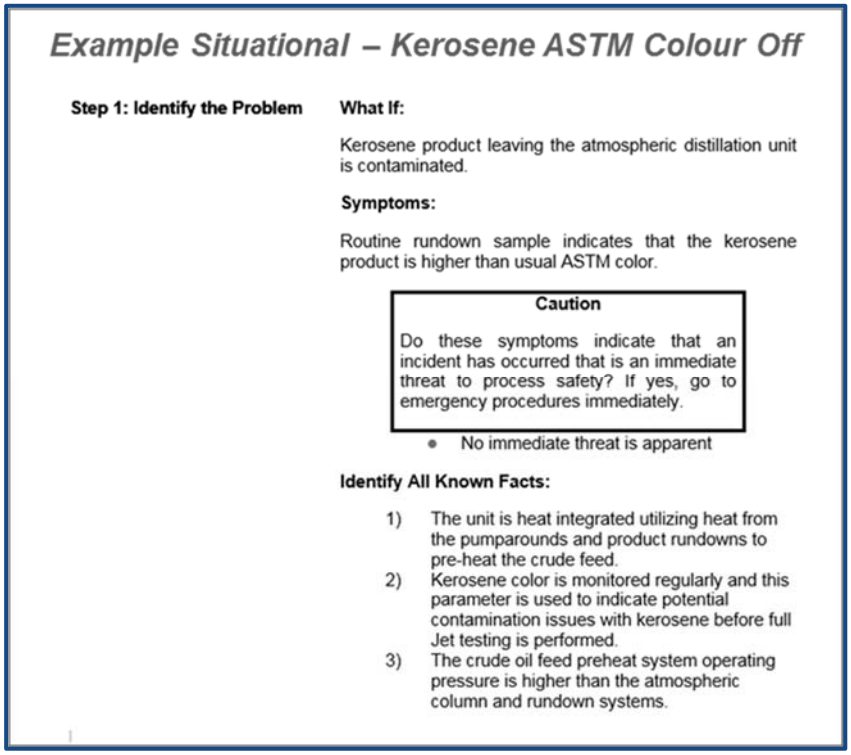


- The blue boxes represent classroom training on targeted topics, with training material developed in full accordance to Instructional System Design principles that maximise training efficacy.
- The green boxes represent self-paced learning modules and relevant drills that build on classroom training topics. These modules help trainees to internalise the principles that are taught.
- Periodic reviews with supervisors and trainers are critical parts of the learning pathway to drive accountability and to develop the trainee's sense of self-efficacy. These are represented by the yellow diamonds.

Such training pathways have been shown to increase trainee engagement and training effectiveness. By imparting the necessary skills to the operators in an accelerated manner, the risk exposure of the plant is reduced.

Effective Knowledge Capture and Sharing

One mechanism that KBC has been using to good effect to enhance knowledge capture and transfer is the development and application of situational documents. These documents are based on "what-if" scenarios that could occur in the plant. The situationals are designed to facilitate applied problem solving and thereby reinforce the application of underlying competencies.



Example Situational – Kerosene ASTM Colour Off

Step 1: Identify the Problem

What If:

Kerosene product leaving the atmospheric distillation unit is contaminated.

Symptoms:

Routine rundown sample indicates that the kerosene product is higher than usual ASTM color.

Caution

Do these symptoms indicate that an incident has occurred that is an immediate threat to process safety? If yes, go to emergency procedures immediately.

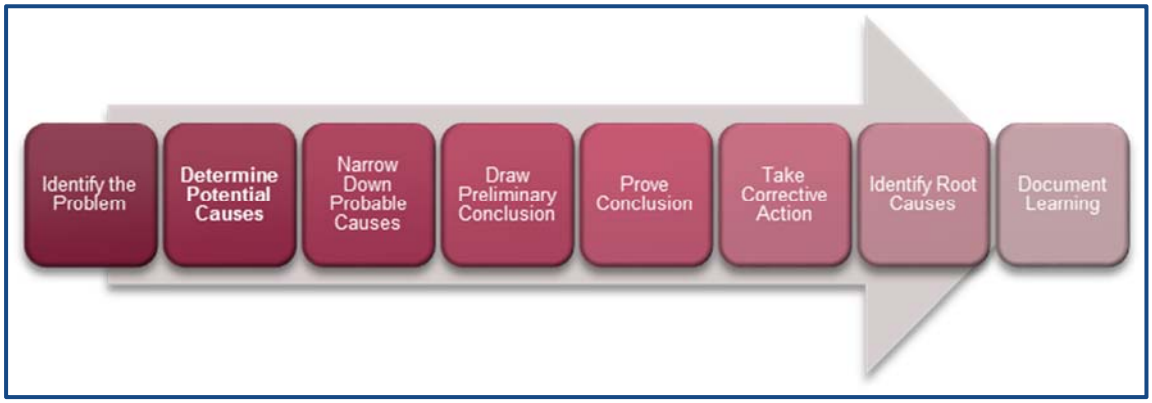
- No immediate threat is apparent

Identify All Known Facts:

1) The unit is heat integrated utilizing heat from the pumparounds and product rundowns to pre-heat the crude feed.
2) Kerosene color is monitored regularly and this parameter is used to indicate potential contamination issues with kerosene before full Jet testing is performed.
3) The crude oil feed preheat system operating pressure is higher than the atmospheric column and rundown systems.

The diagram above shows an example situational for kerosene colour off-spec. Step 1 in the troubleshooting process involves identifying the problem. In this case, the symptoms are described and all known facts are identified to frame the issue at hand.

The trainee then follows the remaining troubleshooting steps.



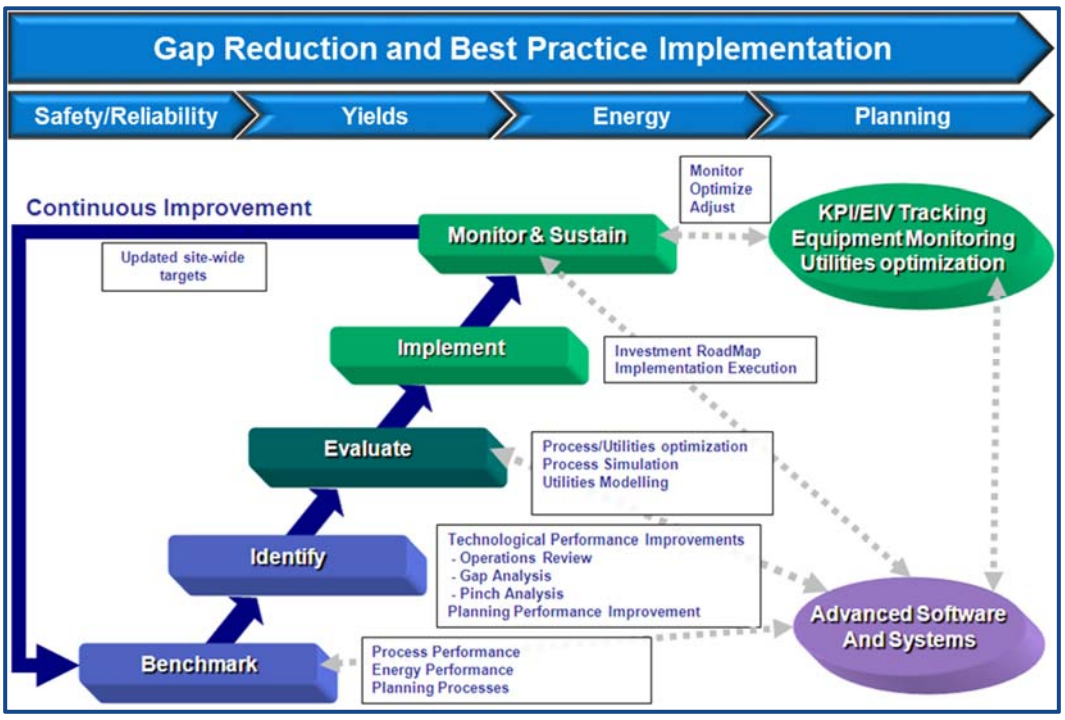
By going through these analysis steps, the trainee is exposed to the various possibilities and verification methods that can be used to narrow down the likely root causes.

Experienced operators often find it difficult to effectively document their knowledge and experience even when they are motivated to pass on their knowledge. One main reason is that they often deem their knowledge as anecdotal and they do not have a coherent way to document this information. The situational documents presented provide one avenue to effectively document operational knowledge and experience.

Often, experienced operators need such focusing events to act as funnels and provide context before tacit knowledge can be drawn out effectively. By engaging experienced operators to develop the situational documents, operational knowledge and experience can be thus captured. Having documented the situationals, these documents then provide an intuitive structure that allows less experienced operators to follow the logic applied by the experienced operators.
These situational documents have proven to be especially powerful when used for group discussions. By engaging a larger operational group to go through the troubleshooting steps, various anecdotal experiences, assumptions and practices are often brought up for discussion. Such discussions often provide a richness that is missing in standard operating procedures.

Developing Technical Excellence

While the training components are similar to the ones for operators (shown earlier), the training and development of the technical engineers have a stronger emphasis on plant optimisation, technical depth and software application. A core defining feature of KBC's technical engineer development programme is that it has a very strong on-the-job training emphasis that is often integrated with a profit improvement programme. The key steps and components of such a programme is shown below.



The skills developed are not only applied to daily activities such as plant monitoring. The trainees are challenged to apply these skills to more technically-demanding tasks such as opportunity identification, development and implementation. This way, both plant performance and the organisation's technical capabilities are enhanced in a synergistic manner.

Developing Supervisory Skills

There is a popular saying that "People leave managers, not companies". Your frontline supervisors and managers are the keystones to unlock shift team performance. Being a good supervisor requires a different set of skills apart from technical competency and experience. Some of these skills are shown in the "Supervising for Operational Excellence" course content.

Course Content

1. The process industry
2. The process plant supervisor position
3. The various aspects of human behaviour
4. How to better communicate with employees
5. How to effectively solve problems and make decisions
6. How to lead employees in a work environment
7. How to train and develop employees
8. How to manage the production plan
9. How to manage employee performance

In the current demographic landscape, supervisors can no longer rely on the vast experience pool of the senior operators. Instead, they are faced with leading an operational crew largely made up of young, less experienced operators. Are your supervisors up to the challenge?

Conclusion

In this paper, competitive and demographic pressures faced by refineries and petrochemical plants have been discussed. A multi-pronged workforce development programme and its constituent components are described. Demographic issues do not emerge overnight. Have a look at your plant's demographic profile and project to see what it look will like in the near future. Together, we can address tomorrow's problem today.

About KBC

KBC Advanced Technologies is a leading consultancy and software provider to the global hydrocarbon processing industry. With over 35 years of experience, KBC combines industry leading technology with experienced engineers and operations personnel using robust methodologies to create personalised, sustainable solutions for its clients.

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