

Webinar Series on **Training and Qualification for Nuclear Facility Personnel**



05

Training completed:
Assessing its effectiveness





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Romana Květoňová
Training Specialist
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Webinar Series on Training and Qualification for Nuclear Facility Personnel | IAEA



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Learning Objectives

By attending this 5th webinar, you'll be able to:

- Describe the main principles and methods of evaluating the effectiveness of training
- Describe the benefits and challenges of different stages of the evaluation
- Describe methods to calculate Return on Investment for training



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Today's Speakers



**Matthew
Van Sickle**

Consultant

USA



**Noora
Kajander**

**Knowledge
Management Expert**

Teollisuuden Voima Oyj
(TVO), Finland



**Patrick
Berry**

Consultant

Patrick Berry
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**Stephen
Page**

**Training Standards
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EDF Energy, UK



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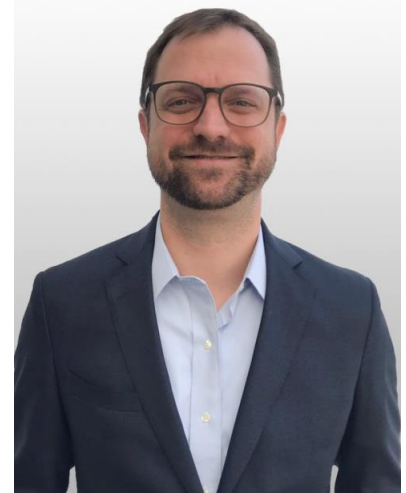
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Matthew Van Sickle

Consultant

- More than 15 years of experience in nuclear area
- Started career with U.S. Department of Energy's National Nuclear Security Administration
- Served at IAEA in Nuclear Infrastructure Development Section, and in Nuclear Power Engineering Section.



IAEA Webinar Number 5

Training Completed: Evaluating Effectiveness

Introduction to TECDOC 1893: A Methodology to
Evaluate the Effectiveness of Training in Nuclear
Facilities

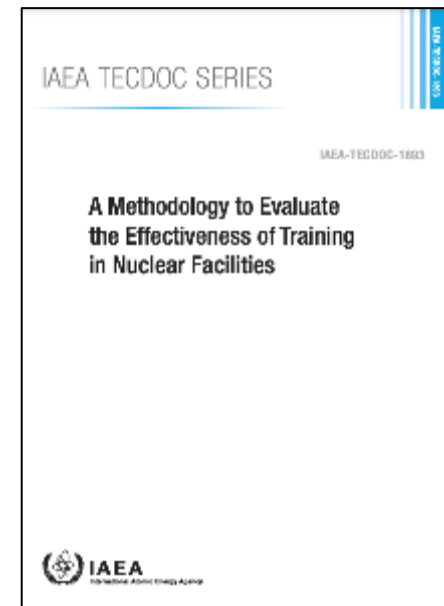
Matthew Van Sickle
International Consultant
June 2021

Outline

- Introduction to TECDOC 1893
- Standards
- Conducting Self Evaluations
- Role of Peer Review
- Independent Validation/Accreditation
- Summary

Overview of the TECDOC 1893

- Developed by the IAEA's Department of Nuclear Energy, Nuclear Power Engineering Section, with participation of international consultants, including:
 - Phillip McCullough, United States
 - Brian Molloy, Ireland
- Based on the internationally accepted Systematic Approach to Training ([recently updated by IAEA](#)).
- Document presents a methodology that can be used by nuclear facilities to evaluate the quality of training processes and programs, including learning and development.



Overview of the TECDOC 1893

- Nuclear facilities can use the methodology to conduct a self-assessment of the training program.
- Self-assessment can be conducted on an individual training program, at the departmental level, at facility site level or even at a corporate/organizational level.
- Discusses role of peer review, which the IAEA can help facilitate.
- Highlights the role of independent validation /accreditation.

Standards and Conditions

- **Standard 3:** Initial and continuing training programs are based on the systematic approach to training, each step graded as appropriate to job safety or performance risk.
 - Application of SAT to all training activities and programs
- **Standard 4:** All personnel involved in training activities are competent for their assigned roles.
 - Training personnel understand SAT
- **Standard 5:** Training is reviewed to confirm its impact on the facility's safety, performance and commercial goals.
 - Training effectively supports facility performance and safety.

Standards and Conditions

- Standards have conditions that are expected to be met, based on the relevant IAEA guidance document and/or Safety Standard.
 - Each standard includes examples, good practices and explanations/evidence.
- **Standard 1:** Senior managers use training as a strategic tool to support the achievement of the facility's safety, performance and commercial goals.
 - Training as a performance management tool.
- **Standard 2:** Managers at all levels are responsible for the competence and qualification of their staff and take ownership of training programs
 - Management ownership and effective partnership between the line organization and the training staff.

Example: Standard 3

I.3. STANDARD 3

Initial and continuing training programmes are based on the systematic approach to training (SAT), graded as appropriate to job safety or performance risk (see TABLE 3).

TABLE 3.

No.	Condition	IAEA Basis
3.1	A performance review process is in place to determine a need for training.	"4.20. Performance based programmes for initial and continuing training shall be developed and put in place for each major group of personnel (including, if necessary, external support organisations, including contractors)." [5] "4.9. The organisation's training plan should include: ... —An evaluation of the effectiveness of the training, including individual performance, the performance results of the organisation carrying out the training, and the training process." [7]

II.3. STANDARD 3

Initial and continuing training programmes are based on the systematic approach to training (SAT), graded as appropriate to job safety or performance risk (see TABLE 8).

Standard 3 is about the application of SAT to all training activities and programmes, both initial and continuing, to ensure that workers are always competent to perform the tasks to which they are assigned. There is an expectation that worker performance will improve over time and that this will be reflected in facility performance. It recognises that the rigour of application of SAT may be based on the safety or performance requirement of the assigned tasks.

TABLE 8.

No.	Condition	Good Practice	Examples	Explanations and Evidence
3.1	A performance review process is in place to determine a need for training.	- Performance indicators are used to review human performance and trends are monitored. - A performance-based needs analysis process is used to identify whether training, or an alternative solution such as better tools, or procedure or equipment change, is appropriate. - Competent personnel (line managers, experienced workers, subject matter experts and instructors) participate in identifying training needs.	- A root cause/human performance review process is used to identify training needs. - Clear standards are provided for management review of analysis products. Training committees monitor changes and take appropriate actions if their programmes are affected by: - Engineering changes - Regulatory changes - Policy changes - New processes - New facility/equipment	- Check whether a performance review process exists. - Check the use of performance indicators and trending. - Check the existence/quality of root cause analysis reports. - Check whether human performance training is provided for managers and staff.

Conducting Self Evaluations

- The self-evaluation process should include:
 - Observing training activities.
 - Interviewing senior, line and training managers and staff.
 - Reviewing of training facilities, equipment, materials and procedures.
- Consider conducting a pilot self-evaluation on a single program.
- The result should be a report that notes the progress of the training programs/processes in meeting the standards and conditions.
- Should identify gaps (and actions to address them) and any good practices.

Conducting Self Evaluations

- Graded approach can be used:
 - Excellent (exceeds standard).
 - Successful (standard fully met).
 - Satisfactory, but with gaps/areas for improvement - action plan required.
 - Below expected standard (backed by performance evidence) - action plan required.
- IAEA can provide expert missions to assist organizations in establishing a self-evaluation process and/or provide training prior to undertaking an initial self-evaluation.

Role of Peer Reviews

- Peer reviews can enhance the self-evaluation process by providing additional expertise and insight.
- Three options for peer reviews:
 - Internal peer review, where the team members belong to the same organization but are independent of the facility being reviewed.
 - External peer review, where the reviewers come from other organizations and the team can be considered completely independent of the organization hosting the review.
 - Mixed peer review, which is a combination of internal and external peers as defined above.

Independent Validation/Accreditation

- Facilities may consider formally validating /accrediting the training programs and processes through independent organizations.
- Two options:
 - Using an existing body, such as a nuclear safety review board.
 - Establishing a new body dedicated to the review and validation of training program.
- Note: the IAEA does not serve as an accrediting organization for training programs.

Return on Investment

- Implementation of SAT-based training programs can be costly.
- Part of reviewing the training effectiveness is understanding the origin of the training requirements and determining if the training providing is improving safety/performance.
- Some key indicators that can be used to calculate the return on investment include:
 - Safety improvement measured as a reduction in reportable nuclear safety related events.
 - Savings resulting from improved electrical generation due directly to improved personnel performance.
 - Savings resulting from improved efficiencies in maintenance or servicing activities.
- Having training performance indicators in place will support this process.

Summary

- TECDOC 1893 provides a methodology to evaluate the effectiveness of training programs in nuclear facilities based on SAT.
- Proposes a set of five standards that can be used to evaluate the effectiveness of the training arrangements at a facility.
- Peer reviews of the findings will increase the objectivity of the results of the self-evaluation.
- Independent validation/accreditation programs may also be considered to increase confidence in the facility's training program and overall performance.
- Important to measure the return on the investment as part of the evaluation.



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Noora Kajander

Knowledge Management Expert

- Since 2007 has worked in TVO General Training Dept.
- Involved in all areas of a nuclear power plant training
- Developed a competence mapping system for the concern
- Participating in IAEA's consultancy meetings.



Main Principles and Methods of Evaluating the Effectiveness of Training

Main principals

Critical, active and effective self-assessment and continues improvement

Training is strategic tool to enhance both worker and facility performance

Performance indicators support

Core part of business

Training policy

Training facilities

Training is owned by the management line

Resources

Training committee

Observation on the field

direction in terms of performance expectations and results

Follow up of training performance indicators

Graded and systematic approach to training

SAT process
ADDIE. KSA in place

designed by the line organisations

based on the safety or commercial significance of the job or task under consideration

Evaluation standards

Senior managers use training as a strategic tool to support the achievement of the facility's safety, performance and commercial goals

Training is a performance management tool. Managers demonstrate understanding of the link between competence and performance. Training objectives and activities are linked to the goals of the organisation. Senior management invest in, and promote, training as a means to improving performance

Managers at all levels are responsible for the competence and qualification of their staff and take ownership of training programmes

Ownership and ensuring an effective partnership between the line organisation and the training staff. Managers take responsibility for the competence of their staff and work effectively with training staff to ensure the qualification of personnel

Initial and continuing training programmes are based on the systematic approach to training, each step graded as appropriate to job safety or performance risk

Application of SAT to all training activities and programmes, both initial and continuing, to ensure that workers are always competent to perform the tasks to which they are assigned. There is an expectation that worker performance will improve over time and that this will be reflected in facility performance. It recognises that the rigour of application of SAT may be based on the safety or performance requirement of the assigned tasks

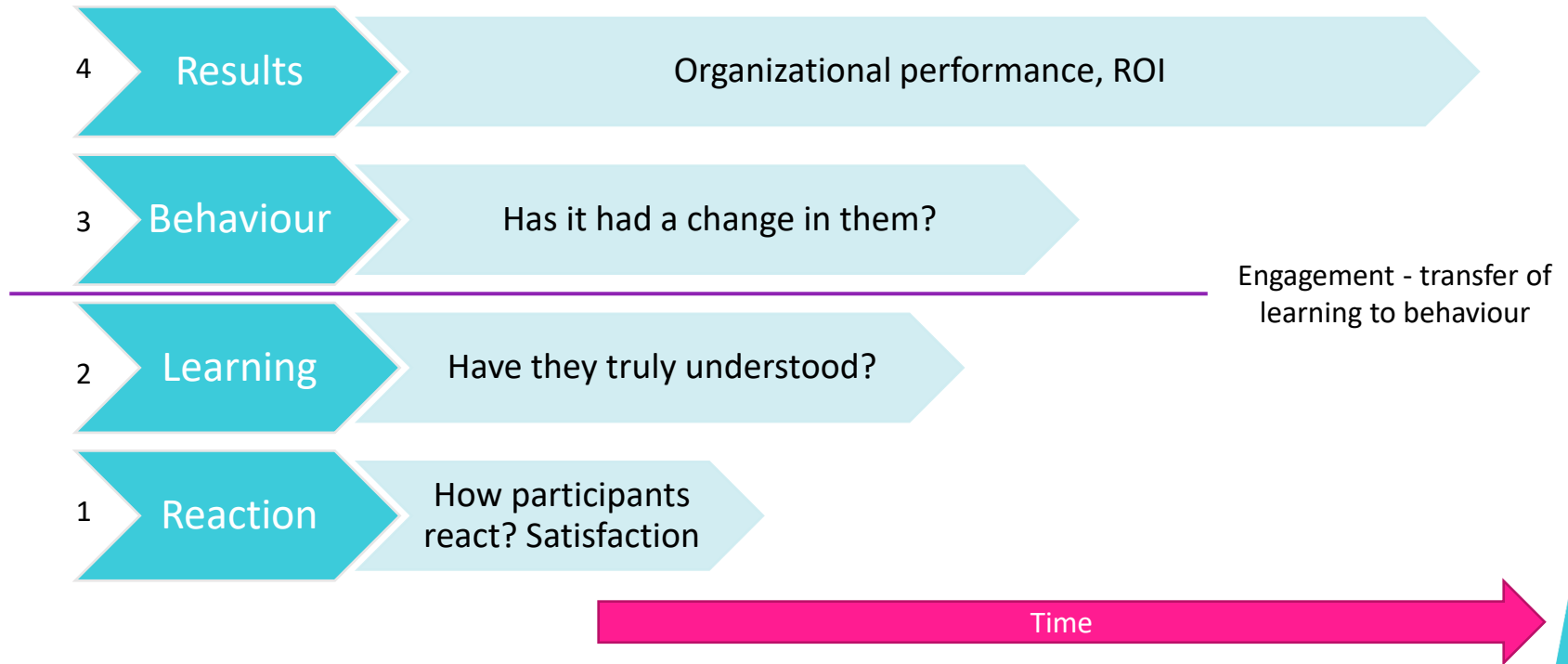
All personnel involved in training activities are competent for their assigned roles

Ensuring that all personnel involved in the training process have a good understanding of SAT, particularly as it applies to their roles in the process. Where personnel have specific roles in the training process, this is reflected in their roles and training profiles and they are competent and qualified to carry out these roles

Training is reviewed to confirm its impact on the facility's safety, performance and commercial goals

Ensuring that training effectively supports facility performance. Training performance is monitored at the highest level in the facility. Trainer and trainee performance is evaluated, and action is taken to remedy any shortcomings. Facility performance is monitored to evaluate overall training effectiveness. Self-evaluation is used to enhance training performance and effectiveness.

Kirkpatrick model – evaluation levels



In practice - training evaluations



Immediate feedback

- Feedback to the trainers
- Effectiveness index of internal trainings



Learning

- Pre-test & end test
- Knowledge has been transferred
- Engagement – will they adapt it to their work tasks?
- Competence mapping and review by person and manager



Implementation

- Observation rounds
- Behaviour and work methods have changed
- Long-term training effectiveness questionnaire
- 360 evaluations



Results

- Safety observations results
- Occupational safety improvements
- Contamination cases
- Processes are being followed
- Projects are well planned and implemented on time and safely

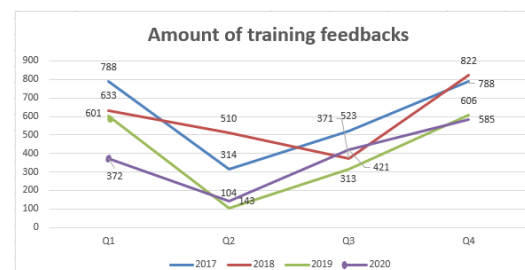
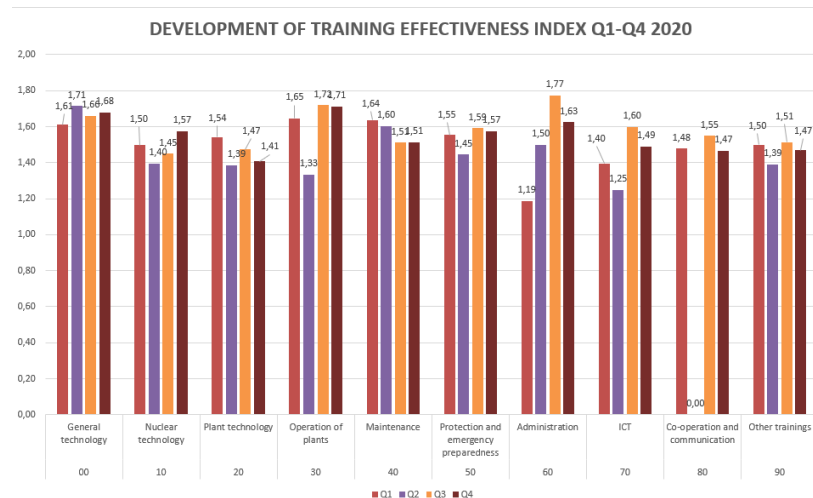
Training effectiveness index

Four questions chosen from the feedback questionnaire.

Each choice has a numerical value, per category an average is calculated.

Action limits have been developed.

- 1,00-1,89 Effectiveness good and participants have received information and skills to their tasks.
- 1,90-2,49 Effectiveness has been partial and has only had limited effect to their tasks
- 2,50-4,00 No effect to participants.



7.6.2021

26



Thank you!



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Patrick Berry

Consultant

- Nuclear professional with over 40 years of experience
- Experience in operations, maintenance, radiation protection and training
- Served as Director, Training and Development for Entergy Nuclear
- Served as Accreditation Team Manager in INPO
- Currently works as a consultant to the nuclear industry



GOOD PRACTICES FOR TRAINING PROGRAM SELF- ASSESSMENTS

Patrick Berry

Patrick Berry Consulting, LLC

GOOD PRACTICES FOR ORGANIZATIONS BEING ASSESSED

Develop a formal self-assessment plan

- Use some recognized standard of excellence
- Add site specific focus areas if necessary

Ensure team is big and experienced enough to cover all objectives

- Appoint a team lead
- Consider external peers
- Assessment expertise?

GOOD PRACTICES FOR ORGANIZATIONS BEING ASSESSED

Provide logistical support

Prep the organization to be receptive to feedback

Consider a 'sequester period' prior to the formal self-assessment

Provide an easy to use tool for recording and sorting facts

Conduct causal evaluations and extent-of-condition reviews for issues identified by the team

Designate a report writer

GOOD PRACTICES FOR SELF-ASSESSMENT TEAMS

Clear communications with the organization – no surprises!

Focus on facts.

“That’s not how we do it” does not equal a problem.

Use the collective expertise of the team.

Cover all elements of the assessment plan, document any gaps.

Observe training in all settings possible, document any gaps.

If you identify an issue, document it and move on.

Don’t ignore strengths!

Provide clear documentation of all observations, comments, issues.

ISSUES FREQUENTLY IDENTIFIED DURING SELF-ASSESSMENTS

SAT implementation gaps

Gaps in training program readiness

Gaps in using training to address performance issues

LESSONS LEARNED

Biggest factors in self-assessment effectiveness:

- Team experience
- Senior leadership sponsorship
- Organization follow-up on issues identified by the team

Leading good self-assessments is a skill that needs to be developed.

Self-assessments are still possible when travel is not.

CONTACT INFORMATION

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Stephen Page

Training Standards and Assurance Manager

- Currently working for EDF Energy UK as a Training Standards and Assurance Manager
- Experienced also as Training Manager, Training Standards Group Head and Training Specialist
- 27 years worked as a serving member of Royal Air Force as an aircraft maintenance engineer



Challenges when Evaluating Training in a Knowledge Worker Environment

Presented By:
Stephen Page
EDF Energy



Some of the challenges

- Training is often used to build a long term capability
- The need for training is often an anticipated need rather than immediate
- Not all tasks trained are time bound and observable
- Knowledge worker errors tend to be latent rather than active
- Knowledge held is often Tacit rather than Explicit



Measuring the effectiveness of training

Level 1: Reaction

- Captured immediately after a training event, this feedback captures how satisfied learners were with the training content, delivery style, training environment and relevance to their work
- A key improvement has been the incorporation of measuring a student's commitment and confidence to transfer the learning to the work place thus providing a leading indicator for Level 3 behaviour
- Targeted level 1 reaction forms are being used which prompt a graded response depending on the immediate impact to nuclear safety of the training being delivered

Measuring the effectiveness of training

Level 2: Learning

- This is an immediate measure of how much learning has taken place after a training event and a measure of the confidence and commitment demonstrated by a student to transfer the learning back to the workplace
- Specific learning objectives are used to engage and measure students' attitude in recognising the need for the learning and its subsequent transfer to the workplace
- A standard summary form is used which captures both level 1 and level 2 analysis, providing a more holistic view of the effectiveness of the course from both the trainee and the instructors' perspective

Measuring the effectiveness of training

Level 3: Behaviour

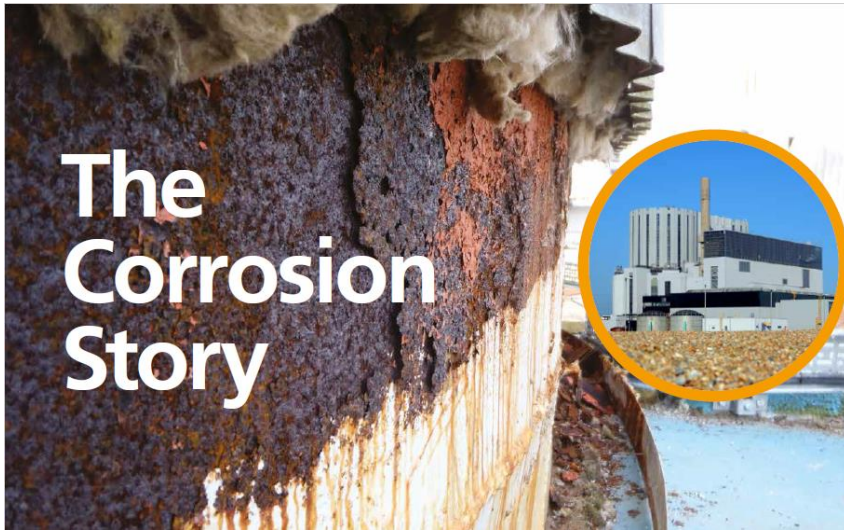
- This is a lagging measure of how learning is being used back at the work place, normally conducted 6 to 12 months after training has taken place and is captured through surveys or observation of work
- There has been an increased focus for line managers to record observations of performance and ask themselves the following questions:
 - Have students applied what they have learned back on the job, transferring knowledge to workplace?
 - Have they changed their behaviour?
 - Is the organisation reinforcing the knowledge & skills?

Measuring the effectiveness of training

Level 4: Results

- This is a measure of whether the training delivered is realising a business benefit. This would normally be measured through increased process productivity, increased plant reliability, increased output etc.
- It was seen that in a knowledge worker environment it can be more effective to identify where work has been completed (that has been seen to deliver a business benefit) and work backwards to identify how training supported this, and whether there are any lessons to be learnt to further improve the training delivered (Reverse Level 4 approach)

Reverse Level 4 Case Study (from 2017)



Corrosion is a significant issue across the fleet impacting nuclear and generation safety, in the last 10 years corrosion related incidents have cost EDF Energy in excess of £1/2 billion.

With the business focus on equipment reliability and looking at how to reduce losses the organisation has worked hard to take control of the issue and drive it to completion.

It was identified that commercial benefits could be gained by early detection of corroded plant that impairs the safe reliable operation of the plant. A robust and effective approach to the management of Corrosion was required to ensure a coordinated and sustained vigilance from all areas of the business.

Training Intervention

Having identified that Corrosion affects the business at many levels, a training request was raised in December 2012.

The following needs analysis identified a lack of knowledge, new/revised procedures and inadequate training following modifications to HDPE pipework and new coatings.

Following training committee approval in December 2013, it became apparent that co-ordination and development of this initiative would operate at four distinct levels:

1. Responsibility for overall management of corrosion as a program
2. SQEPs
3. Those with a working knowledge
4. Other staff and contractors.

Reverse Level 4 Effectiveness Review

Following a review in 2017 the following key messages were identified. Collectively these demonstrate the positive impact of the interventions, thus reducing the cost of losses due to corrosion:

- Heysham A return ONR visit in December 17 received a green rating, with the ONR stating that – “We normally get to this point and have some buts – but there are no buts”
- CV1 Systems Risk Based Inspection (RBI) completion rate is 88%. CV2 Systems RBI completion rate is 96%.
- Significant findings include HRA & HPB CO2 pipework, HYA & HRA RFTs, HRA HPBUCs tanks, DNB ECW pipework, HYA GT Fuel Oil Day Tanks, SZB RUHS & CSTs, HNB BUCW pipework. **The training has increased visibility and enabled effective prioritisation of remedial work.**
- Work Management have integrated Corrosion coding into their Work Management Matrix enabling tracking of high priority corrosion defects.
- Asset management have compiled a view on financial risk status across the fleet.
- 4 independent reviews have been completed with minor actions for HYA, HYB and HPB. DNB received a considerable number of actions
- Since corrosion coding has been available 1,851 corrosion WRs have been raised.
- There are currently 1,312 open Work Order Cards (related to corrosion), 7 of which have been prioritised as a P1 or P2.

Operational impact

“Where I have personally found the 'Categorizing Corrosion' course and the 'corrosion cards' most useful is when I raise works requests. I include the corrosion severity score to ensure the correct priority is given.

A good example of this was when we found external corrosion on a DA vent pipe-line and I raised a works request (01717669) stating CORROSION SEVERITY 1 highlighting the fact that attention was required now. We replaced the pipe-section in the current outage here at Dungeness”.

Training alone is too small a platform to stand on



Thank You





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Q & A



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Upcoming Webinars

06



Training the next wave: Feeding the talent pipeline

07



Troubleshooting SAT:
Practical solutions to common challenges



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Before you go...

All registered participants will receive a short post-webinar survey with a link to the recording, including your suggestions for future topics. This will strengthen the experience and we would be grateful for your advice on how to move forward.

Thank you for your feedback in advance.



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THANK YOU!