OSART Good Practices
TECHNICAL SUPPORT
Organization and functions

Doel, Belgium

Mission Date; 8-25 Mar., 2010

In the plant engineering department and in major projects, senior and junior engineers work in pairs in a planned and structured way, thus facilitating the transfer of knowledge.

Many new young engineers have recently been recruited in order to take on future workload when older staff retire and/or when the workload increases because of new challenges like long term operation projects, ten-yearly periodic safety analyses, adaptation to new regulations, etc. These undertakings can be used to transfer knowledge from more experienced employees to a younger generation. The transfer of knowledge is crucial from a long-time perspective in order to prevent existing knowledge and experience from being lost in the organization.

Besides the standard training programmes, based on the Systematic Approach to Training (SAT) concept in the engineering department, teams composed of a senior engineer and a junior engineer work in pairs to facilitate this transfer of knowledge. This systematic approach for the transfer of knowledge improves and facilitates the build-up of the required competency and skills in a natural way.

Seabrook, USA

Mission Date; 6-23 Jun., 2011

The Probabilistic Risk Assessment (PRA) Group at the plant utilizes an All-Modes Risk Model to effectively manage risk associated with plant configuration on-line (Mode 1), during plant transitions (Mode 2 to 5) and during refuelling outages (Mode 6). This All-Modes PRA allows configuration risk management to be performed using the same PRA tool (Safety Monitor), the same risk thresholds, and similar processes for the plant in any configuration. In addition, the At-Power PRA explicitly includes all internal hazard events (internal flood, internal fire) and external events (seismic events, high wind, etc). Another PRA model has been developed for fuel in the spent fuel pool. These models allow for quantitative assessment of all locations where irradiated fuel is located - reactor core, spent fuel pool, or in transit.

Examples/Results Achieved

- On-line configuration risk evaluations are performed weekly by the PRA department. This evaluation identifies maintenance configurations that, if they occurred simultaneously, would result in excessive risk. In most cases, the risk management action is simple - to maintain schedule adherence which assures important activities do not occur at the same time. In a ew cases, the maintenance schedule is revised to control critical activities that should not occur at the same time.

- Risk assessment of the proposed outage schedule is performed prior to each refuelling outage. This assessment allows Outage Management to optimize the schedule with regard to risk. During each outage, the PRA Group evaluates the schedule daily and works closely with Outage Management to assure schedule changes do not introduce any excessive risk. There were no unplanned/unintended risk colour changes during refuelling outages OR12, OR13 and OR14 due to the PRA group support and integration with the station.

Seabrook, USA

Mission Date; 6-23 Jun., 2011

The Engineering Support Personnel (ESP) Training Program at the plant exhibits excellent line ownership.

This ownership has led to control of training topics, timely completion of qualification requirements by new and experienced engineers, the development of a contract engineer qualification process, and an internalization of the importance of verifying qualifications prior to performing work.

The following items are in place to ensure qualified contract engineers perform work at the plant:

1) A list of Contract Engineers working at the plant is reviewed at the ESP Training Review Committee (TRC) Meeting on a monthly basis for inclusion of personnel into the ESP Training Program Continuing Training Program. Selected Contract Engineers (based on their work activities) are required to attend the same Continuing Training as in-house engineers.
2) A unique Qualification Guide has been prepared for Contract Engineers to provide qualification of the work activity processes that are employed at the plant. Contract Engineers are required to be qualified for tasks that in-house engineers are qualified to perform.
3) The qualification verification tools in place allow for verification of qualifications of all engineering personnel, including Contract Engineers. Contract Engineers are required to verify qualifications similarly to those of in-house engineers (in accordance with QM 4.11).

The ESP Training Program also utilizes a New Engineer Training Kick-off Meeting to provide new engineers with a clear understanding of the expectations and requirements associated with training and qualification. The meeting covers topics such as Accreditation History, Qualification processes and requirements, Training Attendance Expectations, and utilization of the Learning Management System (LMS) database.

Clinton, USA

Mission Date; 11-28 Aug., 2014

Exelon Engineering has developed a guide that defines leadership excellence for core business functions in Design, Plant and Programs Engineering to improve engineering leadership skills and reinforce the Technical Conscience Principles. Engineering Managers routinely engage knowledge workers at the 10%, 50%, and 90% completion milestones to ensure technical products meet the required standards. The benefits and feature of such an approach include:

- Engineering Managers have a unique role in evaluating technical human performance as compared to a field supervisor who observes the physical behaviours of the craft performing work. Exelon has implemented processes such as desktop observations and the 10%, 50%, and 90% manager reviews to assess technical human performance by knowledge workers.

- The guides identify the core business functions of the discipline, the associated key governance, and the required behaviours that define how leaders ensure excellence.

- The leadership guides were used to assess the leadership skills of engineering managers in overseeing knowledge workers in performing key engineering functions.

- The Engineering Leader Development Guides were used to develop Engineering Leader Self-Assessment Worksheets and an Oral Board Interview Guide. The Oral Board reviewed the engineering leader's self-assessment and interviewed the leader to confirm/identify strengths and gaps to excellence.

- The Board's assessments provided input into the 2013 mid-year performance reviews and Individual Development Plan (IDP) updates for each engineering leader.

The leadership guides and oral boards have allowed Engineering Managers to focus on closing leadership gaps and leveraging their strengths. This has benefited both the manager and his staff in becoming more effective in implementing the management model. The Engineering Managers were able to hone their leadership skills and use those skills in improving engineering products and achieving excellence in equipment reliability.

The Quality Review Team (QRT) review of engineering products and the annual Check-In Assessment of Modification Quality have found an improving trend in the quality of engineering work products – including Modifications, Technical Evaluations, System and Programme health reports, and Support/Refute Matrixes. These improvements are, in part, due to improving the leadership skills and engagement of engineering managers.

Clinton, USA

Mission Date; 11-28 Aug., 2014

Exelon University Engineering Training Programme

Exelon University is a corporate-led engineering training initiative that leverages the resources of the 10 Exelon sites, corporate offices and contract partners 'Engineers of Choice' (EOC) to prepare and deliver fleet-wide qualification and advanced technical training. The benefits from using such an approach include:

- Provision of specialized engineering training led by subject matter experts and qualified mentors for job specific engineering training and qualification.

- Providing a key component of Exelon's Engineering Knowledge Transfer and Retention effort.

- Enabling Exelon to retain, transfer and/or develop critical knowledge, skills and subject matter experts at a reduced cost with more timely delivery, which results in improved efficiency.

- Allowing more timely delivery of training content, efficient use of instructor resources, and reduced cost per student.

- Ensuring a curriculum selection process that follows the INPO Systematic Approach to Training process. In the fourth quarter of each year, the sites Engineering Curriculum Review Committees identify their training needs for the upcoming year.

- Developing and implementing cooperative agreements with EOC firms that allow them to participate in each other's training.

- Allowing Exelon under EOC cooperative agreements to place less experienced engineers in EOC offices to work on Exelon projects under the instruction of experienced EOC engineers.

Dampierre, France

Mission Date; 31 Aug.-17 Sep., 2015

Improved component reliability by a detailed assessment of critical component failures and evaluation of system reliability.

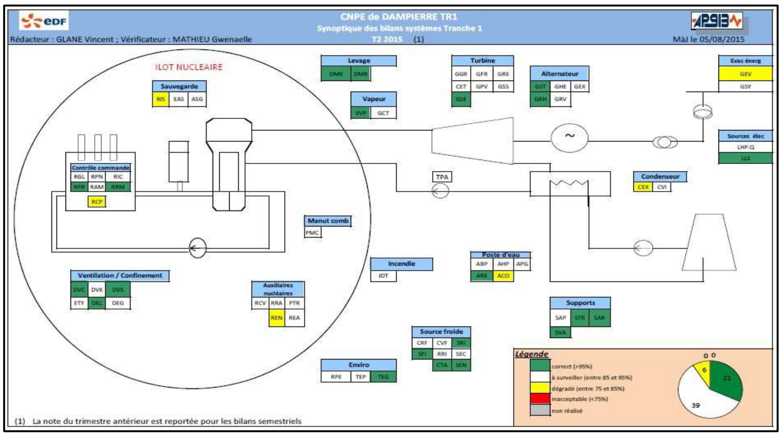
The aim of the INPO AP913 approach is to improve nuclear power plant reliability. The essential elements of the implementation at the plant are the following:

- A systematic root cause analysis for each critical component failure,
- The use of a reliability mimic panel created every quarter for each unit based on AP913 system health reports.

The specific features of this process at the Dampierre plant include system experts performing independent quarterly plant tours and monthly reviewing all work requests concerning their systems.

A yearly report is compiled to identify the main causes of critical component failures and to check the effectiveness of actions implemented.

This approach uses a mimic panel developed at Dampierre plant, based on AP913. A simplified drawing of a nuclear power plant gives a quick vision of the reliability level of the various systems for each unit. The colour coding allows for easy identification of the safety functions (reactivity, cooling or containment) which are affected by critical failures. The mimic panels are presented during the reliability committee meetings. The most degraded areas are given priority in planning maintenance interventions.



Results:

The number of « red » and « yellow » systems went from 9 per unit during 2014 to 6 per unit during 2015. Systems have been more reliable since the implementation of this practice. This increases their capacity to fulfill their safety functions.

The yearly assessment of critical component failures shows that, in 2014, for all 4 units at Dampierre, only 33 critical component failures were recorded.

The main cause of critical failures is the degradation over time of some materials. In most cases, the situation was already known but two new issues were identified in 2014:

- Ageing of exhausts on diesels
- Cracks in pipes used for the regulation of the intake of the turbine

For both, replacement programs were started.

Bruce B, Canada

Mission Date; 30 Nov.-17 Dec., 2015

The plant has implemented several new and innovative reactor inspection tools that have contributed to safe and reliable continued operation of its units

Examples of new innovative tooling systems include:

The Bruce Reactor Inspection and Maintenance System (BRIMS), which replaces three existing, remotely operated machines used to perform fuel channel inspection and maintenance work, establishes a common delivery and inspection process that can be deployed and utilized during planned outages. When fully commissioned, the system results in reducing dose by 71% or 26 Rem and reducing inspection time by 73% or 27.4 days for a standard outage inspection campaign. Dose reductions and time savings are realized from improved deployment methods and less time for in-vault work, craning and inspection.

Use of Circumferential Wet Scrape Tool (CWEST) automates the collection of reactor core samples for deuterium measurement improving reactor safety by eliminating the need for ice plugs to establish the coolant system pressure boundary thus reducing severe core damage frequency by 2.9% and reducing worker radiation exposure by more than a factor of three (15 mSV per channel).

Modal Detection and Relocation (MODAR) system that locates and repositions reactor core components to ensure safety margins are maintained. This system is the first in the world to perform this function and is applicable to CANDU reactors built after Bruce Unit 8.

Leningrad, Russia

Mission Date; 13-30 Nov., 2017

Application of automatic argon arc welding with 9o bevel angle on 300mm austenitic piping.

The major problem with welds on 300 mm austenitic piping is defect formation due to the intergranular stress corrosion cracking mechanism (IGSCC).
The IGSCC effect on austenitic piping welds is caused by several factors:

- Post-welding tensile residual stresses on the weld inner surface;
- Metal sensibilization - chromium carbide deposition at grain boundary;
- Corrosive environment.

Elimination of one of these factors reduces degradation of austenitic piping welds by IGSCC mechanism.
The Plant has developed effective compensatory measures to control this mechanism. One of the measures is application of automatic argon arc welding with 9o bevel angle. A general view of the automatic argon arc welding machine is given in Fig.1.

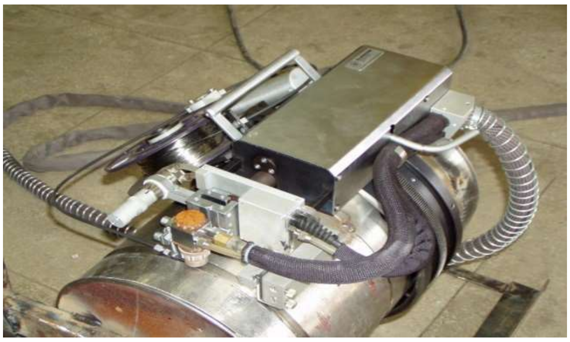


Fig.1 General View of automatic argon arc welding machine.

Automation of the welding process allowed significant reduction of the volume of weld metal, down to 70 cm3. (for 300mm pipeline), which is 3 times less than in the case of manual argon arc welding with 35o bevel angle.

Reduction of welded metal volume provides lower heat input, which reduces sensibilization of the near-weld area by a factor of 2-3.
At present, 3121 welds of austenitic pipelines were welded by argon arc welding (46% of the total number of the welds of this type).

The flaw rate of automatic argon arc welds at 300 mm pipes is 0.2%, while the flaw rate of joints welded using an old manual technique with 35° bevel angle is 4-5%.

Hence, automation of the welding process:

- Makes a significant contribution to the integrity of pipelines;
- Reduces inspection frequency;
- Reduces radiation doses to personnel;
- Reduces maintenance cost.

Torness, UK

Mission Date; 22 Jan. - 8 Feb, 2018

Corrosion Cards

Corrosion is a growing concern in the station that can lead to significant nuclear, industrial or environmental safety events and/or a loss of generation. As part of a fleet-wide Corrosion Programme, station needs to be able to appropriately act to highlight risks in a format that allows for tracking and trending:

- Personnel are being provided with corrosion cards to be able to categorise Cases of Corrosion, to assign Corrosion Priorities and to know the further actions associated with each Priority.
- The station developed a way for personnel to be able to easily report corrosion related condition reports & working requests in a format that will enable tracking & trending.

Benefits include:

- Risk mitigation for corrosion vulnerable plant has been assessed (CV1 to CV4), and action plans undertaken to improve the plant.

- Staff awareness is heightened by distribution of corrosion identification cards with pictorial guidance.

- Work request panel has been amended so that analysis and recording the ‘as-found’ condition can be investigated promptly.

- Essential plant areas such as Auxiliary Boiler Exhaust Stack, Diesel Generator Exhaust Stack, CO2 Storage Plant and Nitrogen Storage plant have been improved greatly through hard work and plant investment.

- Plant investment strategy can be influenced on a risk based approach to improve value and efficiency.

- Toolbox talk 160 was distributed to raise awareness throughout the plant.

CATEGORIES

CORROSION CATEGORY	DESCRIPTION	WM JOB TYPE CODE	ALIGNS WITH
1	SEVERE substrate degradation	C1	Corrective
2	SIGNIFICANT substrate degradation	C2	Elective
3	NO SIGNIFICANT substrate degradation	C3	Other
4	SUPERFICIAL substrate degradation	C4	Other

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PRIORITIES (as per BEG/SPEC/WM/A1/100)

PRIORITY	DESCRIPTION
1	Requires immediate evaluation. Begin immediately and work around the clock or as agreed with Operations.
2	Schedule at earliest opportunity (<5 weeks).
3	Schedule within the Execution Plan or within the 1st Cycle of the Cycle Plan (<30 weeks AGR/<15weeks SZB).
4	Schedule as resources allow within the normal process.
5	Work only when time allows.

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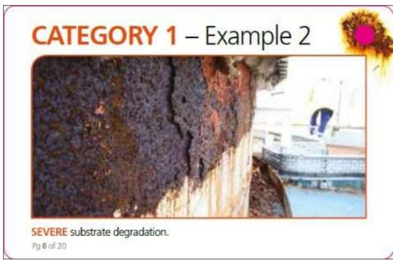

Penly, France

Mission Date; 4 - 21 Sep., 2023

The plant has installed remote monitoring capability on safety critical seawater piping.

The new remote monitoring equipment installed on the coolers for the essential service water and component cooling water system is used to monitor the biofouling of safety related piping that draw water from the sea. Information collected by the monitoring equipment is transmitted wirelessly to plant and corporate software platforms and displays the data in real-time. Engineering staff analyze and trend the data in order to determine the efficiency of chemical treatment, reduce maintenance time, and increase the availability of these critical systems.

Penly, France

Mission Date; 4 - 21 Sep., 2023

The plant has developed and installed a system for monitoring sedimentation in the intake cooling water channel.

The weather and water current conditions outside the plant can lead to a higher risk for sand sedimentation in the intake cooling water channel. The sedimentation has historically jeopardized requirements for intake cooling water. The new system allows the plant to have margin to avoid torrential flow in the channel. This prevents cavitation of intake water pumps.

To make sure that the plant has control over sedimentation buildup, the plant, together with corporate functions, developed software to monitor the sedimentation and to make projections about the future. These projections are used for trending on the conditions and evaluation of when to dredge the intake cooling water channel.

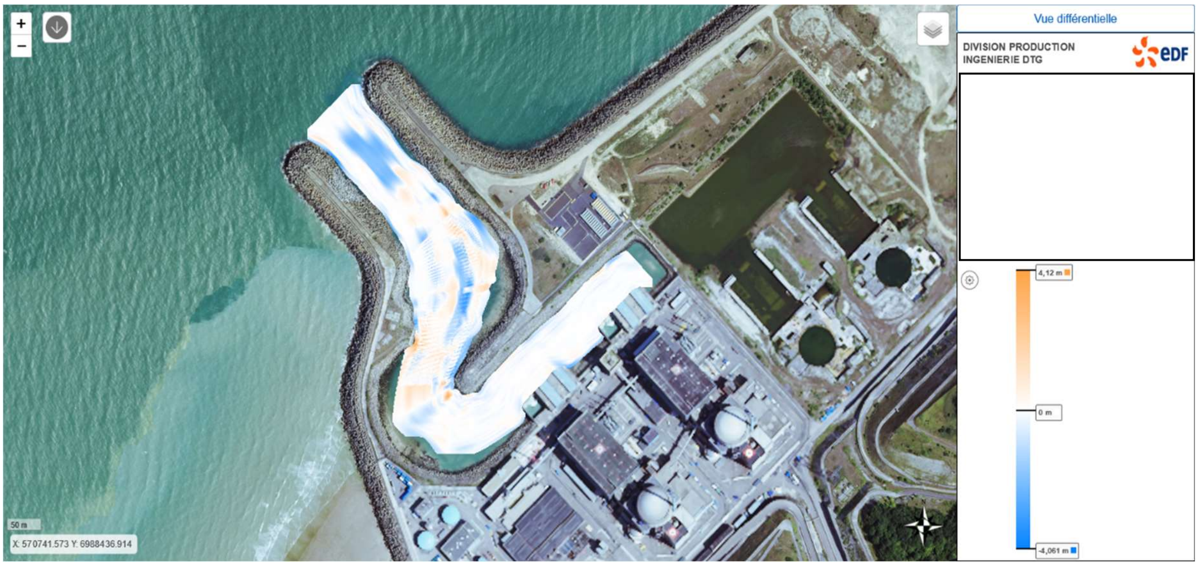

Figure 1 Intake channel bathymetry analysis