The Maintenance Self Improvement Process was designed to be used by Maintenance personnel as a method of identifying concerns, ensuring appropriate levels of review and providing timely resolution. The process consists of the Check Tech Program, Maintenance Review Board (MRB), and the Maintenance Work Around Program.

Check Techs are voluntary personnel acting in the capacity of a peer inspector within their discipline. A primary function of the Check Tech is to perform field observations of maintenance activities. This individual observes work and industrial safety practices, adherence to technical and administrative procedures, proper tool usage, foreign material exclusion, pre and post job briefs and other aspects of the job as appropriate.

Station management and department heads utilize documented observations made by the Check Tech to help focus resources on areas needing the most improvement. Procedural, physical and administrative barriers to performing tasks are documented by the Check Tech for inclusion in the maintenance department electronic log. This also allows review by other departments, adding to their awareness. These observations may also written down for presentation to the Maintenance Review Board.

The Maintenance Review Board (MRB) provides a focal point to facilitate addressing of maintenance issues and concerns by maintenance personnel. Each item is given a number for tracking purposes and then is presented to the MRB for consideration. The board decides if the item is to be pursued by the board or if it could be handled internally within that department. The board is composed of and chaired by maintenance personnel. Management participates in an advisory capacity only. Issues that cannot be resolved or are felt to be beyond the scope of the MRB are escalated to the Maintenance Work Around list.

Maintenance Work Around items are assigned a number and priority based on the area of significance. Personnel safety deficiencies, procedural technical inadequacies, ALARA concerns, and rework items, which have alternative actions pending, are given highest priority. Enhancements to procedures, processes, and work practices fall into the next category. The status of these items are periodically presented to upper management. This increases attention to the items by the responsible department heads.

Since its inception in January 1997, the Maintenance Self Improvement Process has been instrumental in identifying and tracking to resolution approx. 270 items.

In addition, Quality Maintenance Teams (QMT) have been appointed with the responsibility to perform Quality Assurance checks during work performance. This strengthens ownership for Quality Assurance in the maintenance department.
The different tasks of the maintenance groups are co-ordinated via the administrators and the planning and maintenance information systems. The maintenance information system provides excellent information on Technical issues, schedules, failure trends, status of jobs ongoing, contractors, costs and other relevant information used in maintenance. In the system information of jobs already performed is recorded in such a way that a cost benefit assessment can be performed. The information system also keeps track of individuals skills to assure that only qualified people are used. The architecture of the system and the way the information system is used in the Maintenance Division is as a good practice for the industry.

**Dukovany 1/4, Czech Republic**

Mission Date: 5-22 Nov., 2001

Implementation of outage working time follow-up and self-check system within the MMCR department (maintenance-mechanics-boilerwork-valves department) designed to prevent any deviation from employment regulations. During plant unit outage periods, work monitors are provided with a paper chart for logging their activity providing them with a simple means of ascertaining that they comply with employment regulations (daily and weekly working time, rest time). This is stand alone chart that provides a reminder of the rules to be followed and allows the working periods assigned to the work inspector to be formalized by the project manager at management level. System provides: rapid simple to use self-check, traceability provided between the worker and his functional supervisor and than his hierarchical manager, a remainder of employment regulations and system for anticipating the working time margins available for weekend on-call work.

**Nogent, France**

Mission Date: 20 Jan.-6 Feb., 2003

The use of the contractors’ self-assessment and correction action plans in assuring the continued development of contractors is a good practice. In conjunction with long-term contracts or long term relationships, allow high standards in contractors’ performance to be established in particular for a country with a limited market. The enhancement of the contractor performance quality through technical specification of procurement request is implemented as follows: QA programs, qualification and training of personnel, documentation, procedures, standards, history tracking, special tool and remote control equipment, reports, and self assessment and correction action plans as a tool for development. These obligations are evaluated by maintenance and officially checked by QA department. Moreover common training of involved personnel is used to improve cooperation between utility and contractor.

**Krsko, Slovenia**

Mission Date: 20 Oct. 6 Nov., 2003
An I&C simulator has been used since design of the plant systems to improve technical knowledge and to train the personnel of I&C branch (CIO). This simulator is used to enhance the use of the full digital system configuration tool; simulate and correct the code transportation and simulate proposed design modifications. It is also used as I&C personnel training station before practical use. As it is a static logic generating station the signals can be simulated and the feedback can be reviewed to find the best configuration for a design change. It is composed of a workstation, similar to the ones used in the main control room, that permits verification of the operation of the plant controls, tracking failures, diagnosis and first approach to plant control design changes.

Tianwan, China
Mission Date; 26 Jan.-12 Feb., 2004

The maintenance department has an extensive and comprehensive Computerized "Maintenance Expertise and Personnel Qualification Control" ensuring that skills and qualifications to perform maintenance activities, keeping equipment reliability and availability are completed.

This program gathers data on all maintenance staff, including name, date of birth, qualifications, skills, experience time, law retire expectation based on date of birth, status of retirement contract, date of retirement, date when the successor should be contracted, the name of the successor, the average age of maintenance staff and years of knowledge in nuclear industry. This system allows a statistical evaluation according to the actual status and future personnel development to keep maintenance expertise.

To fulfil the requirements for keeping expertise and personnel development, a training procedure workflow was developed, considering "Individual Development" and "New Employee", which establish a matrix about job requirements and knowledge level of each technical employee in the maintenance department. This matrix is used to define the necessary training and education for maintenance staff as well as to ensure that maintenance activities are only done by qualified staff.

Philippsburg, Germany
Mission Date; 11-28 Oct., 2004
Maintenance Handbook

Maintenance Department created its own "Maintenance Handbook" and distributed to all maintenance staff both in the plant and from contractors.

This handbook aims to facilitate all people who are engaged in maintenance work to improve safety of their activities, and to give them basic necessary information on maintenance work.

The book consists of several chapters including: Maintenance organization and responsibility, Standards for conduct of maintenance in TQNPC, Maintenance work planning and implementation, and Appendix.

In the beginning of Chapter 2, "Safety First" is clearly mentioned and five (5) safety fundamentals are shown. These five (5) safety fundamentals are: "Nothing is so important than that it can not be done safely"; "Safety is every staff’s responsibility"; "Events and accidents are preventable"; "Safe method is good method"; "Safety events must be reported".

A conservative decision-making, self-check method and ownership, Stop-Think-Act-Review (STAR) method are also described in this chapter.

The following chapter shows a basic workflow from the work request initiation to creation of a maintenance work report and some important points on which all maintenance staff should pay attention during his/her work. Maintenance staff can easily follow them.

An appendix shows all relevant manuals and general procedures and a list of maintenance behavior standards for major work steps that include also incorrect behavior.

All people who is engaged in maintenance department work carry this handbook. By the information provided in the Maintenance Handbook, every staff including short period contractors will easily find what procedures they need to follow, what are the maintenance and outage organization like, what are the TQNPC encouragements and forbidden by its safety culture, to give them a clear requirements and enhance their knowledge acquired by the fresh-up training.
Safety Meetings with participation of major contractors

All maintenance groups in the maintenance department and the fuel handling department weekly hold a safety meeting with participation of major contractors to share information on the recent events and to enhance safety of their activities.

Since 2003, all groups in TQNPC weekly hold a safety meeting. In case of maintenance groups in Maintenance Department and Fuel Handling Department, representatives from major contractors also take part in the meeting. Long-term contractors are also required to hold a weekly safety meeting in the same manner. The objectives of the meeting are to share the updated information on recent safety experience among members, to enhance their safety knowledge and to encourage them to safely complete their work.

During the meeting, participants discuss the national safety regulations, the company safety programmes, safety condition of equipment and systems for which they are responsible for and recent events and their recent experience related to safety. These events and experience include events and near misses in the plant and events in other nuclear power plants and in other industries.

Several special safety meetings were also held in the past two years to discuss specific topics such as TQNPC human factor events, Six Safety Experience shown by WANO, the I-beam falling down event and the collection of condition reports in TQNPC.

The meeting is organized by a plant group leader. Creation and preservation of meeting minutes is a mandatory request and they are kept by a group leader. Documents, materials and safety regulations used for the meeting, analysis result of the safety condition of the equipment and system, summary of the safety condition in the week and summary of the recent safety events, potential risks (near misses) and their resolutions should be attached to the minutes of the meetings.

The plant has very effectively implemented the system of supervision of contractors. For 60% of the plant maintenance activities, the site relies on the services of contractor companies. As part of its monitoring policy, the NPP has set up a structure in order to supervise and evaluate its contractors.

For this purpose, the NPP has provided professional enhancement training to dedicated EDF staff members. This professional enhancement training is based on theoretical and practical training with support of supervisory network. This network is an effective means of exchanging information on good supervisory practices. Also supervision programmes and reports, reference standards, field observation techniques for detecting deficiencies, specialist involvement has been exhaustively implemented, in order to provide the opportunity for rapidly incorporating experience feedback. The feedback experiences database has been set up to build on the work performed by this network.

The structure has brought about ongoing improvements in the quality of sub-contracted work, in terms of nuclear safety, industrial safety, radiation protection and technical performance. It forms part of a sustained improvement initiative.
Contractors Management.
Contractor Management is very efficient due to the contract elaboration, conduct of maintenance work and experience feedback.
Contractor companies are qualified by Rosenergoatom utility and are licenced by the Safety Authorities for work on safety related materials. Contractor companies are regularly checked by Rosenergoatom utility.
The plant calls for bids to choose contractors to perform the planned work. This competition is based on a very high-quality requirements specification. This requirements specification takes into account all the areas connected to contractor involvement. 14 divisions take part in development and control of these contracts. This process management is very strict. After this development, the contracts are approved by plant management and Rosenergoatom utility.

Rosenergoatom utility previously defined the type and the shape of all the documents needed to perform maintenance works. This rule is very well applied by the plant and the contractors. As a result, there is a good comprehension and very good adherence to procedures.
For example:
- work management is exactly the same for plant departments and contractors;
- all the work packages (risk assessment, procedures, step by step following procedures, authorization for work..) are uniform;
- maintenance reports, statements, list of defects, control records are also uniform for plant divisions and contractors.
This situation improves the quality of maintenance work reports and contributes to the improvement of strictness and communication during all maintenance processes.
Contractors and plant staff offices are very closely located. Contractors and plant staff have the same equipment. The contractors work process is very well controlled and managed by the plant staff.
The plant staff evaluates the quality of contractors works, this evaluation is transmitted to Rosenergoatom utility.
Independence of technical control of maintenance quality

Technical Control Department was established at KhNPP to implement quality control of maintenance on safety related equipment.

As an example, this department was in charge of controlling the preparatory activities on joints for welding. These controls tasks are clearly described for systems important for safety.

For independent decision making, Technical Control Department is subordinated to Deputy General Director for QA and Management. Experience of other NPPs was regularly studied that resulted in the improvement of the development of procedures and check-lists.

Representatives of Technical Control Department take part in all committees dealing with cause investigation of equipment failures and defect detection, registration and accounting, which occur during equipment disassembling for maintenance. They also participate in equipment entry control.

This practice allowed the plant to improve reliable performance of equipment and to improve safety.
Contractors management.
Distinction is drawn between contractor oversight and processing of deficiencies. Support is provided in terms of contractors qualification.

- Distinction drawn between contractor oversight and processing of deficiencies:
  - The contractor supervisor applies the oversight programme produced during the work planning phase. He performs field observations in various areas (nuclear safety and quality assurance, work practices and work quality, worker skills, industrial safety, environmental protection, contract management, compliance with labour regulations, etc.)
  - In the event of a serious deficiency, the contractor supervisor is required to suspend the job and alert management, who will then take measures to rectify the deficiency.

- The contractor relations team and department management process the complaint:
  - meeting with management of the company responsible for the deficiency,
  - contractual penalties if applicable,
  - reminder of EDF requirements pertaining to the incident,
  - statement of what is required to rectify the situation,
  - approval of action plan produced by the contractor,
  - feedback to corporate level (UTO),
  - definition of reinforced supervisory actions to be applied by the contractor supervisor,
  - status of contractor’s action plan tracked through periodic exchanges,
  - Chinon safety/quality department or UTO asked to audit work performance.

This system is an effective means of "protecting" the contractor supervisor by helping to maintain the legitimacy of his position.

- Support provided in terms of contractor qualification:
  - Chinon NPP contributes actively to the qualification of new contractor companies. Every year, 5 to 10 new contractor companies are qualified by Chinon for working on EDF plants. The contractor relations team also supports contractor companies by providing them with guidance on how to draw up skills assessment documents and helping them to incorporate OE into their reference base, in close cooperation with UTO, the EDF entity in charge of qualification. If the need arises, the plant is able to provide guidance and support when it comes to professional enhancement training of workers (OMEXOM for containment penetration tests, PNS for the cleaning of conventional cooling/conventional sampling heat exchangers).
Plant commitment to industrial safety for maintenance activities is clear and highly visible. Examples of this commitment include:

- Safety Observer:
  Following a plant initiative to significantly improve industrial safety performance, ANO management and the general contractor have worked together to introduce and develop the role of Safety Observer. While the responsibility for personal safety remains clearly with the worker, the safety awareness level of the crew has been augmented by the oversight that the Safety Observer brings to the work. The Safety Observer is selected by the working team, from the team, prior to performing the pre-job brief. The Safety Observer's responsibility is to ensure that the team adheres to all safety rules (such as ensuring personal protective equipment (PPE) is worn and a safety minute is performed at the work area). Additionally, the Safety Observer is a visible point of contact for questions when industrial safety concerns arise or actions need to be taken. The safety observer position is well recognized, his authority is fully accepted among his co-workers and fully supported by management.

The safety observer is identified by highly visible lanyard cards which also details the expectations of the position.

Lanyard card 1 states the following:
Side 1= "SAFETY OBSERVER".
Side 2= What would make the Task Safer??
- REINFORCE:
  - PPE Requirements
  - Use of "The Safety Minute"
  - Fall Protection Requirements
- Reminder of Plant Conditions
- Watch for Heat Stress Issues
- Maintain Questioning Attitude

Lanyard card 2 states the following:
- Employee Authorization to STOP Work
  "As a contractor representative, you have the Authority without fear of reprimand or retaliation, to immediately stop any work activity that presents a danger to you, your co-workers, our clients, partners or the public. It is your responsibility to get involved by questioning and rectifying any situation that is identified as not in compliance with our Environmental Health and Safety policies. You are to report any conditions or activities that involve violation of established Environmental Health & Safety policies. If you don’t feel the issue is addressed adequately, you have the responsibility to raise the issue higher."
GIM-EST, a non-profit organization was founded by the EDF, to gather contractors and to enhance industrial safety, health and well-being of contractors.

The GIM-EST association was set up in 1991 with the support of the public authorities, EDF and contractor companies working on the three Nuclear Power Stations in the north east of France (Cattenom, Chooz and Fessenheim). GIM-EST is a non profit making association (law of 1908).

Organizational structure: the association has more than 50 member companies and structures, major industrial groups, training organizations, temping agencies, etc.. It has an oversight committee consisting of 15 members and four full-time employees (1 industrial safety engineer, 2 project managers, 1 secretary).

Roles and responsibilities: training/advice and industrial safety/contractor living conditions/employment opportunities and promotion of nuclear career opportunities/customer relations.

Agreement with EDF:
- Service agreement between GIM-EST and Cattenom- Chooz- Fessenheim: industrial safety, radiation protection, enhancement of professional skills, skills renewal, working and well-being conditions on nuclear power plants, communication, operating experience, maintenance, etc.
- Charter on progress and sustainable development in the north eastern region: transparent bidding process, development of contractor skills, reduction of individual and collective dose, improved risk prevention, improved working conditions and housing assistance, housekeeping and environmental protection.

Plant results demonstrating that this good practice produces the expected results:
- CIESCT (Comite Inter-Entreprise Securite et Conditions de Travail) committee overseen by the GIM-EST Vice Chairman.
- Hiring of a full-time project manager at Fessenheim, who attends contractor instruction sessions, sits on outage industrial safety committees, participates in accident and near-miss investigations (EDF and contract staff), coordinates contractor satisfaction surveys, etc.
- Contractor training initiatives: human performance and error reduction techniques, bolted assemblies, craft training academy for nuclear professionals.
- Improving living conditions: list of available housing/accommodation options close to the site.
Plant staff and permanent contractors working for the maintenance department follow the same initial and refresher training courses.

During normal operation, the maintenance workforce at the plant is made up of 50% own personnel and of 50% permanent contractors. Both follow the same initial training courses on nuclear and industrial safety, human performance, radiation protection, and other topics. In addition, the same refresher training is given to both groups.

As a result contractors are regularly informed on the expectations and requirements set up by the plant on nuclear and industrial safety.

The permanent contractor supervisors also attend the daily operational meetings together with the plant supervisors and they are encouraged to participate and provide solutions to plant issues.

This approach has helped to achieve a 30% decrease in the number of events with incapacity as well as a 70% decrease in the number of events without incapacity for the permanent contractors in maintenance since 2006. In 2009 there were two events with incapacity and one without incapacity.

Certification program for maintenance work planner

The work planner has a key role in the Maintenance department at the plant. An intensive training program has been developed for this particular function, leading to a formal accreditation. The training program lasts 18 months and consists of 4 modules. During the training program, there are 3 examinations (after the first 3 modules), a on-the-job training period, and a final examination with certification after the fourth module, where line management is present. This program entails classroom training modules, self-study and formalized on-the-job training.

In this programme equal weight is given to the 3 barriers of the defense in depth model (design, work practices and behavior). The head of Care Nuclear Safety is a member of the evaluation committee, to determine if the work planner has sufficient knowledge in that particular area.

Maintenance has drawn up an accreditation program for maintenance work planner with the same depth as that of a reactor operator.
Assessment of contractors’ competency in nuclear safety culture during outages

The plant has established a coaching and training program in nuclear safety culture for all contractors.

A 4-day training course was developed for this purpose, involving general training in nuclear safety culture as well as more specific training for contractors in the management expectations of the plant. This is comparable with the contractor safety and quality programs that exist in other countries.

In addition, a coaching program is provided in which the instructor coaches the contractors in the field during outages.

To ensure that the training program is about more than just attaining a certificate, the contractors receive an assessment of their competency in nuclear safety culture after the field coaching program, to underline the importance of continuous improvement, which is a key characteristic of nuclear safety culture.

A special edition of the management expectations designed for contractors has been produced for this purpose. The booklet of management expectations is the common denominator throughout the training. The contractors receive a copy of this booklet during training.

There is very strong focus on Human Performance during the training. The head of the 4-day training program is also the HU coach from the plant Maintenance, which ensures that contractors receive identical HU training to plant staff.

All contractors who work in technical installations at the plant, must obtain a certificate in nuclear safety culture. This certificate is issued after a theoretical and practical evaluation of contractors’ competency in Nuclear Safety Culture.

Up to now, 3,938 contractors have been certified.

The training programs are given in Dutch, German, English and French.

The instructors are trained and have been qualified by the plant.
Supervisor Short Course – Standards Training

A supervisor Training program is delivered in order to enhance site and contractor supervisory leadership skills to ensure that poor jobsite behaviours are recognized, confronted and corrected. This training is delivered to all managers, supervisors, stand-ins, temporary and new short term contract supervisors prior to each refuelling outage. The training is current for up to 2 years unless absent from the site for greater than 6 months. On completion of the theoretical components, individuals complete a practical and oral assessment

Examples:
• Program is designed to ensure understanding and alignment with site standards, expectations and processes
• Program focus is on standards “What to correct” and coaching skills “How to coach”
• The “What to correct” focus includes such topics as:
  - Station safety programs including situation awareness
  - Arc Flash (electrical safety)
  - Human Performance Tools and expectations
  - Rework and quality of work
  - Foreign Material Exclusion (FME)
  - Contamination and Dose Control
  - Lifting and Rigging
• The “how to” focus includes such topics as:
  - Approach and Coach
  - Assertiveness
  - Building rapport
  - Communication Skills
  - Observation Skills
  - Conflict Management

In order to enhance lessons learned and improve CAP quality the Maintenance Department developed the Maintenance Corrective Action Review (MCAR) process. Maintenance Department has established a weekly meeting with the maintenance managers and CAP support staff (CAPCO) to review department CAP program performance and individual investigation results. The meeting is intended to review the department CAP investigations to reinforce department standards and enhance lessons learned across the department.

Examples:
• Reviews all department investigations and assessments
• Share OE across the maintenance departments
• Quality of assessments, analysis and corrective actions is reviewed
• Identifies trends for the department
• Review of corrective action completion to ensure CA meets the intent and proper evidence is provided
Gravelines, France

Use of valve skill map to select the most suitable workers for field activities

A valve skill map has been developed by the plant, which maps out skill levels (level 1 being the lowest and level 4 the highest) for each individual in the valve group for work on differing valves. This skill map is used to identify the most appropriate worker(s) for the job to be carried out, particularly for sensitive activities.

It provides the following advantages:

- Easy identification of working group skill level prior to starting work;
- Establishes checks to be carried out prior to starting work;
- Selects the most appropriate person for the activity, particularly for safety-sensitive work.

Following the implementation of this approach, there has been a reduction in the number of maintenance deficiencies in valve maintenance activities.

Chooz, France

Crossover professional development for maintenance personnel.

The plant has adopted a programme for crossover professional development of maintenance personnel. A joint employment structure, which is shared by the plant and its contractors, recruits two persons for duration of two years: one of them will be hired by the plant and the other will be hired by the contractor.

These two persons are seconded to the plant for outages, where they provide support to the work coordinators. The rest of the time, they work for the contractor on outages at different plants in the EDF fleet. The two year programme enables the trainees to carry out numerous activities, develop professional capability, understand practices and experience different plants in terms of work planning and coordination.

The persons who have gone through this crossover development programme have shown some marked characteristics:

1. They have a more complete overview of the way things are done at EDF and within the contractor companies.
2. They are more knowledgeable about the practices on other sites.
3. They acquire the necessary technical skills for infrequently-performed activities.
4. They are qualified more rapidly as work coordinators or contractor monitoring supervisors at NPPs.