

REGULATORY CONTROL OF MAINTENANCE ACTIVITIES IN ARGENTINE NUCLEAR POWER PLANTS



XA0054502

J. C. CALVO, G. CARUSO
National Board of Nuclear Regulation,
Buenos Aires,
Argentina

Abstract

The main maintenance objective is to assure that the safety features of structures, components and systems of nuclear power plants are kept as designed. Therefore, there is a direct relationship between safety and maintenance.

Owing to the above mentioned, maintenance activities are considered a relevant regulatory issue for the Argentine Nuclear Regulatory Authority (ARN).

This paper describes the regulatory control to maintenance activities of Argentine nuclear power plants. It also addresses essential elements for maintenance control, routine inspections, special inspections during planned outages, audits and license conditions and requirements.

1. INTRODUCTION

The Law N° 24,804 "Nuclear Activity National Law" defines the regulatory activity's scope and gives to Nuclear Regulatory Authority the responsibility for the nuclear activities control and regulation referring to radiological and nuclear safety issues. Maintenance activities are considered important to plant safety so it is one of the relevant regulatory issues.

The Regulatory Standard AR 3.7.1 - "Documentation to be submitted to the Regulatory Authority prior to the commercial operation of a nuclear power plant". requires the presentation of the installation Maintenance Program within one month prior to the request of an operating license for full-power operation.

The operating license of the argentine NPP's is granted by Regulatory Authority and, it establishes that degradation of components, equipment and systems shall be prevented by means of adequate preventive and predictive maintenance. Besides, such license requires the implementation of both in-service inspection and surveillance programs.

2. NPP'S REGULATORY CONTROL

The regulatory control in each NPP is performed by two on-site inspectors in charge of inspection regarding radiological and nuclear safety to ensure that plants are operated in accordance to regulatory requirements and license conditions. In case of inspection activities requires specialized expertise, it is foreseen that other specialists of the Regulatory Authority supporting and supplementing on-site inspectors activities.

The regulatory activities related with NPP's maintenance are mainly focused on the safety-related systems, and includes: selecting the safety related maintenance activities.

assessing the applicable procedures and work instructions and, witnessing such activities by regulatory inspectors.

The above mentioned regulatory activities are divided into regulatory inspections, audits and evaluations. Regulatory inspections are subdivided into routine inspections and special inspections (non-routine inspections).

2.1. Maintenance routine inspections

Routine inspections are performed during plant normal operation by on-site inspectors, emphasizing control on safety-related systems. The main routine inspections activities are the following:

- Procedures control review.
- Controlling that all maintenance activities are carried out in such a manner that the radiation exposure of site personnel is kept as low as reasonably achievable (ALARA).
- Witnessing during maintenance works and post maintenance testing.
- Verifying compliance of preventive and predictive maintenance program. Checking that frequencies of maintenance - with the procedures applied - are performed in accordance with such program.
- Periodic tests follow-up: The plant periodic tests are performed in accordance with the surveillance program. Such periodic tests are carried out on safety systems to check that components availability is maintained all the time. The Regulatory Authority has implemented an updated data base of periodic tests that includes the component performance during such tests.
- Regulatory requirements follow-up.
- During plant construction works progress follow-up: stored components condition, mechanical assembly, electrical assemblies and civil works.

2.2. Maintenance special inspections

Special inspections are performed by both on-site inspectors and specialists of Regulatory Authority. Such inspections are basically performed during planned outages and in case of abnormal events occurrence. The main special inspections activities are the following:

- Planned outages:

During planned outages the inspection activities are similar those routine inspections. Additional regulatory control in this case of both fulfillment in service inspection program and design modification are included.

- Abnormal events:

In case of abnormal event occurrence an inspection team is organized to review: corrective actions, root cause analysis and lessons learned.

2.3. Audits

Audits are prepared on a "check-list" based on: applicable documentation analysis and assessment, audit team members expertise and both specialists and on-site inspectors recommendations.

Upon the audit completion, the audit team issued an audit report that includes: findings, strengths, weaknesses, observations and recommendations of the audited activities. Then, as required, follow up audits to verify the finding related corrective actions taken by the utility will be performed.

2.4. Evaluations

Evaluations consists in the analysis and assessments of data resulting from routine and special inspections, audits, operational experience and abnormal event occurrences. Such evaluations involve the use of deterministic and probabilistic methods, computer codes, termohydraulic analysis, reactor kinetics, and reliability calculations, etc. The main evaluation activities related with maintenance are the following:

- Abnormal event assessment occurred at both argentine and foreign NPP's.
- Operating experience assessments.
- Radiological safety assessment to detect weaknesses in practices and to propose measures to reduce personnel doses (ALARA).
- Periodic test: procedures assessments and review of acceptance criteria
- Assessment of preventive, predictive and corrective maintenance activities.
This activity includes the evaluation of the scope maintenance works and criteria applied. Results trend to evaluate component performance and aging effects are analyzed.
- Definition and implementation of performance indicators.
- Design modifications and backfitting assessment.
- Assembly procedures assessment.
- Commissioning procedures assessment.
- Regulatory requirements.

3. MAINTENANCE ACTIVITIES PERFORMED BY UTILITIES

The NPP's maintenance program is fundamentally based on manufacturer recommendations, operating experience, safety analysis and engineering judgment. The licensee's preventive and predictive maintenance programme is defined establishing the scope, methods to be implemented, the planning activities and the applicable controls in accordance with the following considerations:

- Maintaining and improving reliability and availability of components, equipment and systems
- Reducing failures to minimize outages.
- Reducing maintenance costs.
- Reducing doses by applying adequate techniques and procedures.
- Collecting historical maintenance data from all plant components to evaluate component performance.
- Assessing operational parameters of equipment, components and systems for early detection failures.

4. REVIEW OF MAINTENANCE REGULATORY POLICY

Considering the recognized dependency between maintenance and plant safety, that Argentine regulatory philosophy is based on performance-based regulation (non-prescriptive regulation) and regulatory applications of PSA methodology, the Regulatory Authority decided to face a reviewing process of the maintenance regulatory policy.

The overall objective of such reviewing process is to improve the maintenance activities regulatory control. The effort will be focused on monitoring the results of the maintenance activities, assessing the evaluation equipment performance carried out by utility and verifying the safety assessment before programming the maintenance activities schedule.

The above mentioned reviewing process is in progress. However, at present it is possible to comment that the following issues have been highlighted:

- Need to issue a specific maintenance regulatory standard based on monitoring results of maintenance activities.
- Maintenance related indicators: Presently the Regulatory Authority is working in a regulatory project aimed at defining the performance indicators that include preventive, predictive and corrective maintenance and will be used to assess the maintenance programs effectiveness. Some of the issues below are being discussed:
 - Number of deficiency reports.
 - Number of pending deficiency reports.
 - In service inspection programme compliance.
 - Maintenance re-working
 - Spare parts availability applied to safety systems.
- Encourage the use of Probabilistic Safety Assessment (PSA) applications and Reliability Centered Maintenance (RCM) by the licensees. Such tools are useful for maintenance optimization.

5. CONCLUSIONS

The maintenance activities are regulated through regulatory standards, license conditions and limiting condition for operation. To verify the above mentioned compliance, both on-site inspectors and specialists personnel inspect, audit and evaluate the NPP's maintenance activities.

The maintenance regulatory policies review in progress, will produce:

- Strengthen the licensee's maintenance self-monitoring system related with its effectiveness.
- Use of performance safety indicators to assess the maintenance programs effectiveness.
- Encourage utilities to use maintenance optimization tools as probabilistic safety assessment and reliability centered maintenance.

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