Unclassified **NEA/CNRA/R(2013)1**

Organisation de Coopération et de Développement Économiques
Organisation for Economic Co-operation and Development **26-Mar-2013**

English text only

NUCLEAR ENERGY AGENCY
COMMITTEE ON NUCLEAR REGULATORY ACTIVITIES

WORKING GROUP ON INSPECTION PRACTICES (WGIP)

INSPECTION OF LICENSEE - MAINTENANCE PROGRAMME AND ACTIVITIES

JT03337075

Complete document available on OLIS in its original format

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ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

The OECD is a unique forum where the governments of 34 democracies work together to address the economic, social and environmental challenges of globalisation. The OECD is also at the forefront of efforts to understand and to help governments respond to new developments and concerns, such as corporate governance, the information economy and the challenges of an ageing population. The Organisation provides a setting where governments can compare policy experiences, seek answers to common problems, identify good practice and work to co-ordinate domestic and international policies.

The OECD member countries are: Australia, Austria, Belgium, Canada, Chile, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Luxembourg, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, the Republic of Korea, the Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States. The European Commission takes part in the work of the OECD.

OECD Publishing disseminates widely the results of the Organisation's statistics gathering and research on economic, social and environmental issues, as well as the conventions, guidelines and standards agreed by its members.

NUCLEAR ENERGY AGENCY

The OECD Nuclear Energy Agency (NEA) was established on 1 February 1958. Current NEA membership consists of 31 countries: Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Luxembourg, Mexico, the Netherlands, Norway, Poland, Portugal, the Republic of Korea, the Russian Federation, the Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States. The European Commission also takes part in the work of the Agency.

The mission of the NEA is:

- to assist its member countries in maintaining and further developing, through international co-operation, the scientific, technological and legal bases required for a safe, environmentally friendly and economical use of nuclear energy for peaceful purposes, as well as
- to provide authoritative assessments and to forge common understandings on key issues, as input to government decisions on nuclear energy policy and to broader OECD policy analyses in areas such as energy and sustainable development.

Specific areas of competence of the NEA include the safety and regulation of nuclear activities, radioactive waste management, radiological protection, nuclear science, economic and technical analyses of the nuclear fuel cycle, nuclear law and liability, and public information.

The NEA Data Bank provides nuclear data and computer program services for participating countries. In these and related tasks, the NEA works in close collaboration with the International Atomic Energy Agency in Vienna, with which it has a Co-operation Agreement, as well as with other international organisations in the nuclear field.

COMMITTEE ON NUCLEAR REGULATORY ACTIVITIES

The Committee on Nuclear Regulatory Activities (CNRA) of the OECD Nuclear Energy Agency (NEA) is an international committee made up primarily of senior nuclear regulators. It was set up in 1989 as a forum for the exchange of information and experience among regulatory organisations.

The committee is responsible for the programme of the NEA, concerning the regulation, licensing and inspection of nuclear installations with regard to safety. The committee's purpose is to promote cooperation among member countries to feedback the experience to safety improving measures, enhance efficiency and effectiveness in the regulatory process and to maintain adequate infrastructure and competence in the nuclear safety field. The CNRA's main tasks are to review developments which could affect regulatory requirements with the objective of providing members with an understanding of the motivation for new regulatory requirements under consideration and an opportunity to offer suggestions that might improve them or avoid disparities among member countries. In particular, the committee reviews current management strategies and safety management practices and operating experiences at nuclear facilities with a view to disseminating lessons learned.

The committee focuses primarily on existing power reactors and other nuclear installations; it may also consider the regulatory implications of new designs of power reactors and other types of nuclear installations.

In implementing its programme, the CNRA establishes cooperative mechanisms with the Committee on the Safety of Nuclear Installations (CSNI) responsible for the programme of the Agency concerning the technical aspects of the design, construction and operation of nuclear installations. The committee also co-operates with NEA's Committee on Radiation Protection and Public Health (CRPPH) and NEA's Radioactive Waste Management Committee (RWMC) on matters of common interest.

FOREWORD

The Committee on Nuclear Regulatory Activities (CNRA) believes that safety inspections are a major element in the regulatory authority's efforts to ensure the safe operation of nuclear facilities. Considering the importance of these issues, the Committee established a special Working Group on Inspection Practices (WGIP) in 1990. The purpose of the WGIP is to facilitate the exchange of information and experience related to regulatory safety inspections among NEA member countries.

A fundamental goal a regulatory authority's oversight of nuclear facilities is to establish confidence that each licensee is maintaining Systems, Structures, and Components (SSC) in accordance with the requirements specified in the design and the assumptions made in the safety analysis. Therefore, the WGIP determined that it would be prudent for member countries to share good inspection practices associated with maintenance programmes. This project was approved by CNRA in October 2009.

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EXECUTIVE SUMMARY

An effective maintenance programme is critical to sustained safe and reliable operation of nuclear power plants. The Working Group on Inspection Practices (WGIP) concluded that when a licensee has an effective maintenance programme, the overall operating safety of the plant is improved and the protection of public health and safety enhanced.

All Regulatory Bodies (RB) consider maintenance to be an important area for oversight. Although a variety of inspection practices are being used; RB are actively monitoring licensee performance. Specifically the following conclusions were reached and commendable practices identified:

- Maintenance oversight by regulators appears to be in a stable continuous improvement state. Most regulators are executing inspection oversight based on an existing regulatory framework.

- The performance of a licensee's maintenance programme is recognized as important part of maintaining nuclear safety. The result of the maintenance program assessment is included in the overall performance assessment of a license.

- Maintenance inspection activities are recognized as an important part of the regulatory oversight process. Inspection activities are based on the safety significance and nature of work being performed by the licensee.

- The effectiveness of the maintenance inspection activities is recognized to rely on properly qualified inspectors; who are adequately supported by specialists. Training and qualification of inspectors should be based on how the RB reviews and inspects licensee maintenance programmes.

- Reporting requirements are identified to provide information on the licensees maintenance programme, and to help guide inspection activities.

- Performance Indicators are recognized as a useful tool for helping focus regulatory activities. Basic PI are identified and tracked by the RB, and use of PI by the licensee is monitored.

- Inspections are designed to confirm that the licensee is planning and scheduling maintenance with due consideration to the impact of the maintenance activities on reactor safety.

INTRODUCTION

This task originated at the 38th meeting of the Working Group for Inspection Practices (WGIP) Members were unanimous in recommending a proposal to Committee on Nuclear Regulatory Activities (CNRA) to examine and evaluate how maintenance programs are inspected and the benefits of the inspections. This information would then be used to identify areas of importance for the development of good inspection practices. CNRA approved the task request in October 2009.

The aim is to identify good inspection practices that can assist regulatory body in verifying licensee maintenance programme performance. The main focus would be to identify commendable inspection practices which would promote more effective inspection activities on maintenance programmes.

BACKGROUND

Maintenance programmes play a significant role in ensuring safety related structures and components (SSC) will function according to design and therefore minimize risk during the life of a NPP. A licensee that has a strong maintenance programme is likely to require less regulatory oversight than one that does not. SSC would meet reliability and performance requirements. The NPP would experience fewer transients and failed equipment that challenges safe operation. Therefore, inspections of maintenance programmes provide a significant benefit for regulatory agencies.

Maintenance is important to lifetime management of the plant. It's important that regulatory bodies (RB) maintain good oversight of licensee processes and be learning organizations.

Adequate NPP maintenance programmes and adequate delivery and performance of the maintenance programmes are important to minimize the risk during the life of the NPP.

Regulatory inspectors would benefit from the exposure to different policies and methods of peer regulatory bodies (RB) in the inspection of the quality of the licensee maintenance arrangements.

This is a follow-up activity to WGIP report no. 36.

OBJECTIVES/SCOPE

1. Review how regulatory bodies inspect licensee maintenance activities and programme and identify commendable practices that RB developed in achieving this objective.

2. Review specifically how peer regulators determine that the licensee maintenance programme ensures overall safety and conformity.

3. Describe specifically the regulatory inspection activities carried out during corrective and/or preventive maintenance.

QUESTIONNAIRE

General

1. Does your RB have specific requirements, rules, license conditions, criteria or regulations to require regulatory oversight for maintenance of systems, structure and components at NPPs? (Y/N)
Please briefly summarize the nature of the documents referred to above.

2. Is your RB developing or planning new policies, documents or methods? (Y/N)
Please briefly describe.

3. Does your RB verify the completeness and quality of the licensee programme description submitted at the time of licensing or relicensing? (Y/N)
Please summarize the nature of the licensing (and relicensing) review above at your RB?

4. Is this review, at the licensing or relicensing phase, completed by inspectors or specialists or contractors?

Training

5. Does your RB hire specialist contractors to do the inspection work, or is this a task for inspectors?

6. Are the inspectors specifically trained on the topic of maintenance? (Y/N)
Please briefly describe the nature of the training received.

Methods

7. Does your RB verify the quality, completeness of the delivery of the maintenance programme during normal operations? (Y/N)

8. During outages? (Y/N)
Please summarize the nature of the compliance inspection and enforcement methods related to maintenance at your RB.

9. Do licensees have an obligation to report to RB on the activities and events related to maintenance? (Y/N)

10. What regulatory performance indicators (PIs) does the RB use?
Please list the PIs.

11. How are these PIs used in the regulatory oversight of the programme?

Review

12. Does your RB rate the licensee on the topic of maintenance program performance? (Y/N)
Please describe or show a process for the rating model.

13. Does your RB verify the rework rate of licensees? (Y/N)

14. Does your RB show interest in comparing preventive and corrective maintenance completion ratios for efficiency and effectiveness? (Y/N)

15. Does your RB evaluate forced outage rates? (Y/N)

16. Is there consideration of ageing and new degradation mechanism considered in the review? (Y/N)

Other

17. Please add any supplementary issue under maintenance for discussion, and key points about maintenance which are important or successful in your organization.

ANALYSES OF RESPONSES

1. General (Questions 1-4)

The first four questions focused on the general regulatory requirements and the interaction the RB has with the licensee in the area of maintenance.

Nearly all regulators have explicit regulations on maintenance. As a result, most RB are not performing any explicit work on new inspection policies. Routine reviews and revisions of maintenance oversight are being performed; but are not being driven by problems with the inspection programme. Several RB are basing their requirements on common standards (e.g. IAEA NUSS Safety Series 50-SG-07 Maintenance, or USNRC 10CFR50.65, "Requirements for monitoring the effectiveness of maintenance at nuclear power plants).

Maintenance programmes are reviewed as part of licensing and relicensing by most RB. RB who do not review maintenance programmes during licensing carry out a form of review through inspection or routine licensee submission of maintenance programmes. The nature of a particular RB licensing process has a strong impact of how the RB oversees the licensee. RB who issue long period licenses are more likely to rely on the inspection process to provide a periodic review of the maintenance programme.

Inspections are generally executed by inspectors, with some specialist involvement. This appears to be strongly dependant on the organizational structure the RB and supporting organizations. The degree of program review built into the licensing process, and the nature of the licensing process also affects the nature of the inspection process.

Observations

Maintenance oversight by regulators appears to be in a stable continuous improvement state. Most regulators are executing inspection oversight based on an existing regulatory framework. In some cases the maintenance requirements are specified in regulations; in others the license.

The questionnaire generated mixed responses by the RB on how they verify the completeness and quality of the licensee maintenance programme. Some include maintenance program reviews as part of the licensing process reviews. The rest rely on outputs from their inspection programs.

Commendable Practices

Regular review by RB of their regulations related to maintenance programme oversight and supporting regulatory framework; such as the inspection programme. RB reviews should include international experience, and expectations for maintenance programmes.

Maintenance inspection activities are recognized as an important part of the regulatory oversight process.

2. Training (Questions 5, 6)

Two questions focussed on the breadth and depth of the training that inspectors receive prior to performing inspections of licensee maintenance programs.

Maintenance inspections are largely executed by specialist inspectors (sometimes with contractor support). Some RB have specialists who are also inspectors. Contractor support is often used for pressure boundary maintenance.

The questionnaire generated mixed responses by the regulatory bodies on how training is applied. Some rely on extensive training in maintenance practices, others use on-the-job training supported by basic inspectors skills. Degree of training may depend on the nature of the inspection and the nature of supporting inspection documents such as checklists.

Observations

The RB responding to the questionnaire indicated a very mixed response on the use of specialists versus inspectors and the balance of training required. Training and qualification of inspectors appears to be very dependant on the regulatory framework, nature of the licensing process, and the RB inspection practices.

Commendable Practices

The effectiveness of the maintenance inspection activities is recognized to rely on properly qualified inspectors; who are adequately supported by specialists. Training and qualification of inspectors should be based on how the RB reviews and inspects licensee maintenance programmes.

3. Methods (Questions 7-11)

Five questions were directed at the inspection methods applied by regulators in the area of maintenance.

Almost all countries verify the quality and completeness of the licensee maintenance programmes. Some RB limit their activities to performing risk informed inspections on maintenance activities. However, other RB devote a significant resource load to maintenance overall. Areas such as planning and scheduling of maintenance work, execution of maintenance, review of records and reports generated by maintenance work, and a review of performance indicators (PI) are used. The effectiveness of the licensee's assessment of risk is also inspected.

Outages are included in RB oversight of maintenance programmes. The inspection of maintenance during outages actually increases due to the greater number of maintenance activities during outages. In addition, several RB require the licensee to obtain permission to restart a reactor after an outage. The permission is granted based on a review of the completeness and quality of the maintenance performed during the outage.

RB have various means for requiring licensee reporting on maintenance activities. Most, if not all RB have explicit event maintenance related reporting requirements. Some also have progress reporting requirements on the status of operations, or an outage (and its completion). The questionnaire responses are not clear on how the reporting requirements and RB follow-up are applied to maintenance oversight.

The questionnaire generated mixed responses by the regulatory bodies on the application of PI. Some RB are using formally defined PI and other are not. Licensees have a variety of PI in the maintenance area.

Many of these indicators are derived from various industry peer associations. Many RB use a similar set of indicators to assist in oversight of maintenance.
RB use of PI provides a useful means of monitoring for changes in a licensee maintenance program that may require a change in the RB inspection programme. Commonly used performance indicators include the following:

- Ratio of preventive and corrective maintenance.
- Ratio of failed safety test/examination.
- No. of Unplanned Automatic or Manual Scrams per 7,000 Critical-hrs.
- No. of Unplanned Power Changes per 7,000 Critical-hrs.
- No. of Unplanned Scrams with Additional Licensee Actions.
- Unavailability of Safety Systems.

Licensee peer organisations maintain extensive lists of PI for various levels in the operations, planning and maintenance organisations. These more detailed PI may not be appropriate for direct RB use. But the failure of a licensee to use detailed PI to monitor their own programme health, may suggest a need for more RB oversight.

Observations

RB apply a variety of methods for overseeing or inspecting licensee maintenance programmes. The selection of what to inspect by the RB is based on reports provided by the licensee on planned maintenance, events, and results from inspections of other programmes.

Many RB apply a risk based approach to selecting inspection areas.

Generally RB use some form of performance indicators. RB that use PI appear to rely on them to help focus regulatory oversight rather than for forming direct conclusions. This is consistent with the general expectation for PI.

Commendable Practices

Inspection activities are based on the safety significance and nature of work being performed by the licensee. Unusual or rarely performed maintenance activities should receive more attention.

Reporting requirements are identified to provide information on the licensees maintenance programme, and to help guide inspection activities.

Performance Indicators are recognized as a useful tool for helping focus regulatory activities. Basic PI are identified and tracked by the RB, and use of PI by the licensee is monitored.

4. Review (Questions 12-16)

The next five questions address how the RB reviews and reports on the licensee's maintenance programme.

Generally RB do not explicitly rate the licensee on the topic of maintenance program performance. Note that a rating against regulatory expectations does not necessarily include comparison between power plants.

The response to questions on rework, maintenance completion ratios, and forced outage rates indicated most RB do not specifically monitor those areas. Some RB do use performance indicators based on the above to track performance and guide the inspection programme.

All RB consider aging to some extent. Some use routine licensing reviews, or a Periodic Safety Reviews to accomplish this.

Observations

Generally RB do not explicitly rate the licensee on the topic of maintenance programme performance. A few RB includes results from maintenance programme reviews and inspections in an overall assessment of licensee performance. Other RB use the results of inspections and events to trigger evaluations of performance with the potential for enhanced regulatory oversight.

Commendable Practices

The performance of a licensee's maintenance programme is recognized as important part of maintaining nuclear safety. The result of the maintenance program assessment is included in the overall performance assessment of a license.

5. Other (Question 17)

The final question covered any supplementary issue under maintenance for discussion, and key points about maintenance which were important or successful in the RB.

Observations

Several RB (and licensees) are directing effort towards risk informing the maintenance programme. In particular, some RB (and licensees) considering the impact of maintenance activities on the safety of the power plant. Equipment taken out of service for maintenance is not available if needed.

Commendable Practices

Inspections are designed to confirm that the licensee is planning and scheduling maintenance with due consideration to the impact of the maintenance activities on reactor safety.

6. Conclusions and Commendable Inspection Practices

This section summarises the key conclusions and commendable practices from the report and feedback from the WGIP members.

6.1. Key Conclusions and Commendable Inspection Practices

The WGIP concludes that Regulatory Bodies recognise the importance of maintenance to the safe operation of NPP. All regulators conduct some form of oversight or licensee maintenance.

- Maintenance oversight by regulators appears to be in a stable continuous improvement state. Most regulators are executing inspection oversight based on an existing regulatory framework.

- The performance of a licensee's maintenance programme is recognized as important part of maintaining nuclear safety. The result of the maintenance program assessment is included in the overall performance assessment of a license.

- Maintenance inspection activities are recognized as an important part of the regulatory oversight process. Inspection activities are based on the safety significance and nature of work being performed by the licensee.

- The effectiveness of the maintenance inspection activities is recognized to rely on properly qualified inspectors; who are adequately supported by specialists. Training and qualification of inspectors should be based on how the RB reviews and inspects licensee maintenance programmes.

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