Performance of regulatory inspections in radiation protection at the Koeberg Nuclear Power Station (KNPS)

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Abstract. The South African National Nuclear Regulator (NNR) was established in 1999 to provide for the protection of persons, environment and properties from the harmful effects arising from ionizing radiation produced by radioactive materials.

It is the responsibility of the licensee to have in place the necessary safety measures and resources in order to protect the population, the workers and the environment against the possible harmful effects of ionizing radiation caused by the KNPS's operations, and, it is the responsibility of the NNR through radiation protection inspections to ensure the licensee comply with regulatory requirements.

To fulfill its mission, the NNR performs regulatory inspections at KNPS according to the National Nuclear Regulator Act, 1999 (Act No. 47 of 1999). This Act describes the following in terms of duties of the inspectors: 'An Inspector maycarryout inspections and use any applicable equipment during such inspections at any of the nuclear installations, sites or placesand conduct such investigations as are necessary for the purpose of monitoring or enforcing compliance with this Act'.

This Act provides the bases for inspections but not the magic formula on how to conduct with success such inspections. 'Learn from yesterday, live for today, hope for tomorrow. The important thing is not to stop questioning.' This quote from Albert Einstein describes best the task of a radiation protection inspector. This poster presents the techniques and practices used by NNR inspector at KNPS with limited resources in order to honor the mandate of NNR.
The inspection scope and techniques include development of a checklist based on regulatory documents, licensee standards, and feedback of operating experience. During the performance of the inspection certain findings may lead to an investigation and audit which may involve in-depth analysis and additional resources. The completion of the inspection includes a written report where observations/ findings are highlighted and rated. Sometimes the severity of findings is not addressed properly by the NNR grading system. New issues the inspector has to address are:

- How to enforce changes to the practices of the licensee?
- How to encourage the licensee to review its standards on continuous bases and without prompting by the regulator?

Ongoing efforts are pursued to improve the NNR inspection program at KNPS, these include the implementation of team inspections and the participation in inspections by inspectors of other technologies.

KEYWORDS:Regulation, Inspections findings, Self-Assessment Tool, Regulator issues.

1. Introduction

The nuclear energy sector in South Africa is mainly governed by the Nuclear Energy Act, 1999 (Act No. 46 of 1999)''(NEA)'' and the National Nuclear Regulatory Act, 1999 (Act No. 47 of 1999)''(NNRA)''. NNRA established the National Nuclear Regulator ''(NNR)'' as a regulatory body under the Minister of Energy. The NNR is mandated by NNRA to regulate matters related to safety in nuclear energy, waste management and mining and mineral processing sectors.The primary function of the NNR is to provide for the protection of persons (workers & members of public), environment and properties from the harmful effect arising from ionizing radiation

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produced by radioactive material, in this case produced by Koeberg Nuclear Power Station ‘’(KNPS)’’.

KNPS is situated approximately 30km northwest of Cape Town in South Africa and is operated by Eskom Holdings. KNPS is the only nuclear power station in Africa and has two pressurised water reactors (PWR) design of 900 MWe which were commissioning in 1984 and 1985.

Safety Standards and Regulatory Practices “(SSRP)”, Regulation R 388 are used to regulate KNPS. The SSRP are consistent with international safety standards and provide for criteria and requirements related to exclusion, exemption and regulation (authorization is by way of Certificate and Licensing) of practices involving the use of radioactive material and sources of ionizing radiation. The NNR has issued a license for operation to Eskom KNPS (NIL-01, variation 17). This license stipulates the conditions that must be followed by the operator in terms of radiation protection.

Requirements Documents “(RD)” are issued by the NNR and provide the details of the radiation protection conditions that KNPS must comply with. Eskom establishes their own standards which provide the internal requirements that will allow KNPS to meet the requirements of the NNR.

2. Method

The NNR conducts independent compliance assurance activities that include inspections to determine the extent to which the holders of authorizations comply with their authorization conditions. Holders are required to address identified non-compliances and close-out of these are tracked and followed-up by the NNR inspectors. In 2011, about 60 inspections were conducted by four Inspectors at Koeberg Nuclear Power Station of which 11 inspections were conducted by the RP Inspector in the area of radiation protection. The scope of an inspection is determined by the appropriate authorisation condition, operating experience and events related to area inspected. The Inspector develops a check list prior to the inspection. The check list is derived from the requirements in the NNR Requirements Documents, Eskom KNPS standards documents, KNPS process documents and KNPS working procedures.

Most of the radiation protection inspections take place at the plant and involve areas such as personnel dosimetry, medical (health registers), radioactive sources, environmental surveillance, meteorology, radioactive waste management and nuclear emergency preparedness and response.

The Inspections can either have a review/assessment focus and/or a pure compliance focus.
The inspection is concluded by the generation of a report where the non-compliances and findings are documented. Grading of non-compliances is performed in accordance with the impact they have on nuclear safety. Enforcement action is pursued based on the severity of the non-compliance or group of non-compliances observed.

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3. Results

- The maximum public dose at KNPS for 2001 was 2.962 µSv, which is considered commendable given the NNR regulatory limit of 250 µSv per annum for KNPS.
- The maximum individual dose at KNPS for 2011 was 17032 µSv which is considered satisfactory given the NNR regulatory limit of 20000 µSv per annum for KNPS.
- The average dose to workers at KNPS for 2011 was 388.6 µSv/ person which is considered commendable given the NNR regulatory ALARA target of 4000 µSv.
- RP inspections identified some findings which resulted in the issue of a Directive by the NNR and an in depth review of the KNPS waste management programme. Other results of the RP inspections identified generic problems.

4. Problems and non-compliances identified

❖ **Problem 1: Certain inspection findings should be investigated/ audited and analysed further but NNR supplementary resources are not available**

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Consequence: Findings are not investigated/ analysed in depth where required

Reason: Limited capacity

Example: The lid of the waste steel drum came off, the reason was not investigated

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❖ **Problem 2: Identified Inspection findings are not considered important if not linked to the integrity of the core or fuel**

Consequence: Delayed response and findings not treated with the appropriate rigor.

Reason: NNR grading system is not appropriate

Example of findings not considered important: register not stored in the locked waterproof/ fireproof cabinet.

❖ **Problem 3: Inspectors are only competent within their area of expertise**

Consequence: Possibility that Inspector is unable to detect non-compliances as part of inspections that requires cognitive thinking

Reason: Inspectors are qualified/ trained only in one area of expertise or they are not appropriately trained

Example: NNR Inspectors with operating experience examined the Koeberg control room but were not looking if the security access of this room is appropriate.

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❖ **Problem 4: Inspection findings are of a recurring nature and sometimes not resolved by the licensee**

Consequence: Encourage development of a laissez-faire attitude

Reason: Inadequate penalty system in the NNR enforcement process.

Example: Radioactive waste stored in the container without trefoil sign/ Radiological information

❖ **Problem 5: Some RP practices might meet regulatory requirements but are not aligned with current world best practices**

Consequence: Practices not pro-actively reviewed and possible safety benefits not realized

Reason: No requirement from regulator to consider best practices

Example: Container Storage Yard doesn't have Personal Contamination Monitor at the exit.

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5. Solutions

The NNR undertook a Self-Assessment to review the effectiveness of the national legislative and regulatory framework for nuclear and radiation safety. The approach to the Self-Assessment Review was based on the IAEA Self-Assessment Methodology and its associated Self-Assessment Tool (SAT) software. The Self-Assessment methodology is derived from all the relevant IAEA safety standards and the associated guidance pertinent to all the thematic areas.The Self-Assessment revealed that the following issues should be given high priority as they will contribute significantly to the enhancement of the overall effectiveness of the regulatory system:

- Amendment of the legislative frameworks and specific identified deficiencies in the legislation.
- Development and implementation of strategies and plans by the Regulatory Bodies to adequately address their respective resource constraints, including the development and implementation of regulatory training and development programmes.
- Review and optimization of the regulatory framework (requirements, codes of practice conditions, regulatory philosophy, guidance etc.) and internal documentation (procedures, manuals, document management systems, etc.) in line with international standards and the implementation of a plan to address identified shortcomings.

The implementation of the Self-Assessment project plan was started in April 2010 and assisted with the resolution and close-out of some of the problems identified in section 4.

Problem 1: Certain inspection findings should be investigated/ audited and analysed further but NNR supplementary resources not available.

- Corrective action: The NNR will initiate a staff expansion (± 32 persons) programme over the next two/ three years.

Problem 2: Identified Inspection findings not considered important if not linked to the integrity of the reactor core or fuel.

- Corrective action: The findings of inspections shall be graded and categorized in terms of a new process taking into consideration severity and impact on safety. The Inspector will grade the non-compliance and the Chief Inspector will review the grading allocated. If a holder refuses to correct a minor non-compliance within a reasonable time frame the finding may be upgraded to carry the same enforcement action as considered for a finding of safety significance.

Problem 3: Inspectors only competent within their area of expertise

- Corrective action: Implementation of an enhanced training program for the NNR Inspectors that attend requalification training. Apart from receiving the normal induction, technology, program and legal training the Inspectors shall be required to attend requalification training every three years. The Compliance Assurance Plans “(CAP)” shall be developed and implemented in accordance with the concept of pooling of inspectors and rotation between

technologies will be applied. The CAP shall focus more and larger rather than on ‘single topic’ inspections. This shall be conducted by a multi-disciplinary team of inspectors, as appropriate, typically covering a range of topics.

Problem 4: Inspection findings of non-compliances are of a recurring nature and sometimes not resolved by the licensee

- Corrective action: Establishment of legislative amendments to address the issue of sanctions for non-compliance and development of an enforcement procedure. The enforcement actions will be carried out as per section 52 of NNRA in accordance with due legal process and other applicable regulations and legislations concerned. Typical enforcement actions that shall be considered are written warnings/ directives, suspension of the authorization, penalties…

Problem 5: Some RP practices might meet regulatory requirements but not align with current world best practice

- Corrective action: The NNR established a Regulatory Framework Project Plan approved in December 2011 and based on the outcome of the Self-Assessment performed.The purpose of this action plan was to document the outcome of the gap analysis and the schedule to revise and update the Regulatory Standards, viz the set of Regulations and Regulatory Guidance documents. The methodology that will be used to develop the Regulations was to consult the relevant international standards representing best practice.

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References

[1] National Nuclear Regulatory Act, 1999 (Act No. 47 of 1999).

[2] Safety Standards and Regulatory Practices, Regulation R 388.

[3] Koeberg Nuclear Installation License (NIL-01, variation 17).

[4] NATIONAL NUCLEAR REGULATOR, Action Plan (PLN-SARA-12-002), Self-Assessment Regulatory Framework subproject (Action Item #11): Gap Analysis and Plan to Update and Develop Regulations.

[5] SELF-ASSESSMENT OF THE NATIONAL REGULATORY INFRASTRUCTURE FOR SAFETY, REPUBLIC OF SOUTH AFRICA, SUMMARY REPORT.

[6] NATIONAL NUCLEAR REGULATOR, POLICY& PROCEDURE, PPD-COM-03, Appointment of NNR Inspectors.

[7] NATIONAL NUCLEAR REGULATOR, POLICY& PROCEDURE, PPD-COM-02, Enforcement Procedure.

[8] NATIONAL NUCLEAR REGULATOR, POLICY& PROCEDURE, PPD-COM-01,

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Compliance Assurance.

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