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Organisation de Coopération et de Développement Economiques
Organisation for Economic Co-operation and Development

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**NUCLEAR ENERGY AGENCY
COMMITTEE ON NUCLEAR REGULATORY ACTIVITIES**

**NEA/CNRA/R(2005)5
Unclassified**

**INTERNATIONAL WORKSHOP ON RISK INFORMED INSPECTION,
INSPECTION OF PERFORMANCE OF LICENSEE ORGANISATION, AND
INSPECTION ASPECTS OF PLANT NEAR OR AT END-OF-LIFE**

APPENDIX – COMPILATION OF SURVEY RESPONSES

Fekete-hegy (near Budapest), Hungary, 26 – to 29 April, 2004

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- to achieve the highest sustainable economic growth and employment and a rising standard of living in Member countries, while maintaining financial stability, and thus to contribute to the development of the world economy;
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NUCLEAR ENERGY AGENCY

The OECD Nuclear Energy Agency (NEA) was established on 1st February 1958 under the name of the OEEC European Nuclear Energy Agency. It received its present designation on 20th April 1972, when Japan became its first non-European full Member. NEA membership today consists of 28 OECD Member countries: Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Luxembourg, Mexico, the Netherlands, Norway, Portugal, Republic of Korea, Slovak Republic, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States. The Commission of the European Communities 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 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.

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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.

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ABSTRACT / FOREWORD

This appendix provides the complete compilation of responses received to the questionnaire issued in conjunction with the workshop announcements. The responses are provided as received, with changes made only to the formatting.

Each of the respondents were given the following instructions in relation to their response:

- Only one response per country is required. If more than one person from your country is participating, please co-ordinate the responses accordingly.
- Please provide responses on separate sheet and clearly identify the questionnaire part and topic.
- Please provide Submittal prior to 1 February 2002. Submittals should be sent by email to: barry.kaufer@oecd.org
- For preparation of the workshop, participants are invited to supply their national inspection approaches used in inspection of events and incidents according to the following questionnaire:

RISK INFORMED INSPECTIONS

Introduction to the Questionnaire:

Since the NEA/WGIP international workshop of 1998 included this topic, risk-informed inspection processes have been evolving rapidly in many NEA member countries. This includes the development of risk models and use of their results in inspection programmes. While the 1998 workshop recognised the increasing value of risk information, the intent of the 2004 workshop is to exchange information on changes in this area during the past six years and to imagine new and forward-looking ways for Regulatory Bodies to better utilise this information for the purpose of improving the effectiveness and efficiency of inspections for reactor safety.

Questions

1. Briefly describe how probabilistic and deterministic information influence inspection planning, including the selection and prioritisation of inspection areas and specific items to be inspected.
2. Describe the sources of probabilistic and deterministic information made available for use by the inspector.
3. Describe how and to what extent probabilistic and deterministic information is used to evaluate the significance of issues found as a result of inspections and to assign priority for additional inspection follow-up.
4. Describe the form or style of probabilistic information given to inspectors for their use (e.g. risk importance measures, categorisation of systems into high and low risk, dominating core damage sequences, etc.).
5. If PSA models or results are used by your regulatory body:
 - a) Who is responsible for maintaining the PSA model?
 - b) What is the PSA model used for by the regulatory body?
 - c) How does the regulatory body verify the adequacy of the PSA model?
 - d) Is the PSA model kept to any standard and if so which one?

- e) To what extent does the PSA model account for fire, earthquakes, severe weather, external flooding, containment performance, and offsite dose consequences?
 - f) Has any policy or goal been established within your regulatory body for use of PSA by inspectors? If so, briefly describe it.
6. Please list any specific issues on this topic that you would like to be discussed at the workshop.

Survey Responses

Belgium

- 1 Briefly describe how probabilistic and deterministic information influence inspection planning, including the selection and prioritisation of inspection areas and specific items to be inspected.

In Belgium, the control of the NPP safety by the Inspection Body is permanent. There are three kinds of inspections: thematic (periodic and systematic overview of a specific field of activities with all associated elements), systematic (verification of the compliance of the operation with the license) and specific (meetings on a defined field or response to an important event).

The planning of the thematic inspection is dependent of the safety related importance of the field-inspected activities. The scope includes, of course, the events related to the field and the follow-up of the safety related operational problems.

In case of important event, some study results or important experience feedback, specific inspections are organized with the licensee.

The systematic inspections take a picture of the operations between the last and the present inspection date. The licensee informs the inspector of all safety related events during this period and a discussion take place. The short term follow-up of event analyses or actions is also discussed. The systematic and specific inspections can be dependent of operating critical phases (outage, transients, specific test,...).

Currently, probabilistic information is not directly influencing inspection planning.

- 2 Describe the sources of probabilistic and deterministic information made available for use by the inspector.
 - Information given by the licensee during inspections, operating report and event analyses of the licensee;
 - results of PSA studies obtained during the safety decennial re-evaluations;
 - internal experience feedback databank (including some PSA-based Event Analyses – PSAEA) and weekly co-ordination meeting of the inspectors;
 - external experience feedback;
 - at this time, safety-related performance indicators are developed in AVN (some of them are based on PSAEA and are risk-informed – see answer to question 3); they will be an indication for further inspection activities.
 - some future developments are discussed in answers to questions 3 and 4 below.

- 3 Describe how and to what extent probabilistic and deterministic information is used to evaluate the significance of issues found as a result of inspections and to assign priority for additional inspection follow-up.
- additional inspections over a significant issue are first depending of the safety culture of the inspectors and their knowledge of the SAR.
 - some characteristics of the issue can imply additional inspections (safety system actuation, common cause, recurrent events, multiple organisational aspects or failures, human factor component).
 - some screened operational events are analysed with PSA-based Event Analysis (PSAEA). Such a probabilistic precursor analysis allows to assess the conditional core damage probability (CCDP) induced by the event, which is considered as an objective measure for its safety significance. For important events, more resources are spent to perform “what if” type of analyses, to assess the impact of potential corrective actions, etc. All the results of the PSAEA analyses are presented to the licensee for further consideration and for follow-up (e.g. regarding the completeness of the licensee's incident analysis, for corrective actions, ...)
 - in the future, other PSA applications will be considered that can be performed by the AVN risk analysis group on request of plant inspectors (such as the evaluation of proposed plant changes, of requested TechSpec waivers, ...)
- 4 Describe the form or style of probabilistic information given to inspectors for their use (e.g. risk importance measures, categorisation of systems into high and low risk, dominating core damage sequences, etc.).
- no probabilistic information is given at this time about risk importance measures;
 - categorisation of systems into high and low safety importance can be deducted from SAR information and specifically completion times (deterministic; not risk-informed);
 - For some plants, a final report of the plant-specific PSA has already been issued and is in principle also available to the inspectors. For other plants, the PSA study is not yet finalised. However, this report in its present form is not easily useable for inspectors to learn and to apply relevant risk insights.
 - Therefore, AVN has allocated R&D resources for the development of the use of PSA in regulatory inspections. First steps included a screening of similar initiatives in other countries, and – in general – of possible ways and tools to make risk insights accessible to non-specialists (regulators as well as utilities). This is seen as a multiple year project.
- 5 If PSA models or results are used by your regulatory body:

a) *Who is responsible for maintaining the PSA model?*

The architect engineer is responsible for maintaining the PSA model. AVN is the reviewer of the PSA model and is also a user of the PSA model.

b) *What is the PSA model used for by the regulatory body?*

- evaluation of the (deterministic) design by probabilistic analysis methods (in the framework of the Periodic Safety Review). This includes in particular:

evaluation of the system design and operational procedures.

evaluation of the safety during shutdown states.

- PSA-based event analyses (see question 3).
- future uses (see questions 3 and 4)

c) *How does the regulatory body verify the adequacy of the PSA model?*

The PSA models are developed in the framework of the Periodic Safety Review. There is a PSA level 1 study for each unit, covering internal events (without fire, flooding or hazards). Some units have also partial level 2 PSA models.

AVN performs an on-line review of the PSA during its development (methodology, initiating events, data, the systems modelisation with its FMEA analyses, accident scenarios, human reliability, analysis of results). An evaluation report is written after the finalisation of every PSA. Remaining recommendations and open issues will be reconsidered at the next update of the PSA.

d) *Is the PSA model kept to any standard and if so which one?*

There is a detailed on-line review of the PSA by AVN. Moreover, the same architect-engineer is performing all the Belgian PSA studies according to basically the same methodology. Therefore, there was no need to follow a formal (and probably more general) PSA standard.

e) *To what extent does the PSA model account for fire, earthquakes, severe weather, external flooding, containment performance, and offsite dose consequences?*

Fire: no; earthquake: no; severe weather: no; external flooding: no; containment performance: yes for five units; offsite dose consequences: no.

An extension of the scope of the PSA studies will be considered at the occasion of the next periodic PSA update.

f) *Has any policy or goal been established within your regulatory body for use of PSA by inspectors? If so, briefly describe it.*

Not at this time but future actions are foreseen (see question 4).

6 Please list any specific issues on this topic that you would like to be discussed at the workshop

No response listed.

Canada

7. Foreword

Since the NEA/WGIP international workshop of 1998 included this topic, risk-informed inspection processes have been evolving rapidly in many NEA member countries. This includes the development of risk models and use of their results in inspection programmes. While the 1998 workshop recognized the increasing value of risk information, the intent of the 2004 workshop is to exchange information on changes in this area during the past six years and to imagine new and forward-looking ways for Regulatory Bodies to better utilise this information for the purpose of improving the effectiveness and efficiency of inspections for reactor safety.

- 1 Briefly describe how probabilistic and deterministic information influence inspection planning, including the selection and prioritisation of inspection areas and specific items to be inspected.

Risk models have been generated for only some of the plants in Canada. From those models critical equipment has been identified (some of this equipment was not originally thought to be critical). Licensee's maintenance programs for this equipment have been improved, and regulatory inspections enhanced.

- 2 Describe the sources of probabilistic and deterministic information made available for use by the inspector.

The source of the information has all come from the licensees or plant designers' using the results of the mandatory surveillance program, safety report, safety design matrixes.

- 3 Describe how and to what extent probabilistic and deterministic information is used to evaluate the significance of issues found as a result of inspections and to assign priority for additional inspection follow-up.

Up to now the risk models has been primarily use by the licensees' to show an issues would have economical impact, but is not risk significant. In other cases the licensee has used the model as the bases to enhance and expedite the completion of an issue.

- 4 Describe the form or style of probabilistic information given to inspectors for their use (e.g. risk importance measures, categorisation of systems into high and low risk, dominating core damage sequences, etc.).

The licensees' that have models are in the process of categorising systems and equipment for risk, this information is made available to the inspector. The inspector can also ask the licensee to model any scenario thought to be of concern. The CNSC's Engineering department was also given a controlled copy of the programs and models for verification and self assessment.

- 5 PSA models or results are used by your regulatory body:

- a) *Who is responsible for maintaining the PSA model?*

Licensees maintain the model. The CNSC's Engineering department has controlled copy and can request changes based on their review and verification.

b) *What is the PSA model used for by the regulatory body?*

Models are different between stations, and only some stations have models. The CNSC has not yet establishing a process.

c) *How does the regulatory body verify the adequacy of the PSA model?*

Verification by the licensee is by peer review. Verification by CNSC's Engineering is by internal review.

d) *Is the PSA model kept to any standard and if so which one?*

The standards for Engineering Change Control are used for control and verification of the model. (CSA-N286.2-86)

e) *To what extent does the PSA model account for fire, earthquakes, severe weather, external flooding, containment performance, and offsite dose consequences?*

Different accident scenarios are ran by manual manipulation of failure rates.

f) *Has any policy or goal been established within your regulatory body for use of PSA by inspectors? If so, briefly describe it.*

CNSC's policy on the use of risk modelling to enhance inspections at sites, has not yet been established.

6 Please list any specific issues on this topic that you would like to be discussed at the workshop.

Czech Republic

1 Briefly describe how probabilistic and deterministic information influence inspection planning, including the selection and prioritisation of inspection areas and specific items to be inspected.

Inspection plans are basically created on deterministic information as the results of previous inspections, operational events during previous period, status of the systems, operational plans of the utility.

The results of probabilistic evaluation of design changes are used to select which change should be inspected. Licensee mostly does the probabilistic evaluation.

Development is under way to make the use probabilistic approach more significant.

2 Describe the sources of probabilistic and deterministic information made available for use by the inspector.

The general results of PSA studies for both NPPs (Dukovany and Temelín) as monthly results of Risk monitoring are made available for each inspector by Intranet application INFORISK.

On the other hand the main sources of deterministic information are the Safety Reports with results of all the prescribed analysis.

- 3 Describe how and to what extent probabilistic and deterministic information is used to evaluate the significance of issues found as a result of inspections and to assign priority for additional inspection follow-up.

The results of inspection are mostly evaluated mostly only using deterministic information. Development is under way to make the use probabilistic approach in evaluating the inspection results comparable to deterministic approach.

- 4 Describe the form or style of probabilistic information given to inspectors for their use (e.g. risk importance measures, categorisation of systems into high and low risk, dominating core damage sequences, etc.).

- Dominating core damage sequences,
- Categorisation of systems and components into high and low risk.
- Human factor influence,

- 5 If PSA models or results are used by your regulatory body:

- a) *Who is responsible for maintaining the PSA model?*

Licensee.

- b) *What is the PSA model used for by the regulatory body?*

Risk monitor application,

Operation Limits and Conditions exemptions and permanent changes evaluation for SUJB approval.

- c) *How does the regulatory body verify the adequacy of the PSA model?*

by IPSART missions

- d) *Is the PSA model kept to any standard and if so which one?*

PSA study for NPP Dukovany is as Living PSA.

- e) *To what extent does the PSA model account for fire, earthquakes, severe weather, external flooding, containment performance, and offsite dose consequences?*

PSA level 1 and 2, external events, fires, low power and shutdown studies were done for both NPPs.

- f) *Has any policy or goal been established within your regulatory body for use of PSA by inspectors? If so, briefly describe it.*

The document “Strategy on utilisation of PSA” was developed and subsequently approved by the SUJB management and its advisory bodies.

Finland

- 5 Briefly describe how probabilistic and deterministic information influence inspection planning, including the selection and prioritisation of inspection areas and specific items to be inspected.

The inspection activities in Finland include pressure vessel inspections (STUK is pressure vessel authority in Finland), resident inspectors daily work and inspections of so called periodic inspection programme.

Pressure vessel inspections are performed according to safety classification which is based on deterministic information. STUK has conducted a pilot study concerning risk informed in-service inspection in co-operation with the licensees, insights of which have been implemented in regulatory guides. For new NPPs it is required that risk informed methods have to be utilized in drawing up of the scope and content of ISI programme. This would obviously affect also regulatory inspection programme.

Resident inspectors supervise the daily activities of the licensee by going through the failure reports, the results of periodic tests and following the maintenance activities. The inspection activities are mainly targeted to systems which have requirements in Tech Specs. The current Tech Specs is based on deterministic analyses and engineering judgment. In few cases Tech Specs requirements have been changed based on PSA insights. STUK has also developed a methodology for risk informed Tech Specs evaluation (mainly for determination of AOTs).

The periodic inspection programme includes annually about 15 inspections at one NPP. The inspections are divided into three categories as follows; management, main processes and technical or organisational issues. The objective of the programme is to verify the functioning of the licensee quality management system. The inspections related to technical issues have, to some extent, utilized probabilistic information in targeting of inspections for example on maintenance activities of the most important component. The periodic inspection programme also includes a specific inspection to verify how the licensee is using PSA in plant safety management, based on regulatory guide YVL 2.8 requirements.

- 6 Describe the sources of probabilistic and deterministic information made available for use by the inspector.

IAEA documents, licensee event reports, STUK investigations, results from research projects funded by STUK, engineering judgment, results and insights from both probabilistic and deterministic analyses, and reviews.

- 7 Describe how and to what extent probabilistic and deterministic information is used to evaluate the significance of issues found as a result of inspections and to assign priority for additional inspection follow-up.

PSA and deterministic insights have been combined on case by case basis in evaluating the significance of inspection findings. Systematic approach and procedures are under consideration.

- 8 Describe the form or style of probabilistic information given to inspectors for their use (e.g. risk importance measures, categorisation of systems into high and low risk, dominating core damage sequences, etc.).

So far estimates of system level importances have been used in limited number of cases to provide assistance for targeting inspections. PSA experts have interpreted importance measures and PSA insights together with inspectors.

9 If PSA models or results are used by your regulatory body:

a) *Who is responsible for maintaining the PSA model?*

Both the regulatory body (STUK) and the licensees use the same PSA models, which are developed and maintained by the licensees.

b) *What is the PSA model used for by the regulatory body?*

Various PSA applications in support of decision making e.g.

Evaluation of plant modifications

Exemptions from Tech Specs

Evaluation of Tech Specs

Analysis of safety margin during incidents

Event analysis

c) *How does the regulatory body verify the adequacy of the PSA model?*

By thoroughly reviewing the PSA model, documentation and licensee's PSA quality management procedures. All technical disciplines are represented in the review team. Also verification calculations are performed in the form of e.g. sensitivity analyses and re-modelling, if needed. In some cases external consultants and TSO expertise is used.

d) *Is the PSA model kept to any standard and if so which one?*

STUK has required (reg. guide YVL 2.8) that the full scope PSA model has to be kept updated and it has to reflect the current configuration of the NPP. State-of-the art methodology has to be applied and analyses have to be based on best estimate assumptions. All relevant initiating events have to be analysed in all operating modes, both level 1 and 2 PSA.

e) *To what extent does the PSA model account for fire, earthquakes, severe weather, external flooding, containment performance, and offsite dose consequences?*

See above. All relevant initiators have to be considered in the analyses.

f) *Has any policy or goal been established within your regulatory body for use of PSA by inspectors? If so, briefly describe it.*

STUK is in the process of implementing risk informed regulation concept, which would include e.g. support information and procedures for risk informed targeting of regulatory inspections in co-operation with PSA experts.

g) *Please list any specific issues on this topic that you would like to be discussed at the workshop.*

Quantitative and qualitative measures (criteria) to support regulatory decision making process (needs, plans, experiences).

France

- 1 Briefly describe how probabilistic and deterministic information influence inspection planning, including the selection and prioritization of inspection areas and specific items to be inspected.

Our inspection planning is based on 27 different topics being inspected each 3 or 5 years on each NPP. These topics and the associated period are not linked to a probabilistic approach, but rather to a deterministic one. Some specific issues are considered as cross cutting issues (for instance safety management).

Examples of topics to be inspected every 3 years

- First Barrier - Fuel cladding - Fuel safety ; Second Barrier Integrity; Static/dynamic Confinement; Safeguard Systems

Examples of topics to be inspected every 5 years

- Emergency Diesel Generators; Maintenance and operation of RBWMS – CVCS systems; Power and air supply systems; Waste management; Emergency preparedness Organisation (including PUI)

Inspection guidance are available for most of these topics, but they do not focus on specific subjects from a probabilistic point of view.

- 2 Describe the sources of probabilistic and deterministic information made available for use by the inspector.

PSAs are available but they are not used directly by inspectors. The result of PSAs is used to provide improvements in design, and operating: This leads for example to modifications or new references for operation (for instance new tech specs), which can be inspected.

This information, laying for instance in safety reports, and technical specifications, is useful when inspection guidance is to be issued.

- 3 Describe how and to what extent probabilistic and deterministic information is used to evaluate the significance of issues found as a result of inspections and to assign priority for additional inspection follow-up.

If the result of an inspection is significant (for instance tech specs, or periodic testing program have not been respected), licensee has to declare an event. The very large majority of events are declared under licensee's responsibility.

Each event requires a report by the licensee. In specific cases probability of core damage is evaluated by the licensee, or by DGSNR technical support (IRSN).

If corrective actions are necessary (design, operating), new references (evolution in design or operating) are determined and their implementation will be inspected.

Moreover each inspection topic among the 27 topics previously mentioned is synthesized each year so that recurrent findings can be treated: indeed repetition can be a criteria for significance.

- 4 Describe the form or style of probabilistic information given to inspectors for their use (e.g. risk importance measures, categorisation of systems into high and low risk, dominating core damage sequences, etc.).

See answer to point 2.

- 5 If PSA models or results are used by your regulatory body:

- a) *Who is responsible for maintaining the PSA model?*

Licensee is responsible.

Our technical support develops its own models. In some cases when a single PSAs developed by IRSN is available (for instance for fire), DGSNR can ask the licensee to take it into account.

- b) *What is the PSA model used for by the regulatory body?*

Events and findings: see previous answers.

When a non-compliance with design basis is found, the quickness for repair can be linked to probabilistic considerations.

PSAs (available for a model of reactors) are used for periodic safety reviews. For instance level 2 PSAs has to be issued for 900 Mwe model for the next periodic safety review. Main contributors to core damage and radioactive release frequency have to be treated, to reduce accurately the risk.

- c) *How does the regulatory body verify the adequacy of the PSA model?*

First PSA model for 900 Mwe has been developed by IRSN and then it had to be taken into account by the licensee.

More generally RB verifies, helped by technical support, that the PSA model has been performed with acceptable methods defined in the safety rule (see point d).

- d) *Is the PSA model kept to any standard and if so which one?*

A safety rule has been issued to define an adequate method for PSAs elaboration.

- e) *To what extent does the PSA model account for fire, earthquakes, severe weather, external flooding, containment performance, and offsite dose consequences?*

PSAs take fire into account, containment performances (level 2 PSA), but external hazards are not introduced yet (this is due to complexity of this specific subject). It should be done for next periodic safety review of 1300 Mwe model, for seismic and flooding hazards.

- f) *Has any policy or goal been established within your regulatory body for use of PSA by inspectors? If so, briefly describe it.*

No but previous answers show how results of controls performed by licensee's and RB can be addressed under a probabilistic point of view.

- 6 Please list any specific issues on this topic that you would like to be discussed at the workshop.
- External hazards;
 - Risk to focus too much on the results of PSAs.

Hungary

- 1 Briefly describe how probabilistic and deterministic information influence inspection planning, including the selection and prioritisation of inspection areas and specific items to be inspected.

At the moment deterministic info influence the inspection. We plan in a 3-5 year period to introduce more risk into the regulatory approach. Licensee may have proposals.

- 2 Describe the sources of probabilistic and deterministic information made available for use by the inspector.

Final Safety Report and modification specific occasional documentation, plus computerised PSA-1 model in the office, for volunteers. The wide utilisation requires some training.

- 3 Describe how and to what extent probabilistic and deterministic information is used to evaluate the significance of issues found as a result of inspections and to assign priority for additional inspection follow-up.

First the deterministic information is used, PSA is an auxiliary tool, according to our safety policy.

- 4 Describe the form or style of probabilistic information given to inspectors for their use (e.g. risk importance measures, categorisation of systems into high and low risk, dominating core damage sequences, etc.).

This information is available in the Final Safety Report, in computerised PSA-1 model, and plant modification specific documentation, submitted for assessment by the Licensee.

- 5 If PSA models or results are used by your regulatory body:

a) *Who is responsible for maintaining the PSA model?*

TSO: Electric Power Research Institute (Hungary)

b) *What is the PSA model used for by the regulatory body?*

To give floor to the probabilistic arguments coming from the Licensee.

c) *How does the regulatory body verify the adequacy of the PSA model?*

With assessment activity, during the recent years, with some PHARE support.

d) *Is the PSA model kept to any standard and if so which one?*

IAEA Safety Series 50-P-4, 50-P-8, 50-P-12

- e) *To what extent does the PSA model account for fire, earthquakes, severe weather, external flooding, containment performance, and offsite dose consequences?*

Flooding is in the model, for fire, earthquake and Containment performance model is different.

- f) *Has any policy or goal been established within your regulatory body for use of PSA by inspectors? If so, briefly describe it.*

First of all Configuration Control and Outage Time assessment.

- 6 Please list any specific issues on this topic that you would like to be discussed at the workshop.

- Can you regulate the risk approach alone, as a nuclear safety authority, independently from the other authorities, or do you need general legislative statements about risk tolerance?
- Do we have nation wide risk targets?

Japan

- 1 Briefly describe how probabilistic and deterministic information influence inspection planning, including the selection and prioritization of inspection areas and specific items to be inspected.

Our basic policy for prevention of disasters at nuclear power facilities lies in achieving safety effectively by first evaluating potential risks scientifically and rationally and then taking appropriate measures in response to the evaluated risks.

At present, there are guidelines specified by the Nuclear Safety Commission on the classification by importance of safety-related equipment based on deterministic information. And our regulatory body or licensee organization (nuclear plant operator) drafts their inspection programs by selecting inspection areas and specific items to be inspected as well as the frequency thereof according to the guidelines.

In the years ahead, risk information quantitatively showing the importance in ensuring safety and necessity for disaster prevention will be used so that resources for regulation should be used effectively. For the time being, we consider it appropriate to conduct risk evaluation for each design type, for instance, of nuclear installation and determine the area, frequency and method of inspections with reference to the evaluation results. We are beginning to study the use of probabilistic information.

- 2 Describe the sources of probabilistic and deterministic information made available for use by the inspector.

At present, there are guidelines specified by the Nuclear Safety Commission on the classification by importance of safety-related equipment based on the deterministic information. And our regulatory body or licensee organization drafts their inspection programs by selecting inspection areas and specific items to be inspected as well as the frequency thereof according to the guidelines.

We consider it worthwhile for ensuring safety of nuclear facilities that information on operations management or minor troubles that have little to do with disaster prevention, though it may differ from accident or trouble information in its degree of emergency and importance for safety, should be shared among the licensee organizations (power companies), nuclear manufacturers, universities and research

organs, and regulatory body and that such information should be analyzed for maximum utilization in the improvement of safety-related activities and safety regulation.

For broader use of these pieces of information, study is now underway to create a database through cooperation between academy, industry and government, which can be utilized for the evaluation of inspection methods and inspection results.

- 3 Describe how and to what extent probabilistic and deterministic information is used to evaluate the significance of issues found as a result of inspections and to assign priority for additional inspection follow-up.

At present, there are guidelines specified by the Nuclear Safety Commission concerning the classification by importance of safety-related equipment based on the deterministic information. The regulatory body conducts evaluation of the significance in terms of safety of issues found in accidents, troubles or in inspections by referring to the guidelines.

In order to further improve the safety-related activities by the licensee organizations, the inspections must include verification of the performance of safety practices by each power company. At the same time, it is necessary to raise the effectiveness of inspections as a whole by properly combining them with periodic inspections of facilities.

Hence, we intend to study concrete techniques for risk evaluation and types of information to be collected so as to structure a system for collecting reliability information, such as on minor troubles, about each of the reactor facilities and evaluating the findings of inspections based on the risk evaluation for each reactor facility.

- 4 Describe the form or style of probabilistic information given to inspectors for their use (e.g. risk importance measures, categorization of systems into high and low risk, dominating core damage sequences, etc.)

Toward the introduction of inspections based on risk information, we are now at the stage of investigating the basic policy, conditions and concrete techniques therefore. Thus it is undecided yet as to how risk information be put to practical use.

- 5 If PSA models or results are used by your regulatory body: a), b), c), d), e) and f).

For example, the licensee organizations perform PSA evaluation during plant operation and stoppage at the time of periodical safety review, which is conducted by them once every 10 years.

It will be in the years ahead that we will study the possibilities of utilization of PSA models in our inspection and safety regulation.

- 6 Please list any specific issues on this topic that you would like to be discussed at the workshop.

We want the discussion to include how risk information is being used in the regulatory system of each participating country.

For instance, use for the safety evaluation of a plant as a whole, use in the selection for ISI items or in the decision on the frequency of inspections, and use in the evaluation of effects on safety at the time of troubles.

Korea

- 1 Briefly describe how probabilistic and deterministic information influence inspection planning, including the selection and prioritisation of inspection areas and specific items to be inspected.

Inspection areas and items have not been officially selected utilizing probabilistic information so far. But in 1994, we applied risk based inspection to the auxiliary feed water system of Younggwang unit 4 which showed the highest contribution to the CDF. This year, we plan to perform a pilot inspection which reflects the risk insights such as risk importance measures, dominant accident sequences.

- 2 Describe the sources of probabilistic and deterministic information made available for use by the inspector.

In an effort to follow the regulatory policy statement, utility is performing PSAs for the most of nuclear power plants in Korea. The PSA results provided by the utility are available for use in inspections. But the application of these results in regulation is limited because the technical adequacy of the PSA model, data, etc., is not yet fully verified.

The regulatory purpose PSA model is under development in cooperation with Korea Advanced energy Research Institute (KAERI). KINS is performing R&D projects for the use of PSA in regulations, including setting-up of the computer tools and reliability database to be used for the risk-informed inspection. The results will be available to the inspectors in the near future (within 2 to 3 years).

For deterministic information, Web-based incident & equipment failure information, and safety-related performance indicators, etc, are currently available from the operational performance information system (OPIS) developed by KINS.

- 3 Describe how and to what extent probabilistic and deterministic information is used to evaluate the significance of issues found as a result of inspections and to assign priority for additional inspection follow-up.

There is no official rule or system requiring probabilistic information for the regulatory inspections and decision-making. However, some operational events were analysed utilizing the probabilistic information, where the corresponding PSA models were primarily provided by the licensee. The low power PSA of Ulchin 5,6 revealed that the mid-loop operation during the refuelling outage contribute significant portion to the total CDF. To improve to this situation, the minimum cooling time required for the mid-loop operation was increased to lower the CDF. This practice was expanded to all similar PWRs in Korea.

We have a operational performance information system (OPIS) which contains the accumulated operational history and equipment failure data. The statistics show that secondary side failures are the main cause of unexpected reactor shutdown. To cope with this problem, KINS is considering the expansion of inspection into the secondary side.

Currently, the regulatory body (KINS) is developing the PSA model for regulatory uses. Level 1 PSAs for internal events are utilized. In the evaluation of the risk significant issues such as Steam Generator Tube Rupture of Ulchin Unit 4, the PSA models reflecting the realistic plant configuration was used to evaluate CDF and other significant information.

- 4 Describe the form or style of probabilistic information given to inspectors for their use (e.g. risk importance measures, categorisation of systems into high and low risk, dominating core damage sequences, etc.).

The plant-specific PSAs for all plants are being prepared by the licensee and the PSA results of some plants are now available. But up to now, the inspectors are not requested to reference the probabilistic information for inspection. The frame of risk informed regulation, such as scope, guide-line and time-table is under preparation.

5 If PSA models or results are used by your regulatory body:

a) *Who is responsible for maintaining the PSA model?*

Licensee is developing and maintaining the plant specific PSA model.

KINS is developing regulatory purposes PSA model in cooperation with KAERI and will maintain the model as well.

b) *What is the PSA model used for by the regulatory body?*

Probabilistic information used so far is mainly from licensee's PSA results.

The regulatory purpose PSA model for Korean Standard Nuclear Power Plant (KSNP) is under development. This PSA model is generally consistent with the ASME code grade II and will be available next year, and will be used for the following areas:

Analyses of operational events and issues,

Operational risk monitoring,

Regulatory audit for submittals from the licensee with changes to the licensing-basis.

c) *How does the regulatory body verify the adequacy of the PSA model?*

To verify the adequacy of the regulatory PSA model, KINS reviews the overall logic, data, assumptions and QA procedures in the course of development process. The regulatory purpose PSA model will be compared with the results of licensee's PSA analysis.

KINS has also performed an independent review of the licensee's PSA model during its development. Open items issued in the process of licensing review are revisited at the next update of the PSA.

d) *Is the PSA model kept to any standard and if so which one?*

We have an intention to follow the ideas of ASME PRA standard (ASME RA-S-2002) for the implementation of risk-informed applications, as far as practicably achievable.

e) *To what extent does the PSA model account for fire, earthquakes, severe weather, external flooding, containment performance, and offsite dose consequences?*

In developing regulatory PSA model, we primarily focus on the internal events. After finishing the development of level 1 PSA, we will consider the expansion of regulatory PSA to the external events and others.

Licensee's PSA model accounts for fire, earthquakes, severe weather, and containment performance.

The offsite dose consequences will be contained in the PSA model for the Korean Next Generation Plant.

- f) *Has any policy or goal been established within your regulatory body for use of PSA by inspectors? If so, briefly describe it.*

The Korean regulatory policy statement for the safety assurance against severe accident was announced in 2001. The objective of this statement is to establish the following essential elements in Korea:

Setting-up of probabilistic safety criteria;

Implementing PSA in the design and operation;

Providing capability for the mitigating and preventing features against severe accidents;

Establishing of severe accident management program (SAMP).

This implies the intentions to find the effective means of safety improvement for nuclear facilities, to assure the consistency of regulation with PSA results, and to establish the basic guidelines in the regulatory implementation of PSA. Especially, the statement asks:

“PSAs should be performed to determine countermeasures such that the risk from the operating plants is reduced to as low as reasonably achievable. As for relatively high probability accident scenarios bringing plant damages, available means for accident prevention and mitigation should be identified and implemented in the design and operating procedures of the plants, through cost-benefit analysis.”

- 6 Please list any specific issues on this topic that you would like to be discussed at the workshop

How to systematically provide inspector with risk information data?

Mexico

- 1 Briefly describe how probabilistic and deterministic information influence inspection planning, including the selection and prioritisation of inspection areas and specified items to be inspected.

The annual inspection programme is prepared on deterministic and probabilistic basis. Deterministic criteria is applied from the USA NRC and IAEA inspection documents, operating experience and programme requirements which are used to identify the most important organisational structures and working processes that are recommended to be inspected once a year and every two years.

Once a year a risk-based inspection is included as part of the annual inspection programme for a plant system. In addition, during the annual refuel inspection activities several plant systems are inspected.

- 2 Describe the sources of probabilistic and deterministic information made available for use by the inspector.

The source of probabilistic information for use by inspector is the plant-specific PSA study and the Risk-Based Inspection Guidelines for Laguna Verde Nuclear Power Plant.

The source of deterministic information came from deterministic engineering requirements, operating experience and programme requirements. In addition, some USA NRC and IAEA documents are reviewed to identify insights that should be inspected.

- 3 Describe how and to what extent probabilistic and deterministic information is used to evaluate the significance of issues found as a result of inspections and to assign priority for additional inspection follow-up.

A Significance Determination Process (SDP) has been adapted from the USA NRC methodology to our country. The SDP is being applied to evaluate the significance of some issues found as a result of inspections. Emphasis on licensed event reports (LERs) and inspection findings regarding with violations of technical specifications (Tech Specs) are evaluated to determine their risk-significance. Actually, we are making administrative arrangements to require support from the Technology Department in order to evaluate all the findings resulted from the inspections performed during this year to determine their risk-significance. Additional inspection follow-up activities are performed depending on the risk-significance resulted from the evaluation of the inspection issues (green, white, yellow and red).

Actually, the “Enforcement Process” manual is under revision, which includes the evaluation of the significance of issues and inspection findings found as a result of inspections applying the SDP and deterministic criteria. For those inspection issues or findings which can not be evaluated with the SDP a deterministic criteria is applied to determine the gravity level (typically four gravity levels).

The deterministic criteria is applied to determine the impact of the inspection issues or findings on the following areas for each gravity level:

- Reactor operation
- Plant Design
- Safeguards
- Health physics
- Transportation
- Fuel cycle
- Other regulatory items
- Emergency planning

- 4 Describe the form or style of probabilistic information given to inspectors for their use (e.g. risk importance measures, categorisation of systems into high and low risk, dominating core damage sequences, etc.).

The Probabilistic Risk Assessment (PRA) methodology was used to develop the Risk-Based Inspection Guides (RIG's) for Laguna Verde Nuclear Power Plant. The RIG's are being used by inspectors as a helpful tool to plan and perform inspection activities at LVNPP.

Information from LVNPP Unit 1 PRA Study (owner) and Internal Event Analyses Study of LVNPP Unit 1 (regulatory body) have been used to identify plant systems and components most important to minimizing

the probability of core-melt, and to identify failure modes for these components. The analysis required three major steps to produce a series of tables (guides), organized by systems and prioritised by risk importance, which identify components associated with 98% of the core-melt probability resulting from plant operation. In the first step the plant systems were ordered according to system risk importance. Systems were then selected from the ordered list until more than 98% of the core-melt probability was accounted for. The second step was the re-analysis of system fault trees from the PRA Study to rank system components according to both their importance to system failure and risk increase measure of core damage. The third step was the correlation of components and their dominant failure modes with inspection modules from the Nuclear Regulatory Commission (NRC) Inspection and Enforcement (IE) Manual, Regulatory Guides (NRC), and plant-specific procedures all of which are being used by inspectors to planning and performing inspections at LVNPP U-1. Finally, a general description of both initiators and dominant sequences accident were included in the RIG's in order to assist the regional inspectors and resident inspector during their inspection activities.

5 If PSA models or results are used by your regulatory body:

a) *Who is responsible for maintaining the PSA model?*

The responsible for maintaining the PSA model is the plant owner.

b) *What is the PSA model used for by the regulatory body?*

For inspection purposes the model used by the regulatory body is the "Internal Event Analyses Study of LVNPP Unit 1" which was elaborated by the regulatory body specialists and was used to prepare the RIG's for LVNPP.

c) *How does the regulatory body verify the adequacy of the PSA model?*

The specialists in charged to review and evaluate the adequacy of the PSA model applied the criteria established in some NUREG's (USA) and IAEA documents regarding with this topic.

d) *Is the PSA model kept to any standard and if so which one?*

The PSA model should satisfy the requirements established in the Generic Letter 88-20 and supplements of the USA NRC.

e) *To what extent does the PSA model account for fire, earthquakes, severe weather, external flooding, containment performance, and offsite dose consequences?*

In relation to external events the PSA Level model for LVNPP take into account internal flooding only.

f) *Has any policy or goal been established within your regulatory body for use of PSA by inspectors? If so, briefly describe it.*

Currently, the managers have not established any policy or goal for use of PSA by inspectors. But, since June 2000 we have available for inspection applications the RIG's for LVNPP which have been applied for some inspectors (not all) to assist him in establishing a more efficient approach to planning and performing inspections at plant systems and components most important to ensuring public safety. The most inspectors attended the RIG's applications training course in 2001 year.

On other hand, our traditional inspection philosophy is being analysed in order to determine the advantage to change the orientation to the “Oversight Process” used by the USA NRC which is based on risk informed insights.

g) Please list any specific issues on this topic that you would like to be discussed at the workshop.

- The significance determination process applied to evaluate the inspection issues or findings
- What kind of information should be included as part of the inspection report?
- Computer codes used to evaluate risk-increase and risk-reduction of inspection findings
- Criteria applied to initiate a follow-up inspection on risk-significance basis

Spain

1 Briefly describe how probabilistic and deterministic information influence inspection planning, including the selection and prioritisation of inspection areas and specific items to be inspected.

Nowadays our Basic Plan of Inspection is based on processes and the information used to determine inspection planning and to prioritize inspection areas and specific items is mainly deterministic.

Recently the Spanish Regulatory Body (CSN) has started studying the convenience of implementing a risk informed model of inspection, (RII), similar to the RII used by USA in his Reactor Oversight Process (ROP).

The CSN has started increasing the specific training of inspectors based on probabilistic terms and is performing inspections following the model of risk informed inspections.

2 Describe the sources of probabilistic and deterministic information made available for use by the inspector.

The Individual Plan Examination of the PRA’s levels one and two of every nuclear power plant, including its actualization, is available for the CSN inspectors. There is a summary of the main results of PRA’s on the internal web of the CSN.

3 Describe how and to what extent probabilistic and deterministic information is used to evaluate the significance of issues found as a result of inspections and to assign priority for additional inspection follow-up.

The evaluation of the significance of inspection’ findings is deterministic with the exception of those risk informed inspections the CSN has performed.

4 Describe the form or style of probabilistic information given to inspectors for their use (e.g. risk importance measures, categorisation of systems into high and low risk, dominating core damage sequences, etc.).

Until now, and besides the information derived from the analysis of events and incidents in the nuclear installations, the CSN is using a global program of evaluation taking in account the results of the inspections in each inspectable area in order to assign priority for additional inspection follow-up.

The inspectors are periodically training in P.R.A and they can review the probabilistic information as risk importance measures, dominating core damage sequences, failure rates of components, etc, on the NPP probabilistic studies and in the internal web of the CSN.

All the NPP's are developing the risk matrix necessary to carry out the risk informed inspections, three of them have already been finished.

5 If PSA models or results are used by your regulatory body:

a) *Who is responsible for maintaining the PSA model?*

The licensees.

b) *What is the PSA model used for by the regulatory body?*

The same model that has been sent for review to the CSN, with the necessary adjustments.

c) *How does the regulatory body verify the adequacy of the PSA model?*

The CSN has reviewed and verified individually the adequacy of each P.R.A study levels one and two.

There are specific inspections that are including in the Basic Plan of Inspection, in order to review and verify the adequacy and actualization of IPE's.

d) *Is the PSA model kept to any standard and if so which one?*

No, there are no standards

e) *To what extent does the PSA model account for fire, earthquakes, severe weather, external flooding, containment performance, and offsite dose consequences?*

The plants have IPEEE for external events and the PSA IPE's (level one and two) are very detailed, specially to that concerning fire and flooding.

f) *Has any policy or goal been established within your regulatory body for use of PSA by inspectors? If so, briefly describe it.*

As in the answer to previous questions have been mentioned, the CSN has starting the performing of several risk informed inspections and is following very closely the Reactor Oversight Process model (ROP) of the NRC.

The CSN has contracted in September 2003 a technical supplier to support the RB with some of the different aspects to implement a RII plan such as:

Development of RII Tools (significance determination process SDP; risk information matrix RIM),

Infrastructure and Training (PRA).

It is quite probable the CSN is going to implement a model similar to the ROP adjusted to the nuclear capacity/ market of Spain.

6 Please list any specific issues on this topic that you would like to be discussed at the workshop.

What would be the best way to evaluate the risk in that subjects of inspection that result difficult to value quantitatively by probabilistic models, as the use of PRA's in the inspections of preparedness of emergency.

Would be considered convenient to create an international scale of findings found by risk informed inspections?

Switzerland

1) Briefly describe how probabilistic and deterministic information influence inspection planning, including the selection and prioritisation of inspection areas and specific items to be inspected.

The basic inspection program is based on experiences from plant design and calculations on accident plant behaviour. Risk models have been generated for all of the plants in Switzerland. From those models plant dependent critical equipment and procedures have been identified.

Findings from yearly safety evaluations identify areas for selective inspections.

Reactive inspections are mainly caused by reportable events.

At present there is a program on integrated supervision going on at HSK (effectiveness, comprehensiveness and balance) which influences also regulatory inspections.

2) Describe the sources of probabilistic and deterministic information made available for use by the inspector.

At HSK there is no special group of full-time inspectors, most employees are using this supervision tool. HSK employees are aware of the design basis and licensing topics because of their involvement in the process.

Each licensee has to have a PSA model. HSK have made their own models for independent surveillance of the licensees results. This information is available within HSK. In addition information is used from plant designers using the results of the mandatory surveillance program and safety reports.

3) Describe how and to what extent probabilistic and deterministic information is used to evaluate the significance of issues found as a result of inspections and to assign priority for additional inspection follow-up.

On a case to case basis PSA information is used for this purpose. Main inputs are from deterministic information.

The measures demanded by HSK depend on the significance (with respect to plant safety) of the inspection results.

4) Describe the form or style of probabilistic information given to inspectors for their use (e.g. risk importance measures, categorisation of systems into high and low risk, dominating core damage sequences, etc.).

The PSA results are available to all HSK employees on paper. At present a databank is being built up for easier use.

5) PSA models or results are used by your regulatory body:

a) *Who is responsible for maintaining the PSA model?*

Licensees and HSK maintain their models.

b) *What is the PSA model used for by the regulatory body?*

HSK uses PSA insights within the supervision process. Special fields are component surveillance, assessment of events, risk informed inspections and severe accident management guidance. HSK has not yet established a process.

c) *How does the regulatory body verify the adequacy of the PSA model?*

Verification by the licensee is by peer review. This plant model is mandatory. The HSK model is used to review the licensee model. In addition inspections are used to clarify if plant modifications are in the model and how appropriate the model is.

d) *Is the PSA model kept to any standard and if so which one?*

The models are kept to international standards. HSK is in the process of building up a guideline.

e) *To what extent does the PSA model account for fire, earthquakes, severe weather, external flooding, containment performance, and offsite dose consequences?*

The plant models account for all mentioned subjects in detail except the last one the offsite dose consequences. HSK accounts for level 1, level 2 and not level 3.

f) *Has any policy or goal been established within your regulatory body for use of PSA by inspectors? If so, briefly describe it.*

No policy or goal has been established by HSK.

6) Please list any specific issues on this topic that you would like to be discussed at the workshop.

United States

1) Briefly describe how probabilistic and deterministic information influence inspection planning, including the selection and prioritization of inspection areas and specific items to be inspected.

- NRC inspection guidance requires risk insights, when available, to be integrated with other relevant (non-PRA) factors for inspection planning. Risk analysts with extensive inspection experience (Senior Reactor Analysts or SRAs) work closely with the inspectors stationed at the plant site and in the regional office to assist in the selection of systems, components, and programs for inspection based on risk significance. They also have developed contacts with licensee PRA/PSA analysts and obtain updated risk information from the licensee when

needed. Much of the risk insights are obtained through importance measures of systems and components obtained from the licensee's PRA/PSA model.

- Deterministic information that influences inspection planning focus is based on emergent plant issues, potential adverse trends, current equipment problems, and ongoing activities. Based on the knowledge gained through the plant status review, the inspectors are expected to make adjustments to their inspections so that they can inspect activities that are of higher risk-significance.
- 2) Describe the sources of probabilistic and deterministic information made available for use by the inspector.
- The NRC developed the Significance Determination Process (SDP), which provides a simplified plant-specific risk-informed framework to estimate the increase in core damage frequency due to conditions that contribute unintended risk increases caused by deficient licensee performance. Each plant has site-specific notebooks that replicate a simplified version of the licensee's PRA model. The SDP notebooks contain worksheets that are used to assess the remaining mitigation capability for the applicable initiating event likelihood to assist in identifying the significance of the inspector's findings. These notebooks have been benchmarked by comparing and analyzing the risk significance of hypothetical inspection findings obtained using the SDP notebook and the plant-specific PRA. Following benchmarking, the notebooks are updated considering licensee's updated PRA, and any changes in plant design and operational practices. The SDP tool is designed to provide NRC inspectors and management with a simple probabilistic risk framework for use in identifying potentially risk-significant issues for at-power operations and fire protection. SDPs have also been developed for assessing the risk significance of issues in the areas of shutdown operations and containment integrity.
 - Two principle sources of risk information are the documented results of licensee-developed PRA/PSA and the NRC-developed "simplified" PRA models used by NRC risk analysts. These simplified PRA models include support systems, common-cause failure and human error/recovery modeling; however, they may not contain the detailed component-level modeling normally found in licensee-developed PSA models.
- 3) Describe how and what extent probabilistic and deterministic information is used to evaluate the significance of issues found as a result of inspections and to assign priority for additional follow-up.
- As stated in Question 2, the fundamental tool used by inspectors to determine the risk significance of inspection issues is the SDP site-specific notebooks.
 - The SRAs in the regional offices are most directly involved with evaluating the risk significance of inspection findings, operating events, and licensee-reported conditions. In addition, NRC headquarters staff includes three separate organizational groups that perform risk analysis of reactor operational events. Two of these groups perform rapid assessments, while the third group conducts longer and more detailed studies. All of these analyses are done, where possible, using simplified risk models and the SAPHIRE suite of PRA codes developed for the NRC by the Idaho National Engineering Laboratory (INEL). The numerical results (e.g., conditional core damage probability) of the SAPHIRE analysis are used as an indicator, but not as a sole determiner, of risk significance. NRC risk analysts provide risk insights to NRC inspectors and management within the limitations of the analysis method used. This requires the analyst to accurately characterize these limitations, as appropriate, to

ensure that risk insights are understood and not misused. In some cases, this has meant acknowledging that a risk analysis simply cannot provide any useful insights for a particular issue. Largely because of this need to assess the quality of the underlying PRA analysis relative to the issue at hand, there is no rigorous or systematic method to use PRA for assigning inspection follow-up priorities. The extensive training and experience of the SRAs and headquarters-based risk analysts are relied upon to obtain and integrate the best available risk insights for any given issue.

- Licensees submit data to the NRC on specific risk-significant systems/components to support Performance Indicators (PI) that provide system/component performance compared to generic, objective thresholds established by the NRC. Performance Indicators (PI) provide indication of problems that, if uncorrected, may increase the probability of risk or consequence of an event. Since all aspects of licensee performance can not be monitored by PIs, safety significant areas not covered by PIs are assessed through inspection and the SDP notebooks.
- 4) Describe the form or style of probabilistic information given to inspectors for their use (e.g. risk importance measures, categorization of systems into high and low risk, dominating core damage sequences, etc.).
- Inspectors main source of probabilistic information is the site-specific SDP notebooks. These notebooks evaluate the impact of an inspection finding on the core-damage scenarios. The SDP worksheets contain two parts. The first identifies the functions, the systems, or combinations thereof that have mitigating functions, the number of trains in each system, and the number of trains required (success criteria) for the initiator. It also characterizes the mitigation capability in terms of the available hardware (e.g., 1 train, 1 multi-train system) and the operator action involved. The second part of the SDP worksheet contains the core-damage accident sequences associated with each initiator; these sequences are based on SDP event trees.
 - The inspectors also use licensee-provided importance values for systems/components.
- 5) If PSA models or results are used by your regulatory body:
- a) *Who is responsible for maintaining the PSA model?*
- Although no regulatory framework requires maintaining the licensee's PSA model, the NRC has found that most licensees' have continued to update their PRA/PSA models to coincide with plant modifications and operating practices.
 - The NRC, in conjunction with INEL, maintains the SAPHIRE suite of PRA models used by the agency to independently assess risk significance of plant events and issues.
- b) *What is the PSA model used for by the regulatory body?*
- The NRC uses simplified risk models in the SAPHIRE suite of PRA codes developed by the Idaho National Engineering Laboratory (INEL). These simplified PRA models include support systems, common-cause failure and human error/recovery modeling; however, they may not contain the detailed component-level modeling normally found in licensee-developed PSA models.

c) *How does the regulatory body verify the adequacy of the PSA model?*

- Although the NRC does not formally verify the adequacy of the licensee’s PRA/PSA model, informal verification is performed when benchmarking the SDP notebooks and when a licensee submits a request for a license change using risk arguments to conclude that the change would not increase the likelihood or consequence of an accident.

d) *Is the PSA model kept to any standard and if so which one?*

- The NRC has endorsed an industry peer review process as a means of meeting the peer review requirement in the ASME Level I PRA Standard RA-S-2002. Licensees use the results of the peer reviews to target improvements to their plant-specific models; however, the NRC does not inspect the overall quality of the licensee’s PRA/PSA. All operating nuclear plants in the U.S. were peer reviewed by November 2003.

e) *To what extent does the PSA model account for fire, earthquake, severe weather, external flooding, containment performance, and offsite dose consequences?*

- In June 1991, the NRC issued NUREG-1407, “Procedure and Submittal Guidance for the Individual Plant Examination of External Events (IPEEE) for Severe Accident Vulnerabilities,” which provided guidelines for conducting IPEEEs. The NRC received approximately 70 IPEEE submittals covering all operating U.S. nuclear reactors. The NRC reviewed the submittals and documented the strengths and weaknesses of the licensee’s IPEEE submittal, the dominant contributors to core damage frequency for fire, seismic, and HFO events; licensee-identified vulnerabilities; and plant improvements made or planned as a result of the licensee’s IPEEE process.

Many licensees have an external events PRA/PSA model that is integrated with their internal events PRA model. These integrated PRA models allow analysts to obtain the combined internal and external events importance measures for systems and components. Approximately 10 of the 70 PRA models are considered ‘full scope’ models that are capable of obtaining importance measures including risk contribution from seismic, fire, and HFO events. Approximately 13 PRA models are ‘partial scope’ that may only integrate a fire PRA or seismic PRA with the internal events model. Partial scope PRA models are deemed partially integrated PRAs since a screening approach (e.g. margins approach) may have been used to demonstrate that a particular external event was a very low contributor to the overall core damage frequency. In addition, the majority of PRA models treat severe weather conditions through external events analysis (e.g. external flooding, tornados). Severe weather is also captured in the internal events modelling of loss-of-offsite power (LOOP) scenarios and the weather related impacts on the time to recover offsite power. LOOP modelling of offsite recovery is typically handled through statistically analysis of historical events occurring industry-wide and the plant-specific experience.

NRC PRA models do not model external events; however, severe weather (e.g. lightning, hurricanes, ice storms) effects inducing a LOOP are modelled. The NRC has only one plant with a SPAR-LERF model.

Regarding containment performance, all U.S. plants have performed a Level II analysis and the NRC uses LERF information in its decision making including backfit analysis.

- f) *Has any policy or goal been established within your regulatory body for use of PSA by inspectors? If so, briefly describe it.*

The Commission believes that the establishment of an overall policy on the use of PRA in nuclear regulatory activities will allow the many potential applications of PRA to be implemented in a consistent and predictable manner that will promote regulatory stability and efficiency. The following policy statement presents policy that the NRC will follow in the use of PRA methods in nuclear regulatory matters.

(1) The use of PRA technology should be increased in all regulatory matters to the extent supported by the state-of-the-art in PRA methods and data and in a manner that complements the NRC's deterministic approach and supports the NRC's traditional defence-in-depth philosophy.

(2) PRA and associated analyses (e.g., sensitivity studies, uncertainty analyses, and importance measures) should be used in regulatory matters, where practical within the bounds of the state-of-the-art, to reduce unnecessary conservatism associated with current regulatory requirements, regulatory guides, license commitments, and staff practices. Where appropriate, PRA should be used to support the proposal for additional regulatory requirements in accordance with 10 CFR 50.109 (Backfit Rule). Appropriate procedures for including PRA in the process for changing regulatory requirements should be developed and followed. It is, of course, understood that the intent of this policy is that existing rules and regulations shall be complied with unless these rules and regulations are revised.

(3) PRA evaluations in support of regulatory decisions should be as realistic as practicable and appropriate supporting data should be publicly available for review.

(4) The Commission's safety goals for nuclear power plants and subsidiary numerical objectives are to be used with appropriate consideration of uncertainties in making regulatory judgments on the need for proposing and backfitting new generic requirements on nuclear power plant licensees.

Through the Safety Goal Policy Statement, the Commission propagated its philosophy that the risk from the operation of a nuclear power plant should be no more than 0.1 percent of the risk to which people are exposed from other sources. This statement of risk translates into objectives on individual risk of $2E-06$ /yr of a latent fatality and $5E-07$ /yr of an early fatality. These risk objectives were then used to develop a design-related subsidiary objective of $1E-04$ /reactor year (RY) core damage frequency (CDF) for accident prevention, and a standard (characterized as an "implementation guideline") of 0.1 conditional containment failure probability for accident mitigation.

PERFORMANCE OF THE LICENSEES ORGANISATION

Introduction to the Questionnaire:

The safety of nuclear power plants greatly depends on the successful interaction between technical systems and human and organisational aspects. A good organisation supports safety-driven activities and promotes the safety culture. The inspections of the performance of the Licensees organisation should ensure that it is focused on safe operation and on the identification and remediation of problems related to safety. This can be done by use of several approaches, e.g. by direct evaluation of the outcome of the organisation, by assessment of the working of important processes in normal operation and in case of events, etc.

The survey is intended to gather information from the member countries on their own way to perform inspection in this area and to gather commendable practices.

Questions:

1. Do you inspect the following organisational structures?

Power plant management

Operation/stand-by duty

Maintenance

Technical support

Fuel management and reactor monitoring

Designing the working environment and instruments

Radiation protection

Chemistry

Security

Emergency organisation

Plant's own safety committee

Other (please detail)

2. Do you inspect the following working processes?
 - Planning, implementing and monitoring special tasks
 - Personnel management
 - Qualification and training
 - Reviews
 - Modifications
 - Industrial safety measures
 - Correction and improvement
 - Management of safety
 - Other (please detail)
3. Do you inspect the management of organisational changes, in the following domains?
 - Safety impact of organisational changes
 - Implementation of changes
 - In-house evaluation of change processes
 - Post implementation
 - Other
4. Do you also inspect aspects of the organisational culture?
 - Communication
 - Co-operation, team working
 - Respect
 - Trust
 - Safety culture
 - Other
5. How do you establish and maintain competence in performing inspections?
 - By establishing a guideline for the organisation of NPPs
 - By training on the job

By lectures

By exchange of information with other Regulatory Bodies

By asking assistance to a consultant

Other

6. When do you inspect the performance of the Licensees organisation?

Periodically according to a basic inspection program

In case of events

In case of organisational changes

Other

Survey Responses

Belgium

7 Do you inspect the following organisational structures?

In Belgium, the control of the NPP safety by the Inspection Body is permanent. There are three kinds of inspections: thematic (periodic and systematic overview of a specific field of activities with all associated elements), systematic (verification of the compliance of the operation with the license) and specific (meetings on a defined field or response to an important event).

ORGANISATIONAL STRUCTURE	YES	NO	TYPE OF INSPECTION
Power plant management	X		Thematic and specific inspections
Operation/stand-by-duty	X		Systematic, thematic and specific inspections
Maintenance	X		Systematic, thematic and specific inspections
Technical support	X		Systematic, thematic and specific inspections
Fuel management and reactor monitoring	X		Thematic and specific inspections
Designing the working environment and instruments	X		Specific Inspections
Radiation protection	X		Systematic, thematic and specific inspections
Chemistry	X		Systematic, thematic and specific inspections
Security		X	Out of scope of AVN mission
Emergency organisation	X		Thematic and specific inspections
Plant's own safety committee	X		Yes (reports) or in case of important organisational changes.
Other (please detail)			
Effluent and waste	X		Thematic and specific inspections
Radio-monitoring: Systematic	X		Systematic, thematic and specific inspections
Fire protection	X		Systematic, thematic and specific inspections
Quality Assurance	X		Thematic inspection
Training facilities and structures	X		Thematic inspection
Experience feedback service	X		Thematic inspection

8 Do you inspect the following working processes?

The processes are inspected during the above inspection programme.

ORGANISATIONAL STRUCTURE	YES	NO	TYPE OF INSPECTION
Planning, implementing and monitoring special tasks	X		Systematic and specific inspections
Personnel management	X		During the thematic inspection of the organisational structures
Qualification and training	X		During thematic inspections but also in the framework of specific inspections
Reviews			cf. QA process
Modifications	X		Systematic, thematic and specific inspections
Industrial safety measures		X	
Correction and improvement	X		Systematic and specific inspections (short term). But also during thematic inspections (long term).
Management of safety	X		During thematic inspection management and follow-up of the work of the operational and safety committees

9 Do you inspect the management of organisational changes, in the following domains?

a) *Safety impact of organisational changes:*

Yes. Important organisational changes are discussed with the inspection body before implementing it. A precise description of the modification is asked before implementation and the inspection body gives the structure of the needed documentation in function of the scope and the safety significance of the change (state of the present organisation, change description with purpose, legal references, description of the before and after change responsibilities, tasks, safety related process impacts, qualification and training of the personnel, work of the new organisation during transient period, documentation impact, operational feedback of similar organization, process performance indicators). The licensee must demonstrate that the changes are acceptable from the safety point of view.

b) *Implementation of changes:*

Yes. The revision of the chapter 13 of the SAR is discussed with the inspection body and a final version is ready before implementation. A planning is defined to up-to-date the documentation. Operational documentation (i.e. technical specifications) must be ready for the implementation.

c) *In-house evaluation of change processes:*

Yes. The inspection results are used to evaluate the meeting of the change goals and the eventual impact on safety.

d) Post implementation

Yes. Performance indicators are defined as necessary before the implementation (see first bullet). The evolution of these indicators is periodically discussed with the licensee and recommendations are made.

10 Do you also inspect aspects of the organisational culture?

Not systematically inspected.

a) Communication

Some aspects (employees information about modifications)

b) Safety culture

In response to an event; credibility and attitude of the responsible during inspections.

11 How do you establish and maintain competence in performing inspections?

a) By establishing a guideline for the organisation of NPPs:

Thematic inspections are based on guidelines. Most of them are quite general (due to great extend of the scope) but some inspections (radioprotection, fire protection, accident management, chemistry, fuel,...) have really detailed guidelines. The criteria are based on SAR, knowledge of the inspector, reference documentation and professional experience. Guidelines exist for inspection of organizational changes and human factors analyses.

b) By training on the job:

Inspector is the single point of contact between the plant and AVN. They follow all the meetings about their unit. For common inspections, the inspectors take part each in turn. For some thematic inspection, a technical specialist assists the inspector.

c) By lectures:

Internal lectures are given to inspectors for new guideline publication. External lectures are not directly followed by inspector but by support team experts.

d) By exchange of information with other Regulatory Bodies:

They are regularly (but not systematic) cross inspections with French and the Netherlands safety authorities.

e) By asking assistance to a consultant:

Not usual but some project can use consultant competencies (i.e. development of human factor inspection methodology)

12 When do you inspect the performance of the Licensees organisation?

a) *Periodically according to a basic inspection program*

Yes for the thematic inspection. The systematic inspections are planning-free but minimum one per couple of weeks.

b) *In case of events:*

Yes. Some specific inspections are done following special events.

c) *In case of organisational changes:*

Yes. The organisational changes are treated as modification and are followed in the framework of systematic, thematic and specific inspections (see also point 3 above).

Canada

Foreword

The safety of nuclear power plants greatly depends on the successful interaction between technical systems and human and organisational aspects. A good organisation supports safety-driven activities and promotes the safety culture. The inspections of the performance of the Licensees organisation should ensure that it is focused on safe operation and on the identification and remediation of problems related to safety. This can be done by use of several approaches, e.g. by direct evaluation of the outcome of the organisation, by assessment of the working of important processes in normal operation and in case of events, etc.

The survey is intended to gather information from the member countries on their own way to perform inspection in this area and to gather commendable practices.

1. Do you inspect the following organisational structures?

ORGANISATIONAL STRUCTURE	YES	NO	TYPE OF INSPECTION
Power plant management	X		Audits and evaluation against the applicable CSA N286.5 quality standard.
Operation/stand-by-duty	X		Audits and evaluations for compliance with CSA N286.5 quality standard, Operation Practices Assessments, Inspection of minimum shift complement.
Maintenance	X		Witness Surveillance test, review of performance indicators, audit of program against CSA N286.5 quality standard
Technical support	X		Engineering design audits against applicable quality standards for Design and Procurement
Fuel management and reactor monitoring	X		Inspection to verify compliance with fuel power limits, inspection of Guarantee Shutdown State during outages
Designing the working environment and instruments	X		Specific Inspections

Radiation protection	X		Regulator reviews and approves station health physicist, approve licensees radiation protection program, audit radiation protection against CSA N286.5 quality standard and ALARA principles
Chemistry	X		We don't look at the organization of chemistry Dept. We inspect a number of Performance indicators that describe the performance of plant chemistry,
Security	X		Assess security organizations staff compliment, training,
Emergency organisation	X		Evaluation of the emergency organization during emergency exercises
Plant's own safety committee		X	Yes (reports) or in case of important organisational changes.
Other			Inspection of licensee organization to deal with large projects e.g. plant refurbishment.

2. Do you inspect the management of organisational changes, in the following working processes?

We inspect a total of 17 work processes throughout the entire organization:

attention to safety, communication, coordination of work, decision-making, formalization, goal and priority-setting, organizational culture, organizational knowledge, organizational learning, performance evaluation, personnel selection, performance quality, problem identification and resolution, resource allocation, roles and responsibilities, training, time urgency.

ORGANISATIONAL STRUCTURE	YES	NO	TYPE OF INSPECTION
Planning, implementing and monitoring of special tasks	X		Examples of special task where planning and implementation is monitored include: Pressure tube replacements, high hazard work, guarantee shutdown state. We inspect against CSA N286.5 quality standard, and Regulatory documents
Personnel management	X		Examples: Conduct assessment of monetary incentives for staff to adhere to Outage schedule, Assessment of personnel reorganizations
Qualification and training	X		Assessments against INPO performance objectives and criteria
Reviews	X		
Modifications	X		Focus on evaluations of modification processes. Specific modification evaluations still conducted for Special Safety Systems and Pressure Boundary modifications.
Industrial safety measures:	X		Fire protection measures only
Correction and improvement	X		Assessment of Licensee programs for managing Operating Experience knowledge and Problem Identification and Correction.
Management of safety:	X		Outage management, management of heat sink how they track the state of the unit. N286 and opps

3. Do you inspect the management of organisational changes, in the following domains?

	Yes	No	
Safety impact of organisational changes:	X		Inspect Organization change management Focus on the impact of change on safety
Implementation of changes:	X		Inspect the following aspect of change implementation: Performance indicators: backlogs, commitments not met. Inspection of minimum knowledge (Downsize knowledge management process). Transition plan for implementing the change
In-house evaluation of change processes.	X		Inspect licensee self assessment processes
Post implementation	X		Assess the impact of implemented changes on safety

4. Do you also inspect aspects of the organisational culture?

– Communication:

Yes, Assessment effort includes both External and Internal Communications External communication refers to the exchange of information, both formal and informal, between the facility, its parent organization, and external organizations (e.g., AECB, the public). Intradepartmental communication refers to the exchange of information, both formal and informal, within a given department or unit. It includes both the top-down and bottom-up communication networks.

– Co-operation

Indirectly assessed (see organizational dimension assessed under: Other below)

– Respect:

Indirectly assessed (see organizational dimension assessed under: Other)

– Trust:

Indirectly assessed (see organizational dimension assessed under: Other)

– Safety culture:

Yes, a pilot project has been introduced where the field inspectors were provided with a set of Safety Culture Evaluation Tools based on Behavioural Anchored Rating Scales.

– Other: The following organizational Dimensions are evaluated:

Organizational Dimension	
Centralization	Centralization refers to the way decisions that affect the operation of the facility are made and who makes those decisions. Particularly, the degree to which decisions are made within a small circle of high ranking individuals versus decisions made by many, at all levels of facility operations.
Coordination of Work	Coordination of work refers to the planning, integration, and implementation of the work activities of individuals and groups.
Formalization	Formalization refers to the extent to which there are well-identified rules, procedures, and/or standardized methods for routine activities as well as unusual occurrences.
Goal Setting/ Prioritization	Goal setting/prioritization refers to the extent to which facility personnel understand, accept, and agree with the purpose and relevance of goals.
Interdepartmental Communication	Interdepartmental communication refers to the exchange of information, both formal and informal, between the different departments or units. It includes both the top-down and bottom-up communication networks.
Organizational Cul- ture	Organizational culture refers to facility personnel's shared perceptions of the organization. It includes the traditions, values, customs, practices, goals, and socialization processes that endure over time and that distinguish an organization from others. It defines the "personality" of the organization.
Organizational Knowledge	Organizational knowledge refers to the understanding facility personnel have regarding the interactions of the organizational subsystems and the way in which work is actually accomplished within the facility.
Organizational Learning	Organizational learning refers to the degree to which individual facility personnel and the organization, as a whole, uses knowledge gained from past experiences to improve future performance.
Performance Eval- uation	Performance evaluation refers to the degree to which facility personnel are provided with fair assessments of their work-related behaviours. It includes regular feedback with an emphasis on improvement of future performance.
Performance Quality	Performance quality refers to the extent to which facility personnel adhere to their job requirements, carry them out correctly, and take personal responsibility for their actions and the consequences of those actions.
Personnel Selection	Personnel selection refers to the degree to which the organization effectively identifies and selects personnel who can meet the demands of the job and the degree to which the facility has personnel who can perform both the routine and unique aspects of their positions.
Problem Identification	Problem identification refers to the extent to which the organization draws upon knowledge, experience, and current information to identify potential problems.
Resource Allocation	Resource allocation refers to the manner in which the facility distributes its financial resources. It includes both the actual distribution of resources as well as individual perceptions of this distribution.
Roles and Responsibilities	Roles and responsibilities refers to the degree to which facility personnel's positions and departmental work activities are clearly defined and carried out.
Time Urgency	Time urgency refers to the degree to which facility personnel perceive schedule pressures while completing various tasks.
Training	Training refers to the degree to which facility personnel are provided with the requisite knowledge and skills to perform tasks safely and effectively. It also refers to facility personnel's perceptions regarding the general usefulness of the training program.

5. How do you establish and maintain competence in performing inspections?

All the activities bellow are deployed to ensure competence of assessments.

- By establishing a guideline for the organisation of NPPs
- By training on the job
- By lectures
- By exchange of information with other Regulatory Bodies
- By asking assistance to a consultant
- We also attend conferences, symposia, in the field to stay current. We are also engaging in a technology transfer exercise with the consultant.

6. When do you inspect the performance of the Licensees organisation?

- Periodically according to a basic inspection program:

Yes, our plan is to look at performance of Licensee organization at least once every licensing period. In addition our core compliance program also quality management audits.

- In case of events:

Yes, Event Investigations often extends to assessing event root causes that relate with organizational problems.

- In case of organisational changes:

Yes

- Other:

We inspect the performance of Licensee organization when it is faced with large special projects e.g. Plant Refurbishment.

Czech Republic

1. Do you inspect the following organisational structures?

WORKING PROCESSES	YES	NO
Power plant management	X	
Operation/stand-by duty	X	
Maintenance	X	
Technical support	X	
Fuel management and reactor monitoring	X	

Designing the working environment and instruments		X
Radiation protection	X	
Chemistry	Partially	
Security	X	
Emergency Organisation	X	
Plant's own safety committee	Occasionally	
Other (please detail)		
Safeguards	X	

2. Do you inspect the following working processes?

WORKING PROCESSES	YES	NO
Planning, implementing and monitoring special tasks		X
Personnel management		X
Qualification and training	X	
Reviews		X
Modifications	X	
Industrial safety measures		X
Correction and improvement	X	
Management of safety	X	
Other (please detail)		
Operation	X	
Quality Assurance	X	

3. Do you inspect the management of organisational changes, in the following domains?

Safety impact of organisational changes – Yes, we do.

Implementation of changes

In-house evaluation of change processes

Post implementation – Yes, we do.

4. Do you also inspect aspects of the organisational culture?

Communication – Yes, we do.

Co-operation, team working

Respect

Trust

Safety culture – Yes, we do.

5. How do you establish and maintain competence in performing inspections?

By establishing a guideline for the organisation of NPPs

By training on the job – Yes, we do.

By lectures – Yes, we do.

By exchange of information with other Regulatory Bodies – Yes, we do.

By asking assistance to a consultant – Yes, we do.

6. When do you inspect the performance of the Licensees organisation?

Periodically according to a basic inspection program – Yes, we do.

In case of events – Yes, we do.

In case of organisational changes – Yes, we do.

Note: The questions staying without response mean that the area is not covered by SUJB's activities.

Finland

1. Do you inspect the following organisational structures?

- Power plant management

Yes, the person appointed as a responsible manager or as his deputy, as well as persons who are responsible for the emergency planning, physical protection and nuclear material control of the nuclear facility, must have an approval from the Radiation and Nuclear Safety Authority (STUK) for this job.

- Operation/stand-by duty

Yes, the activities of operation and stand-by are regularly inspected by site inspectors, during the outage by inspection team working on site; there is also a special inspection in the periodic inspection program focusing the operations and operation organisation (inspection **B2 Operation**).

- Maintenance

Yes, especially during the outage there are several inspectors on site; there is also a special inspection in the periodic inspection program focusing the maintenance and management of ageing phenomena (inspection **B3 Power plant maintenance**).

– Technical support

Yes partly, technical support is a wide concept, and functions belonging to technical support are carried out by different organisational units, and they are subject of different inspections; The question "how the technical support is organised and which structures carry out its functions" is so far not inspected as a whole; it could be a theme in the inspection **A1 Safety management**.

However, there are special inspections in the periodic inspection program focusing different aspects of the technical support (in site or in external support organisation), e.g. the inspection **C5 The use of PSA in safety management** or theme operational experiences in the inspection **B2 Operation**.

– Fuel management and reactor monitoring

Yes, the regulatory oversight of fuel management and reactor monitoring are carried out by department of Nuclear Waste and Materials Regulation, and by the office of Reactor Safety in the department of Nuclear Reactor Regulation, respectively; and the inspections of the periodic inspection program focusing to these issues are the inspection **C8 Power plant waste management** and the inspections **BI Safety assessment and improvement** and **CI Plant safety functions**.

– Designing the working environment and instruments

Yes, in the review of plant modifications STUK also pays attention on the planning of working environment and instruments as well as on the human factors verification & validation process; the oversight of these aspects is under development and more conscious inspections process will be developed for the future

– Radiation protection

Yes, the office of Radiation protection in the department of Nuclear Reactor Regulation is responsible for the inspection of this function in the NPP's, and the inspection of the periodic inspection program focusing to these issues are the inspection **C9 Radiation protection**

– Chemistry

Yes, the office of Power Plant Technology in the department of Nuclear Reactor Regulation is responsible for the regulatory oversight of this function in the NPP's, and the inspections of the periodic inspection program focusing to these issues are the inspection **C7 Chemistry**.

– Security

Yes, the office of Safety Management in the department of Nuclear Reactor Regulation is responsible for the regulatory oversight of this function in the NPP's, and the inspection of the periodic inspection program focusing to these issues are the inspection **C12 Physical protection**; in addition, the security manager and the guarding organisation of the NPP need to be accepted by STUK.

- Emergency organisation

Yes, the office of Radiation Protection in the department of Nuclear Reactor Regulation is responsible for the inspection of this function in the NPP's, and the inspection of the periodic inspection program focusing to these issues are the inspection **C1, Emergency response arrangements**; in addition, the person responsible for emergency arrangements of the NPP need to be accepted by STUK and the functioning of the organisation is tested in yearly emergence training

- Plant's own safety committee

The activities of the plant's safety committee is followed regularly but at a general level by the office of Safety Management in the department of Nuclear Reactor Regulation; there is no special inspection focusing in the work of this committee, but the inspections **B1 Safety assessment and improvement** and **A1 Safety Management** may go through the committee work, depending on the specific theme chosen to the inspection; in addition the adequacy of the safety committee is assessed when the regulatory body is evaluating the administrative rules of the NPP.

2. Do you inspect the following working processes?

- Planning, implementing and monitoring special tasks

??? what special tasks??? e.g. operation is inspected continuously by site inspector, outage processes are specially inspected by inspectors on site

- Personnel management
- Yes, in the inspection **A1 Safety management**
- Qualification and training

Yes, the qualification and training of operators is specially inspected in connection with the acceptance (licence approval) process, the same holds for responsible manager, his deputy, as well as persons who are responsible for the emergency planning, physical protection and nuclear material control of the nuclear facility, in general the training and qualifications of the personnel are inspected in inspection **C13 Training and the management of personnel resources**, planned in coordination with the inspection **A1 Safety management**; additionally, the competences of personnel in charge of any special function of the NPP is assessed in the special inspection subjected to the function.

- Reviews

Yes, safety reviews of plant modifications in modification review process, reviews belonging to the quality management of the plant in scope of the inspection **C14 Quality assurance**

- Modifications

Yes, all plant modifications are inspected by STUK according to the safety classification of the structures and apparatus modified, before the modification is installed.

- Industrial safety measures

Yes, e.g. during the regulatory oversight of the outages. The radiation protection is the key question in the industrial safety oversight by nuclear regulatory body, but also compliance of rules and procedures. In addition, the industrial safety authority is inspecting the NPP's regularly, and the nuclear regulatory body is cooperating with them.

- Correction and improvement

Yes, improvements of plant structures and apparatus - see above (Modifications), at more general level also in inspections **BI Safety assessment and improvement** and **AI Safety Management** of the periodic inspection program.

- Management of safety

Yes, in the inspection **A1 Safety Management** of the periodic inspection program.

- Other (please detail)

In general: The periodic inspection programme is a combination of process based inspections and technical and organisational inspections. The programme has three levels: A, B, and C. A-level inspection is process based inspection and the topic is safety management. There are four inspections in level B. The inspections are operation, maintenance, safety assessment and protection (radiation, physical, fire, emergency preparedness). All the mentioned working processes are covered by the inspection programme.

3. Do you inspect the management of organisational changes, in the following domains?

- Safety impact of organisational changes
- Implementation of changes
- In-house evaluation of change processes
- Post implementation
- Other

In general: All organisational changes have to be informed to STUK. Most important changes have impact to the administrative rules of the utility organisation, which shall be submitted to STUK for approval, and to the organisation manual, which is sent to STUK for information. STUK reviews the documents and organises a special hearing if necessary; also the acceptability of the change itself is decided.

For the present there are no detailed requirements on the implementation of organisational changes, thus there is also no specific inspection on that. Regulatory guide YVL 1.7 concerning training and competences is under revision. The revised guide will define the requirements for safety assessment of licensee organisation and for modification process.

The implementation of organisational change has been a special theme in the inspection **A1 Safety management** of the periodic inspection program, where it has been discussed as an issue of safety culture and safety management.

4. Do you also inspect aspects of the organisational culture?

- Communication
- Co-operation, team working
- Respect
- Trust
- Safety culture
- Other

In general: The issues listed above are discussed in the inspection **A1 Safety management** of the periodic inspection program. However, the cultural issues are also touched in all other inspections and document review, and safety culture is taken as an explicit theme in the Ai inspection when the inspectors have perceived special reasons to suggest that there are possible safety culture concerns. However, these issues are always treated in connection with concrete events or processes, never as abstract themes.

In accordance with safety related incidents STUK is performing investigations and safety culture is always one topic.

5. How do you establish and maintain competence in performing inspections?

- By establishing a guideline for the organisation of NPPs

??? not understandable question if means whether there is a guide for the inspection of the organisation of the NPP, the answer is no, but we have a list of issues which are related to the operation, culture and habits of the organisation, circulated to the inspectors with aim to collect findings related to these issues

- By training on the job

Yes, e.g. it is usual, that the novice inspectors carry out their first inspections with an experienced colleague

- By lectures

Yes, major training being implemented every three-four years with outside trainers

- By exchange of information with other Regulatory Bodies

Yes, training visits of 6-12 months have been used, the target institutions being SSI (Sweden)and USNRC

- By asking assistance to a consultant

Yes, but this is a rarely used practice (one example during the last 5 years)

- Other

STUK has an internal guide for inspection programme. The guide gives general advice to perform an inspection. The manager of the inspection programme organises the assessment and planning meetings annually. In those meetings also the inspection methods and needed training needs are discussed. It is also recommended that all the inspectors would participate on the "lead auditor" training courses.

STUK also has competence requirements for inspectors (used in recruitment), a training program for newcomers, as well as regular updating training (including simulator training in NPP full scale simulators).

6. When do you inspect the performance of the Licensees organisation?

- Periodically according to a basic inspection program

Yes, this is seen as a very important practice

- In case of events

Yes, both less formal discussions of site inspector and (most often) an inspector team at site, and formal **event investigations**, when serious or complicated events have occurred or wide organisational root courses are suggested

- In case of organisational changes

Yes, when reviewing the administrative rules of the utility organisation a small-scale or function-based discussion or inspection on the performance may be carried out

- Other

The performance of the organisation is mainly supervised through the normal inspection activities, review and assessment work and through the daily work of the resident inspector. The performance is also supervised systematically with the STUKs indicator system.

France

1. Do you inspect the following organisational structures?

WORKING PROCESSES	YES	NO	Notes
Power plant management	X		Through management of safety
Operation/stand-by duty	X		At least once a year
Maintenance	X		Through specific themes
Technical support	X		License headquarters
Fuel management and reactor monitoring	X		License headquarters
Designing the working environment and instruments	X		

Radiation protection	X		
Chemistry	X		
Security		X	This item is controlled by another administration
Emergency Organisation	X		
Plant's own safety committee	X		Management of safety inspections

2. Do you inspect the following working processes?

WORKING PROCESSES	YES	NO	Notes
Planning, implementing and monitoring special tasks	X		Steam generator replacement
Personnel management		X	
Qualification and training	X		
Reviews	X		
Modifications	X		Every 3 years
Industrial safety measures		X	This item is controlled by another administration
Correction and improvement	X		
Management of safety	X		

3. Do you inspect the management of organisational changes, in the following domains?

- Safety impact of organisational changes:

Yes if it's relevant (for instance changes in operating team organisation)

- Implementation of changes:

yes if relevant (for instance radiation protection)

- In-house evaluation of change processes:

Yes if relevant

- Post implementation:

Yes if relevant

4. Do you also inspect aspects of the organisational culture?

- Communication:

Yes (communication between services + human factor inspections)

- Co-operation, team working:

Yes

- Respect:

No

- Trust:

No

- Safety culture:

Yes

5. How do you establish and maintain competence in performing inspections?

- By establishing a guideline for the organisation of NPPs

Yes

- By training on the job:

Yes

- By lectures:

No

- By exchange of information with other Regulatory Bodies:

Yes

- By asking assistance to a consultant:

Yes

6. When do you inspect the performance of the Licensees organisation?

- Periodically according to a basic inspection program:

- Yes

- In case of events:

- Yes

- In case of organisational changes:

- Yes, if relevant

Germany

1. Inspection of organisational structures

Power plant management, Operation/stand-by duty, Maintenance, Radiation protection, Security:

Recent events in NPPs have indicated a need for improved processes for management of safety. It has become evident that the safety of operation does not rely solely on technical descriptions and procedures, but also on managerial aspects and processes. Human factor and human behaviour affect not only the safety performance of individual persons but also of complex organisational structures.

The actual structure of the plant organisation is within the full responsibility and at the sole discretion of the licensee, provided it accounts for the requirements specified for the responsible persons as well as for the general requirements regarding quality assurance e.g. KTA-safety standards. The organisational structure with the related tasks, responsibilities, and subordination has to be described in separate sections of the so-called safety specification (SSP) which is part of the operation manual and must be submitted to the licensing and supervisory authority. Any modification of the SSP is implemented according to an established process and needs approval by the supervisory authority. Aspects of the power plant management are assessed selectively on reviewing of actually occurred events (reportable events), and on the occasion of the inspection of the licensee's human factor process. The compliance with the rules of the SSP concerning operation/stand-by duty, maintenance, radiation protection and security is inspected by random tests on the occasion of site inspections.

Emergency organisation

The structure of the emergency organisation and the activities in case of an emergency are regulated in the emergency manual. The emergency manual was reviewed by experts and approved by the regulatory authority (licensing / supervisory authority). Any modification of the emergency manual is implemented according to an established process and needs approval by the supervisory authority. The emergency organisation and the working processes in case of an emergency are inspected regularly by the supervisory authority and their expert organisation on the occasion of emergency exercises and drills.

Technical support, fuel management and reactor monitoring, designing the working environment and instruments, chemistry

In these cases the organisational structures are not inspected explicitly. But the responsible persons have also to meet the license prerequisites of trustworthiness and required technical qualification. The outcome of the work of these organisational structures is inspected as far as it is related to safety. If the outcome of the work of these organisational structures shows any indicators for a deficiency in the organisational structures, the deficiency must be remedied.

Plant's own safety committee

In each plant the licensee nominates a Nuclear Safety Officer according to the Nuclear Safety Officer and Reporting Ordinance – AtSMV. The nomination needs approval by the supervisory authority. The duties of the Nuclear Safety Officer are defined in the AtSMV.

Other

The SSP contains further sections which also rely on organisational structures and measures: A section about alarming in case of dangers and incidents, a section about fire protection and a section about first aid. The process for establishing and for modifications of these sections of the SSP is the same as described above. The compliance with the rules of the SSP concerning alarm and fire protection is inspected by random tests on the occasion of site inspections.

2. Inspection of working processes

Planning, implementing and monitoring special tasks

Plant modifications, modifications in the SSP of the operation manual, modifications in the emergency manual, modifications in the periodical tests and the refuelling must be applied for and need approval by the supervisory authority. The related working processes are to be described in designated procedures and in additional papers that deal with further technical details and details of quality assurance. Inspections are carried out on compliance to the processes and the technical rules.

Personal management

The working process of personal management is not inspected.

Qualification and training

The qualification and training of the licensed staff has to meet the requirements of the relevant national guidelines. The compliance with the guideline has to be documented. The initial training of the responsible shift personnel is proved by a written and an oral examination. The documentation of retraining and maintaining of competence is inspected by means of site inspections.

Reviews

The state authority and their expert organisation both carry out reviews (site inspections), the experts act by order of the regulatory authority.

Modifications

(see planning, implementing and monitoring special tasks)

Industrial safety measures

Industrial safety measures are inspected by different competent authorities. Radiation protection organisation is described in a section of the SSP (see Question 1) and inspected by the regulatory supervisory authority, in some cases supported by subordinate authorities.

Correction and improvement

There is no general inspection of a working process for implementing correction and improvement measures. Inspections and review of correction and improvement process are selectively carried out on the occasion of concrete reportable events that require such

correction and improvement measures. Correction and improvement processes are not only important for reportable events in the plant itself but also for events in other plants. The relevant information is disseminated by the Gesellschaft für Anlagen- und Reaktorsicherheit (GRS) by an information notice.

Management of safety

The management of safety at present is inspected on a reactive basis on the occasion of concrete operational events, mostly reportable events. All licensees in Germany were requested by the supervisory authority to develop an indicator-based systematic programme for management of safety. The development and implementation of the management of safety programme was started by the licensees in the year 2003. The regulatory authority expects improvement of management of safety.

Establishing a guideline for the organisational structure of NPPs

On behalf of the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety an expert organisation is compiling requirements for a safety management of the licensee.

Other

(see planning, implementing and monitoring special tasks)

3. Inspection of the management of organisational changes

The outcome of the management of organisational changes is inspected as far as there are effects on modifications of the SSP (see Questions 1 and 2).

4. Inspection of aspects of the organisational culture

Aspects of the organisational culture, primary aspects of team work, like communication, co-operation and management of interfaces, at present are inspected selectively on the occasion of concrete events and on the occasion of inspections of the licensees human factor process.

5. Establishing and maintaining competence in performing inspections

Training on the job

Training on the job is the main practice for maintaining competence in performing inspections. Young inspectors start to work under instruction of experienced inspectors before they gradually begin to perform autonomous inspections.

Despite state budget constraints, some regulatory inspection authorities of the competent *Länder* have hired special experts, such as psychologists, to inspect and review managerial aspects and human factor implications.

Lectures

All inspectors have to attend seminars, workshops and meetings, also about more general subjects for maintaining their competence. These measures serve to support the training on

the job of the young inspectors and serve to a continuous further training of the experienced inspectors till the end of their professional life.

Exchange of information

Exchange of information takes place in different bodies and working groups of the state authorities and of the expert organisations.

Asking assistance to a consultant

All German regulatory authorities intensively make use of experts and expert organisations to support their regulatory inspection and review tasks. In specific cases, which need special knowledge that is not (yet) available in the staff of the state authority and their expert organisation further institutions like universities or research institutes are consulted.

Other

To be an inspector working for the state authority or for an expert organisation requires an appropriate education. Normally this is a university degree in the field of natural science or in the field of engineering science or a degree in an advanced technical college.

6. Timing of the inspections of the performance of the Licensees organisation

Periodical inspections

Site inspections, like mentioned above, are carried out periodically according to a basic inspection programme and in some cases contain managerial aspects as described. At present, there are no periodical inspections foreseen dedicated solely to management aspects and safety management. On introducing an indicator-based systematic programme for management of safety the regulatory inspection authorities have to incorporate appropriate inspections on this programme and its performance.

Inspections in case of events

Inspections in case of events involving managerial factors, are carried out as indicated above, and in close timely connection to the related event. It is the objective of the regulatory authorities in Germany, that by introducing the systematic programme on management of safety involving also safety indicators the proactive inspection activities become more efficient than it is the case in the current use of event based reactive inspections only.

Inspections in case of organisational changes

As organisational changes which are related to safety are to be reviewed and approved by the regulatory inspection authority, (see question 3).

Other

Hungary

1. Do you inspect the following organisational structure?

ORGANISATIONAL STRUCTURE	YES	NO
Power plant management	X	
Operation/stand-by-duty	X	
Maintenance	X	
Technical support		X
Fuel management and reactor monitoring	X	
Designing the working environment and instruments		X
Radiation protection		X
Chemistry	X	
Security	X	
Emergency organisation	X	
Plant's own safety committee		X
Other (please detail)		

2. Do you inspect the following working processes?

WORKING PROCESSES	YES	NO
Planning, implementing and monitoring special tasks	X	
Personnel management		X
Qualification and training	X	
Reviews	X	
Modifications	X	
Industrial safety measures		X
Correction and improvement	X	
Management of safety		X
Other (please detail)		

3. Do you inspect the management of organisational changes, in the following domains?

DOMAINS	YES	NO
Safety impact of organisational changes	X	
Implementation of changes		X
In-house evaluation of change processes		X
Post implementation		X
Other		

4. Do you also inspect aspects of the organisational culture?

ASPECTS	YES	NO
Communication		X
Co-operation, team working		X
Respect		X
Trust		X
Safety culture		X
Other		

5. How do you establish and maintain competence in performing inspections?

	YES	NO
By establishing a guideline for the organisation of NPP's		X
By training on the job	X	
By lectures		X
By exchange of information with other Regulatory Bodies		X
By asking assistance to a consultant		X
Other		

6. When do you inspect the performance of the Licensees organisation?

	YES	NO
Periodically according to a basic inspection program	X	
In case of events	X	
In case of organisational changes	X	
Other		

Japan

1. Do you inspect the following organizational structures?

- a) In Periodic Safety Management Review, JNES (Japan Nuclear Energy Safety Organization) examines the organization, inspection methods, management of processes, management of licensee organizations cooperating in the inspections, inspection records and education and training for inspections concerning the Licensee's Periodic Inspections. The review criteria used are the industry standard "Quality Assurance Rules for the Safety of Nuclear Power Stations," which are based on ISO 9001-2000 and approved by the Japanese government as satisfying all regulatory requirements.
- b) Accordingly, the organizational and structural items listed in the question are covered by PSMR. The review also includes surprise inspections.

- c) Safety Inspection by NISA covers the quality assurance system related to the licensee's safety-related activities, which includes the licensee's organizational structure for safety-related activities.
2. Do you inspect the following working processes?
- a) As mentioned above, the items of working processes listed in the question are basically covered by PSMR, which includes surprise inspections. Note, however, that personnel management to be reviewed concerns only the placement of personnel in the organization related to the licensee's periodic inspections.
- b) Also, in Safety Inspection, the quality assurance system related to the licensee's safety-driven activities shall be inspected, so that the various working processes can be checked in it.
3. Do you inspect the management of organizational changes, in the following domains?
- a) Organizational changes must basically be done on the licensee's own responsibility. However, the fitness for safety rule of licensee specifies the organization concerning the safety-related activities at nuclear energy facilities. The licensee, when carrying out organizational changes as specified in the safety regulations, must obtain governmental approval.
- b) Also, how the organizational changes implemented affect the safety-related activities are reviewed in our safety inspections and PSMR.
- c) As for the internal evaluation of changed processes, the licensees are required by law to conduct their internal audit. The internal audits should be examined in safety inspections and PSMR.
4. Do you also inspect aspects of the organizational culture?
- a) In Japan, the issue of the falsification in inspection records by Tokyo Electric Power Company revealed in August 2002, which gravely affected the national confidence in nuclear safety. It goes without saying that TEPCO should restructure its safety culture and implement it on its own responsibility. At the same time, one objective of the new inspection system is to introduce quality assurance as a system to ensure safety-related activities by the licensees. Therefore, the NISA, in cooperation with JNES, is grappling with the verification of the systems in safety-related activities at the licensee organizations.
5. How do you establish and maintain competence in performing inspections?
- a) Qualifications for NISA inspectors are stipulated by the government ordinances according to the Electricity Utilities Industry Law or the Law for the Regulations of Nuclear Source Material, Nuclear Fuel Material and Reactors. Qualifications for inspectors and reviewers from JNES are stipulated by the ministerial ordinance concerning inspections and other matters to be conducted by JNES according to the Electricity Utilities Industry Law. JNES inspectors and examiners are appointed by President of JNES from among those who have sufficient scholastic aptitude and experience and have finished the training specified by the Minister of Economy, Trade and Industry.
- b) The inspectors and examiners are further encouraged to attend courses of lectures and academic seminars conducted by external organs so as to develop their professional capacities.

- c) In newly introduced PSMR, the review team can get support from a supervisor, and the inspectors who do not belong to the review team are allowed to participate in the review as observers, thus gaining OJT training.
- d) Likewise, the NISA inspectors are also required to take trainings to improve their capabilities.
6. When do you inspect the performance of the Licensees organization?
- a) Trough PSMR, JNES reviews the licensee's performance, maintenance and improvement of the quality management system, and then NISA evaluates those results.
- b) Also, NISA conducts Safety Inspection to check for the proper performance of the licensee's organization in their safety-related activities as part of the quality assurance system.
- c) Whenever any serious trouble occurs, the NISA carries out extremely strict inspections.
- d) As well as during normal operation, safety inspectors of NISA inspect properly Licensee's organization by patrol as needed.

Korea

1. Do you inspect the following organisational structures?

In Korea, there are five kinds of inspections: periodic inspection, preoperational inspection, QA inspection, special inspection and daily inspection. Periodic inspection is carried out for the operating plants during the refuelling outage and preoperational inspection is carried out for the commissioning plants. QA inspection is performed for all plants and major vendors. Special inspection is performed when important safety issues are found. These inspections are carried out by Korea Institute of Nuclear Safety (KINS) while daily inspections are carried out by the resident office at plant sites.

ORGANISATIONAL STRUCTURE	YES	NO	TYPE OF INSPECTION
Power plant management	X		Periodic inspection (every cycle) and QA inspection
Operation/stand-by-duty	X		Periodic inspection (every cycle) and QA inspection
Maintenance	X		Daily inspection and QA inspection
Technical support	X		Periodic inspection (every cycle) and QA inspection
Fuel management and reactor monitoring	X		Periodic inspection (Core physics tests and fuel inspection at every cycle), Daily inspection
Designing the working environment and instruments	X		Periodic inspection (every cycle)
Radiation protection	X		Periodic inspection (every cycle)
Chemistry	X		Periodic inspection (every cycle)
Security	X		Daily inspection by resident office

Emergency organisation	X		Periodic inspection (every cycle) , Emergency exercise with provincial government(every year for twin unit, once for 3 years for each plant site)
Plant's own safety committee	X		Periodic inspection (every cycle), QA inspection
Other (please detail)			
Effluent and waste	X		Periodic inspection (every cycle) and daily inspections by resident office
Radio-monitoring: Systematic	X		Periodic inspection (every cycle)
Fire protection	X		Periodic inspection (every cycle)
Quality Assurance	X		QA inspection for the operating plants(every 2 years) and the commissioning plants(every year)
Training facilities and structures	X		Periodic inspection (every cycle), QA inspection
Experience feedback service	X		Periodic inspection (every cycle), QA inspection

2. Do you inspect the following working processes?

The following processes are inspected in the periodic inspection programme and QA inspection programme.

ORGANISATIONAL STRUCTURE	YES	NO	TYPE OF INSPECTION
Planning, implementing and monitoring special tasks	X		Periodic inspection (every cycle) and QA inspection
Personnel management	X		Periodic inspection (every cycle) and QA inspection
Qualification and training	X		Periodic inspection (every cycle) and QA inspection
Reviews	X		Periodic inspection (every cycle) and QA inspection
Modifications	X		Periodic inspection (every cycle) and QA inspection
Industrial safety measures		X	
Correction and improvement	X		Periodic inspection (every cycle) and QA inspection
Management of safety	X		Periodic inspection (every cycle) and QA inspection

3. Do you inspect the management of organisational changes, in the following domains?

a) Safety impact of organisational changes:

The application of organisational changes should be submitted to the regulatory authority for approval before it's implementation, and is reviewed by Korea Institute of Nuclear Safety (KINS). The application should include detailed description of the changes in structures and

functions. The task, responsibility and qualification for each position are reviewed in detail. The implementation of the approved organizational changes are inspected by the periodic inspection and QA inspection.

b) Implementation of changes:

Only after the application of organizational changes with the revisions of the relevant FSAR section is approved, the licensee can implement the modification. Other plant documents including the administrative procedures and the technical procedures are also subject to changes.

c) In-house evaluation of change processes:

In the licensing review of organizational changes, the reason of changes and the expected effects are evaluated by KINS. During the licensing review, meeting with utility for discussion is usual process.

d) Post implementation

With the accumulated inspection results after the implementation, the effect of the changes is reviewed and recommendations for further improvement are discussed with the licensee.

4. Do you also inspect aspects of the organisational culture?

Organisational culture is not a regulatory requirement.

a) Safety culture

1. Although we do not inspect safety culture, we have been communicated with utility this matter and the utility is trying to expand the safety culture to it's employees and vendors.

5. How do you establish and maintain competence in performing inspections?

a) By establishing a guideline for the organisation of NPPs:

The organization of NPP is reviewed in the process of plant licensing. There are 'Safety Review Guidelines' which contain the basic principles and requirements of the plant organization. We also have 'Periodic Inspection Guidelines' and 'QA Inspection Guidelines' which contain the inspection of the organizational aspects.

b) By training on the job:

The inspector qualification program in Korea requires that newly assigned inspectors participate in inspections together with senior inspectors for the training period. Training of inspectors at the foreign organizations or regulatory bodies is done irregularly.

c) By lectures:

We have inspector qualification systems which mandate the inspectors to meet the minimum requirements for each specialized inspection area. For the renewal of inspector

qualification, internal lectures are given to inspectors performing inspections on the organizational aspect of NPPs.

d) By exchange of information with other Regulatory Bodies:

To discuss specific problems, short term visits to foreign regulatory organizations and invitations of foreign regulatory experts are often.

e) By asking assistance to a consultant:

Not usual but in some cases, we ask external consultant to review specific issues to improve the objectivity of our analysis.

6. When do you inspect the performance of the Licensees organisation?

a) Periodically according to a basic inspection program

The organizational aspect of the plant are inspected during periodic inspection at every refuelling outage. QA inspection also covers inspection on licensee organization.

b) In case of events:

We do not inspect the plant organizational performance for all specific events. The above mentioned periodic inspection and QA inspection include review of all the accumulated performance after the previous inspection.

c) In case of organisational changes:

Same as the above answer.

The effects of organizational changes can be monitored by periodic inspection and QA inspection.

Mexico

1. Do you inspect the following organisational structures?

ORGANISATIONAL STRUCTURE	YES	NO	COMMENTS
Power plant management	X		
Operation/stand-by-duty	X		
Maintenance	X		
Technical support	X		
Fuel management and reactor monitoring	X		
Designing the working environment and instruments	X		
Radiation protection	X		
Chemistry	X		
Security	X		CNSNS has a special department for this organisational structure
Emergency organisation	X		
Plant's own safety committee	X		
Other (please detail)			Quality Assurance

2. Do you inspect the following working processes?

WORKING PROCESSES	YES	NO
Planning, implementing and monitoring special tasks	X	
Personnel management		X
Qualification and training	X	
Reviews	X	
Modifications	X	
Industrial safety measures		X
Correction and improvement	X	
Management of safety		X
Other (please detail)		

3. Do you inspect the management of organisational changes, in the following domains?

DOMAINS	YES	NO
Safety impact of organisational changes	X	
Implementation of changes	X	
In-house evaluation of change processes		X
Post implementation		X
Other		

4. Do you also inspect aspects of the organisational culture?

ASPECTS	YES	NO
Communication	X	
Co-operation, team working	X	
Respect		X
Trust		X
Safety culture		X
Other		

5. How do you establish and maintain competence in performing inspections?

	YES	NO
By establishing a guideline for the organisation of NPP's		X
By training on the job	X	
By lectures	X	
By exchange of information with other Regulatory Bodies	X	
By asking assistance to a consultant		X
Other		

6. When do you inspect the performance of the Licensees organisation?

	YES	NO
Periodically according to a basic inspection program	X	
In case of events	X	
In case of organisational changes		X
Other		

Spain

1. Do you inspect the following organisational structures?

Since they came into operation, all the Spanish NPPs are required to present to the CSN (Spanish Nuclear safety Council) prior approval any change in the structures or functions of their organisations. CSN Safety Guide 1.13 describes the contents of the licensing document "Operation Rules". This document includes a description of the utility's operating organisation. Also, more recently, the CSN is putting special emphasis in achieving that the licensees develop their own capabilities to make adequate organisational assessments, to implement the changes appropriately and to make an adequate follow up of them. The licensees must assure that the changes respond to the expectations and do not impact negatively on nuclear safety.

In this way, all these organisational structures are assessed and inspected. The CSN develops biennial Basic Inspection Plans on regular basis. Each Plan includes inspections that cover the whole set of technical disciplines or areas or activities related to nuclear safety. It is within the responsibility of the inspectors not only to inspect the performance of the licensees on each area or discipline, but to inspect the adequacy of the structures and processes put in place by the licensees from the point of view of safety.

In addition to those included in the Basic Inspection Plan, some inspections focused on organisational structures and resources have been carried out. They have been a reaction to very relevant organisational changes in some licensees or after some important events.

2. Do you inspect the following working processes?

Yes, all these working processes, and another like safety management investments, are inspected. See the response to question n. 1 for the different kind of inspections. Notwithstanding, some particularities are explained below.

Several of these processes have been historically inspected by the CSN, like qualification and training or like modifications.

Some others like management of safety and safety management investments are rather new, at least in a formal way:

In October 2002, one Spanish NPP was required to develop and implement a formal Safety Management System. Nowadays, a recently created CSN-Utilities group is working in order to define a similar requirement to all the Spanish NPPs. The Safety Management System has already been designed and partially implemented by this plant. Nowadays, all the plants are elaborating a common proposal that would be based basically in a process management approach developed by the Nuclear Energy Institute in USA. This proposal is under discussion with the CSN.

In October 2002, the same NPP was required to develop and implement an Investments Management System. Nowadays, all the Spanish utilities have already completed a generic guide that will be used as a common reference to develop the specific systems and procedures at each plant. The Investments Management System has been designed and is almost completely implemented by that plant. Nowadays, the other plants are developing their specific procedures, which are based on a generic guide. This guide was developed by the Spanish utilities taking also into consideration the process management approach developed by the Nuclear Energy Institute in USA.

In those new processes or issues, the main role of the CSN up to now has been to specify the requirements and to collaborate with the utilities in establishing acceptable guides to answer to these requirements. However, one inspection has already been done to the NPP previously mentioned for each of those two new issues. An inspection plan on those new issues is being prepared for the rest of the plants.

3. Do you inspect the management of organisational changes, in the following domains?

Yes, management of organisational changes is inspected in those domains.

In July 2000, all the Spanish NPPs were required to develop their own procedures to assess organisational changes with impact on human resources. In 2002 all the NPPs were required to extend the scope of such procedures to any kind of organisational changes. All the NPPs have already implemented internal procedures to manage organisational changes with impact on human resources. Nowadays, some NPPs have already completed, and others are still developing, such procedures for any type of organisational change. They are based on internationally accepted standards and good practices, included mainly in IAEA and NEA reports.

In this issue, the main role of the CSN up to now has also been to specify the requirements and to collaborate with the utilities in establishing acceptable guides to answer to these requirements. Anyway, several specific inspections have already been done for meaningful organisational changes, like the merge of two companies for the integrated operation and exploitation of resources of two different NPPs. Another inspections are being prepared related to the downsizing and early retirement of licensee staff in several plants.

4. Do you also inspect aspects of the organisational culture?

Since December 1995, the CSN Safety Guide 1.10 on Periodical Safety Reviews requests to all the Spanish NPP to develop an assessment and improvement program on Human and Organisational Factors and another one on Safety Culture.

The main criteria followed by the CSN is that the utilities are the first responsible of nuclear safety in their NPPs. So, the main CSN emphasis in this area is to encourage the NPPs to put in place all the processes needed to maintain adequate safety management systems and that these systems be developed by experts on these matters and taking into account internationally accepted standards. This includes, obviously, as an important part, the aspects of the organisational culture mentioned in the question. Related to that, it could be added that all the Spanish NPPs are encouraged (it is not a requirement at this moment) to apply periodically any sounded methodology on organisational self-assessment. A methodology has already been tested successfully in three Spanish NPPs. It includes cultural and other organisational aspects.

The CSN is following, mainly, a process-based regulatory approach on these issues. Licensees actions in response to this requirements are assessed and inspected by the CSN. But the CSN inspects, mainly, the processes put in place by the licensees to assess and improve those aspects of the organisational culture.

5. How do you establish and maintain competence in performing inspections?

Basically, all these mechanisms have been more or less used up to know to establish and maintain the competence in performing inspections. The CSN is trying to develop expertise and competence in these matters within its own organisation in the same way that it is requiring them within the licensees.

One of the most significant and recent events at the CSN on this issue was the organisation of a workshop on Safety Culture. It was given to some CSN staff with inspection responsibilities by the IAEA in May of 2003. The participants were the resident inspectors, the project managers and the human and organisational

factor specialists. It is the objective of the CSN to go on with this initiative by going in-depth on this training to the previously mentioned inspectors, by extending the training to other inspectors and by developing a formal plan of activities related to these issues.

6. When do you inspect the performance of the Licensees organisation?

In all those situations. All these approaches are complementary. As mentioned in the answer to question n. 1, the CSN develops biennial Basic Inspection Plans. Additionally, the CSN closely follows the licensees operating experience programs and, when an important event happens, an inspection could be organised. Also, as mentioned in response to question n. 4, the CSN has done specific inspections to meaningful organisational changes and, when considered necessary, it is assessing and inspecting other changes affecting the licensing document "Operating Rules".

It is considered that all these approaches are needed, although the CSN is trying to put more emphasis in a preventive and process-based approach, that means, not to react to this kind of organisational deficiencies just in case of events or very bad performance.

United Kingdom

1. Do you inspect the following organisational structures?

We regard organisational aspects and safety management systems as necessary elements of successful safe operations. The inspections we specifically do of licensees safety management systems are usually audits or similar, carried out in small teams and targeted on safety management. Site Inspectors, however are trained on safety management systems and all their inspections on specific other topics, would draw conclusions on safety management or organisational factors. So inspections could be categorised as "general" - which draw conclusions on safety management from inspections on other topics, or "specific", targeted on a particular aspect, which might be organisational. Important aspects of a licensee's activities may be targeted for specific inspections as a result of events, deteriorating performance, observations by Site Inspectors, etc. In general, inspections of any aspect, on-site or off-site may yield conclusions on organisational matters.

ORGANISATIONAL STRUCTURE	YES	NO	COMMENTS
Power plant management	X		Conclusions drawn from "general" inspections and "specific" inspections
Operation/stand-by-duty	X		Conclusions drawn from "general" inspections and "specific" inspections
Maintenance	X		Conclusions drawn from "general" inspections and "specific" inspections
Technical support	X		Conclusions drawn from "general" inspections and "specific" inspections
Fuel management and reactor monitoring	X		Conclusions drawn from "general" inspections and "specific" inspections
Designing the working environment and instruments	X		Conclusions drawn from "general" inspections and "specific" inspections
Radiation protection	X		Conclusions drawn from "general" inspections and "specific" inspections
Chemistry	X		Conclusions drawn from "general" inspections and "specific" inspections

Security		X	NII has no jurisdiction over security aspects
Emergency organisation	X		Conclusions drawn from “general” inspections and “specific” inspections
Plant’s own safety committee	X		Conclusions drawn from “general” inspections and “specific” inspections
Other (please detail)			
Licensee’s own safety oversight organisation	X		Conclusions drawn from “general” inspections and “specific” inspections
Quality Assurance	X		Conclusions drawn from “general” inspections and “specific” inspections
Qualifications, experience, instructions and Training	X		Conclusions drawn from “general” inspections and “specific” inspections
Modifications to plant	X		Conclusions drawn from “general” inspections and “specific” inspections
Records	X		Conclusions drawn from “general” inspections and “specific” inspections
Construction and commissioning of new plant	X		Conclusions drawn from “general” inspections and “specific” inspections
Modifications to organisational structure	X		Conclusions drawn from “general” inspections and “specific” inspections
Decommissioning	X		Conclusions drawn from “general” inspections and “specific” inspections
Radioactive waste management	X		Conclusions drawn from “general” inspections and “specific” inspections
Criticality	X		Conclusions drawn from “general” inspections and “specific” inspections

2. Do you inspect the following working processes?

As stated in the answers to Question 1, in general, inspections of any aspect, on-site or off-site may yield conclusions on organisational matters.

ORGANISATIONAL STRUCTURE	YES	NO	TYPE OF INSPECTION
Planning, implementing and monitoring special tasks	X		Conclusions drawn from “general” inspections and “specific” inspections
Personnel management	X		Conclusions drawn from “general” inspections and “specific” inspections
Qualification and training	X		Conclusions drawn from “general” inspections and “specific” inspections
Reviews	X		Conclusions drawn from “general” inspections and “specific” inspections
Modifications	X		Conclusions drawn from “general” inspections and “specific” inspections
Industrial safety measures	X		Conclusions drawn from “general” inspections and “specific” inspections
Correction and improvement	X		Conclusions drawn from “general” inspections and “specific” inspections
Management of safety	X		Conclusions drawn from “general” inspections and “specific” inspections

3. Do you inspect the management of organisational changes, in the following domains?

a) Safety impact of organisational changes:

Yes, a new Licence Condition (Licence Condition 36) was introduced in 2000 that requires licences to introduce a quality system to control changes to organisational structures and resources. Licensees, as part of this are required to have a system to assess the safety impact of the proposed change - we consider this to be very similar to the requirements for engineering change.

b) Implementation of changes:

Yes, to meet the requirements of Licence Condition 36. Licensees need in addition to plan changes and assess the safety during the implementation stage (not just for the end state). An important part of the planning function is the identification and management of pre-requisites (as in Engineering change projects). An example of a pre-requisite in this context might be the need to train staff in new functions before releasing staff in a downsizing. A further requirement for the implementation phase is the need to develop performance indicators which are specific to the change being proposed, this is particularly important as organisational change is often irreversible and it is therefore necessary to detect deterioration as soon as possible.

c) In-house evaluation of change processes:

Yes. A small sample of change proposals, particularly of those submitted to NII because they are of the highest category, are evaluated by NII. Site Inspectors routinely inspect the change register at every site. The whole process of change is inspected either by Site Inspectors or specialists.

d) Post implementation

Yes. Performance indicators are inspected after changes. Licensees are also expected to review all changes on a regular basis (say twice a year) for interactions. NII Inspectors sample these reviews. Baselines (see below) are expected to be reviewed in the Periodic Safety Review.

e) Other

Baselines - Licensees are expected to create baselines - the equivalent of a safety case for the organisational structure and human resources. The Baseline evaluates and justifies the tasks to be performed, the skills necessary and the available skills, together with the organisational structure.

4. Do you also inspect aspects of the organisational culture?

A small number of specific safety culture inspections are carried out. Site Inspectors, however have training to enable them to draw conclusions on safety culture. In general, inspections of any aspect, on-site or off-site may yield conclusions on organisational culture or safety culture matters.

a) Communication

This is recognised as an integral element in a licensee's Safety Management System. As such, it would sometimes be covered in specific inspections of safety management. Some specific inspections have been

carried out on communications. In general, inspections of any aspect, on-site or off-site may yield conclusions on communication.

b) Co-operation

This is recognised as an integral element in a licensee's Safety Management System. As such, it would sometimes be covered in specific inspections of safety management. I am not aware of any specific inspections done on this subject, but in general, inspections of any aspect, on-site or off-site may yield conclusions on this.

c) Respect

This is recognised as an integral element in a licensee's Safety Management System. As such, it would sometimes be covered in specific inspections of safety management. I am not aware of any specific inspections done on this subject, but in general, inspections of any aspect, on-site or off-site may yield conclusions on this.

d) Trust

This is recognised as an integral element in a licensee's Safety Management System. As such, it would sometimes be covered in specific inspections of safety management. I am not aware of any specific inspections done on this subject, but in general, inspections of any aspect, on-site or off-site may yield conclusions on this

e) Safety culture

Some specific inspections have been carried out on safety culture and in addition inspections of any aspect, on-site or off-site, may yield conclusions on safety culture.

f) Other

“Control” is also recognised as an integral element in a licensee's Safety Management System. As such, it would sometimes be covered in specific inspections of safety management.

5. How do you establish and maintain competence in performing inspections?

a) By establishing a guideline for the organisation of NPPs:

“Specific” inspections, either by specialists or Site Inspectors, are done against guidance, in a lot of the areas noted above. In some cases these guidance is quite general and considerable interpretation is made by specialists.

b) By training on the job:

Yes. For example, a secondary purpose of a team inspection is to give some experience of the topic in question to Inspectors who are less experienced.

c) By lectures:

Internal and external training courses are a major feature of gaining skills and experience.

- d) By exchange of information with other Regulatory Bodies:

Yes, the outcomes of International workshops, visits etc. inform NII's activities. We have long exchanges of inspectors irregularly with French and US RBs.

- e) By the assistance of a Consultant

Consultants are sometimes used to contribute to the development of regulatory approaches, especially in areas that are novel.

- f) Other:

NII is concerned on the licensing and regulatory aspects of complex organisations such as joint ventures, partnerships, alliances, parent/subsidiary structures etc.

NII is also considering how to inspect the organisational aspects of the Executive controlling organisation of a licensee.

6. When do you inspect the performance of the Licensees organisation?

- a) Periodically according to a basic inspection program

Yes.

- b) In case of events:

Yes. In particular, investigations often have an organisational component. Investigations are often carried out in small teams and conclusions on safety management or organisational factors are often made.

- c) In case of organisational changes:

Yes (see above).

- d) Other

When deteriorating safety performance is suspected and there is an organisational component to this.

United States

- 1 Do you inspect the following (listed) organisational structures?

The Nuclear Regulatory Commission (NRC) may examine certain organisational structures that are listed in the licensee's Technical Specifications or their Quality Assurance Plan. Standard Technical Specifications state:

"Lines of authority, responsibility, and communication shall be defined and established throughout highest management levels, intermediate levels, and all operating organization positions. These relationships shall be documented and updated in organization charts, functional descriptions of departmental responsibilities and relationships, and job descriptions

for key personnel positions. These requirements are for those personnel fulfilling the responsibilities of the positions delineated in licensee Technical Specifications and shall be documented in their Quality Assurance Plan.

The individuals who train the operating staff, carry out health physics, or perform quality assurance functions may report to the appropriate onsite manager; however, these individuals shall have sufficient organisational freedom to ensure their independence from operating pressures."

2 Do you inspect the following (listed) working processes?

Yes, in general, with the exception of personnel management, personnel competence, personnel capability, or optimal organisational structure.

3 Do you inspect the management of organisational changes in the following domains?

The applicant's operating organization, as described in its Safety Analysis Report (SAR), is reviewed. This section of the SAR should describe the structure, functions, and responsibilities of the onsite organisation established to operate and maintain the plant. This section of the SAR should demonstrate the applicant's commitment to and implementation of plans to staff the onsite operating organization and to define and delegate responsibilities to provide assurance that the plant can be operated safely.

In reviewing and evaluating the subject matter in this section of the SAR, the following points are considered:

Plant staff organisational structures are not rigidly fixed. However, experience has shown that certain components are common to and necessary for all plants. Among these are operational, onsite technical support, and maintenance groups under the direction and supervision of a plant manager.

The operating organization should be free of ambiguous assignments of primary responsibility. Operating responsibilities should be reasonably well defined in both numbers and experience of persons required to implement the project.

The total on-shift manpower available should include enough full operating-shift crews that excessive overtime is not routinely scheduled.

4 Do you also inspect aspects of the organisational culture?

The NRC inspects operational events such as Davis-Besse that stemmed at least in part from safety culture issues.

The NRC staff (through the inspection program) currently assesses the adequacy of safety culture attributes on a limited basis from plant performance. Throughout the NRC's Reactor Oversight Process (ROP), the overall adequacy of a licensee's safety culture can be inferred from these assessments. A direct assessment of overall safety culture is not performed, although some underlying elements of safety culture such as those aspects of safety culture associated with the identification and resolution of problems are currently assessed.

The NRC "Policy Statement on the Conduct of Nuclear Power Plant Operations" (54FR3424, 01/24/89), states that nuclear power plant licensees have the duty and obligation to foster the development of a strong

safety culture at each facility and to provide a professional working environment, in the control room and throughout the facility, that ensures safe operations.

5 How do you establish and maintain competence in performing inspections?

Manual Chapter 1245 of the NRC Inspection Manual, establishes the qualification program for inspectors. Inspectors have initial training requirements as well as refresher and continuing training as a means for updating and maintaining qualification. The qualification program ensures that the inspectors have the necessary knowledge and skill to successfully implement the inspection requirements.

Staff assigned to perform inspections must have successfully completed the applicable requirements of the qualification program within 24 months. The program includes formal training with lectures, inspector competencies and general orientation topics.

6 When do you inspect the performance of the Licensee's organisations?

Periodically according to a basic inspection program?

Yes, according to the ROP baseline inspection program. In case of events? - Yes, according to NRC Inspection Procedures IP 71153, 93800, and 93812 as appropriate to the situation and severity of the event. In case of organisational changes? - Yes, upon initial licensing and when a license transfer occurs.

INSPECTION ASPECTS OF PLANT NEAR OR AT END-OF-LIFE

Introduction:

The regulator's major interest is to maintain safety during operational life. At or near "end of life" operation particularly challenges this position in two ways: at a defined end of life and for an unknown but expected end of life.

The first is how to A) maintain corporate expertise and B) ensure objective decision making on improvements, as plant approaches a known end of life. The particular need from item A) is to maintain both the numbers of staff and the quality of expertise to an adequate standard during a period where quality staff will be attempting to move to better opportunities. And for point B), can a regulator accept a reduced standard of investment in improvement on an economic argument.

The second issue is what additional inspection practices need to be introduced as we move to an unknown but expected end of life point. In essence the workshop should discuss what methods exist to identify additional concerns arising during later periods of operation and what actual inspection requirements have already, or will need to be, introduced.

Questions

- 1) Considering an already fixed date for the final shutdown of an NPP,
 - a) What changes in inspection practices have been discussed in your countries?
 - b) How do you deal with the potential attempt of the Licensee to cut down financial means for further supporting the safety of the plant?
- 2) For plant with an unknown end of life date
 - a) What processes are adopted to determine the occurrence of new safety concerns in operation of plant in its latter years?
 - b) What key issues have so far arisen?
 - c) What changes of inspection practices have been introduced arising from these processes?
- 3) And for all
 - a) Are there any additional concerns in these areas so far not included?

Survey Responses

Belgium

1 Considering an already fixed date for the final shutdown of an NPP,

In Belgium, at the start-up of the NPP, there was no limit for their lifetime; only a safety decennial re-evaluations. The 31st January 2003, a law has been promulgated to stop the electricity production from NPP forty years after start-up. This can be re-evaluated in case of threat for electricity supplying. At this time, the programmed ends of life for the Belgian NNPs are then between 2015 and 2025.

- a) *What changes in inspection practices have been discussed in your countries? No, at this time.*
- b) *How do you deal with the potential attempt of the Licensee to cut down financial means for further supporting the safety of the plant?*

Permanent evaluation of the adequacy of the resources, of the reactivity capacity in case of important events, attitude in case of mechanical defects identification on important structural equipments.

2 For plant with an unknown end of life date

- a) What processes are adopted to determine the occurrence of new safety concerns in operation of plant in its latter years?
- b) What key issues have so far arisen?
- c) What changes of inspection practices have been introduced arising from these processes?

3 And for all

- a) Are there any additional concerns in these areas so far not included?
 - Ageing of the staff and loss of technical competencies.
 - Motivation of young people to study for license.
 - Licensee attitude against important projects or future decennial re-evaluations.

Canada

Foreword

The regulator's major interest is to maintain safety during operational life. At or near "end of life" operation particularly challenges this position in two ways: at a defined end of life and for an unknown but expected end of life.

The first is how to A) maintain corporate expertise and B) ensure objective decision making on improvements, as plant approaches a known end of life. The particular need from item A) is to maintain both the numbers of staff and the quality of expertise to an adequate standard during a period where quality staff will be attempting to move to better opportunities. And for point B), can a regulator accept a reduced standard of investment in improvement on an economic argument.

The second issue is what additional inspection practices need to be introduced as we move to an unknown but expected end of life point. In essence the workshop should discuss what methods exist to identify additional concerns arising during later periods of operation and what actual inspection requirements have already, or will need to be, introduced.

1 Considering an already fixed date for the final shutdown of an NPP,

a) *What changes in inspection practices have been discussed in your countries?*

Our actual experience has evolved from a case where the time between announcement of shutdown and shutdown date was small (6 months). Inspections remained the same until the unit was de-fuelled, then inspections were modified to suit the new configuration.

b) *How do you deal with the potential attempt of the Licensee to cut down financial means for further supporting the safety of the plant?*

Our actual experience has evolved from a case where the time between announcement of shutdown and shutdown date was small (6 months). With regulatory approval some capital projects had their completion dates extended to "prior to (an eventual) restart". This was done on a case by case basis with some cost/benefit arguments being used.

2 For plant with an unknown end of life date

a) *What processes are adopted to determine the occurrence of new safety concerns in operation of plant in its latter years?*

Operating Licences are issued by the CNSC for a specific period (in the range of 2 to 5 years). The periodic re-licensing process and subsequent regulatory inspection are designed to ensure that the safety risk remains bound by the risks defined in the licensing basis. CNSC is presently evaluating the possibility of introducing to its licensing process the requirement for Periodic Safety Reviews.

b) *What key issues have so far arisen?*

Predicted plant life has been significantly shortened by material problems: (Hydrogen uptake on Zircalloy Heat Transport Pressure Tubes, Erosion corrosion in Heat Transport pipes (feeders)) and Stress corrosion cracking of boiler tubes has limited the life of one station.

Finland

1 Considering an already fixed date for the final shutdown of an NPP,

- a) *What changes in inspection practices have been discussed in your countries?*
- b) *How do you deal with the potential attempt of the Licensee to cut down financial means for further supporting the safety of the plant?*

No plants in shutdown-phase.

2 For plant with an unknown end of life date

- a) *What processes are adopted to determine the occurrence of new safety concerns in operation of plant in its latter years?*

The normal regulatory practices - inspections, records (of failures, transients) periodic safety reviews, oversight on utilisation of operational experiences - have been efficient also in issues related to plant ageing. A regulator-driven discussion on ageing phenomena has been going on for a rather long period, and the NPP's have understood the need to systematic follow-up of plant condition. The main result is, that the NPP's have developed their activities with aim to identify symptoms of ageing in a early stage, e.g. early replacement of unreliable equipment, and new organisational unit has been founded for this task in one plant.

- b) *What key issues have so far arisen?*

for example:

water chemistry is top priority: the need to be very accurate and careful with water chemistry (and purity) has been identified in a early stage of plant life, and this is seen as a key factor for the condition of the primary and secondary circuits

the embrittlement of RPV is followed by accurate inspections by the utility; the regulatory body gets the results and follows the development

the crack in the shroud tube of a control rod was found in a regulatory check

the vibrations of pumps have accelerated ageing phenomena; thus the vibrations, their reasons and means to control them have been studied in depth

cables inside containment in spaces with high temperature.

- c) *What changes of inspection practices have been introduced arising from these processes?*

As the ageing of the plants has been one theme in the periodic inspection program for years, no significant changes have been made lately. In general, the regulatory body has paid much attention to the ageing problems also during last years, and the yearly reports on ageing follow-up programs have been required from the NPP's.

3 And for all

a) *Are there any additional concerns in these areas so far not included?*

the human and organisational factors related to shut-down; they are a subject in a SEGHOFF-driven discussion in CNRA workshop on decommissioning, to be held in Rome, September 2004

Lifetime Management also includes maintenance of skills and knowledge of the operating organisation:

- training of personnel
- improving operating procedures
- keeping plant design documentation updated
- ensuring availability of adequate knowledge on the key design features of each equipment

France

1 Considering an already fixed date for the final shutdown of an NPP...

- a) What changes in inspection practices have been discussed in your countries ?
- b) How do you deal with the potential attempt of the licensee to cut down financial means for further supporting the safety of the plant ?

a) In France, as all the nuclear power plants are operated by a state company, the risk of major cut down of financial means is quite low. That is why no major change was introduced in our inspection practice. But, in the forthcoming years, the risk will exist, because of the opening of the electricity market, and the competition between electricity companies. For this reason, we already pay attention to the reducing of the test and maintenance operations, and to the safety indicators.

By now, the financial aspects are not discussed during routine inspections or technical surveillance of the plants. But, if the licensee refused to deal with technical topics, because of financial reasons, we could organise specific inspections to evaluate the balance sheet and the financial means of the licensee.

Furthermore, we meet the board of the plant every year for the global safety report. Generally the discussion includes safety results but also regulation, production, social and economic aspects. This meeting is the adequate place for being informed of financial difficulties.

b) When the safety indicators of a plant worry us, the plant can be placed under reinforced surveillance, which consists in more inspections (about twice) and a specific monitoring, with many reports and specific meetings between the licensee and the regulator.

In case of important safety issues, as the nuclear safety authority grants authorisations for the plants to operate, it is possible to limit the operation-life of the plant, or to cancel the plant's license (temporarily or definitively).

The French nuclear safety authority is also in charge of informing the public about nuclear safety. If important safety concerns arose without the will of the NPP owner to sort them out, the media profile of

the situation would give a bad image to the company. This would help us to prod the licensee into investing in the plant safety.

The safety after final shutdown of an installation is also part of the initial authorisations which are granted to the licensee.

2 For plant with an unknown end of life date...

- a) What processes are adopted to determine the occurrence of new safety concerns in operation of plant in its latter years ?

The most important process to identify new safety concerns is the conformity examination and the safety revalue. The compliance of the plant and its systems with original standards, and with the most recent standards are examined by licensee. The reviewing is examined by the Nuclear Safety Authority and its technical supports.

For the deviations from the original standard the operator has to find solutions to be allowed to continue operating the plant.

For the deviations from more recent standards, the operator has to study the possible solutions to comply with new rules. The decisions are taken regarding the importance of the deviations and regarding if the new standards can be achieved (technically and financially).

In the discrepancies are too important, the regulator can enjoin the licensee to definitively stop operating an installation.

The second process is the ageing surveillance programme, which has been discussed with EDF, to identify the most sensible components of the plants regarding ageing phenomena. Two families were listed, components which could be replaced and others. For each component, EDF proposed a strategy to identify the ageing phenomena and to limit them by minimising the transient of the systems. In case a new ageing phenomena is found, the licensee has to check that it does not concern similar systems.

- b) What key issues have so far arisen?

Key issues revealed by this approach were mainly:

- seismic resistance of the installations,
- ageing phenomena of rubbers and concrete,
- resistance to external hazards
- accident scenarios .

Most of them were resulting from changes in calculation methods and new experience feedback. Discussions were all the more important that the solutions were technically complicated and expensive.

- c) What changes of inspection practices have been introduced arising from these processes ?

Main safety concerns found are usually integrated to the inspection priorities. For example, the resistance to external hazard was defined as a priority of inspection in 2002, meaning that all PWR shall be inspected in a year.

3 And for all...

The corporate level of expertise is inspected through the ‘Estimated Jobs and Proficiency Forecast’. The licensee has to manage the needs for the jobs essential for safety, and for the specific needs regarding the decommissioning tasks. This prevision, generally done for ten years has to take into account departures and arrivals of the staff. By now, this approach was successful for the jobs important for nuclear safety, but not really for decommissioning, because of the difficulties to schedule precisely the different works.

Germany

The Atomic Energy Act was amended to introduce the phase-out policy for the use of nuclear energy for electricity production and subsequently several other nuclear regulations. It came into effect on 27 April 2002.

It made fundamental changes to the objectives of the 1959 Atomic Energy Act: instead of aiming to promote nuclear energy, the purpose of the Act now is to phase out its use in a structured manner.

The main points of the act in this sense are:

- a ban on the construction of new nuclear power plants
- restriction of the so-called residual operating life to a equivalent of 32 years as of the commissioning of the plant
- each nuclear power plant was assigned a corresponding residual electricity volume
- electricity volumes of older NPPs can be transferred to newer plants
- legal stipulations for regular safety reviews

Consequently in Germany the final shut down of all NPPs is fixed based on the electricity volumes, with the final dates depending on the electricity actually produced.

The operation of NPP's in Germany is intensively supervised by regulatory authorities of the Federal States (*Länder*). Corresponding principles and requirements are laid down in the Atomic Energy Act, in ordinances, in regulations and in the operating license of NPP's. The supervisory authorities consult technical expert organizations.

Supervising activities performed by the authority and the experts comprise evaluation of technical documents as well as on-site inspections at the NPP itself. On this occasion the behavior of the licensee can also be evaluated with regard to cost reducing actions.

Inspection activities of the authority and the consulted technical experts concentrate on the following points:

- Periodical tests of safety-related facilities
- Events/Incidents at the plant
- Events/Incidents at other plants (Information Notice - “GRS-Weiterleitungsnachrichten”)

- Overall maintenance inspection and core refueling
- Technical modifications of the NPP, modification of the organization structure and of the personnel responsibilities and modification of the plant operating procedures
- Periodical inspections and functional tests of all safety-related facilities (structures, components, systems) of the plant
- Compliance with licensing requirements
- Elimination of realized deficiencies
- Technical qualification of the staff and trustworthiness of the licensee

In accordance with the current practice there are no signs that manner or intensity of the governmental supervision will change. However, it is planned to include the licensee's safety management system (including the used indicators) into the supervision process.

Japan

Foreword

Japan has the experience of decommissioning the research reactor JPDR. The Tokai Nuclear Power Station (GCR), whose decommissioning was decided in 1998, is today in the process of decommissioning. Another plant whose decommissioning has been decided on is Fugen, which is a nuclear reactor at a stage of research. While many commercial reactors aged over 30 years are operating in Japan, there are no other plants whose decommissioning has been decided in recent years.

Periodic Safety Reviews are conducted on all the plants at intervals of about ten years. Furthermore, for the plants of 30 years or longer in use, the aging phenomena are evaluated, and long-term maintenance programs are drafted by licensee. Such evaluated information is reflected in the selection of the area and items of periodic inspections as well as in the decision on the frequency of the inspections.

1 Considering an already fixed date for the final shutdown of an NPP,

a) *What changes in inspection practices have been discussed in your country?*

Until October 2003, NISA only inspects important safety-related equipment while the licensees were required to conduct voluntary checks on other equipment. Since then, however, a new system (Periodic Safety Management Review) was induced, in which the licensees themselves are required to carry out inspections by themselves and the regulatory body examines the performance of inspections and organization system of the licensees. Concerning the licensee's inspections, the regulatory body examines the results, licensee's organization necessary to ensure safety, staff training, etc. Until the end of commissioning, the licensees are required to maintain safety as same as normal condition mentioned above and regulatory body inspects those performances.

- b) *How do you deal with the potential attempt of the Licensee to cut down financial means for further supporting the safety of the plant?*

With or without their attempt at cutting down financial means, the proper performance of licensee's safety-related activities shall be inspected strictly by periodic inspections, periodic safety management review and safety inspections in such a manner that regulatory body inspects the licensee's observance for the fitness for safety rule.

2 For plant with an unknown end of life date

- a) *What processes are adopted to determine the occurrence of new safety concerns in operation of plant in its latter years?*

The licensees carry out Licensee's Periodic Inspections on equipment as specified by law. For the aging plants of 30 years or longer since commissioning, the licensees perform aging evaluation and draft the long-term maintenance program, determining middle-term inspection frequency and items.

- b) *What key issues have so far arisen?*

Not applicable.

- c) *What changes of inspection practices have been introduced arising from these processes?*

As for the in-service inspection (ISI) of aged plants, the followings have been revised in JEAC (industry standard) recently. Thus periodic inspections are conducted for increased items of equipment with greater frequency for aged plants.

For class 1 equipment of 30 years or longer in use, the ISI interval has been shortened from 10 years to 7 years.

For area for which corrosion, thinning or fatigue is anticipated, visual inspection and ultrasonic thickness tests are to be performed every 10 years.

Visual inspection of the core shroud of BWR has been added.

Fixed point sampling is introduced.

3 And for all

- a) *Are there any additional concerns in these areas so far not included?*

We are interested in how the regulatory bodies establish the inspection framework for aging countermeasures and end-of-life.

Korea

1 Considering an already fixed date for the final shutdown of an NPP,

In Korea, an operating license is issued without a fixed term, but design life described in FSAR is generally regarded as the operating lifetime. The utility has not declared a closure date for any NPPs in Korea, but has a life extension plan for the 22 years old Kori unit 1. Institutional scheme for plant life extension and the definition of operating lifetime should be devised in the near future.

a) *What changes in inspection practices have been discussed in your countries?*

Because we do not have NPPs to be closed in the near future, the regulator conducts a routine periodic inspection prescribed in the provision of the Atomic Energy Law. Special inspections are initiated by the regulatory authority if any problems are identified at the aged plants.

b) *How do you deal with the potential attempt of the Licensee to cut down financial means for further supporting the safety of the plant?*

Utility has life extension plans for the old plants and also has plans to improve the safety of the plants for which PSR result reveals the need of safety improvement. The utility has been doing the major equipment replacement (ex. Steam Generators), inspection technology improvement for the aged plants.

2 For plant with an unknown end of life date

a) *What processes are adopted to determine the occurrence of new safety concerns in operation of plant in its latter years?*

Utility has life extension plans for the old plants and also has plans to improve the safety of the plants for which PSR result reveals the need of safety improvement. The utility has been doing the major equipment replacement (ex. Steam Generators), inspection technology improvement for the aged plants.

b) *What key issues have so far arisen?*

Establishment of Aging Management Program

Establishment of Equipment Qualification System (Seismic and Environmental Qualification)

Improvement of Fire Protection System (Separation of Electric Power Cable, Fire Wall etc.)

Improvement of Control room Man Machine Interface(MMI)

c) *What changes of inspection practices have been introduced arising from these processes?*

As a part of Aging Management Program, enhanced in-service inspection (ISI) are added to routine periodic inspection for aged plant.

Application of Flow Accelerated Corrosion (FAC) Program.

Application of Boric Acid Corrosion (BAC) Program.

Visual and UT examination Reactor Vessel Penetration

Performance Demonstration

3 And for all

a) Are there any additional concerns in these areas so far not included?

None

Spain

1 Considering an already fixed date for the final shutdown of an NPP,

a) *What changes in inspection practices have been discussed in your countries?*

Jose Cabrera is the oldest Spanish nuclear plant in Spain, it is a one single loop PWR with 150 MWe. In 2002 the utility had applied for a 6 more years license renewal (until 2008), however, the Ministry of Economy followed the CSN recommendation that on the decision should be taken into account a clear degradation in the safety culture of the plant after three events which revealed that the plant had been operating outside the design basis related to the ultimate heat sink. These events did not pose an immediate safety threat. Finally, a license for three more years (until April 2006), was passed and with some actions for safety improvement were requested.

Among these actions there are 17 technical instructions that cover multiple activities: design modifications, specific emergency procedures, additional service inspection during the refuelling outage, revision of the coherence of the design basis and technical specifications, etc. Besides these technical specifications, the licensee was requested to develop a Safety Management System and Investment Management System and a program to improve safety culture at Jose Cabrera.

Regarding the safety culture improvement, the licensee signed a contract with Little Harbor Consultants (LHC) at the end of 2002 to perform periodic reviews of progress in the changes implemented by the licensee. Three sets of campaigns of one-on-one interviews and written surveys have been conducted in 2002 and 2003. This contractor has tried to assess the health of the safety culture at Jose Cabrera NPP by evaluating the attitude and actions of site personnel through detailed structured interviews of employees and contractors. The contractor has used interviews and written surveys in a statistically cross-section of Jose Cabrera personnel and main contractors.

The first campaign in October 2002 revealed the following problems:

The overall organizational structure is adequate.

Staffing level is also adequate with the exception of three areas (operations, training and technical support engineering) where staff is below needed.

The overall health of the licensee safety culture needs improvement.

The current safety culture program is inadequate.

Communications, especially to workers from management need to be improved.

Also, in this first campaign it was highlighted the concern about the impact on individuals, families and the community by the early cease of operations in April 2006.

Since the decision for a 3 more years license was passed in 2002, CSN was aware that in Jose Cabrera there are safety concerns clearly indicated in the October 2002 report and potential concerns due to the fact that in 2006 the plant will have to cease its operations. These potential concerns, common to other plants in a similar situation, are the following ones: a) workers motivation and lack of trust in management, b) uncertainty for the future, c) human resources, d) internal and external communications, e) lack of investment in safety, etc.

Considering all these safety concerns, CSN decided, since the beginning of 2003, to develop and implement an action plan. With this plan CSN tries to reinforce most important licensee processes related to nuclear safety and CSN processes (inspection, evaluation, inspector training, communications and international exchange of information).

As mentioned before, CSN performs a biennial Basic Inspection Plan for every NPP. On average there are 15 inspections per plant and year plus additional inspections on other licensing issues. However in 2002 there were 42 inspections at Jose Cabrera and in 2003 33 inspections. In the case of Jose Cabrera the corresponding biennial Basic Inspection Plan has been incremented so there have been additional inspections on areas such as: maintenance, operating experience, investment and safety management systems, operating radiological protection and low and medium waste management.

Up to now CSN has considered that in the area related to organizational issues (safety culture and safety management systems) and investment system is better to concentrate on the process itself and an important effort has been done to review and assess those systems developed. However, in 2004 and 2005 the utility will work also on preparatory decommissioning activities so in order to avoid that human and financial resources be diverted from normal operation activities CSN will conduct inspections on those areas.

Throughout 2003 the safety culture of the plant has significantly improved as is indicated by the evolution of the 11 organizational attributes measured with the set of interviews and written surveys of LHC . This improvement is based on: a) an efficient communications plan in the utility organization, b) a clear and negotiated plan for the future of the personnel, c) a policy and strategy safety culture plan, and d) organizational and human factors program.

b) How do you deal with the potential attempt of the Licensee to cut down financial means for further supporting the safety of the plant?

As it has been mention there is a condition and the corresponding instruction associated to the renewed license in 2002 requesting the licensee to establish a system to control and assess safety investments. Every year the licensee in compliance with this instruction will submit to CSN a report with the safety investments of the previous and current year.

2 For plant with an unknown end of life date

- a) *What processes are adopted to determine the occurrence of new safety concerns in operation of plant in its latter years?*
- b) *What key issues have so far arisen?*
- c) *What changes of inspection practices have been introduced arising from these processes?*

Non applicable to Spain at this moment

3 And for all

- a) *Are there any additional concerns in these areas so far not included?*

Concerns are mentioned in response to question 1 of this group.

United Kingdom

General Comment.

It should be noted that in the UK all plants are regulated against a set of 36 Licence Conditions which are attached to the Site Licence. These conditions are the same for all plant and apply through out all plant life cycles from Design to return to Greenfield site.

However, as the plant moves through into the various phases of its life cycle different conditions will attract greater or lesser regulatory interest.

Inspection activities focus around those that are currently prominent.

The Periodic Safety Reviews themselves also have to take into account the “end of life or near end of life” operational phases of the plant and therefore become a focus point of forward attention.

Also all UK plants are subject to an annual regulatory review meeting between the Regulator and the Licensee. At this meeting NII requires the Licensee to review the activities of the previous year and predict the intentions of the forthcoming year specifically identifying changes that **they** will have to make to operations, maintenance and Inspections.

Finally NII carries out its own Internal Regulatory Review Process (RRP) as part of its Integrated Enforcement Strategy (IES), at which it reviews the intelligence gathered during the year on all its Licensed Sites, and determines the impact of this data on its future activities.

All three of the above processes have focused NII attention on this topic of “end of life or near end of life” operation.

1 Considering an already fixed date for the final shutdown of an NPP,

- a) What changes in inspection practices have been discussed in your countries?

For the period of normal operation but prior to cessation of operation, the following matters have been the subject of discussion regarding changes to Inspection Practices.

Detailed Regulator focus is applied to understand those aspects of the safety case where original knowledge of the plant contained uncertainties about how the plant would age. Consideration is given by the regulator to whether additional technical examination of the plant by the Licensee, would give a clearer indication of the actual plant condition and programmes of work are agreed to achieve this where appropriate. Regulator Inspection activity focuses on these areas. Examples are Additional NDT tests of materials in vessel. Inspection of control rod drive operations, Inspection of Primary Pressure Circuit boundary material conditions.

A greater interrogation of the challenge by the Licensee to its own knowledge of the state of its plant is required and so Regulatory Inspection activity focuses in inspecting the results of the Licensees findings.

Regulatory Inspection Activity focuses on ensuring that the Licensee has created an adequate Decommissioning Safety Case prior to them moving to the shutdown phase.

In the UK, Licence Condition 36 requires Licensees to make visible its management of organisational change. Any attempt to reduce staffing during this latter end will need to be justified and require the Licensee to demonstrate that it can tolerate any reduction in quality or quantity of staff. Regulatory attention will focus on this area.

b) What changes in inspection practices have been discussed in your countries?

The periodic Safety Review should clearly identify work, required to be carried out, to ensure continuing safety during the period of continued operation that the review enables. The work involved may arise from absolute requirements or from an assessment of time at risk. The review should make clear the arguments supporting this. For absolute requirements the Licensees will be made to either complete their obligations or cease to operate. An example of this may be a requirement to replace components on guardlines that are obsolete. However, for time at risk arguments, consideration will need to be given to the change to time at risk, which may occur if the actual shutdown date creates a period of operation less than that considered in the PSR. If an adequate justification can be presented by the Licensee, NII will agree to a change to the scope of the original PSR commitments.

2 For plant with an unknown end of life date.

a) What processes are adopted to determine the occurrence of new safety concerns in operation of plant in its latter years?

The answer to this is similar to that in part 1. Only here the level of uncertainty as to the actual state of the plant is unknown but expected to possibly be approaching end of life. Therefore for completeness I have included the same answers as before.

The following matters have been the subject of discussion regarding changes to Inspection Practices.

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b) What key issues have so far arisen?

- Enhanced irradiation embrittlement of materials used in Reactor Pressure Vessels. This has been uncovered in inspection and testing of materials from already shutdown plants. Increased and enhanced inspection programmes have been needed for this area to understand the current state of material in near end of life plants.
- C&I electronics equipment. Again, the combination of obsolescence and long life exposure to adverse environmental equipment has seen increased inspection work to determine the state of this plant.

c) What changes of inspection practices have been introduced arising from these processes?

For the materials aspects,

Increased in vessel non destructive testing of the vessel structures and welds.

Removal of sacrificial samples for metallurgical examination and inspection and destructive testing.

For the electronics aspects, this work is still being considered.

3 And for all

a) Are there any additional concerns in these areas so far not included? Not at this time.

United States

1 Considering an already fixed date for the final shutdown of an NPP,

a) *What changes in inspection practices have been discussed in your countries?*

None. As long as a NPP remains commercially operating, the NRC conducts a baseline inspection (approximately 2000 hrs per site per year) at a minimum. Additional inspections under the Reactor Oversight Process (ROP) are conducted as necessary if licensee

performance problems are determined to exist. All regulatory and licensing requirements remain fully in effect until a licensee requests and receives NRC staff approval for relief from

the provisions of its 10 CFR Part 50 license. Many NPPs are requesting and receiving license renewals (i.e., license extensions beyond their original licensed expiration date). Prior to granting such renewals, the NRC staff conducts an inspection using the guidelines of NRC Inspection Manual Chapter 2516 (<http://www.nrc.gov/reading-rm/doc-collections/insp-manual/manual-chapter/mc2516.pdf>) to determine if a licensee's aging management programs are adequate to support the staff's approval of the license renewal request. Additionally, another NRC inspection is conducted at about the time that the license renewal period begins, to ensure that any commitments made by the licensee related to those programs the NRC staff relied upon for safety assurance are in place and functioning adequately.

- b) *How do you deal with the potential attempt of the Licensee to cut down financial means for further supporting the safety of the plant?*

The NRC does not inspect or review a licensee's financial means, other than to ensure adequate decommissioning funds will be available. The ROP inspections conducted for an operating plant throughout its licensed lifetime are aimed at identifying the most safety-significant licensee performance deficiencies. The threshold for identifying inspection findings that the licensee must correct does not change as the plant ages. If a licensee is not providing sufficient funds for supporting the safety of the plant, this is expected to be revealed through deficiencies that will be identified by the inspection program.

2 For plant with an unknown end of life date

- a) *What processes are adopted to determine the occurrence of new safety concerns in operation of plant in its latter years?*

All NRC NPP licensees have fixed-period licenses.

- b) *What key issues have so far arisen?*

All NRC NPP licensees have fixed-period licenses.

- c) *What changes of inspection practices have been introduced arising from these processes?*

All NRC NPP licensees have fixed-period licenses.

3 And for all

- a) Are there any additional concerns in these areas so far not included?

No, the NRC license renewal inspection program defined in IMC 2516 is intended to review and evaluate the adequacy of licensee aging management programs.