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Research

Assuring Competency in Nuclear Power Plants: Regulatory Policy and Practice

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SKI

SKI PERSPECTIVE

Background

The Swedish Nuclear Power Inspectorate (SKI) regulates how the licensees assure competency in nuclear power plant operations. According to this, SKI wants to obtain deeper knowledge of in what way other regulatory bodies in other countries work with regulation of competence, staffing and education. This knowledge will provide contribution to SKI in developing continued regulatory activities within this area.

Purpose

The purpose of this project was to make an overview of how other countries regulate competence, staffing and education within the nuclear industry. More specifically, SKI sponsored this study to obtain information on how nuclear power regulators assure competency in nuclear power plant operations.

Results

The project resulted in an overview of how different regulatory bodies work with regulation of competence, staffing and education. The results from the study have given SKI a deeper understanding and knowledge of the strategies in different countries in this area.
The report provides descriptive and comparative information on competency regulation and oversight in selected countries and identifies competency issues. Competency specialists, inspectors, and other experts were interviewed in Sweden, Finland, Spain, Canada and the United Kingdom concerning:

- the regulations and other requirements regarding training and qualifications in nuclear power plants
- the regulatory strategies and the methods and tools used to assure competency
- current and emerging issues of regulatory concern
- examples of competency regulation

The results showed that there were interesting differences between the various ways for regulation competence e.g. concerning if the licensee authorizes or certifies operations personnel or if the regulator licenses or certifies operations personnel. Another difference between the countries could be found regarding who takes the primary responsibility for determining the appropriate educational and experience requirements. The conclusion that can be drawn from this study is that Sweden has a good strategy in regulating competence. However, there are other tools and methods as well that can contribute to good regulation within this area.

Continued work

SKI has now both domestic as well as international, reviewed strategies of regulatory bodies to regulate competence. The project has contributed with knowledge which SKI will use in developing continued regulatory activities within this area. However, SKI has for the time being no need for further exploration of this area.

Project information

SKI project coordinator: Anne Edland
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Summary

Background

The Swedish Nuclear Power Inspectorate (SKI) sponsored this study to obtain information on the regulations and methods and tools nuclear power regulators use to assure adequate competency in nuclear power plants. This report provides descriptive and comparative information on competency regulation and oversight in selected countries and identifies issues concerning competency

Implementation

Interviews with competency experts in five countries, Sweden, Finland, Spain, Canada, and the United Kingdom were conducted and analyzed. The report provides a summary and comparison of the regulations used in these five countries.
Regulations and policies in four areas are discussed:

- Licensing, certification and approvals
- Educational qualifications
- Training
- Experience

Results

Methods and tools used by regulators in the five countries are discussed with regard to how regulators:

- Assure that licensees determine the competencies needed for the safe operation of nuclear facilities and fill positions with competent staff
- Oversee training and examinations in the areas of operations, engineering and maintenance
- Assure competence of contractors
- Oversee work group performance
- Assure competency of managers
- Assure competency of other personnel
- Assure competency when modifications and other changes occur

Competency experts identified the following as the biggest challenges in regulating competency:

- The continued availability of qualified personnel
- Determining appropriate criteria for competency and assuring those criteria are met.
- Determining whether licensees have adequately identified and met training needs, especially evaluating systematic approaches to training (SAT)
- Overseeing contractors.

The following issues related to competency are discussed in the report

- The sufficiency of qualified personnel
- The evaluation of personnel requirements (determining appropriate criteria for competency and assuring those criteria are met)
- The effects of major organizational changes, including downsizing
- Assurance of competency of contractors
- International competency issues
- The historical and current focus on technical and hardware issues over human factors issues

Selected examples illustrate regulatory approaches to assuring competency, these include:

Implementing new programs

- Requiring a systematic approach to training (SAT)
- Responding to audit findings using the IAEA guidelines on training programs

Anticipating and addressing potential problems

- Assuring licensee remains an intelligent customer
- Assuring competence after organizational changes
- Building a new facility: 'pre-regulation' concerns

Outcomes of proactive inspections

- Checking on a new regulation
- Checking contractor qualifications before an outage
- Checking qualifications of managers: two examples
- Checking training after a modification
- Checking training as part of a quality system review

Outcomes of reactive inspections

- In depth evaluation of incident leads to increased attention to competence
- Deteriorating performance traced to poor training program
- Licensee needs training in root cause analysis
- Two licensees lose function that tracks training in safety related positions

Conclusions

The authors noted the following as concluding remarks

- Regulators seem to be moving towards more process based regulations and/or process based inspection methods for the oversight of competency.
- There is increasing attention to training and qualifications of personnel outside of operations, particularly those in maintenance positions
- Competency specialists are concerned about the effects of two trends that seem to be increasing—downsizing, and the increased use of contractors
- While there is an increased emphasis on human factors areas in nuclear power regulation, there is still an emphasis on technical systems and hardware by regulators and utilities. There is also concern about inadequate availability of expertise in the area of human factors in nuclear power regulators and industry.

Sammanfattning

Bakgrund

Denna studie finansierades av Statens Kärnkraftinspektion och syftade till att få information om tillsyn och metoder och verktyg som tillsynsmyndigheter använder för att bedriva tillsyn av kompetens, utbildning och bemanning inom kärnkraftbranschen. Rapporten beskriver och jämför information inom tillsyn av kompetens i olika länder och identifierar frågor som rör området.

Genomförande

Länderna som studerades är Sverige, Canada, Spanien, England och Finland. Studien genomfördes bland annat genom att intervjua de personer på myndigheterna som arbetar med kompetenssäkringsprocessen, både inspektörer och specialister, samt samla in dokument som beskriver myndigheterna och dess verksamhet. Slutligen gjordes en analys och jämförelse mellan de olika länderna gällande tillsyn, verktyg och metoder för att reglera kompetens. Tillsyn och policys diskuteras inom fyra områden:

- Licensiering och behörighet
- Utbildning
- återträning
- Erfarenhet

Slutsatser

Följande slutsatser framkom:

- Tendenser att tillsynsmyndigheter mer går mot en processorienterad tillsyn och/eller processbaserade inspektionsmetoder för att tillse kompetens.
- Ett ökat fokus på utbildning och kvalificering av personal utanför driften, speciellt inom underhåll
- Kompetensspecialister är bekymrade över utvecklingen av två trender nämligen neddragningar och ökad användning av leverantörer
- Även om man ser en ökad fokusering på samspelet Människa, Teknik och Organisation (MTO) inom tillsynsmyndigheter och industrin så fokuseras det fortfarande på tekniska system och hårdvaror. Det framkom vidare att en oro finns gällande tillgänglighet av expertis inom MTO området.

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1 Introduction

The Swedish Nuclear Power Inspectorate (SKI) sponsored this study to obtain information on how nuclear power regulators assure competency in nuclear power plant operations. The report provides descriptive and comparative information on competency regulation and oversight in selected countries and identifies competency issues. Competency specialists, inspectors, and other experts were interviewed in Sweden, Finland, Spain, Canada and the United Kingdom concerning:

- the regulations and other requirements regarding training and qualifications in nuclear power plants
- the regulatory strategies and the methods and tools used to assure competency
- current and emerging issues of regulatory concern
- examples of competency regulation

This project was carried out in conjunction with an exploratory study on regulatory strategies sponsored by SKI.

2 Methodology

Information on competency regulations and oversight was collected from competency specialists and inspectors from nuclear regulatory agencies in Sweden, Finland, Spain, Canada, and the United Kingdom. The information was then analyzed for this report. The data collection and analysis methodology is described below.

Data

Qualitative data were collected from structured open-ended personal interviews with competency specialists and inspectors from nuclear regulatory agencies. One structured interview guide (see Appendix A) was used to conduct interviews with competency specialists. This interview guide covered areas 1 to 4, listed below. A second structured interview guide (see Appendix B) was used to interview one or more individuals with experience in conducting inspections of training and qualification programs. This interview guide covered areas 3 and 4, listed below.

Areas covered by interview guides:

1. Regulations and policies (competency specialists only)
2. Major issues with regard to assuring competency (competency specialists only)
3. Experience with regulatory strategies for competency (competency specialists and inspectors).
4. Methods and tools used to assure competency (competency specialists and inspectors)

Regulations and policies: Tables summarizing regulations from the countries in the survey were prepared prior to the interview when written information in English was obtained by the researchers. These tables were used as the basis for the discussion of the regulations and policies regarding competency. Competency specialists provided additional information and clarification to the tables. After the interview the tables were revised and then sent to the competency specialists for review. Chapter 3 summarizes and compares the regulations across the countries. Complete tables for each country are provided in Appendices C1 to C5.

Methods and tools used to assure competency: Competency specialists and inspectors were asked to describe the methods and tools their agency uses to oversee

- licensees' systems to identify the types of expertise needed for the positions at their plants and to assure that they obtain people with the necessary competency to carry out their work
- licensee initial training programs to assure competency of staff to perform their jobs
- licensee maintenance and updating of necessary knowledge and skills to assure that their staff continue to perform their jobs safely
- competency of temporary or contractor personnel
- work group (team) performance

Chapter 4 discusses this information.

Major issues regarding competency regulation: Competency specialists were asked to describe, based on their judgment and expertise, the greatest challenges facing regulators in assuring competency in nuclear power facilities and to comment on downsizing, contractors, future availability of qualified staff, international staffing concerns, and any additional issues they felt were important. Chapter 5 covers the discussion of issues.

Experience with regulatory strategies for competency: Competency specialists and inspectors were asked to "walk us through" an example of their experience with oversight of competency. Examples of regulatory oversight of training and qualifications were also provided by the experts interviewed regarding regulatory strategies for a related project. Examples from both sets of interviews were included in the analysis and are used as illustrating examples in Chapter 6.

Sample

Selection of agencies: Five agencies were selected to be included in the sample for the study. The criteria for selection were that each agency regulated a well developed commercial nuclear program (not a new, emerging program), that the agency be willing to participate, and that the costs associated with the researchers visiting the site and completing in-person interviews would be reasonable.

Selection of interviewees: Regulatory agencies were asked to select one or more competency specialists and one or more inspectors with experience in the oversight of competency as interviewees. Six competency specialists (two from Canada and one from each of the other countries in the study) and eight inspectors (three from Canada, two from Sweden, and one from each of the other countries in the study) were interviewed. In addition, experts on nuclear power plant regulation being interviewed for a project on regulatory strategies conducted concurrently with this study were asked for examples of oversight of training and qualification. Examples from these interviews were included as appropriate.

Analysis

Analysis of regulations and policies included the summarization and comparison of policies across the agencies in the following areas:

- education
- experience
- licensing, certification, and approval of positions
- training

The analysis of methods and tools included summarizing information about the determination of appropriate competencies and the oversight of:

- training

- examinations
- contractors
- working groups (i.e., whether team performance is evaluated)
- managers
- other personnel
- plant and utility changes

Issues were identified from questions about the most challenging areas for oversight of competency: questions on specific concerns about downsizing, contractors, future availability of qualified staff, and international staffing concerns; and from discussions of examples.

Examples were summarized and reported in the following categories

- Implementing new programs
- Anticipating and addressing potential problems
- Outcomes of proactive inspections
- Outcomes of reactive inspections

3 Competency regulations

This chapter provides a summary and comparison of the regulations used in the five countries in the study—Sweden, Finland, Spain, Canada, and the United Kingdom. Regulations and policies for the following four areas of regulatory oversight are discussed:

- Licensing, certification and approvals
- Educational qualifications
- Training
- Experience

Tables 3.1 to 3.4 of this chapter provide comparative summaries for each area. Appendices C1 to C5 provide more detailed information on competency regulations in each country. Interview highlights are provided below.

Licensing, certification and approvals: highlights

- Regulators from Canada, Finland, and Spain directly license or certify operations staff. In Sweden and the United Kingdom, licensees authorize personnel for these positions.
- Recertification is required every five years in Canada and every three years in Finland and Spain. In Sweden the licensee authorization must be renewed every three years.
- Finland is the only country that formally approves management positions; Sweden requires all managers with authority over operations to be authorized by licensees; Canada informally reviews some management positions.
- Positions other than operations that are licensed or certified include health physicists in Canada and radiation protection specialists in Spain; nuclear materials safeguards, emergency response, physical protection, and system inspection positions are approved in Finland.

See Table 3.1 for more detail regarding licensing, certification, and approvals.

Educational qualifications: highlights

- The licensee sets educational requirements in Sweden and the United Kingdom for all positions subject to regulatory guidance, review and approval.
- The only exception in the United Kingdom is that another agency sets some educational requirements for health physics positions.
- In Canada the licensee sets educational requirements for all positions: currently the requirements for operations positions and health physicists are included in the site license and the regulator has issued a draft standard for these positions.
- Spain sets educational requirements for licensed positions, including operators and radiation protection personnel; the licensee sets educational requirements for other positions.

- In Finland the regulator sets educational requirements for selected positions; the licensee sets requirements for all other positions.

See Table 3.2 for more detail regarding educational qualification requirements.

Training: highlights

- Detailed guidelines for training are provided in Finland and must be followed unless the licensee can demonstrate a better alternative.
- Canada requires licensees to use a systematic approach to training (SAT) for all positions; there are currently training requirements for operators and health physics personnel in site licenses and the regulator has issued a draft standard for these positions.
- In Spain the regulator sets some training requirements for operators; the licensees are responsible for other positions.
- In Sweden licensees are required to ensure that adequate personnel are available with necessary competence to perform safety related activities. Licensees are expected to evaluate training needs as assure training to meet this requirement. Sweden also has some specific training requirements for operations personnel, including operations management.
- In the United Kingdom the licensee is responsible for setting training requirements for all positions; the regulator approves the requirements.

More detail on training requirements is provided in Table 3.3.

Experience: highlights

- In Sweden and the United Kingdom experience requirements are set by licensees.
- In Canada requirements are set by the licensee; requirements for certified positions are currently covered by site licenses and the regulator has issued a draft standard for these positions.
- Spain sets experience requirements for licensed positions; the licensee sets requirements for all other positions.
- Finland has detailed experience requirements for selected positions—including specified positions in operations, engineering, maintenance, management and other positions—experience requirements for positions not specified are determined by the licensee.

Changes to regulatory practice regarding training and qualifications

Across the five agencies in the study, Sweden, Finland and the United Kingdom do not plan any major changes to regulation related to competency; Canada and Spain are planning regulatory changes in the competency area.

Although Finland and the United Kingdom are not planning significant regulatory changes, they are considering changes to competency guidance.

- Finland currently has a regulatory guide in which initial education, training, and retraining are specified in detail. This safety guide is under revision.
- The United Kingdom may revise the technical assessment guide and broaden it to include competence.

Canada and Spain are either planning or in the process of making significant changes to regulatory practice in competency.

- Canada is in the process of transferring operator exams to the utilities and requiring utilities to have SAT based training for all personnel. These changes are linked—SAT for all personnel is a condition for transferring operator exams to the plants. The regulator will still certify operators but it will be based on examinations performed by the plants. The regulator is planning to audit testing procedures, tests by licensees, and test design. The interviewees did not expect plants to change the type of tests from what the regulator currently uses.

- Spain is planning to make changes to its current rule in order to separate recommendations clearly from requirements. The plan is to develop:
  - an overarching rule
  - an instruction (with requirements in three areas)
  - a guide (with suggestions for good practice)
    If licensees choose to deviate from the guide, they will have to demonstrate the effectiveness of their alternative.

Table 3.1: Licensing/Certification/Approvals				
Canada	**Finland**	**Spain**	**Sweden**	**United Kingdom**
Operations Regulator certifies: Reactor Operator, Unit Operator, Shift Operating Supervisor, and Shift Supervisor Re-certification every 5 years Licensee conducts examinations as of June 2004	**Operations** Regulator licenses: Reactor Operator, Turbine Operator, Shift Supervisor License renewal every 3 years Licensee conducts examinations	**Operations** Regulator licenses Control Room Operator Turbine Operator Shift Supervisor License renewal every 3 years Regulator conducts examinations	**Operations** Licensee authorizes: Control Room Operator, Shift Supervisor, Operations management Authorization renewal every 3 years Licensee conducts examinations	Licensee selects Duly Authorized Personnel (DAP) who are accredited by licensee, subject to approval of regulator, at regulator's discretion to review. DAPS may be in any functional area. **Operations** Control room operators are DAP positions
Management Regulator interviews upper level managers as a practice, not a requirement	**Management** Regulator approves: Responsible manager and deputy station manager		**Management** Managers with authority over operations are included in operations requirements	
Other Positions Health Physicist—regulator certifies and conducts interview Re-certification every 5 years	**Other Positions** Regulator approves: Nuclear materials safeguards, Emergency response, Physical protection, System inspection positions	**Other Positions** Different technical directorate licenses: Radiation protection specialist		

Table 3.2 Educational Qualifications				
Canada	**Finland**	**Spain**	**Sweden**	**United Kingdom**
Set by licensee for all positions	Set by regulator for selected positions; others set by licensee.	Set by regulator for licensed positions only; all other positions set by licensee. Industry guide specifies qualifications, accepted by regulator.	Set by licensee for all positions Regulator provides guidance document.	Set by licensee for all positions Subject to regulator approval, at regulator's discretion to review.
Operations Currently requirements for 4 certified positions are specified in the station license. Regulator has issued a draft standard for these positions. **Temporary** Licensees required to assure qualifications of contractors as part of QA standard	**Operations** 5 job positions **Engineering** 9 job positions **Maintenance** 3 job positions **Management** 14 job positions **Temporary** same titles as specified in other fields; set by licensee for teams working on systems important to safety	**Operations** Set by regulator for 3 licensed operator positions.	**Operations** Guidance document suggests minimum educational criteria. **Management** Managers with authority over operations are included in operations requirements	**Operations**
Other position Health physicist (certified) Requirements are specified in the station license.	**Other position** 12 job positions (e.g. Quality assurance, Training, Emergency response, Radiation protection)	**Other position** Set by regulator for Radiation protection specialist (licensed by different technical directorate)	**Other position** Licensee must assure all personnel doing tasks important to safety have appropriate documented competence	**Other position** Health physics Some external requirements (set by different regulatory agency)

Table 3.3 Training				
Canada	**Finland**	**Spain**	**Sweden**	**United Kingdom**
Regulator requires licensees to use Systematic Approach to Training (SAT) for training of all personnel	Regulator requires use of its guides unless licensee presents alternatives equal to safety level in guide. For all areas and management, guides indicate training should be job specific to perform tasks under all circumstances, promote safety awareness; general content areas are described; annual training recommended.	Regulator sets requirements for operator positions, licensee sets training requirements for all other positions	Regulator sets some requirements for operator positions; licensee sets all other training requirements. Operations managers included in operations requirements	Licensee is responsible for training all on site with positions which may affect safety, subject to regulator approval, at regulator's discretion.
Operations Training for 4 certified positions specified in station license, including continuing training. Regulator has issued a draft standard.	**Operations** Simulator training required for Shift supervisors and Operators	**Operations** Requirements include continuous training; detailed guide. Common contractor provides all training, including simulator.	**Operations** Regulator requires annual retraining including simulator. Guidance recommends content and length of training.	
Temporary Licensees required to assure training of contractors under QA standard	**Temporary** Familiarization training as needed, based on past experience and training; vocational training provided by licensee as needed		**Temporary** Licensee must assure competence of personnel doing tasks important to safety	
Other positions Health physics training in station license; on going training included.	**Other positions**	**Other positions**	**Other positions** Requirements for those with accident situation duties. Licensee must assure those with safety tasks are competent	**Other positions** Health physics—another agency requires course and testing.

Table 3.4 : Experience				
Canada	**Finland**	**Spain**	**Sweden**	**United Kingdom**
Set by licensee for all positions	Years of general and nuclear experience set by regulator for selected positions; others set by licensee.	Set by regulator for licensed positions; all other positions set by licensee.	Set by licensee for all positions Regulator provides guidance document.	Set by licensee for all positions Subject to regulator approval, at regulator's discretion to review.
Operations Currently requirements for 4 certified positions are specified in the station license. Regulator has issued a draft standard for these positions. **Temporary** Licensees required to assure qualifications of contractors as part of QA standard	**Operations** 5 job positions **Engineering** 9 job positions **Maintenance** 3 job positions **Management** 14 job positions **Temporary** same titles as specified in other fields; set by licensee for teams working on systems important to safety	**Operations** Set by regulator for 3 licensed operator positions.	**Operations**	**Operations**
Other position Health physicist (certified) Requirements are specified in the station license.	**Other position** 12 job positions (e.g. Quality assurance, Training, Emergency response, Radiation protection)	**Other position**	**Other position**	**Other position**

4 Methods and tools used to assure competency

This chapter presents a discussion of the methods and tools used by the nuclear regulatory agencies of Canada, Finland, Spain, Sweden and the United Kingdom to assure competency. In Chapter 3 a brief summary and comparison of the regulations and requirements of these agencies in the areas of qualifications and training was presented. In this chapter the focus is on the tools used by regulatory agencies in these countries to oversee licensee regulatory compliance, provide guidance, and in other ways assure the competency of personnel of nuclear facilities.

This chapter covers methods and tools used by regulators to assure the following:

- Determination of the competencies needed for the safe operation of nuclear facilities and filling positions with competent staff
- Training and examinations in the areas of operations, engineering and maintenance
- Competence of contractors
- Work group performance
- Competency of managers
- Competency of personnel in areas other than operations, maintenance, engineering, and management
- Continued competency when modifications and other changes occur

The interview results focus on the methods and tools used for qualifications and training oversight, not the comparative differences and similarities across the agencies in the study. Therefore the discussion is organized around areas of oversight and methods: specific countries are identified when relevant.

Determining competencies needed and filling positions with competent staff

Regulatory authorities use various tools to assure that plants can demonstrate that they have identified competencies needed for the safe operation of their facilities and that they fill positions with staff with appropriate expertise. Usually this includes a combination of document review—submissions to the regulator as well as review of documents at the plant—and on site inspections, both as part of routine and special (competency-specific) inspections. It also sometimes includes providing education and guidance to the plants in helping them improve their approaches.

All agencies review the system or plan the plants have to show how they have identified the competencies needed for safe operation—usually the focus is on positions identified as having a safety function. Two agencies, Sweden and the United Kingdom, described a process by which licensees demonstrate they have identified needs and systematically compared these needs to current staff to determine any gaps—"gap analysis." Canada, Sweden and the United Kingdom referred specifically to some

licensees conducting job task analysis (JTA) as a systematic approach to identifying competencies needed in specific areas.

Spain and the United Kingdom discussed tools used to oversee changes introduced by plants that affect competency requirements. In Spain a change management tool has been introduced requiring licensees to assess all organizational changes (e.g. staff reductions and/or moving functions to different organizational groups) so plants can identify competencies lacking and how to get training and competency needs fulfilled. In the United Kingdom licensees must analyze any changes to the staffing of the organization for potential impact (part of the gap analysis mentioned above) and need regulator approval prior to implementation.

Interviewees said that they generally focus on the system—the process and program for identifying needs and filling positions. Inspectors indicated that they make sure that licensees comply with their own procedures, since in most instances the licensee has the responsibility for identifying the positions that are safety-related, for selecting the analytical approach for determining what expertise is necessary for carrying out tasks, and for staffing the facility.

A few interviewees also indicated that events triggered audits or inspections that led to a review of the possible relationship of the event to qualifications of staff, particularly for operators.

At one agency the regulatory staff concluded that the plant did not have adequate competency in human factors. Since it is the licensee, not the regulator that sets specific qualifications, the agency took the approach of education and wrote guides on human factors that were sent to both upper level management and plant staff in human factors positions.

A few specific descriptions of inspection methods used are provided below.

> One inspector described conducting audits on a routine rotating basis. Licensees are required to have a procedure for determining appropriate education and experience for positions and the audit checks that the licensee is complying with this procedure. The audit also evaluates the quality of the process for determining the qualifications of these personnel. A key area of concern in modifications is whether financial or other pressures result in the licensee not planning for sufficient time to train staff in the changes from the modification before they take on assignment of duties.
>
> Another inspector described overseeing the process for setting personnel qualifications that are defined by the licensee as having safety critical tasks—this group of "authorized" personnel has a higher, rigorous process of qualification than other personnel. The inspector focuses on looking at the process for setting these qualifications, e.g. formal interview with the executive team, checks of whether the person knows the safety concerns of that job. In the past it was typical for plants to have only operators on the authorized personnel list, now the regulator expects a licensee to include maintenance positions on this list.

The inspector reviews a register of qualifications for positions, which maps out expertise. The inspector looks at the process used to develop the register and then examines specific examples of whether the utility is in compliance with its process. This is accomplished by sampling individuals to assure they meet the requirements.

The inspector evaluates the plant's system to examine the process for determining competencies and resources. The emphasis is on the plant's procedure describing how they analyze their needs, assess their current status and conduct a gap analysis. The inspectors sometimes sample one area in detail. The tools used include plant reports, reviewing plant events and incidents, interviews, and informal information gathered in the course of routine plant visits.

Training and examinations: operations, maintenance and engineering

In this section the focus is on oversight of training and examinations in the areas of operations, maintenance and engineering. As described in Chapter 3, all agencies have general requirements or recommendations concerning training. Some of these are broad (stated as goals or general areas), while some regulatory agencies also have more specific requirements or recommendations, such as detailed content areas or required number of hours of formal classroom training.

Requirements and recommendations for training have focused more on the area of operations than maintenance and engineering (see Chapter 3 and Appendix C). This emphasis on operations also was found in the description of oversight of training, although in recent years there has been more focus on maintenance training and some increase in attention to engineering. Oversight of examinations, which is related to certification of personnel, is centered on operations staff only.

There are general similarities in the methods and tools used for training and those used for determining competency needs (described in the first section of this chapter) in terms of the overarching approaches of document review, inspections and guidance. However, there are differences in the specifics of how these approaches are applied and implemented.

Use of Systematic Approach to Training

Two agencies reported using a Systematic Approach to Training (SAT) as a tool for oversight of training at nuclear facilities. SAT is a specific method that provides guidance on the steps necessary to develop and implement an appropriate training program. A SAT approach generally involves analyzing jobs that have a safety function, developing statements of competency, and then developing training and experience requirements tailored to the competencies identified for carrying out specific job duties.

Canada is using SAT as an overall tool for plants to use in development and implementation of training for all personnel and as a basis for evaluating training programs. The United Kingdom uses SAT primarily as a tool for training inspections.

In overseeing training in Canada the inspectors review SAT documents including training material development. Inspectors conduct interviews and may attend training. They use standard objectives and criteria for SAT programs, available to licensees. Inspectors have recently expanded beyond the earlier focus on evaluation of training in operations to all job families, including engineers, maintenance and instrumentation and control (and other areas covered later in this chapter). Audits are conducted against the plant's own commitments in its training program.

One interviewee from the United Kingdom described how the International Atomic Energy Agency (IAEA) guide on SAT is used as a tool for a training inspection. The general approach is to review how the licensee analyzed jobs that have a safety function, developed statements of competency and then developed training and experience tailored to the competencies identified for carrying out specific jobs.

Inspection approaches to oversee training

All agencies use inspections to assure that licensees are providing appropriate training and following through on their program commitments. Training inspections at most agencies are part of a larger annual inspection program. These programs usually have two levels—a general program covering many areas on a rotating basis, routine inspections—and in-depth inspections that focus on 1) specific content areas, called special or theme inspections, or 2) are in response to events or recurring problems identified at a facility.

General program inspections

Some specific inspection approaches for training oversight are described below.

One agency introduced a process-based inspection program in the late 1990s, changing from the technically focused approach that had been used since the 1980s. The agency uses three levels of inspections and has specific guidance for carrying out each type of inspection. Specific activities include:

- interviewing training staff,
- randomly sampling the operations training program to check that training is being provided as planned,
- sitting in on selected training courses, and
- identifying problems through informal plant visits.

Because there are not formal group training programs in maintenance and engineering but more individualized training, the regulatory agency gathers information on these areas primarily through the periodic general inspections and informal site visits.

Another agency reviews annual reports submitted by plants indicating training completed by all staff. Plants also submit any training program changes for operators and general course program descriptions for non-licensed staff. This document review along with review of incident reports provides the basis for

training inspection preparation—the agency conducts a joint operation experience and training inspection. One example of a training inspection involved minor, but recurring maintenance incidents. Root cause analysis indicated that the problem was due to a change to a new contractor with insufficient experience. The regulator is now developing a guide on the selection process for contractors.

An inspector explained that the regulatory agency focuses on whether the licensee is meeting overall training goals rather than on the specifics of how training is accomplished. Although the regulatory emphasis is on operations training, the regulator checks all areas. All sites are inspected periodically, especially after the introduction of new regulations or guides. Information also is gathered as part of routine plant visits by inspectors.

Response to events

All agencies conduct inspections in response to events to examine any role training may have played in the event—this was particularly common for operations training, but events may also trigger maintenance and engineering training inspections.

Updating training

Several general approaches to the oversight of refresher training and updating training after changes due to modifications or new regulations are described below.

Inspections at one agency look for systematic processes in place to assure refresher training. Training is categorized as mandatory, recommended or developmental. The inspector expects the plant to have an evaluation of what areas require regular refresher training, for example, rarely used skills. The inspection would document whether the system exists and is followed. The inspector also focuses on problem areas, for example, operator training in areas where operators must take critical actions. In one inspection, the inspector used PSA to identify areas where operators were critical and then looked at simulator training in that area.

At another agency changes, such as modifications, may trigger an inspection. Plants must notify the regulator of changes. The agency systematically reviews the changes and selects some for inspection. Training would be one element of these inspections. Events and trends also lead to inspections that include reviews of training or may focus specifically on a competency issue such as maintaining skills.

A third regulatory agency requires licensees to demonstrate that staff participates in continuing training. The inspections do not look at individuals, but review the program—whether refresher training is available—through the regular audit process of the regulator.

Three agencies indicated that updating training was an area of concern since licensees frequently fail to adequately update their training programs. Examples of inspection methods used to address this issue are discussed below.

> An agency site visit identified that training at one plant was not being carried out systematically. An in-depth special inspection followed. The inspection included an assessment of whether the plant had provided adequate training to staff after the introduction of a new fire alarm system. The agency looked at the need for training a broad range of staff (including maintenance workers and safety engineers). The plant had only evaluated training needs for operators. (See Chapter 6 for a full description of this example.) In general, this agency has found updating training after changes is a much greater concern than initial staff training.
>
> Another agency reported that in spite of requirements for continuing operator training, inspections indicated that plants were not providing such training. Plants did not begin to develop programs until a re-certification requirement was established. Regulator evaluations of continuing training indicated these programs were inadequate, not well defined, fragmented and that training and testing was not independent.

Examination oversight

Two agencies (Canada and Finland) that certify selected positions in operations described oversight of examinations. (As described in Chapter 3, Spain licenses and certifies operator positions, but administers the examinations directly and oversees the training the licensee provides for these examinations.)

In Finland, operators are licensed by the regulator based on examinations performed by the licensees. The Finnish regulator oversees the examinations given by the licensees to assure they are reasonable. Utilities are responsible for written, oral and simulator examinations.

Canada is in the process of transferring the responsibility for examinations from the regulator to the licensee. The regulator will continue to certify operators. This change is described in more detail in Chapter 3 in the section on changes in regulatory practice. As the licensee begins administering examinations the plan is to audit a plant's testing procedures, tests given by licensees, and test design. Licensees will be responsible for both written and simulator examinations. The regulator also expects to evaluate the initial implementation of the program after transferring the responsibility to licensees. The focus of the evaluation will be the overall training program—not the evaluation of individuals.

Methods and tools used to assure contractor competence

Interviewees across all regulatory agencies noted that the licensee has the primary responsibility to assure contractor competency. Interviewees also noted that contractors are not, in general, used in the area of operations and never for licensed or

certified positions. Other comments regarding oversight of contractor competency included that contract staff are expected to have the same standards applied as permanent staff and that licensees should be able to explain their motivation for using temporary or contract workers instead of permanent workers. One interviewee noted that competency of temporary personnel was overseen by a different regulatory agency.

Contractor competency is evaluated as an element of routine inspections of training or quality systems. In addition, interviewees described inspections that assessed contractor competence as special inspections prompted by:

- Changes in licensee programs or organizations, such as downsizing and increasing the use of contractors
- Events potentially related to contractor error.
- New training guides or regulations

Approaches to overseeing the licensees' assurance of contractor competency varied, but all contained one or more of the following components:

- Regulator evaluates the process licensees use to assure competence of contractor personnel
- Regulator requires the licensee to keep records on training, qualifications, and experience and the regulator randomly checks these records
- Regulator considers contractor competence as part of the licensee's quality assurance responsibilities and evaluates the licensee's quality assurance regarding the training and qualifications of contractor personnel—this approach examines how the licensee assures competency rather than directly looking at staff competence
- Regulator spot checks contractor skills and visits the contractor organization if concerns arise

One interviewee provided the following example of the approach to assuring contractor competency. The regulatory agency checks contractors in two ways: 1) checking the way the plant assures competency of contractors and 2) looking at operating events to identify any problems that may be related to contractor competency. The licensee is required to keep files on all staff and permanent contractors and the regulator randomly checks these files.

Work group (team) performance

Work group performance (i.e., the ability of a group to work effectively as a team) is primarily examined only in operations staff simulator examinations. In some cases the regulator reviewed work-group, or team, performance in the simulators but in other cases the licensee conducted training and examination without regulatory agency review.

In addition to team or work-group simulator performance evaluations, interviewees noted that work group performance might be evaluated in response to an event or as part of a specialty inspection. One interviewee provided the following explanation:

Some times we focus on maintenance group, mechanical maintainers, for example. We will look at the results of events to help us focus. We look at areas that have problems—access station condition records, search for trends.

One interviewee suggested that his agency may be considering work group performance in future training evaluations. Another interviewee noted that his agency does not require work group evaluation but that a licensee uses a team assessment tool.

Management positions

Interviewees indicated that attention to management training and qualifications has increased in recent years even though operations staff remains the major focus of attention. One interviewee noted that non-conservative decision making and lack of communication led to an increased concern about management competency—including leadership, motivation, people skills, and ability to promote a culture of safety. Another interviewee described an inspection that looked at management performance and training. The regulator found that training was not systematic and identified a need for management training and skills updating. Another interviewee described a training system evaluation that found there were no written criteria for managers.

Specific tools used for evaluating management training and qualifications included:

- Evaluating how the licensee's system determines how many managers are needed—for example, reviewing how managerial responsibility is allocated under new organizational system
- Requiring an integrated management system including how the licensee assures management competence
- Systematic Approach to Training (SAT) requires criteria for all positions, including managers. Licensee reviews individual credentials of those in top positions and the licensee may send the assessment to the regulator for review

Other positions—general areas and specific positions

Overall, the increased use of more systematic approaches to evaluating training needs (discussed above) has led to the inclusion of more positions in competency evaluations. For instance, in Spain a working group of industry and regulators—including personnel from human factors, training and systems—developed a generic guide for main job positions. The new guide includes training and qualifications audits of a range of positions in addition to operating positions.

Another result of the increased focus on systematic approaches such at SAT and JTA has been an increased need for human factors expertise—both for licensees and for regulators. One regulator noted that human performance engineering became a focus when licensee submissions indicated that the licensees did not have competency in this field. Since this regulator does not require specific qualifications, the regulatory agency advised the licensee on the need for this competency through writing guides and informing upper level managers and those in human factors positions of the need for

better human performance engineering. The regulator also asked for a task analysis which prompted the licensee to hire appropriate people.

Health physics and radiation protection are other areas with specific requirements. In some cases external requirements or certifications for personnel in these areas existed. The methods and tools to assure competency included checking certification and training records.

Assuring training after modifications and other changes:

Interviewees noted that regulators evaluate training and qualifications when there are major plant changes. Major changes, such as modifications, act as a trigger to increase regulatory attention, including attention to assurances that staffing remains adequate, trained, and qualified. Interviewees indicated that regulatory staff evaluates changes to see if there is a need for detailed review, special inspection, or informal discussions with people at the plant about changes.

Tools described for assuring continued competence included:

- Requirement that licensees use a change management tool
- Requiring the licensee to
    1. Prepare a report explaining the minimum functions related to safety and competencies and staff for these functions
    2. Develop an internal procedure that when you reduce personnel you have to evaluate that it will not impact safety
    3. Report all changes and reductions that have happened the previous year in the 1st quarter of each year
- Including an organization chart that has all the functions and responsibilities of persons related to safety in an operating document—if the plant is reorganized, it has to revise this document and get approval before change is implemented

One interviewee noted that plant modifications are an area of emphasis because different pressures—e.g., time and/or money—may result in licensees not allowing sufficient time in the planning process for training prior to assignment of duties in the modified plant.

5 Competency issues in nuclear power plants

Competency issues were identified from interviews with competency specialists, inspectors, and other nuclear regulation experts.

Competency specialists were asked about the most significant challenges and to comment on four specific issue areas—downsizing, contractors, future availability of qualified staff, and international staffing concerns.

Competency specialists identified the following based on their experience, as being the biggest challenges to assuring competency:

- Ensuring the continued availability of qualified personnel
- Determining appropriate criteria for competency and assuring those criteria are met
- Determining whether licensees have adequately identified and met training needs, especially evaluating systematic approaches to training (SAT)
- Overseeing contractors

Competency specialists, inspectors, and other nuclear regulation experts provided examples of competency oversight and general discussions of regulatory issues. Six overall issues were identified from the information provided in the interviews:

- Assuring sufficiency of qualified personnel
- Personnel requirements (determining appropriate criteria for competency and assuring those criteria are met)
- Downsizing
- Contractor competence
- Competency worldwide
- The historical and current focus on technical areas and hardware versus training and human factors

Assuring sufficiency of qualified personnel

The assurance of continued availability of qualified personnel was identified as one of the biggest challenges noted by the experts surveyed. Discussions about this issue focused on three areas of concern:

- Pipeline (recruitment and staffing) issues
- Retirement and aging plants
- Availability of specific qualifications in the future

Pipeline issues.

When asked about the issue of availability of qualified personnel there was variation in the level of concern—from "very concerned" to "not really a big issue". All interviewees, however, noted some concern regarding the availability of personnel. Differences in the degree of concern expressed by interviewees may reflect the status of

the industry; one interviewee noted that "since decommissioning [there has been] less concern" and another that "building of new plants will increase demand for qualified workers".

Two main concerns were expressed regarding the availability of workers for nuclear positions: 1) The availability of appropriately trained and educated people for recruitment into the industry and 2) the availability of personnel with appropriate training and experience within the industry.

Experts mentioned two factors that may affect the availability of personnel for entry into the industry: First, reductions in training and education programs, including university degree programs, have reduced the number of individuals prepared to work in the industry. Second, the traditional nature of the industry—described as hierarchical and authoritarian—makes it hard to attract new, younger workers who do not accept this old organizational style.

Regarding the availability of personnel with appropriate training and experience within the industry, some experts expressed concern over whether the industry was bringing enough people into the "pipeline" to be ready to take on jobs when people retire. One interviewee was particularly concerned about the availability of future operators—not because of a poor recruitment pool but because plants have not started enough people in the pipeline over the past 10 years to assure appropriate levels of training and experience to fill key positions in operations.

Although recruitment of qualified personnel into the regulatory agency was not the focus of the interview, it is worth noting that experts from two regulatory agencies expressed concern that regulatory agencies cannot compete with higher industry salaries to recruit qualified personnel.

Retirement and aging plants

Three factors were discussed regarding competency problems that may occur due to retirement and aging plants.

- Individuals who were involved in the original design and building of existing plants are now retiring or will be retiring soon
- Technology used in the old plants is no longer typical outside the industry and is no longer covered by general education and training—meaning that the logic and mechanics of the old plants are unfamiliar to new hires
- There is no longer a large industry producing nuclear power plants—and therefore not a pool of recruits with experience in nuclear power plant design and construction

Some experts expanded on the problem of finding new personnel who are familiar with the technology used in aging plants. One expert noted that this problem was particularly difficult in the area of mechanical maintenance. Another expert noted that although modernization of plants can have some mitigating effects, still "if you look to engineers to handle modernization they need competency in the original design".

Specific areas of qualification:

There were several comments regarding the availability of qualified personnel in specific areas—including training, human factors, reactor physicists and management. One expert noted that a licensee was assuring that there was a person "shadow working"—that is, preparing to take over—in specialty areas where available skills were in short supply.

Evaluation of personnel requirements

Three types of issues arose with regard to the regulators' evaluation of personnel requirements.

- Developing adequate criteria and evaluation methods in specific personnel and subject areas
- Evaluating the processes, such as SAT, employed by licensees
- Evaluating licensee conclusions regarding training needs

Specific personnel and subject areas

Operations personnel were mentioned the most frequently as an area of particular concern by competency experts. Discussions focused on the need to have clear criteria for operator competency and to have tests for competency—not just training. Experts also raised the issue of whether the regulator or the licensee should test and/or certify the competence of the operators.

Assuring training personnel competency was mentioned as a concern by experts from two agencies. Concerns here included that licensees were using contractors for training and that documentation on training personnel qualifications was not always available.

One expert mentioned that it was more difficult to assure competency in areas where cognitive skills rather than physical activities are required because it was harder to demonstrate application of skills in these areas. Another expert mentioned that any area where the regulatory agency had little expertise poses difficulties in assuring competency in the plants.

Evaluating the processes, such as SAT, employed by licensees

This issue arose across a number of discussions of competency issues and examples of competency regulation. Experts mentioned that when licensees use a system, such as SAT or JTA, to evaluate training that the regulator must become familiar with the system and be able both to evaluate the system itself and the application of the system by the licensee. Since there are many available systems for the evaluation of training, the regulator may be faced with becoming familiar with a number of different systems.

Evaluating licensee conclusions regarding training needs

Several examples of regulatory oversight of training and qualifications noted the issue of licensees using a methodology, such as SAT, to justify reductions in staff. Regulatory experts expressed concern over the validity of the analyses—and the ability of the regulator to challenge these analyses.

Downsizing

Several experts noted that plants were responding to deregulation and other pressures by trying to downsize their staff beyond the appropriate level. One expert noted that sometimes licensees' expectations seemed unrealistic regarding their ability to reduce personnel through downsizing and reorganization. Another noted that licensees try to justify fewer personnel by doing a job-task analysis but do not assure enough personnel to cover all emergency situations. Experts from two agencies noted that licensees had reduced operator shift crews to the point that there were not enough to cover both shifts and training requirements.

One interviewee discussed plants reducing personnel by "multi-skilling" or "skill broadening". Workers were trained in additional areas so that they qualified to take on additional duties. Two concerns were raised about this practice:

- Whether there were actually enough workers to complete tasks and respond to an emergency (i.e., one person was qualified to do two tasks but is still only one person)
- Personnel being counted as qualified in areas that they did not routinely work and would not be able to keep their skills sharp without frequent refresher training

Another downsizing concern was outsourcing work and replacing employees with temporary workers. One expert stated that licensees were replacing engineers with contractors and consultants and that as a consequence it was harder to assure engineering competency because the engineers were not employees of the utility. Another utility downsizing strategy mentioned by interviewees was "spinning off" utility units as separate companies—creating changed roles and responsibilities, changed organizational structures, shared responsibilities, and communications issues.

Contractor competency

Two competency experts listed contractors as the area of greatest challenge for assuring competency and two others discussed problems in this area. Contractor issues were also discussed in examples of training and qualifications oversight. A common reason mentioned directly and in examples of regulatory oversight for difficulties in assuring competency of contractors and other temporary workers was that the records on these personnel are usually not as readily available and/or are not kept current. Interviewees also noted problems with contractors not being in conformance with the licensee's own standards—compared to utility employees, assuring qualifications of contractors and

temporary workers seemed more likely to "fall through the cracks" of the quality assurance program.

Specific contractor problems mentioned by interviewees included:

- Licensees using foreign workers who are not fluent in the language spoken at the plant as contractors during outages—these workers are trained but do not understand the training (the regulator is following up on assuring understanding of training by contractor personnel)
- Increased use of contractors for training—the regulator is concerned about the licensees' processes to assure these contractors are competent to train, especially in simulators
- Licensees hiring incompetent contractors because they do not have sufficient internal competence to evaluate qualifications of contractors
- Licensees bringing in a new contractor with insufficient experiences

Competency world wide

In response to a direct question to competency experts on whether they had any concerns about competence internationally, competency experts recommended a systematic and organized effort to share experience and lessons learned and providing support to developing countries. One interviewee expressed concern that an increase in nuclear power worldwide could "result in a shortage of bodies". Another expert commented that the distribution of competence as well as the availability of competence was an issue. He noted that some countries invest in training workers who are then recruited by other countries.

The historical and current focus on technical areas and hardware versus training and human factors

A number of interviewees noted that there is increased attention to training and other human factors issues since these areas have important safety impacts. Representative comments included that "we feel we need to have tight control and to put a lot of effort in this area. [We] need reliable personnel as well as a reliable plant"; and "Looking at behavioral sciences in modern organizations and having more in nuclear industry is needed both in [our agency] and worldwide and both at utilities and in regulatory agencies."

However, interviewees also noted that the history of the industry has left a legacy that undermines intentions to focus more attention in these areas. One interviewee stated simply that "people don't see training as important". This was supported by examples of licensees failing to assure training of personnel—in one case the licensee (unsuccessfully) argued that it was not necessary for a supervisor to have training in an activity he managed.

Several competency experts noted that both the regulator and the industry focus on hardware issues rather than "software" or people issues. Other competency experts noted the lack of expertise in behavioral sciences and in human performance engineering. A particular issue noted is the use of engineers trained in hardware disciplines to perform work needing expertise in human performance. One interviewee stated that the need for human performance engineers became a focus of attention when the licensee submitted human factors engineering reports demonstrating a lack of licensee competence in this area. Licensees also did not have competency to do job task analyses and had to hire appropriate people for these tasks. Another competency expert explained that a key problem was that licensees were not hiring people with the appropriate expertise to oversee the program and using engineers instead of behavioral scientists. A major issue identified by one competency expert was that the plants need competence in psychology, sociology, and organizational factors but that it is almost impossible to convince plants they need these competencies.

In addition to issues of lack of qualified personnel in human factors, competency experts also noted that the history of focusing on technical rather than human factors issues was reflected in a lack of appreciation for the importance of training. One interviewee noted that there were ongoing difficulties with training programs. Another explained that there have been problems with people not going to class—especially supervisors—because they were too busy. The regulator has required that training responsibilities be assigned to higher level managers at the plant. This issue was related to safety culture by one competency expert and by several experts in examples of regulatory oversight. One competency expert noted that training is very important because you have to change minds of people.

6 Examples of regulation of competency

Competency experts, inspectors, and other experts provided examples of the oversight for the assurance of competency of nuclear power plant personnel. Examples were selected to illustrate different aspects of competency regulations:

Implementing new programs
- Requiring a systematic approach to training (SAT)
- Responding to audit findings using the International Atomic Energy Agency (IAEA) guidelines on training programs

Anticipating and addressing potential problems
- Assuring licensee remains an intelligent customer (i.e., has sufficient internal expertise to judge the qualifications of contractors)
- Assuring competence after organizational changes
- Building a new facility: 'pre-regulation' concerns

Outcomes of proactive inspections
- Checking on a new regulation
- Checking contractor qualifications before an outage
- Checking qualifications of managers: two examples
- Checking training after a modification
- Checking training as part of a quality system review

Outcomes of reactive inspections
- In depth evaluation of incident leads to increased attention to competence
- Deteriorating performance traced to poor training program
- Licensee needs training in root cause analysis
- Two licensees lose function that tracks training in safety related positions

Implementing new programs

Several interviewees provided examples of implementing new programs that included a systematic evaluation of training needs—including Systematic Approach to Training (SAT) programs and International Atomic Energy Agency (IAEA) guideline programs. In general, comments on these approaches were positive, with competency specialists noting benefits of flexibility and good safety priorities. Although comments were generally positive, a number of interviewees noted that this approach can have high initial resource costs for both the regulator and the licensees. Below are two examples of implementing this type of program.

Requiring a systematic approach to training (SAT)

Two interviewees from one regulator discussed a recent change which instituted requirements that licensees do a systematic approach to training (SAT). One of the interviewees explained that initially the licensees were not complying with having SAT based training and that there were a lot of issues and non-conformance related to training. The regulator responded by

1. assuring that the requirements were clear and well understood
2. informing licensees of regulatory expectations in formal communications
3. Creating a joint regulator and licensee project with monthly meetings with the upper licensee management and stake holders
4. Creating a detailed plan including resources, scheduling, resolutions, and working groups
5. Tracking the plan on an ongoing basis

The interviewee considers this a combination of outcome based and process based strategies. The requirements for SAT are process based and the plant sets goals (outcomes) for competent personnel. Risk-based assessments were used to assure the positions most important to safety were the focus of the program. The strategy was a very conscious decision. It was decided that process based was the best way to implement the program because training is a system or process. A more performance or outcome based program is desired in the long term. Once it is determined that the system adequately evaluates needs, develops and institutes training, and creates examinations for each position, then they will focus on performance measures to signal any breakdown in the system. Included in the new approach will be transferring the operator certification examinations to the licensees. The regulator will review the exams and results and will still certify the operators.

One interviewee felt that the strategy is effective but had no supporting data because the program has not been in place long. Benefits of this approach mentioned by the interviewees included that it helped regulatory personnel to focus on how the processes relating to training and qualification are done by the licensee, that it had long-term links to operator performance, and that it can be seen as more rational. One interviewee noted that the implementation of this strategy was an onerous process—taking a lot of effort. However, in the long run the interviewee felt that the process based strategy will be less onerous and more effective than a more prescriptive strategy.

Responding to audit findings using the IAEA guidelines on training programs

In this example the interviewee described the implementation of a process based approach to training done by a licensee and overseen by the regulator. A few years ago the regulator did an audit of general management of safety at a large facility. There was a review of required training for safety related positions, coverage of contractors, and documentation. The audit resulted both in specific comments and in recommendations regarding training at a high level.

The management at the facility was open to stepping back and taking an overall look and using an IAEA guide on training. There was a significant change in the whole system; including a systematic process of checking everything that people did and a structured way of collecting data. The assessment determined that there were a number of gaps. These gaps were addressed and there was an extensive change across a number of organizational units. The strategy was selected from the knowledge of what was being done elsewhere, including IAEA guidelines. The benefits include that it gives the licensees a demonstrable system that is transparent and builds on international practice. The interviewee noted that in the long term it should be an efficient approach

but there are high start-up costs. Because it is seen as an overhead expense (as all of human factors) there is resistance to making the investment. Training areas often do not have the authority within the licensee's organization to make this change and it needs upper management support to be instituted.

Anticipating and addressing potential problems

In the following three examples regulators anticipate and respond to potential problems

Assuring licensee remains an intelligent customer

In this example the interviewee noted that changes in the industry had prompted concerns over the continuing ability of licensees to act as intelligent customers when dealing with contractors. This issue was critical because the regulator relies heavily on the licensee to have a full competency. There has been increasing privatization of industry which led to concerns regarding the continued maintenance of full competency. In response to these concerns the agency looked at the ability of the organization as a whole to be an intelligent customer and found that the licensee's system wasn't transparent enough with regard to how the licensee was going to assure that they would continue to be able to be an intelligent customer, run the plant, and do safety cases. In response to this assessment, licensee organizations have developed fairly sophisticated skills matrices and manpower models, including succession planning. They also look at singleton expertise and check reliability of outside expertise (i.e., level of specialty needed for job) to make sure unique skills will be covered. Both the regulator and the licensees learned a great deal in developing and evaluating this system. A difficulty was that the regulator had to develop an understanding of model each licensee selected for training and qualification.

Assuring competence after organizational changes

In this example the regulator has instituted new requirements to respond to potential problems with staffing when plants reorganize. An organizational chart that has all the functions and responsibilities of persons related to safety is included in an operating document. If the plant is reorganized, it has to revise this document and get approval before change is implemented.

Originally the plant only had to do an evaluation of change in the numbers of personnel—not changes in competence needed. In 2002 the regulator decided that an operating report explaining changes in the functions and responsibilities of all persons—not just reductions in personnel—would be required. For example, if licensees change functions from one organizational group to another they must apply a procedure to assess the effects of the change. The regulator checks the self-assessment. This year the regulator is evaluating the procedure itself, in the future they will check the outcomes of procedure. One aspect of the review will be assessing how the licensee will document changes in functions and personnel, what competencies are lacking, and how to get training/competence fulfilled.

Building a new facility: 'pre-regulation' concerns

In this example the interviewee described issues with training and qualification during early stages of regulating the construction of a final repository for spent nuclear fuel. For the last year they have been test drilling at the site. Because these are not "nuclear" activities there is no mandated regulation—but the regulator needs to be involved and consulted. There is a new organization, new people, and a contractor brought in to do the work. The regulator has been trying to assure that the future licensee has the right people to do the preliminary work but does not yet have full regulatory authority and has not yet found a good strategy. The interviewee said the current direction was toward a process based approach—looking at work programs, management systems, and quality systems. The regulatory concern is in ensuring that measurements and the other bases for building the facility are done properly. There is a need for the builder to have a self-assessment based approach but the regulator cannot really require this because they don't have current authority. Once there is a submission of a license application then the regulator will require processes in place to meet result requirements. The current concern is how to assure well qualified staff when so many people are new and not used to regulated activities—there is a rapid increase in staff, a new phase and changes in organization, and a large number of contractors.

Outcomes of proactive inspections

Several interviewees provided examples of the outcomes of proactive inspections.

Checking on a new regulation

Two interviewees from one agency described an inspection done when a new competency regulation went into effect. The plant was informed about the inspection 6 months prior to the inspection date and asked for quality system documents related to competency. The regulator reviewed the documents to assess the program. Two or three weeks prior to the inspection there was a pre-inspection meeting for the plant to present their program. During the inspection the inspection team checked on whether the actual practices (practical application) of the program met the formal documents and whether both the program and the practice meet regulations. In this case a discrepancy was found with regard to training in emergency preparedness. A system at the plant checks annually on training for each employee, this system worked for everything but emergency preparedness. By checking the system the inspection team was able to identify this gap in the training program.

Checking contractor qualifications before an outage

In this example the licensee is required to have specific training and qualifications for individuals engaged in safety related activities. The regulatory agency conducted an inspection prior to an outage to assure that contractors met these requirements. The inspector looked at training requirements and sampled records to assure that workers had suitable qualifications and experience. Only one individual did not meet all of the requirements—this individual was qualified but did not meet the experience requirements. The inspector discussed the result with the licensee and found that the licensee could show this person was being overseen by someone with experience. The interviewee stated that looking at evidence in this way was highly effective and enhanced the visibility of the inspector with contractors.

Checking qualifications of managers: two examples

In the first example the interviewee explained that the regulator has a general regulation that requires a certain background (training and experience) for managing directors. For example, utilities must demonstrate the director has background and knowledge in the primary regulations for operating the plant. There is also a requirement at the unit level. A change in upper management at a plant placed people with economic backgrounds in charge of top management. These individuals didn't meet the regulation for basic knowledge. Utilities have promised to get these new managers up to speed but it is not easy to do this type of training. This issue often arises when the plant reorganizes. There are examples where the strategy has not been successful and it takes time. The licensee selects people and if there is a lack of qualified candidates they put people in place. It has to do with the background of those individuals. A problem for utilities to get these people trained. The regulatory agency has had problems telling managing directors they aren't qualified. The interviewee noted that it is hard for the regulator to prove the individual's background can create safety problems and to be able to insist on more qualified management.

In the second example an interviewee from another regulatory agency discussed evaluating qualifications for high level managers. Plant managers are interviewed to assure that they have a good understanding of reactor safety, have hands-on experience and a good understanding of the legal obligations of the utility. Most candidates are passed. Recently a candidate was given a conditional pass and the licensee was asked to assure that he had a good understanding of the legal requirements. The approach focuses on an individual's safety consciousness. A benefit of the approach is that it emphasizes the importance and responsibilities of the position.

Checking training after a modification

Two interviewees from one regulator described a review of training done by a plant after a new fire alarm system was installed as part of a plant modification. The overall

regulation regarding training at the regulator is prescriptive, requiring the licensee to supervise and have its own training process. The regulator does verification of the program. In this case the regulator used a process based inspection approach to evaluate the training program initiated by the licensee for a new fire alarm system. The regulator evaluated whether the plant addressed how the new system would affect staff. The inspection included reviewing training documents and interviewing staff—including the fire brigade, maintenance workers, operators, and safety engineers—to determine whether training in the new system was adequate. The inspection team found that training was only developed and provided for operators even though the change affected staff across a number of areas. While this was not a deviation from the regulatory guides, it represented a problem. The regulator followed up over a two year period to see whether the plant had collected feedback and improved the training program. Both the interviewees noted that their overall assessments of the results were positive. One interviewee described a new program by the licensee for evaluating and developing training. The licensee also instituted a program of annual reviews with staff to evaluate training needs. The other interviewee, however, noted that the plant had not yet collected feedback to evaluate the effectiveness of the program. Both stated that the approach has been a good oversight strategy and very effective as way to do an in depth evaluation. One interviewee stated that there were no difficulties in carrying out the in-depth inspections in this way, but these inspections are very resource intensive.

Checking training as part of a quality system review

In this example the interviewee describes an inspection of a quality assurance program which included a review of training. In particular, the inspection team reviewed the implementation of a new spent fuel storage facility and the training of people who participate in handling spent fuel. The training program itself was very good, but when the inspection team observed people moving fuel from the spent fuel pool to storage they identified problems. The regulator determined that one supervisor had not been trained for this activity. The plant claimed that the training was not necessary for this position. This resulted in a letter of non-conformance from the regulator. The interviewee noted that the regulatory response was clear and definitive because there was a prescriptive regulation regarding the requirements for training. The benefit of the strategy is that the next time the plant moves fuel the training will have been completed. Having a clear rule requiring the training assured that the licensee would conform even though the plant claimed the training was unnecessary.

Outcomes of reactive inspections

These examples illustrate incidents that lead regulators to identify problems in competency areas

In depth evaluation of incident leads to increased attention to competence

In this example the interviewee described incidents in the 1980's in which the core oscillated. The regulator evaluated the staff and thought there was a good fuel

department and good operators. But looking at the operators separately from the fuel department they found the operators didn't understand why the fuel was behaving strangely. There was a different knowledge base needed and it needed to be applied in a different way than anticipated. The licensee and the regulator determined that the fuel department must be more involved in day to day procedures. They also determined that the knowledge and competence in the fuel department had slowly lost ground over time. In the beginning everyone had basic knowledge of neutron physics but this knowledge eroded because it was not used day to day. The interviewee explained that in this instance the regulator had waited until an event or incident—an outcome based strategy—and then made inspections and required the licensee to also investigate the event. When investigating, both the licensee and the regulator addressed whether there are other aspects that could be affected by same problem. They both also examined whether this type of problem could be affecting other departments. Although the original focus was on the utility where the problem had occurred, similar issues were identified at other plants. Experience feedback was used and there were seminars with the industry. The regulator now uses a process based approach. Now the licensee is required to define needed knowledge and processes.

Deteriorating performance traced to poor training program

In this example the interviewee described a past strategy that relied on (1) examination scores as the basis for determining the quality of personnel and (2) on good plant performance as the basis for accepting that training programs were adequate. Under this system the regulator reviewed event reports and reacted to events. The licensee did root cause analyses on any problems that occurred and proposed solutions. For a long time the licensee did well because they had a good staff that "passed the torch" from generation to generation. That is, the training was being done informally on-the-job. Then experience levels dropped and problems started to occur. The problems were systemic and recurring. The regulator required a full scale review and found that there was not an adequate overall system for assuring training and competence of staff. Because the individuals had been effective in doing their jobs, the use of outcome indicators failed to identify the underlying systematic problems with training. Because there wasn't a good established training program it was a big job to get the training in order. The interviewee thought it was important to look at outcomes but also to be sure there is a good system—there needs to be a system to fix when problems occur. The regulator has now moved to a more process based system requiring systematic assessments of training.

Licensee needs training in root cause analysis

In this example the interviewee explained how problems in one area can highlight problems in another. Using station condition records and searching for trends a problem was identified involving repeat incidents of maintainers working in the wrong unit. In response to this finding the licensee did a root cause analysis. The root cause analysis submitted to the regulator was inadequate. This led to a review of the licensee's training program in root cause analysis.

Two licensees lose function that tracks training in safety related positions

In this example the interviewee describes differences in response to a finding by licensees under different pressures. The licensees are required to assure that all staff who have safety responsibilities be reviewed against requirements for their positions. Inspectors review processes and outcomes on a sampling basis. If something indicates processes aren't being carried out then the regulator responds. Incidents were identified at two licensees where the licensees had lost their tracking of training programs fulfillment. The regulator went to both licensees and found that a staff reduction of the person tracking required training had been made at each facility. Because this position was outside front line safety it was not carefully reviewed and a key function was lost. One licensee replaced the staff person. The other licensee was under severe financial pressure and contested the need to replace this position. The regulator had to take regulatory action. The inspection started with what the licensees were supposed to be doing and looked for gaps.

7 Concluding remarks

A number of comments on the status and direction of competency regulation seem warranted.

- Competency specialists are concerned about the effects of two related trends—downsizing permanent staff and the increased use of contractors.
- Regulators seem to be moving towards more process based regulations and/or process based inspection methods for the oversight of competency.
- There is continued emphasis on operations staff, but increased attention to a broader range of personnel, particularly maintenance personnel
- While there is increased attention to human factors, there is still an emphasis on technical systems and hardware by regulators and utilities.

Downsizing permanent staff and the increased use of contractors

Concerns about downsizing of permanent staff and the related trend of increased use of contractors were presented in Chapter 5, Competency issues in nuclear power plant regulation. Regulators are addressing these concerns in a number of ways, introducing both new regulations and new oversight methods and tools to assure that licensees maintain sufficient numbers of staff with appropriate expertise on site. A few examples of these approaches are provided here. Two countries, the U.K and Spain, have recently introduced new regulations. The U.K has recently added a license condition for organizational change; compliance requires licensees to show the processes used to determine their resource and competence needs—how they arrived at the numbers and qualifications for specific staff in different technical areas. Once established, changes cannot be made without agency approval (Appendix C5). Spain introduced a requirement for reporting organizational changes (e.g. reduced staffing levels or moving functions to different units) and analyzing their effects to determine impacts on competency needs (Chapter 4, Methods and tools to assure competency). Examples of oversight methods and tools described in Chapter 4 include the use of job and task analysis and gap analysis, oversight of licensee capability to be an intelligent customer in selecting and managing contractors and conducting inspections that cover contract worker performance.

Process based regulations and inspection methods for the oversight of competency

Agencies in Finland and Canada described recent increased use of process-based approaches in oversight. Finland changed from a technically focused to a process-based inspection program in 1997. Canada has been developing a new standard under which a systematic approach to training (SAT) will become a requirement for all training programs. Their agency has been in the process of implementing this program with the utilities for the past few years as described in Chapters 4 and 6. The Spanish regulatory agency described the introduction of process-based oversight in human

factors in the 1990s, and agencies in Sweden and the U.K. make extensive use of process-based regulation and methods of oversight.

Continued emphasis on operations staff, but increased attention to broader range of personnel, particularly maintenance personnel

The regulations and oversight methods and tools in competency continue to emphasize operations staff, in terms of the resources, licensing/certification and specificity of requirements devoted to this group compared to other staff groups. However, there is increasing attention to the broader range of personnel on site. This is evidenced, for example, by the use of SAT, which applies to all personnel, and by inspections which increasingly include a wider range of staff groups. Maintenance personnel have received much more attention in recent years. Examples in Chapters 4 and 6 describe in-depth inspections covering maintenance staff and the expectation that some maintenance positions be specifically on a licensee list of "authorized" positions important to safety at one agency.

Increased attention to human factors, but still an emphasis on technical systems and hardware by regulators and utilities

There has been increasing attention to organizational and human factors in recent years as the discussion of oversight of competency in Chapters 4 and 6 demonstrates. For example, at one agency all licensees were required to hire staff with expertise in organizational and human factors; another agency invested resources for its human factors staff to develop guides and educational materials for plants because of the lack of adequate human factors competency at the plants.

However, interviewees also noted that the history of the industry has left a legacy that undermines intentions to focus more attention in these areas. Both the regulator and the industry focus on hardware issues rather than organizational and human factors or people issues. There is concern about inadequate availability of expertise in human factors both for nuclear power regulators and industry. It is still typical to use engineers without appropriate training or background to perform human factors work.

Appendix A: Interview guide for competency specialists

Assurance of Competency by Nuclear Regulators in Selected Countries

Interview guide: Competency Specialist

Interviewee name:
Date of interview:
Location of interview:

Introduction

We are working with the Swedish Nuclear Power Inspectorate (SKI) to better understand how different regulators assure competency in nuclear power plant personnel. We are interviewing competency specialists such as you in a number of countries. We are interested in regulations and the methods and tools used to assure competency in nuclear power facilities. We are particularly interested in what are the bases for deciding that competency is adequate. SKI plans to publish a report on the findings of this study that will be available after all of the work is complete.

Overview of interview

- We would like to begin by going over a general outline of how your agency oversees competency by asking you to briefly summarize your agency's regulations on competency.
- Next, the major focus of this interview is to discuss the methods and tools you use to assure competency.
- Then we would like your ideas about what are some of the major issues in regulating competency.
- Finally we would like to go over your experience with using different regulatory strategies for competency.
- Do you have any questions?

Interview Questions

Current regulations with regard to competency

The major question is how your agency oversees that licensees assure competency of their personnel. We want to begin with a summary of information on regulations on competency. We are interested in general regulations that apply to all personnel as well as regulations that apply to specific positions.

Our focus is on **qualifications** for **obtaining positions** (e.g. education, experience, initial training, and certification) and for **keeping positions** (e.g. periodic training, re-certification).

We want to make sure we are clear about whether there are qualifications for positions that are:

- Set and required by the regulatory agency,
- Recommended by the regulatory agency but not required—up to the industry,
- Decided on by the industry but need the specific approval of the regulator,
- Decided on by the industry, subject to oversight by the regulator as part of overall safety oversight.

Qualification regulations may be of a general nature—*e.g. "personnel must have adequate expertise to perform their assigned duties properly"*—or specific—*"experience and one year of job experience in a nuclear power plant"*.

Hand blank chart to interviewee.
We plan to use this chart to help us summarize and organize the major competency regulations of your agency.

1. Are there general regulations that **apply to all** personnel? Can you briefly describe them? *Record regulations on chart.*
2. Next, are there competency regulations for **obtaining** specific types of positions? Specifically, are there any regulations for engineering, maintenance, operations or management personnel?
   Probe for education, experience, certification, licensing and initial training regulations.
   Note approaches: specific rules set by agency—or industry sets specifics to fulfill broad safety or performance expectations.
3. Finally, are there competency regulations for **keeping** engineering, maintenance, operations or management positions?
   Probe for re-certification, license renewal and ongoing training regulations.

We will prepare a summary to reflect what you have told us and would like to send it to you in order to verify that we have accurately characterized your agency's regulations regarding competency.

<u>Methods and tools used to assure competency</u>

We'd like to discuss what methods and tools you use to assure competency.
Assuring competency across all personnel is a large undertaking. In order to understand your approach we will be asking you about selected areas to give us an idea of how you use methods and tools for specific areas (such as oversight of qualifications or training programs).
We'll be asking about four types of personnel in particular:
- engineering,
- maintenance,
- operations and
- management

1. What methods and tools do you use to oversee that **licensees know what types of expertise they need for the positions at their plants and that they obtain people with the necessary competency** to carry out their work? *(Probes: methods to evaluate licensee hiring as adequate or inadequate—e.g. job task analysis to*

identify skill levels needed for jobs, reliance on educational credentials, review of basis for how job experience requirements are set. Ask if any differences among or special approaches used for engineering, maintenance, operations or management.)

2. What methods and tools do you use to oversee that **initial training programs** assure competency of staff to perform their jobs? (*Probes: submissions by licensee of curriculum, site visits, review of course schedule*. *Ask if any differences among or special approaches used for engineering, maintenance, operations or management.)*

3. What methods and tools do you use to assure that licensees **maintain and update** necessary knowledge and skills of their staff so that they continue to perform their jobs safely? *(Probes: review of ongoing training, programs for dealing with modifications, new regulations, safety changes etc., refresher certification, oversight of licensee's identification of poor performance. Ask if any differences among or special approaches used for engineering, maintenance, operations or management.)*

4. What methods and tools do you use to oversee the competence of **temporary or contractor** personnel? (*Probes: same as used in hiring and training above or different—e.g. review contracting process? Ask if any differences among or special approaches used for engineering, maintenance, operations or management—e.g. no temporary workers allowed in operations or management.)*

5. Do you use any methods or tools to evaluate **work-group** performance or competence of staff in addition to individual competency? If yes, please explain what these are and for what specific areas you use them. (*Probes: Ask if any differences among or special approaches used for engineering, maintenance, operations or management—e.g. work group performance for operators in simulator performance of shift crews.)*

6. Are there other areas/fields that you want to comment on with regard to your agency's oversight of competency? (*E.g. quality assurance, radiation protection.)* What methods and tools do you use to oversee that licensees assure competency of these personnel? *(Probe: ask for similarities and differences from information provided above about other groups.)*

Next, we would like to ask you to generally describe your agency's approach to the following issues.

1. What are your criteria for follow-up action? *(Probes: What triggers you to take action? Can you give us an example, such as, failing to meet a performance measure, an exam failure, an accident or event associated with staff actions)*
2. How do you follow-up on concerns? (e.g., meeting, notice, monetary fine)
3. Where are challenges you currently face in assuring competency?
4. Are any changes to your approach being considered at this time?

<u>Major issues with regard to assuring competency</u>

1. In what areas do you feel it is most difficult for a regulator to assure competency in the industry?
2. Have you had any concerns about downsizing and competency—doing more with less—either in your country or more generally?
3. Have any issues regarding the assurance of competency when using contractors emerged (or may emerge)?
4. Are you concerned about the ability of the industry to recruit competent personnel in the future? That is, do you have concerns with the long-term availability of competency in the nuclear industry? (Probe: generally or in specific areas of expertise?)

5. What is your overall impression of world wide nuclear power competency? (e.g. reliance of countries new to nuclear power on countries with established nuclear power programs)
6. Are there any other issues regarding competency we should be aware of?

Experience with regulatory strategies for competency

Finally, we'd like you to think an example of your experience with oversight of Competency.
Please describe this example. (Prompt with "walk through")

Please look over this list of regulatory strategies and definitions; we'd like to discuss which strategy or combination of strategies you feel this first example represents.

1. What strategy or strategies would you say was used in this example?
2. Do you know how this strategy came to be selected? If yes, please describe.
3. How effective do you think this strategy has been in this case?
4. Please describe the major benefits, if any, of using this strategy for this case.
5. Please describe the major difficulties, if any, of using this strategy for this case
6. If there were difficulties, do you think this strategy would usually result in these kinds of problems or would better implementation have solved most of them?
7. Do you think that other strategies would work equally well for this area of oversight, or is this strategy the most appropriate given the context of your country and agency? Please explain.

- Referring back to the table of strategies, what do you think are some overall benefits and difficulties of the different strategies for competency (e.g. common pitfalls of particular strategies, such as specific types of implementation problems)?
- Do you think that some strategies for competency are a better or worse fit with the culture of your country or with the context of your country's nuclear industry? Please explain.

Conclusion of interview

Thank you for taking the time to discuss competency issues with us. Do you have any further comments about this area or questions about this study for SKI?

REGULATORY STRATEGIES AND DEFINITIONS

Strategy **Description**

Prescriptive

A prescriptive strategy establishes very detailed requirements for technical solutions and conducting specific activities. Safety is assured because the regulator has established that its requirements provide for the safe conduct of these activities.

Case based

A case-based strategy determines the safety requirements for each licensee through individual assessment of its operation, considering the unique history of each facility. The regulator does not establish general, universal requirements that apply equally to all licensees of a particular type of facility.

Outcome based

An outcome-based strategy establishes specific goals or outcomes for licensees to attain but does not specify how licensees attain these goals. Licensees are free to determine how they will conduct their work activities to result in the achievement of the required safety goals.

Risk based

A risk-based strategy identifies areas and systems of significant potential risk—looking at risk as the combination of the consequences of a potential accident (e.g., would it be catastrophic) and the probability of an accident happening. A specific methodology and specific criteria are established for the identification of areas of greatest risk and these areas therefore receive priority for regulatory attention.

Process/system based

A process-based or system-based strategy identifies specific key processes and systems that lead to safe performance and requires licensees to establish and implement these processes and systems effectively. (Examples of processes would include a way of identifying, recruiting, training and retaining competent staff and ways to develop, assess and implement changes in facilities, policies, and procedures; Examples of systems would be a quality system and the overall system of operations.)

Self-assessment based

Licensees develop and implement a self-assessment program to identify both good practices and problem areas needing improvement. The regulator evaluates the licensee self-assessment program, reviews the results of the licensee assessments, and selectively inspects the licensees' follow up on self-assessment results.

Appendix B: Interview guide for inspectors

Assurance of Competency by Nuclear Regulators in Selected Countries

Interview guide : Inspector

Interviewee name:
Date of interview:
Location of interview:

Introduction

We are working with the Swedish Nuclear Power Inspectorate (SKI) to better understand how different regulators assure competency in nuclear power plant personnel. We are interviewing inspectors with experience in competency in a number of countries. We are interested in regulations and the methods and tools used to assure competency in nuclear power facilities. We are particularly interested in what are the bases for deciding that competency is adequate. SKI plans to publish a report on the findings of this study that will be available after all of the work is complete.

Overview of interview

- The major focus of this interview is to discuss the methods and tools you use to assure competency.
- Then we would like to go over your experience with using different regulatory strategies for competency.
- Do you have any questions?

Interview Questions

Methods and tools used to assure competency

We'd like to discuss what methods and tools you use to assure competency. Assuring competency across all personnel is a large undertaking. In order to understand your approach we will be asking you about selected areas to give us an idea of how you use methods and tools for specific areas (such as oversight of qualifications or training programs).

We'll be asking about four types of personnel in particular:

- engineering,
- maintenance,
- operations and
- management.

7. What methods and tools do you use to oversee that **licensees know what types of expertise they need for the positions at their plants and that they obtain people with the necessary competency** to carry out their work? *(Probes: methods to evaluate licensee hiring as adequate or inadequate—e.g. job task analysis to identify skill levels needed for jobs, reliance on educational credentials, review of*

basis for how job experience requirements are set. Ask if any differences among or special approaches used for engineering, maintenance, operations or management.)

8. What methods and tools do you use to oversee that **initial training programs** assure competency of staff to perform their jobs? (*Probes: submissions by licensee of curriculum, site visits, review of course schedule*. *Ask if any differences among or special approaches used for engineering, maintenance, operations or management.)*

9. What methods and tools do you use to assure that licensees **maintain and update** necessary knowledge and skills of their staff so that they continue to perform their jobs safely? *(Probes: review of ongoing training, programs for dealing with modifications, new regulations, safety changes etc., refresher certification, oversight of licensee's identification of poor performance. Ask if any differences among or special approaches used for engineering, maintenance, operations or management.)*

10. What methods and tools do you use to oversee the competence of **temporary or contractor** personnel? (*Probes: same as used in hiring and training above or different—e.g. review contracting process? Ask if any differences among or special approaches used for engineering, maintenance, operations or management—e.g. no temporary workers allowed in operations or management.)*

11. Do you use any methods or tools to evaluate **work-group** performance or competence of staff in addition to individual competency? If yes, please explain what these are and for what specific areas you use them. (*Probes: Ask if any differences among or special approaches used for engineering, maintenance, operations or management—e.g. work group performance for operators in simulator performance of shift crews.)*

12. Are there other areas/fields that you want to comment on with regard to your agency's oversight of competency? (*E.g. quality assurance, radiation protection.)* What methods and tools do you use to oversee that licensees assure competency of these personnel? *(Probe: ask for similarities and differences from information provided above about other groups.)*

Next, we would like to ask you to generally describe your agency's approach to the following issues.

5. What are your criteria for follow-up action? (Probes: What triggers you to take action? Can you give us an example, such as, failing to meet a performance measure, an exam failure, an accident or event associated with staff actions)

6. How do you follow-up on concerns? (e.g., meeting, notice, monetary fine)

7. Where are challenges you currently face in assuring competency?
8. Are any changes to your approach being considered at this time?

<u>Experience with regulatory strategies for competency</u>

We'd like you to think of an example of your experience with oversight of Competency.

Please describe this example. (Prompt with "walk through")

Please look over this list of regulatory strategies and definitions; we'd like to discuss which strategy or combination of strategies you feel this first example represents.

8. What strategy or strategies would you say was used in this example?
9. Do you know how this strategy came to be selected? If yes, please describe.
10. How effective do you think this strategy has been in this case?
11. Please describe the major benefits, if any, of using this strategy for this case.
12. Please describe the major difficulties, if any, of using this strategy for this case
13. If there were difficulties, do you think this strategy would usually result in these kinds of problems or would better implementation have solved most of them?
14. Do you think that other strategies would work equally well for this area of oversight, or is this strategy the most appropriate given the context of your country and agency? Please explain.

- Referring back to the table of strategies, what do you think are some overall benefits and difficulties of the different strategies for competency (e.g. common pitfalls of particular strategies, such as specific types of implementation problems)?

- Do you think that some strategies for competency are a better or worse fit with the culture of your country or with the context of your country's nuclear industry? Please explain.

Conclusion of interview

Thank you for taking the time to discuss competency issues with us. Do you have any further comments about this area or questions about this study for SKI?

REGULATORY STRATEGIES AND DEFINITIONS

Strategy **Description**

Prescriptive

A prescriptive strategy establishes very detailed requirements for technical solutions and conducting specific activities. Safety is assured because the regulator has established that its requirements provide for the safe conduct of these activities.

Case based

A case-based strategy determines the safety requirements for each licensee through individual assessment of its operation, considering the unique history of each facility. The regulator does not establish general, universal requirements that apply equally to all licensees of a particular type of facility.

Outcome based

An outcome-based strategy establishes specific goals or outcomes for licensees to attain but does not specify how licensees attain these goals. Licensees are free to determine how they will conduct their work activities to result in the achievement of the required safety goals.

Risk based

A risk-based strategy identifies areas and systems of significant potential risk—looking at risk as the combination of the consequences of a potential accident (e.g., would it be catastrophic) and the probability of an accident happening. A specific methodology and specific criteria are established for the identification of areas of greatest risk and these areas therefore receive priority for regulatory attention.

Process/system based

A process-based or system-based strategy identifies specific key processes and systems that lead to safe performance and requires licensees to establish and implement these processes and systems effectively. (Examples of processes would include a way of identifying, recruiting, training and retaining competent staff and ways to develop, assess and implement changes in facilities, policies, and procedures; Examples of systems would be a quality system and the overall system of operations.)

Self-assessment based

Licensees develop and implement a self-assessment program to identify both good practices and problem areas needing improvement. The regulator evaluates the licensee self-assessment program, reviews the results of the licensee assessments, and selectively inspects the licensees' follow up on self-assessment results.

Appendix C1: Summary of Canadian competency regulations

CANADA
Canadian Nuclear Safety Commission
Competency Regulations Summary
General Qualification Regulations for All Positions

The Canadian Nuclear Safety Commission (CNSC) operates within a legal framework that includes law and supporting regulatory documents. Law includes such legally enforceable instruments as acts (e.g. Nuclear Safety and Control Act), regulations, licenses, and orders. Regulatory documents support and provide further information on these legally enforceable instruments. Together, law and regulatory documents form the framework for the regulatory activities of the CNSC. The main classes of regulatory documents developed by the CNSC are:

Regulatory Policy (P): a document that describes the philosophy, principles, or fundamental factors, which underlie the CNSC's approach to its regulatory mission. It provides direction to CNSC staff and information to stakeholders.

Regulatory Standard (S): a document that describes CNSC requirements. It imposes obligations on the regulated party, once it is referenced in a licence or other legally enforceable instrument.

Regulatory Guide (G): a document that indicates acceptable ways of meeting CNSC requirements, as expressed in the Act, Regulations, regulatory standard, or other legally enforceable instrument. It provides guidance to licensees and other stakeholders.

Regulatory Notice (N): a document that provides licensees and other stakeholders with information about significant matters that warrant timely action.

The document types do not create legally enforceable requirements. However, they do support regulatory requirements found in regulations, licenses and other legally enforceable instruments. Where appropriate, the CNSC makes regulatory document into legally enforceable requirements by incorporating them into a regulation, a license, or other legally enforceable instrument.

The basis for competency regulation is *The Nuclear Safety and Control Act* (the Act) and other, next tier, regulations. The *General Nuclear Safety and Control Regulations* require licensees to ensure the presence of a sufficient number of qualified workers to carry on the licensed activity safely and to train the workers to carry on the licensed activity in accordance with the Act, the regulations made under the Act, and their license.

Licensees must have a sufficient number of qualified personnel in all positions. The CNSC focus with regard to sufficient numbers of personnel has been primarily on control room staffing and minimum station complement. The regulations do not define the number of control room personnel, but the current Nuclear Power Plant (NPP) Power Reactor Operating Licenses (PROL) do. The number of station minimum

complement personnel is defined in specific licensees` documents, which the CNSC approves.

The *Class I Nuclear Facilities Regulations* empowers the CNSC to certify and decertify persons for positions referred to in the PROL. Current NPP PROLs require candidates to the positions of Reactor Operator, Unit 0 Operator, Shift Operating Supervisor, Shift Supervisor, and Responsible Health Physicist to obtain a certification by the CNSC before they can assume their responsibilities. In the opinion of the CNSC, these positions may impact directly on the safety of an NPP and on the health and safety of workers, the public, and the environment.

Candidates for these positions are required to complete written and simulator-based regulatory examinations, or interviews, to demonstrate their competence to perform the duties of the position before the CNSC will consider issuing a certification. The CNSC will only issue certifications to candidates who the licensee has declared competent.

The CNSC has decided to withdraw from a direct examination of candidates. The CNSC will then rely on the soundness of the training programs, and on certification examinations set by licensees, to gain assurance of the competence of those candidates prior to their initial certification. The CNSC will continue to issue certifications and to conduct compliance verification activities in the areas of training and certification examinations.

PROLs and licenses for non-power reactors all include a condition requiring the licensee to base the training programs for persons seeking or holding a certification on a systematic approach to training (SAT). In the new standards, yet defined, SAT will become a requirement for all training programs at all Class 1 facilities.

The CNSC is in the process of issuing a Standard for certification of persons working at nuclear power plants. This document describes the qualifications, training, the examinations and certifications that may be required of nuclear power plant (NPP) personnel for positions referred to in a term or condition of their operating license. Previously, these requirements were contained in each license.

The CNSC is also in the process of issuing Guides for developing and conducting written and simulator-based examinations of candidates for certification at NPPs. These guides intend to help licensees develop and conduct examinations for candidates, in support of an application for certification of the candidates.

The CNSC issues all certifications for 5 years. The CNSC recently endorsed the document *Requirements for the Requalification Testing of Certified Shift Personnel at Canadian Nuclear Power Plants*, for the formal implementation of requalification tests for certified staff. The PROLs now refer to this document. CNSC staff will monitor the requalification tests conducted by the licensees to obtain assurance that licensees comply with the requirements of the document and that those tests consistently confirm that all certified individuals retain the knowledge and skills required to work competently in their position.

Qualification Regulations to Obtain Positions

Area	Education	Experience	Licensing / Approvals	Initial Training
Operations *Positions as specified in the license:* *-Reactor Operator, -Unit 0 Operator,* *-Shift Operating Supervisor,* *-Shift Supervisor.*	*The requirements are specified in the license.* *The CNSC has issued a draft Standard on training and qualifications.*	*Same as education*	*CNSC currently conducts examinations and certifies individuals as required by the license.* *Starting in June 2004, the licensee will conduct the certification exam but CNSC will still issue the certification.*	*Required and specified in detail in the license, including comprehensive exams by the licensee. These exams should sample the whole range of information while the CNSC exam is a sample of the material.*
Engineering				*SAT will be required under the new standard.*
Maintenance				*SAT will be required under the new standard.*
Management	*A licensee document, referred to in the license, describes the roles and responsibilities of managers.*		*Previously a formal requirement specified a CNSC interview of higher-level managers.* *There is no longer a legal requirement (in C204), but in practice there is an interview.*	*SAT will be required under the new standard.*
Temporary positions *Contractors are covered under the requirements*				*No specific requirements for training in a regulatory document but licenses include*

for quality assurance management system as these include procurement.				*requirement that licensees assure qualifications of contractors. Using since the mid-80's. These QA standards ask the owner (of a NPP) to ensure that overall and second-tier measures are established which provide for personnel who are skilled and knowledgeable to perform the tasks assigned to them*
Other positions *Responsible Health Physicist is certified, as required in license. This requirement will continue.*	*Health physicist position requires specific education*	*Health physicist position requires specific experience*	*CNSC certifies health physicists based on an interview by CNSC staff and licensee assurance that the person is qualified.*	

Qualification Regulations to Keep Positions

Area	Licensing/Approvals	Continuing Training
Operations	*Licensee must recertify every 5 years, this started in 2000 (first recertification in 2005.)*	*Required—done by licensee as specified in license. This training is based on SAT.*
Engineering	*None*	*None*
Maintenance	*None*	*None*
Management	*None*	*None*
Other	*Health physicist must recertify every 5 years, this started in 2000 (first recertification in 2005.) CNSC renews a certification based on an interview by CNSC staff.*	*Required—done by licensee as specified in license. This training is based on SAT.*

Appendix C2: Summary of Finnish competency regulations

FINLAND
Radiation and Nuclear Safety Authority (STUK)

Note: *Information was derived from STUK Guides YVL 1.6 and 1.7. These guides are being rewritten this year with consideration to providing fewer details and criteria and focusing on principles with more responsibilities resting with the utility. Utilities would determine details and criteria under their own initiative.*

General Qualification Regulations for All Positions

YVL Guides are rules licensees…shall comply with unless STUK….presented with…other acceptable procedures or solutions by which the safety level set forth in the Guide is achieved.

Section 55 of the Nuclear Energy Act, the Finnish Centre for Radiation and Nuclear Safety shall set qualification requirements for persons involved in the use of nuclear energy.

Nuclear power plant personnel shall be well-suited for their duties, they shall be competent and have sufficient basic education. (Section 25 of the Council of State Decision (395/91).

-professional qualifications appropriate to their duties
-aware of administrative and technical requirements relating to safety

Qualifications include: basic education and work experience; suitability (medical, aptitude, security); initial, refresher and continuing training; specific approvals.

Qualification Regulations to Obtain Positions

Area	Education	Experience	Licensing/ Approvals	Initial Training
Operations *e.g. Safety Engineer, Shift Supervisor, Operator, Field Operator (5 job titles)*	*Specific educational level set by regulator (e.g. Engineer, Technician, Vocational training)*	*Years of general and of nuclear field work experience set by regulator*	*Licensing by regulator for shift supervisor and control room operator positions (3 persons per shift must be licensed; reactor operator, turbine operator and supervisor) (written and oral exam; professional skill; simulator skill)*	*Job specific to perform tasks under all circumstances safety awareness promoted general content areas described* *simulator training required for shift supervisors and operators*
Engineering *e.g. Reactor Engineer, Fuel Engineer, Reliability Engineer (9 job titles)*	*specific educational level set by regulator (e.g. Master of Science in Technology, Engineer)*	*years of general and of nuclear field work experience set by regulator*		*Job specific to perform tasks under all circumstances safety awareness promoted general content areas described*
Maintenance *Work supervisor, Mechanic, Work planner (3 job titles)*	*specific educational level set by regulator (e.g., Technician, Vocational training)*	*years of general and of nuclear field work experience set by regulator*		*Job specific to perform tasks under all circumstances safety awareness promoted* *general content areas described*
Management *Responsible manager, deputy, all department and section*	*specific educational level set by regulator (e.g. Master of Science in Technology, Engineer)*	*years of general and of nuclear field work experience set by regulator*	*Responsible manager and deputy specifically approved by regulator*	*Job specific to perform tasks under all circumstances; safety awareness promoted*

managers (14 job titles)				
Temporary positions *e.g. outage staff*	*for positions listed in Guide- same as permanent* *others: set by licensee for teams working on systems/components important to safety*	*for positions listed in Guide- same as permanent* *others: set by licensee for teams working on systems/components important to safety*		*Familiarization training as needed based on past experience and training of temporary staff* *Vocational training provided by licensee to subcontractor personnel as needed*
Other positions *QA, emergency response, radiation protection, training (12 job titles)*	*specific educational level set by regulator (e.g. Master of Science in Technology, Engineer, Technician)*	*years of general and of nuclear field work experience set by regulator*	*Nuclear materials safeguards, emergency response, physical protection and system inspection positions specifically approved by regulator*	*Job specific to perform tasks under all circumstances; safety awareness promoted*

Qualification Regulations to Keep Positions

Area	Licensing	Continuing Training
Operations	*Renewal every 3 years for Shift Supervisor and Operators* *(written and oral exam; demonstrate professional skill; demonstrate team simulator skill, annual training required.*	*annual training recommended, cover changes,* *review items important to nuclear safety at least every 3 years* *content areas described* *Simulator training for operators and shift supervisors. Plants have a systematic three year program, not required in detail in regulations but a general practice.*
Engineering		*annual training recommended, cover changes,* *review items important to nuclear safety at least every 3 years* *content areas described*
Maintenance		*annual training recommended, cover changes,* *review items important to nuclear safety at least every 3 years* *content areas described*
Management		*annual training recommended, cover changes,* *review items important to nuclear safety at least every 3 years*
Other		*annual training recommended, cover changes,* *review items important to nuclear safety at least every 3 years* *content areas described*

Appendix C3: Summary of Spanish competency regulations

SPAIN
Consejo de Seguridad Nuclear, (CSN) [Nuclear Safety Council]
Competency Regulations Summary

General Qualification Regulations for All Positions

Spain requires that licensees follow the regulations of the country where the nuclear power plant was manufactured. In most cases this means licensees must follow the regulation of the United States. U.S. rules include that the licensee shall have a systematic approach to training (SAT) 10 CFR 50.120. Other requirements include the use of plant specific simulators.

All staff must be trained and to know the rules governing their positions. All personnel are trained in and must follow radiation protection requirements and emergency procedures. The licensee of each nuclear power plant must submit their training program to CSN for approval. All personnel at the plant work under the responsibility of licensee and under their supervision.

Qualification Regulations to Obtain Positions

Area	Education	Experience	Licensing/ Approvals	Initial Training
Operations	*Rule requires a 3 yr university degree in science for all licensed positions. Turbine operator was added to license requirement in 2000 (current turbine operators can be continued or promoted, i.e., grandfathered).*	*Not in rule.* *Some experience levels specified in license requirements, for example, supervisor license requires at least one year of previous operator experience.*	*Rule defines who needs license and type of license. License is required for control room operators and supervisors. Aux. operator and operations manager do not need license. Licenses are for one plant. There is a licensing tribunal that evaluates the application. Licensed operators are required to have a medical certificate—physical and psychological requirements based on an exam selected by the tribunal. The tribunal has 4 from CSN and one from NPP. Licensee can include a limiting condition, e.g., medical dose limit, therefore no exposure or time limit. Can be licensed only for turbine or reactor. Operator communication—must send information to CSN regarding any change in ability.*	*There is a guide. A common contractor provides all the training and has the simulators. Very established methods. Requirements for initial training include minimum training requirements.*
Engineering	*No requirements from CSN. There is an industry guide that has been accepted by CSN.*			

Area	Education	Experience	Licensing/ Approvals	Initial Training
Maintenance	*No requirements from CSN. There is an industry guide that has been accepted by CSN.*			
Management	*No requirements from CSN. There is an industry guide that has been accepted by CSN.*			
Temporary positions	*No requirements from CSN. There is an industry guide that has been accepted by CSN.*			
Other positions	*Radiation protection specialist needs a 5 year degree in science*		*Radiation protection expert requires a license, not regulated by CSN but by other technical directorate. Radiation protection job is specified, there is a guide for radiation. Protection.*	

Qualification Regulations to Keep Positions

Area	Licensing/Approvals	Continuing Training
Operations	*License renewal: License expires after 3 years. Have to show evidence of meeting training requirements and good evaluation of their performance. No exam. Other reasons for revocation: Lost mental or physical capacity to perform or severe omission or intentional (malevolent) action in control room or end of NPP license.*	*In the guide there are requirements for continuous training.*
Engineering		
Maintenance		
Management		
Other		

Appendix C4: Summary of Swedish competency regulations

SWEDEN

Swedish Nuclear Power Inspectorate (SKI)

General Qualification Regulations for All Positions

Note: *(information from SKIFS 1998:1 and 2000:1)*

SKIFS 1998:1 2.3 *The licensee shall*

1. *establish documented guidelines for how safety shall be maintained at the facility as well as ensure that the personnel performing duties which are important to safety are well acquainted with the guidelines,*

4. *ensure that adequate personnel is available with the necessary competence and the suitability otherwise needed for those tasks which are of importance to safety as well as ensure that this is documented,*

The Guidance in reference to 2.3, Point 4 specifies that

- Competence and staffing plans shall be prepared for several years in advance
- A systematic method should be used based on analyses of the tasks which must be carried out in order to ensure that a high level of safety is maintained in the activity.
- The training needs determine the preparation of training programmes and training materials.
- Course evaluation is required following the completion of training
- Systematic competence follow-up should also be carried out. The follow-up should be conducted with explicit criteria regarding acceptable performance.
- The competence follow-up should, with regard to tasks of importance to safety, be carried out on an annual basis.
- The advantages and disadvantages of using in-house personnel should be weighed against those of using sub-contractors and other hired personnel, with respect to tasks which are of importance for safety.
- The necessary competence should always be maintained within the facility's organization in order to be able to order, manage and evaluate the result of work which is of importance for safety and which is carried out by sub-contractors on other hired personnel.

5. *ensure that responsibilities and authority are defined and documented with respect to personnel carrying out work which is important to safety,*

7. *ensure that experience from the facility's own and from similar activities is continuously utilized and communicated to the personnel concerned.*

App. 3: Technical specifications must have a specification of the necessary staffing to ensure safe operation during different operating states

Some specific types of training or expertise are required or suggested for all personnel.

- Entire staff must have training and exercises in physical protection (Guidance for SKIFS 1998:1 2.5) and emergency preparedness (5.5). Emergency preparedness exercises annually (Guidance to 5.5). In the area, SKI looks at the system rather than at specific elements.
- Personnel with technical competence in the specific area as well as in behavioral sciences are required for safety reviews (SKIFS 1998:1 4.3).
- All personnel shall be well acquainted with the technical specifications of the plant (SKIFS 1998:1 5.1) and procedures (5.2) and shall be made aware of experience feedback findings (5.6)

There are specific requirements relating to competency for records and reporting

- *Reporting must include any modifications in competency requirements and training programs as well as implemented and planned training for personnel with importance for safety (Guidance for 7.1)*
- *Competence follow-up and training activities must be recorded and records maintained (Guidance for 8.2).*

SKIFS 2000:1 *The Swedish Nuclear Power Inspectorate's Regulations concerning the Competence of Operations Personnel at Reactor Facilities,* contains provisions concerning the competence of operations personnel. Basic provisions include that licensees must use a systematic method to analyze necessary competence of operations personnel and to check that the personnel have the required competence. Operations personnel must also be authorized by the licensee for specific positions, with a maximum authorization period of three years. Training and retraining are required for authorization to a position. Operations personnel include operations management (personnel authorized to order a change in facility operating status and/or personnel authorized to make technical operational decisions in the facility's emergency preparedness organization), control room personnel and field operators.

Qualification Regulations to Obtain Positions				
Area	**Education**	**Experience**	**Licensing/ Approvals**	**Initial Training**
Operations *(includes: operations management, control room personnel, field operators*	*Requirements based on systematic competence evaluation conducted by licensee. It shall include the establishment of criteria for each position and the evaluation of competence based on these criteria. [Guidance document suggests criteria]. The requirements and evaluation shall be continuously investigated by the licensees quality assurance function (SKIFS 2000:1) Guidance document suggests minimum educational criteria*	*Requirements based on systematic competence evaluation conducted by licensee. It shall include the establishment of criteria for each position and the evaluation of competence based on these criteria. Criteria are also provided for testing. [Guidance document suggests criteria]. The requirements and evaluation shall be continuously investigated by the licensees quality assurance function (SKIFS 2000:1)*	*Licensee must authorize individual to hold positions (SKIFS 2000:1)*	*Employee must have documented training in accordance with licensee requirements (SKIFS 2000:1)*
Engineering	*	*	*	*
Maintenance	*	*	*	*
Management	*Managers with authority over operations are included in operations requirements*	*Managers with authority over operations are included in operations requirements*	*Managers with authority over operations included in operations requirement*	*Managers with operations authority included in operations requirements*
Temporary Positions	*	*	*	*
Other positions	*	*	*	*
**** Note: All personnel doing tasks important to safety must have appropriate documented competence***				

Qualification Regulations to Keep Positions

Area	Licensing	Continuing Training
Operations	*Renewal every 3 years for Shift Supervisor and Operators* *Licensee must have criteria and there must be a written and oral exam; demonstration of professional skill; demonstration of team simulator skill.* *Annual training is required based on a three year program developed by the licensee. SKI assures there is a program and criteria and checks program if there are indicators of problems.* *To continue authorization for control room work, employee must maintain control room experience* *Guidance document suggests 40 shifts a year as a possible guideline for work experience needed to maintain familiarity with tasks.*	*Operations personnel shall undergo retraining annually. Part of training shall be in a full scale simulator.* *Documented procedures for documenting training must exist.* *Guidance document suggests topics for retraining, minimum days of training, and some aspects of simulator training.*
Engineering		
Maintenance		
Management	*Managers with authority over operations are included in operations requirements*	*Managers with authority over operations are included in operations requirements*
Other *Personnel appointed by name for responsibilities during accident situations*		*Personnel appointed by name for responsibilities during an accident situation shall be provided with training (Guidance for 5.4).*

Appendix C5: Summary of United Kingdom competency regulations

UNITED KINGDOM
Nuclear Installations Inspectorate (NII)

General Qualification Regulations for All Positions

License applicants must provide the Nuclear Installations Inspectorate (NII) with a Safety Management Prospectus (SMP). The SMP must include a clear statement about how the company proposes to operate, including the "application of adequate staff resources" and "appropriately trained, suitably qualified and experienced staff".

Licensees must meet licensing conditions. Several licensing conditions are related to the qualifications and training of licensee staff. Licensing Conditions 10, Training, and 12, Duly Authorized and Other Suitably Qualified and Experienced Persons are the most relevant.

Licensing condition 10—Training

(1) The licensee shall make and implement adequate arrangements for suitable training for all those on site who have responsibility for any operations which may affect safety.
(2) The licensee shall submit to the Executive for approval such part or parts of the aforesaid arrangements as the Executive may specify.
(3) The licensee shall ensure that once approved no alteration or amendment is made to the approved arrangements unless the Executive has approved such alteration or amendment.

Licensing Condition 12—Duly Authorised and other Suitably Qualified *(DAPS and SQEPS)* and Experienced Persons

(1) The licensee shall make and implement adequate arrangements to ensure that only suitably qualified and experienced persons perform any duties which may affect the safety of operations on the site or any other duties assigned by or under these conditions or any arrangements required under these conditions.
(2) The aforesaid arrangements shall also provide for the appointment, in appropriate cases, of duly authorised persons to control and supervise operations which may affect plant safety.
(3) The licensee shall submit to the Executive for approval such part or parts or the aforesaid arrangements as the Executive may specify.
(4) The licensee shall ensure that once approved no alteration or amendment is made to the approved arrangements unless the Executive has approved such alteration or amendment.
(5) The licensee shall ensure that no person continues to act as a duly authorised person if, in the opinion of the Executive, he is unfit to act in that capacity and Executive has notified the licensee to that effect.

There is guidance in the Safety Assessment Principles, which sets a high level approach to assessing the licensee safety case, including human factors. One example is Safety Management. Safety Assessment Principles: page 35, under Management systems, 402 (P321). **Note:** *Safety Assessment Principles are currently under revision.*

> *"Provisions should be made for training of staff who will have responsibility for the safety of the plant. These should include a management system for training on the site, analysis of jobs and tasks, development of training methods, assessment of trainees, revision of training as required, and regular evaluation of training."*

License conditions apply to all positions. There are no separate conditions by position. The licensee determines which positions are safety related (SQEPS). Similarly, the licensee selects the positions to be on the "duly authorized" list (DAPS).

The licensee determines specific competency qualifications.
Based on these license conditions, licensees must assure adequate training and assure that suitably qualified and experienced personnel are in specific safety related positions.
DAPS and SQEPS have a fitness for service requirement.

Qualification Regulations to Obtain Positions

Area	Education	Experience	Licensing/ Approvals	Initial Training
Operations	*Based on licensee assessment subject to regulator approval, at regulator's discretion (license condition 12).*	*Based on licensee assessment subject to regulator approval, at regulator's discretion (license condition 12).*	*Control room operators are considered Duly Authorized Personnel. There is an assessment and internal accreditation process for DAPS. Subject to regulator approval, at regulator's discretion (license condition 12).*	*Based on licensee assessment, subject to regulator approval, at regulator's discretion (license condition 10).*
Engineering	*Based on licensee assessment. Subject to regulator approval, at regulator's discretion (license condition 12).*	*Based on licensee assessment. Subject to regulator approval, at regulator's discretion (license condition 12).*	*Any DAPS certified by licensee. Subject to regulator approval, at regulator's discretion (license condition 12).*	*Based on licensee assessment subject to regulator approval, at regulator's discretion (license condition 10).*
Maintenance	*Based on licensee assessment. Subject to regulator approval, at regulator's discretion (license condition 12).*	*Based on licensee assessment. Subject to regulator approval, at regulator's discretion (license condition 12)*	*Any DAPS certified by licensee. Subject to regulator approval, at regulator's discretion (license condition 12).*	*Based on licensee assessment subject to regulator approval, at regulator's discretion (license condition 10).*

Management	*Based on licensee assessment. Subject to regulator approval, at regulator's discretion (license condition 12).*	*Based on licensee assessment. Subject to regulator approval, at regulator's discretion (license condition 12).*	*Any DAPS certified by licensee. Subject to regulator approval, at regulator's discretion (license condition 12).*	*Based on licensee assessment subject to regulator approval, at regulator's discretion (license condition 10).*
Temporary positions	*Based on licensee assessment. Subject to regulator approval, at regulator's discretion (license condition 12).*	*Based on licensee assessment Subject to regulator approval, at regulator's discretion (license condition 12).*	*Based on licensee assessment Subject to regulator approval, at regulator's discretion (license condition 12).*	*Based on licensee assessment subject to regulator approval, at regulator's discretion (license condition 10).*
Other positions *Health physics. Radiation protection*	*Health physics—response in part to external requirement. Subject to regulator approval, at regulator's discretion (license condition 12).*	*Health physics—response in part to external requirement Subject to regulator approval, at regulator's discretion*	*Any DAPS certified by licensee. Health physics—response in part to external requirement. Subject to regulator approval, at regulator's discretion*	*Health physics—response in part to external requirement. Radiation protection. Must have taken a course and been tested. Based on licensee assessment Subject to regulator approval, at regulator's discretion (license condition 12).*

Qualification Regulations to Keep Positions

Area	Licensing/Approvals	Continuing Training
Operations	*Internal continuing certification process for control room operators by licensee* *Subject to regulator approval, at regulator's discretion (license condition 12)*	*Based on licensee assessment subject to regulator approval, at regulator's discretion (license condition 10).*
Engineering	*Any DAPS continuing certification done by licensee.* *Subject to regulator approval, at regulator's discretion (license condition 12)*	*Based on licensee assessment subject to regulator approval, at regulator's discretion (license condition 10).*
Maintenance	*Any DAPS continuing certification done by licensee.* *Subject to regulator approval, at regulator's discretion (license condition 12)*	*Based on licensee assessment subject to regulator approval, at regulator's discretion (license condition 10).*
Management	*Any DAPS continuing certification done by licensee. Subject to regulator approval, at regulator's discretion (license condition 12)*	*Based on licensee subject to regulator approval, at regulator's discretion (license condition 10).assessment*
Other	*Any DAPS continuing certification done by licensee.* *Subject to regulator approval, at regulator's discretion (license condition 12)*	*Based on licensee assessment subject to regulator approval, at regulator's discretion (license condition 10).*

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