Principal Working Group No. 1 -
Extended Task Force on Human Factors

TASK 5: ROLE OF SIMULATORS IN OPERATOR TRAINING

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VOLUME 3: EXPERIENCES OR STUDIES ON SPECIFIC ISSUES
QUESTIONNAIRE

SECTION 0: Organisation/s replying to the questionnaire

1. **Name of Organisation/s.**
   ELECTRABEL - Scaldis Training Center

2. **Contact Person/s.**
   Henri Michiels, Manager

3. **Address and contact information (telephone, fax).**
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SECTION 1: General Information (answers for Doel only)

1. **Number of nuclear reactors (Units) in operation.**
   4

2. **Number of Sites with at least one Unit in operation.**
   1

3. **Number of full-scope (replica and no replica) simulators used for operator training.**
   2

4. **Number of replica simulators used for operator training.**
   2

5. **Number of part-task simulators used for operator training.**
   0

6. **Number of basic principles simulators used for operator training.**
   0

7. **Number of concept simulators used for operator training.**
   0

8. **Number of special-purpose simulators used for operator training.**
   0
9. For how many Units is the training done on replica training simulators?

4

10. For how many Units is the training done on full-scope (replica and no replica) training simulators.

4

IMPORTANT QUESTION

Are your answers to the subsequent sections (2 to 5) of the questionnaire related to a specific Organisation or Training Centre in your Country?

Yes ___  No ___  (Mark your answer with an X)

If yes, indicate the name of the Organisation or Training Centre and describe briefly the simulation facility referred to in answer to the question below (f.i. located on-site or off-site, type of simulator/s, sample photograph, reference NPP/s, NPP/s which receive training in this facility, size and composition of the simulator instructional and support staff, etc.) and, also, describe this/these NPP/s (f.i. type (PWR, BWR, etc.), vendor, start of operation, degree of automation, Operators which constitute the Control Room Shift Team, sample photograph of the control room/s, etc.).

SECTION 2: Current practices with simulators closely related to operator training.

1. Based on your experience, describe advantages and disadvantages of the location of the Simulation Centre with regard to the plant: on-site versus off-site. Specifically, describe those factors which have some influence on the Operators' attitude towards the simulator training and in the quality of the simulator training.

The Simulator Training Center is situated at ± 15 km from the plant.
Advantages: quiet training atmosphere, less disturbances of trainees.
Disadvantages: separate maintenance staff required.

2. a) During simulator training sessions, what factors (time, communications, etc.) influencing the interactions between Control Room Operators and other Plant Personnel (Operations Department outside of Control Room Personnel, Maintenance or Instrumentation, and Control Departments, Technical Support Centre, etc.) are simulated?

Instructor is playing the role of field operators and maintenance people. Communication is by phone.
b) Do these other Plant Personnel participate in the training sessions?
Describe the present training format pertaining to involvement of non Control Room Personnel in simulator training sessions and explain why this format is used.

Other plant personnel does not participate in the training sessions. There are plans to do so in 1997.

3. What environmental conditions (normal and emergency lighting, humidity, noise, vibrations, sounds generated by equipments, etc.) that could be experienced by the reference plants, are usually simulated in the Simulator Rooms?
Describe the use of such effects at your simulator centre and explain why they are, or are not, incorporated into simulator training sessions.

Normal and emergency lighting, used during malfunctions on the electrical grid.

4. Do Control Room Operators receive simulator training for operations outside the Control Room, for example: operations from Remote Shutdown Panels?
Describe this type of training as it exists at your Simulator Centre and explain why it is, or is not, used in training sessions.

Simulator training is provided for operations in the “bunker” control rooms, i.e. in case of simulation of external accidents.

5. a) How frequently are the changes taking place in plant (plant design changes, procedures changes, etc.) incorporated to the replica or full-scope simulator?
Describe any process or mechanism in place at your Simulator Centre to incorporate changes to the replica or full-scope simulator.

Modifications to the simulator are carried out once a year during a batch campaign. This method is followed for software Q.A. reasons. Triggers for these modifications can be:
- simulation faults detected during training sessions
- experience feedback from the reference plant or from other plants
- improvements or extensions of the simulation (i.e. MMI)
- modifications to the reference plant.
Every year, in June, a list of plant modifications is requested by the training center operations training manager from the operations department of the reference plant. This list covers the modifications of the last year. The modifications listed are evaluated on their importance for simulator training by the operations training manager and the simulator instructors. The cost of the selected modifications is analysed. A final cost/benefit analysis is carried out by the training center manager and the operations training manager. The approved modifications are included as items in the modification campaign for the next year.

b) Do simulator model modifications require separate approval while the simulator is being used for training?

Simulator modifications are never carried out during training.
6. a) Identify the members of the Control Room Shift Team (Reactor Operators, Turbine Operators, Shift Supervisors, etc.) and indicate the time (in hours) dedicated to simulator training by each member in their initial training programme. Specify, when applicable, the time spent with each type of simulator.

All trainees (operations managers, shift supervisors, reactor operators) spend ± 120 hours on simulator training during their initial training (full scope simulator). This training is preceded by training on a basic principles simulator abroad (± 20 hours).

b) Indicate the time (in hours) dedicated to simulator training by each member of the Control Room Shift Team in their continuous training programme. Specify, when applicable, the time spent with each type of simulator.

All trainees mentioned above spend 40 hours/year on full-scope simulator during their continuing training programme.

c) What is the minimum time, if any, required by the Regulatory Body?

20 hours/year.

7. a) Indicate the percentage of simulator training time by the different Members of the Control Room Shift Team devoted to i) normal, ii) abnormal and iii) emergency conditions in their initial training programme.

1/3 for each.

b) Indicate the percentage of simulator training time by the different Members of the Control Room Shift Team devoted to i) normal ii) abnormal and iii) emergency conditions in their continuous training programme.

Not specified, but the emphasis is on abnormal and emergency conditions.

c) What are the minimum percentages, if any, required by the Regulatory Body?

None.

8. What is the role and the policy of the Regulatory Body regarding the use of simulators for Control Room Operators licensing and training?

?

9. a) What standards (ANSI/ANS 3.5, IAEA, etc.) are simulators built to and maintained?

ANSI / ANS 3.5 (exceeded).

b) What exceptions are typically taken to the standard?

Non applicable.
c) **What types of simulators are used that are not included in industry standards?**

None.

10. a) **Describe the role of part-task simulators in your current training programs.**

We do not have part-task simulators. Part-task simulation is carried out on our full-scope simulators during initial training.

b) **Describe the role of special-purpose (analytic) simulators in your current training programs.**

A plant analyser is used occasionally for training on thermohydraulic phenomena.

11. **Have the current operator training programs been conditioned by the availability and capabilities of the simulator(s) or, alternatively, has(ve) the simulator(s) been specified and acquired after analysing and designing the training programs? Explain.**

Our full-scope simulators were specified and acquired after a period of using non- replica full-scope simulators abroad.

12. **What extensions of simulator training are envisaged for the future?**

None.

13. a) **Based on your experience, describe the uses of the simulators for activities other than training (plant drills, procedures validation, design changes validation, testing programs, acquisition of human data, licensing activities, reference plant systems “tuning”, etc.)**

Uses of our simulators for activities other than training are very limited. A few examples can be given: validation of emergency procedures, validation of process computer displays, testing of new control room mimics.

b) **What is the involvement of Control Room Operators for those applications?**

Active participation.

14. **What are the applications of simulator training for jobs other than Operations?**

None, although this might change in the future (training of I & C technicians).
SECTION 3: Systematic Approach to Training: considerations regarding the use of simulators.

A) Training analysis.

1. Are job and task analysis (or any other type of task identification technique) used for establishing a list of task, performance standards, learning objectives and training methods?
   If yes, describe the technique used.
   JTA is not used.

2. a) What are the criteria that determine the limits or scope of the job analysis for the Control Room Operators?

   p.m.

   b) From your point of view, what should the role of risk-based criteria be for determining such limits or scope? Explain your answers.

3. Are there any special requirements for Job and Task Analysis which are imposed by the possibility of associated simulator training?

   p.m.

B) Training programme design.

1. What are the criteria for specifying simulator training rather than another training setting (classroom, laboratory, workshop, on-the-job, etc.)?

   Simulator training offers the unique possibility of hands-on training, especially for incident and accident scenarios!

2. What are the criteria for selecting different types of simulator (full-scope, replica, part-task, basic principles, concept, special-purpose)?

   A full-scope simulator allows several types of training: full-scope, part task...so it is a good economic choice.

3. a) What are the criteria for selecting a replica simulator?

   A replica simulator permits training for the operators in the most realistic environment possible.

   b) What are the fidelity requirements?

   Replica of the actual control room and a response as close as possible to that of the real plant (to be compared with the results of best estimate codes).
4. **What are the specific pre-requisites for operators undertaking simulator training?**

A good general knowledge of physics, thermohydraulics etc. and a good knowledge of the different plant systems and operating procedures.

5. **Does the possibility of simulator training impose any constraints on the definition of learning objectives?**

C) **Training programme development.**

1. **In the case of non-replica simulators, is it necessary to take parallel training actions, and if so, what kind?**

   Explain your answer.

   Non applicable.

2. **Do you use specific procedures for the training simulator, actual plant procedures or a combination of both?**

   Explain your answer and give reasons for the choice.

   Actual plant procedures are used. However for the trainees from the Doel 3 plant, slightly adapted procedures are used on the Doel 4 simulator.

3. **What are the criteria for selecting normal, abnormal and emergency scenarios to be trained with simulators? Are they risk-based criteria?**

   Explain your answer.

   The scenarios are used according to the actual plant procedures for normal, abnormal and emergency scenarios.

4. **How are lesson plans and support documentation developed for simulator training?**

   A 5 year lesson plan is written that contains all major topics of the initial training programme. For every simulator training session, a pedagogical file is written that contains the learning objectives and a day-by-day description of the scenarios to be followed.

D) **Training programme implementation.**

1. **What selection, initial training, and continuing training is arranged for simulator instructors?**

   Simulator instructors are selected amongst young graduated operation engineers holding an operating license for the reference plant and amongst the licensed shift supervisors or deputy shift supervisors of the reference plant. Initial training takes ± 2.5 months and is devoted to pedagogical training and studying of the simulator and its limits, followed by shadow training under close supervision by an experienced instructor. Continuing training focuses on accident scenarios, plant modifications and procedure modifications.
2. **What are the arrangements for instructor monitoring of, and feedback to, trainees during simulator sessions?**

Instructors are continuously monitoring trainees during the sessions. Feedback is given also during the sessions and repeated systematically at the end of the session during a summary meeting.

3. **a) What specific training modes such as simulator freeze, playback, running at higher speed than real time, activity recording, video recording, etc. is made use of during initial training?**

Freeze, playback, running at faster speed.

**b) What specific training modes such as simulator freeze, playback, running at higher speed than real time, activity recording, video recording, etc. is made use of during continuous training?**

Freeze, playback, running at fast speed, video recording for a team of building sessions.

4. **What limits of simulation impede planned training sessions or examination scenarios?**

p.m.

E) **Trainee assessment.**

1. **a) What methods and procedures are used for initial trainee assessment during and after simulator sessions?**

Observation by instructors.

**b) What methods and procedures are used for continuous trainee assessment during and after simulator sessions?**

Observation by instructors.

2. **List and describe the main areas or groups of skills and knowledge of the trainee assessed in training simulators (for example: “control board awareness, event diagnosis, immediate actions / entry-level actions, subsequent actions, control board manipulations, use of procedures / technical specifications / reference data, communications, supervisory ability, team skills” (IAEA-TECDOC-525)). Identify, when applicable, the types of simulator used for addressing each one.**

- knowledge and verification of automatic actions
- use of controls
- use of procedures
- alarm response
- communication

3. **Describe the ranking of importance, if any, given to the main areas or groups of skills and knowledge taken into account for a trainee assessment.**

No ranking.
4. a) Based on your experience, describe difficulties you have had for assessing the individual skills and knowledge of a trainee while operating within a whole Control Room Shift Team during simulator sessions.

The fact that the assessment is done by one instructor; our number of instructors is insufficient to organise an assessment by more than one.

b) Describe the measures adopted to overcome these difficulties.

5. a) Based on your experience, describe influences on trainees performance during simulator sessions resulting from the attendance of personnel such as utility managers, regulatory body inspectors, etc.

No such personnel is attending the simulator sessions.

b) Based on your experience, describe influences on trainees performance during simulator sessions resulting from the attendance of personnel such as utility managers, regulatory body inspectors, etc.

The close contact with instructors is very beneficial.

6. a) Are training simulator examinations used in order to grant initial license to operators? Explain.

For the initial license, the trainee has to complete successfully the three simulator modules on normal operation, abnormal operation and accidents. No formal simulator examination is required

b) Are training simulator examinations used for requalification? Explain.

No.

7. How is examination integrity preserved during the examination/scenario preparation period?

Non applicable.

8. What performance monitoring or data acquisition features of the simulator are used during simulator examinations?

Non applicable.

F) Training programme evaluation.

1. Describe the approach used for evaluating the simulator training programme and main results.

At the end of every simulator session, there is an evaluation meeting where the remarks made by the trainees and instructor are recorded. A yearly summary of these records is made.
2. **What programme is in place for validation and continuous verification of the simulator performance?**

   At the end of the yearly modification campaign, a series of three types of non regression tests is made: the simulator response is verified in steady state, for a well defined number of incident scenarios and for a well defined number of accident scenarios. These responses are compared with those of the previous years.

3. **What types of performance discrepancies are most frequently identified by operators during training sessions?**

   Behaviour of steam generator level during particular transients.

4. **What types of performance discrepancies are most frequently identified by examiners or inspectors?**

   p.m.

**SECTION 4: Use of operating experience for operator training with simulators.**

1. **How is operational experience feedback incorporated into the design of simulator training programs (experience reviewed, schedule, people involved)?**

   Operational feedback reports are screened by the instructors. Where necessary, feedback is incorporated in the simulator training programs.

2. **Has your organisation developed any kind of programme by which simulator operator training is correlated with real operating events? Explain.**

   Instructors introduce some malfunctions that happened in the reference plant.

**SECTION 5: Specific topics on Operator training with simulators.**

A) **Team training techniques.**

1. a) **Are job and task analyses used for defining the role and responsibilities of the Members of the Control Room Shift Teams and, in general, of the various levels of staff who are charged with operation of the plant? Explain your answer.**

   No.

   b) **Are job and task analyses used for establishing performance standards, learning objectives and training methods for Team skills training? Explain your answer.**

   No.
2. List and describe Team skills (communication, management of resources, team cooperation, team leadership, feedback, conflict resolution, team decision-making, etc.) which are trained using simulators. Identify, when applicable, the types of simulator used for training each one.

Trained on full-scope simulator: co-operation communication within the team, communication with external parties, leadership of shift supervisor, performance under stress, understanding yourself and each other, coaching and feedback, influencing, conflict resolution, teamwork in diagnostics, teamwork behaviour styles, personality of the crew, personal growth commitment.

3. Are any guides used for conducting and evaluating Team skills training simulations? Explain your answer.

A guide is used, provided by an external consultant.

4. Based on your experience, describe advantages and disadvantages of Team training with the participation of the same (usual) Members every time or with changes in the Shift Team compositions.

Team training is always conducted with the same usual members of the real teams.

5. Are simulator sessions used for the optimisation of control Room Team Shifts taking into account the characteristics (aptitudes, attitudes, ...) of each Operator? In other words, are simulator sessions used for deciding which Members are going to constitute each Shift Team? Explain your answer.

No.

6. Are there any licensing examinations applied to the whole Control Room Shift Team in addition to the individual licensing examinations? Explain.

No.

B) Training for stress.

1. Is any part of the simulator training programme specifically devoted to train Control Room Operators to operate under stress? Explain you answer.

Incorporated in the team building sessions.

2. Are stress levels induced and measured during simulator training sessions? If yes, describe the methods and results.

No.

3. Based on your experience describe any measures adopted during simulator training to counter stress.

Cfr. team building training.
C) The theoretical basis underlying training.

1. Are any models of human behaviour being used in designing and implementing training programmes?
   If yes:
   i) refer to or describe the models,
   ii) indicate the areas in which these models are being applied (for example: signal detections, decision-making, etc.)
   iii) give the main results.

No.

D) Habits acquired during training sessions with simulators.

1. Describe, based on your experience, undesirable habits which could be acquired by trainees during training sessions with simulators (for example: due to limited number of simulated scenarios, due to lack of physical or functional fidelity, due to the use of conservative codes for simulation instead of best estimate codes, etc.) and discuss their potential consequences on safety.

   We are not aware of such habits. Codes for simulation are not conservative and are validated against best estimate codes.

2. Describe, based on your experience, any measures adopted to avoid acquisition of those undesirable habits or to prevent use of them.

   p.m.

E) Simulator training on normal and emergency conditions during shutdown and low power operation.

1. What use is made of simulators for Control Room Operator training in normal, abnormal and emergency conditions during shutdown and low power operation (simulated scenarios, trained skills, training techniques, ...)?

   Mid-loop operation in normal, abnormal and emergency conditions.

2. What are the criteria (risk-based criteria, deterministic criteria, results of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?

   Frequent problems in many PWR's during this operation mode.

3. Are job and task analysis (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on shutdown and low power operation? Explain.

   No.
4. **What are your plans for the future in this area?**

   Improving the model.

**F)** Simulator training on severe accidents.

1. **What use is made of simulators for Control Room Operator training in severe accidents (simulated scenarios, trained skills, training techniques, ...)?**

   None. Emergency contingency actions are already at the limit of the simulator possibilities.

2. **What are the criteria (risk-based criteria, deterministic criteria, result of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?**

   p.m.

3. **Are job and task analysis (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on severe accidents.**

   Explain.

   No.

4. **What are your plans for the future in this area?**

   None.

**G)** Simulator training on accidents caused by fires, floods, earthquakes, etc.

1. **What use is made of simulators for Control Room Operator training in accidents caused by fires, floods, earthquakes, etc. (simulated scenarios, trained skills, training techniques, ...)?**

   Training in accidents where the control room has to be abandoned due to external accidents. For this purpose the “bunker” control rooms are also simulated.

2. **What are the criteria (risk-based criteria, deterministic criteria, result of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?**

   It is the only way to train the operators in using these additional control rooms.

3. **Are job and task analyses (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on accidents caused by fires, floods, earthquakes, etc.?**

   Explain.

   No.
4. What are your plans for the future in this area?

None.
As architect engineer of all nuclear power plant simulators in Belgium, BELGATOM has built expert knowhow in simulator procurement which has been called on worldwide.

The entire process of specification, analysis, development and validation is governed by a flexible methodology based on sound engineering judgment.

The combination of BELGATOM’s managerial and technical capabilities guarantees the delivery of your training tool within your time and budget constraints.

Upgrades

BELGATOM is responsible for maintaining the Belgian nuclear power plants simulators since they are operational.

The modification projects which concern engrafting of new systems or new control panels, adjunction of safety panels, updatings further to reference plant changes are implemented aiming at “full quality”. Total quality assurance means a detailed specification of the modifications, pertinent analysis and above all systematic control throughout the complete project.

Consequently, you can feel confident that the implemented changes match your actual request for modifications and that your validated software will not be demoted.
Training

Training is a cornerstone to nuclear power plant operational safety.

BELGATOM's "quality" training results from a combination of 3 quality items, namely the pertinence of the course content, the competence of the instructor and the adequacy of the training organization facilities.

BELGATOM's long term experience supports you in achieving and maintaining your operational skills and proficiency.

Multifunctions simulator

The training cycle of nuclear power plant operators has evolved tremendously the last decade. Today's requirements in terms of training and engineering ask for modern simulation tools.

BELGATOM created and implemented the concept of the MULTIFUNCTIONS SIMULATOR, a versatile tool complementary to the full scope simulator.

Training efficiency on a full scope simulator can be largely enhanced by in-depth preparation on basic principle, partial scope simulators and by advanced training in phenomenological understanding. The combination of those simulators types in the BELGATOM MULTIFUNCTIONS SIMULATOR scales down the overall investment costs.

BELGATOM’s multifunction approach can assist you in meeting today’s numerous training needs.
DOEL 1/2  Full scope simulator

DOEL 4  Full scope simulator
QUESTIONNAIRE

SECTION 0: Organisation/s replying to the questionnaire

1. Name of Organisation/s.

2. Contact Person/s.

3. Address and contact information (telephone, fax).

SECTION 1: General Information (related to the whole country)

1. Number of nuclear reactors (Units) in operation.

2. Number of Sites with at least one Unit in operation.

3. Number of full-scope (replica and no replica) simulators used for operator training.

4. Number of replica simulators used for operator training.

5. Number of part-task simulators used for operator training.

6. Number of basic principles simulators used for operator training.

7. Number of concept simulators used for operator training.

8. Number of special-purpose simulators used for operator training.
9. For how many Units is the training done on replica training simulators?

10. For how many Units is the training done on full-scope (replica and no replica) training simulators.

IMPORTANT QUESTION

Are your answers to the subsequent sections (2 to 5) of the questionnaire related to a specific Organisation or Training Centre in your Country?

Yes   X     No   (Mark your answer with an X)

If yes, indicate the name of the Organisation or Training Centre and describe briefly the simulation facility referred to in answer to the question below (e.g. located on-site or off-site, type of simulator/s, sample photograph, reference NPP/s, NPP/s which receive training in this facility, size and composition of the simulator instructional and support staff, etc.) and, also, describe this/these NPP/s (e.g. type (PWR, BWR, etc.), vendor, start of operation, degree of automation, Operators which constitute the Control Room Shift Team, sample photograph of the control room/s, etc.).

Section: Formation sur Simulateur
Service: Sûreté et Formation
Département: Sûreté et Support à l'Exploitation
Zone de Production Nucléaire de Tihange
ELECTRABEL

On site (Tihange)
1 full scope simulator (= replica for 1 unit but used for 3 units)
1 compact simulator (= multifunctional optimised scope simulator)
1 special-purpose simulator (EUROSTAG)

The reference of the full-scope simulator is the unit 2 of Tihange
3 units receive training on this full scope simulator

Simulator instructional and support staff:
2 instructors for each unit (= 6 instructors)
1 responsible for training and for modifications done on the simulators

(1 Maintenance service (included in Service Informatique) with 4 people)

Type of units: PWR
Vendor: Thomson-CSF
First trainings in January 1989.

Normal Control Room Shift Team composition:
1 shift supervisor + 3 operators
SECTION 2: Current practices with simulators closely related to operator training.

1. Based on your experience, describe advantages and disadvantages of the location of the Simulation Centre with regard to the plant: on-site versus off-site. Specifically, describe those factors which have some influence on the Operators’ attitude towards the simulator training and in the quality of the simulator training.

   On-site advantages: easier organisation and contact with operators, instructors are more knowledgeable about activities of the operator's unit.
   On-site disadvantages: Operators are not always completely detached from their previous daily problems of the units (at least in mind) during training, therefore do not have the best conditions to accept and learn.

2. a) During simulator training sessions, what factors (time, communications, etc.) influencing the interactions between Control Room Operators and other Plant Personnel (Operations Department outside of Control Room Personnel, Maintenance or Instrumentation, and Control Departments, Technical Support Centre, etc.) are simulated?

   During the training on simulators, instructors play the role of others non control Room Personnel who interact with simulation scenario (staff, instrumentalist, chemist, electrician, rounds man, ...).

   b) Do these other Plant Personnel participate in the training sessions? Describe the present training format pertaining to involvement of non Control Room Personnel in simulator training sessions and explain why this format is used.

   The staff has to operate the units in strike situation (i.e. other unit staff members from Operation Department and other departments, which have a license as SRO or RO [idem at Doel site]). The STA has also an active role during Emergency Situations training.

3. What environmental conditions (normal and emergency lighting, humidity, noise, vibrations, sounds generated by equipments, etc.) that could be experienced by the reference plants, are usually simulated in the Simulator Rooms? Describe the use of such effects at your simulator centre and explain why they are, or are not, incorporated into simulator training sessions.

   No special conditions (except lights during loss of electricity supply). The original guidelines don’t require those conditions.

4. Do Control Room Operators receive simulator training for operations outside the Control Room, for example: operations from Remote Shutdown Panels? Describe this type of training as it exists at your Simulator Centre and explain why it is, or is not, used in training sessions.

   Yes (‘Bunker’ = Remote Shutdown Panels). Some operations are asked in emergency procedures [emergency procedures: operation of unit from remote shutdown panels in Bunker in case of loss of main control room and external event].
5. a) How frequently are the changes taking place in plant (plant design changes, procedures changes, etc.) incorporated to the replica or full-scope simulator? Describe any process or mechanism in place at your Simulator Centre to incorporate changes to the replica or full-scope simulator.

Continuously for minor modifications (i.e. corrective actions in case of detected anomalies, no real modifications; for real modifications the approach is similar as at the Scaldis Training Centre).

b) Do simulator model modifications require separate approval while the simulator is being used for training?

Descriptions of units modifications are continuously received, examined and studied by the staff of the training branch and if they are applicable the modifications are taken into account for simulator modification, following a similar approach at Scaldis Training Centre.

6. a) Identify the members of the Control Room Shift Team (Reactor Operators, Turbine Operators, Shift Supervisors, etc.) and indicate the time (in hours) dedicated to simulator training by each member in their initial training programme.

Specify, when applicable, the time spent with each type of simulator.

For all operators of the Control Room Shift Team:
6 weeks x 5 days / week x 4 hours / day of effective use of full scope simulator:
– normal operations
– incidental operations
– accidental operations
Plus 2 weeks with compact simulator, before the 6 weeks on full scope simulator.

b) Indicate the time (in hours) dedicated to simulator training by each member of the Control Room Shift Team in their continuous training programme.

Specify, when applicable, the time spent with each type of simulator.

Operators:
2 weeks x 5 days / week x 4 hours / day in a year (in principal on full scope simulator – this was the case up to 1995)
During 1 of these 2 weeks: compact simulator (could be used for specific training objectives; multifunctional simulator is new, and still to be defined).
See also Section 3 G), question 2.

c) What is the minimum time, if any, required by the Regulatory Body?

Minimum: 2 weeks in 2 years on full scope simulator (= 20 hours/year [1 week = 20 hours of simulator time]).

7. a) Indicate the percentage of simulator training time by the different Members of the Control Room Shift Team devoted to i) normal, ii) abnormal and iii) emergency conditions in their initial training programme.

33% – 33% – 33%
b) Indicate the percentage of simulator training time by the different Members of the Control Room Shift Team devoted to i) normal ii) abnormal and iii) emergency conditions in their continuous training programme.

Roughly: normal 10%, abnormal 20%, emergency 70%.

c) What are the minimum percentages, if any, required by the Regulatory Body?

No minimum percentages specified.

8. What is the role and the policy of the Regulatory Body regarding the use of simulators for Control Room Operators licensing and training?

See answer attached to contribution from Scaldis Training Centre.

9. a) What standards (ANSI/ANS 3.5, IAEA, etc.) are simulators built to and maintained?

Full scope simulator: ANSI/ANS 3.5
Compact simulator: ANSI/ANS 3.5 and EPRI NP 3873

b) What exceptions are typically taken to the standard?

c) What types of simulators are used that are not included in industry standards?

10. a) Describe the role of part-task simulators in your current training programs.

N.A.

b) Describe the role of special-purpose (analytic) simulators in your current training programs.

Role of ‘EUROSTAG’ simulator: to give basic principles of behaviours of electrical plants on an electrical network.

11. Have the current operator training programs been conditioned by the availability and capabilities of the simulator(s) or, alternatively, has(ve) the simulator(s) been specified and acquired after analysing and designing the training programs? Explain.

(Approach similar to that of Scaldis Training Centre)

12. What extensions of simulator training are envisaged for the future?
13. a) Based on your experience, describe the uses of the simulators for activities other than training (plant drills, procedures validation, design changes validation, testing programs, acquisition of human data, licensing activities, reference plant systems “tuning”, etc.).

   Plant drills: for on-call staff managing emergency situations with Control Room and outside authorities. To appreciate action duration.

b) What is the involvement of Control Room Operators for those applications?

   The Control Room Operators play their role. For plant drills: they operate the plant.

14. What are the applications of simulator training for jobs other than Operations?

SECTION 3: Systematic Approach to Training: considerations regarding the use of simulators.

A) Training analysis.

1. Are job and task analysis (or any other type of task identification technique) used for establishing a list of task, performance standards, learning objectives and training methods?
   If yes, describe the technique used.

   N.A.

2. a) What are the criteria that determine the limits or scope of the job analysis for the Control Room Operators?

   N.A.

   b) From your point of view, what should the role of risk-based criteria be for determining such limits or scope? Explain your answers.

   N.A.

3. Are there any special requirements for Job and Task Analysis which are imposed by the possibility of associated simulator training?

   N.A.
B) Training programme design.

1. **What are the criteria for specifying simulator training rather than another training setting (classroom, laboratory, workshop, on-the-job, etc.)?**

   Simulator training is useful to manipulate plant controls for rare or risked actions and during initial training for first manipulations. It gives operators practice for transients and accidents. It is required by the operation license.

2. **What are the criteria for selecting different types of simulator (full-scope, replica, part-task, basic principles, concept, special-purpose)?**

   A minimum utilisation tie of full-scope is required by guidelines (see Section 2) but in place of a part of classroom occupation time, it is possible to use other simulators to illustrate some theoretical or specific aspects: for pedagogical and applied learning of some functions, the compact simulator can be used.
   - **Full scope:** required by guidelines for continuous training programme and initial training programme.
   - **Compact simulator:** basic principle training (basic training) and physical understanding of accidental phenomena (basic training and retraining);
   - Compact simulator = complementary to the full scope simulator:
     1. Simultaneous visualisations means of internal, reliable and appropriate parameters are interesting to develop operators' capacity for reflection
     2. For some non simulated functions
     3. Best time management of availability of full scope

3. a) **What are the criteria for selecting a replica simulator?**

   N.A.

   b) **What are the fidelity requirements?**

   See answer from Scaldis Training Centre.

4. **What are the specific pre-requisites for operators undertaking simulator training?**

   Knowledge of Control Room equipments before the initial training and knowledge of adequate theoretical matter before each stage of initial training.

5. **Does the possibility of simulator training impose any constraints on the definition of learning objectives?**
C) Training programme development.

1. In the case of non-replica simulators, is it necessary to take parallel training actions, and if so, what kind? Explain your answer.

No. Adaptations were made to extend the replica full scale (unit 2) to other no replica units:
- some added replica hard panels
- soft panels
- panels masking existing synoptics
The quasi-totality of normal, incidental and accidental procedures can be applied.

2. Do you use specific procedures for the training simulator, actual plant procedures or a combination of both? Explain your answer and give reasons for the choice.

Actual plant procedures: to avoid the necessity to adapt operators’ habits to different contexts and tools (procedures).

3. What are the criteria for selecting normal, abnormal and emergency scenarios to be trained with simulators? Are they risk-based criteria? Explain your answer.

- feedback from operating experience by other plants
- feedback from students and instructors
- wishes from units

4. How are lesson plans and support documentation developed for simulator training?

A lesson plan is written for each retraining session on simulator; technical support documentation of the concerned subjects is written and given to each operators.

D) Training programme implementation.

1. What selection, initial training, and continuing training is arranged for simulator instructors?

See answer from Scaldis Training Centre.

2. What are the arrangements for instructor monitoring of, and feedback to, trainees during simulator sessions?

A feedback report is written by the whole operators’ team and the instructor at the end of each training.

3. a) What specific training modes such as simulator freeze, playback, running at higher speed than real time, activity recording, video recording, etc. is made use of during initial training?

Freezing, playback, high speed running.
b) What specific training modes such as simulator freeze, playback, running at higher speed than real time, activity recording, video recording, etc. is made use of during continuous training?

Freezing, playback, high speed running.

4. What limits of simulation impede planned training sessions or examination scenarios?

E) Trainee assessment.

1. a) What methods and procedures are used for initial trainee assessment during and after simulator sessions?

b) What methods and procedures are used for continuous trainee assessment during and after simulator sessions?

Response applicable to both 1. a) and b).
Team actions for each transient are evaluated following a set of standard criteria (see below) and eventually some particular criteria defined by the instructor for the transient. This evaluation requires “Yes” or “No” responses to each criteria. If at least one response is No, the operator(s) makes either a self-evaluation or the scenario is replayed until successful.

2. List and describe the main areas or groups of skills and knowledge of the trainee assessed in training simulators (for example: “control board awareness, event diagnosis, immediate actions / entry-level actions, subsequent actions, control board manipulations, use of procedures / technical specifications / reference data, communications, supervisory ability, team skills” (IAEA-TECDOC-525)). Identify, when applicable, the types of simulator used for addressing each one.

For full scope:
• correct event diagnosis
• respect of technical specifications
• correct immediate and subsequent actions and/or correct order in the required actions
• respect of technological limits of plants equipments
• continuous vigilance of parameters
• incident recovered without plant protection solicitation

3. Describe the ranking of importance, if any, given to the main areas or groups of skills and knowledge taken into account for a trainee assessment.

N.A.

4. a) Based on your experience, describe difficulties you have had for assessing the individual skills and knowledge of a trainee while operating within a whole Control Room Shift Team during simulator sessions.
b) **Describe the measures adopted to overcome these difficulties.**

Response applicable to both 4. a) and b).
For a continuous training session, there isn’t difficulty; if the error is collective, the self-criticism can be collective as well.

5. a) **Based on your experience, describe influences on trainees performance during simulator sessions resulting from the attendance of personnel such as utility managers, regulatory body inspectors, etc.**

Depending on the team.

b) **Based on your experience, describe influences on trainees performance during simulator sessions resulting from the attendance of personnel such as utility managers, regulatory body inspectors, etc.**

6. a) **Are training simulator examinations used in order to grant initial license to operators?**
   Explain.

b) **Are training simulator examinations used for requalification?**
   Explain.

   Response is applicable to both 6. a) and b).
   No formal simulator examination required; simulator situation as at Scaldis T.C.

7. **How is examination integrity preserved during the examination/scenario preparation period?**

   See answer to 6.

8. **What performance monitoring or data acquisition features of the simulator are used during simulator examinations?**

   N.A.

**F) Training programme evaluation.**

1. **Describe the approach used for evaluating the simulator training programme and main results.**

   The summary of all feedback reports of a training session gives information about the quality of the programme; some feedback from the daily operations on the units can also come to conclusion about non good formation.
   But no objective and calculated indicators about the good quality of a training programme exist.
2. What programme is in place for validation and continuous verification of the simulator performance?

All remarks from instructors or trainees are collected. After validations, the simulator is updated or extended. In addition, see answer from Scaldis Training Centre, also applicable to Tihange Training Centre.

3. What types of performance discrepancies are most frequently identified by operators during training sessions?

4. What types of performance discrepancies are most frequently identified by examiners or inspectors?

SECTION 4: Use of operating experience for operator training with simulators.

1. How is operational experience feedback incorporated into the design of simulator training programs (experience reviewed, schedule, people involved)?

The simulator training programmes are yearly defined by training centre and each staff of operational services.

2. Has your organisation developed any kind of programme by which simulator operator training is correlated with real operating events? Explain.

SECTION 5: Specific topics on Operator training with simulators.

A) Team training techniques.

1. a) Are job and task analyses used for defining the role and responsibilities of the Members of the Control Room Shift Teams and, in general, of the various levels of staff who are charged with operation of the plant? Explain your answer.

No.

b) Are job and task analyses used for establishing performance standards, learning objectives and training methods for Team skills training? Explain your answer.

No.
2. List and describe Team skills (communication, management of resources, team co-operation, team leadership, feedback, conflict resolution, team decision-making, etc.) which are trained using simulators. Identify, when applicable, the types of simulator used for training each one.

Communication, team co-operation, team leadership, feedback, team decision-making are, of course, aspects which can be shown during a normal technical training session. We are interested in specific stress and communication training.

3. Are any guides used for conducting and evaluating Team skills training simulations? Explain your answer.

No.

4. Based on your experience, describe advantages and disadvantages of Team training with the participation of the same (usual) Members every time or with changes in the Shift Team compositions.

The same members of a Control Room Shift Team participate together in training sessions.

5. Are simulator sessions used for the optimisation of control Room Team Shifts taking into account the characteristics (aptitudes, attitudes, ...) of each Operator? In other words, are simulator sessions used for deciding which Members are going to constitute each Shift Team? Explain your answer.

No.

6. Are there any licensing examinations applied to the whole Control Room Shift Team in addition to the individual licensing examinations? Explain.

No.

B) Training for stress.

1. Is any part of the simulator training programme specifically devoted to train Control Room Operators to operate under stress? Explain you answer.

No.

2. Are stress levels induced and measured during simulator training sessions? If yes, describe the methods and results.

No.

3. Based on your experience describe any measures adopted during simulator training to counter stress.

No.
C) The theoretical basis underlying training.

1. Are any models of human behaviour being used in designing and implementing training programmes?
   If yes:
   i) refer to or describe the models,
   ii) indicate the areas in which these models are being applied (for example: signal detections, decision-making, etc.)
   iii) give the main results.
   No.

D) Habits acquired during training sessions with simulators.

1. Describe, based on your experience, undesirable habits which could be acquired by trainees during training sessions with simulators (for example: due to limited number of simulated scenarios, due to lack of physical or functional fidelity, due to the use of conservative codes for simulation instead of best estimate codes, etc.) and discuss their potential consequences on safety.
   No significant undesirable habits.

2. Describe, based on your experience, any measures adopted to avoid acquisition of those undesirable habits or to prevent use of them.
   N.A.

E) Simulator training on normal and emergency conditions during shutdown and low power operation.

1. What use is made of simulators for Control Room Operator training in normal, abnormal and emergency conditions during shutdown and low power operation (simulated scenarios, trained skills, training techniques, ...)?
   Simulated scenarios depend on the existing procedures.
   The operations during shutdown and low power are included.

2. What are the criteria (risk-based criteria, deterministic criteria, results of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?
   Result of need analysis.
   Experiences and feedback from real operations of other plants.

3. Are job and task analysis (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on shutdown and low power operation?
   Explain.
   No.
4. **What are your plans for the future in this area?**

   Extend the simulator to give more possibility on midloop conditions.

**F) Simulator training on severe accidents.**

1. **What use is made of simulators for Control Room Operator training in severe accidents (simulated scenarios, trained skills, training techniques, ...)?**

2. **What are the criteria (risk-based criteria, deterministic criteria, result of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?**

3. **Are job and task analysis (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on severe accidents.**
   Explain.

4. **What are your plans for the future in this area?**

**G) Simulator training on accidents caused by fires, floods, earthquakes, etc.**

1. **What use is made of simulators for Control Room Operator training in accidents caused by fires, floods, earthquakes, etc. (simulated scenarios, trained skills, training techniques,...)?**

   Partial or total loss of the first level nuclear auxiliary systems (Control Room included).
   Total loss of the secondary heat sink is simulated (break of the dam on the river).
   Note: “First level systems” are systems which are not protected against external events, such as plane crash and gas cloud explosion.

2. **What are the criteria (risk-based criteria, deterministic criteria, result of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?**

   Result of need analysis.

3. **Are job and task analyses (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on accidents caused by fires, floods, earthquakes, etc.?**
   Explain.

   No.

4. **What are your plans for the future in this area?**
QUESTIONNAIRE

SECTION 0: Organisation/s replying to the questionnaire

1. Name of Organisation/s.
   Canada; this particular questionnaire is a summary of Canadian responses.

2. Contact Person/s.

3. Address and contact information (telephone, fax).

SECTION 1: General Information (related to the whole country)

1. Number of nuclear reactors (Units) in operation.
   21

2. Number of Sites with at least one Unit in operation.
   7

3. Number of full-scope (replica and no replica) simulators used for operator training.
   7

4. Number of replica simulators used for operator training.
   0

5. Number of part-task simulators used for operator training.
   0

6. Number of basic principles simulators used for operator training.
   0

7. Number of concept simulators used for operator training.
   0

8. Number of special-purpose simulators used for operator training.
   0
9. For how many Units is the training done on replica training simulators?

22

10. For how many Units is the training done on full-scope (replica and no replica) training simulators.

Same as Question 9.

IMPORTANT QUESTION

Are your answers to the subsequent sections (2 to 5) of the questionnaire related to a specific Organisation or Training Centre in you Country?

Yes __ No X  (Mark your answer with an X)

If yes, indicate the name of the Organisation or Training Centre and describe briefly the simulation facility referred to in answer to the question below (f.i. located on-site or off-site, type of simulator/s, sample photograph, reference NPP/s, NPP/s which receive training in this facility, size and composition of the simulator instructional and support staff, etc.) and, also, describe this/these NPP/s (f.i. type (PWR, BWR, etc.), vendor, start of operation, degree of automation, Operators which constitute the Control Room Shift Team, sample photograph of the control room/s, etc.).

SECTION 2: Current practices with simulators closely related to operator training.

1. Based on your experience, describe advantages and disadvantages of the location of the Simulation Centre with regard to the plant: on-site versus off-site. Specifically, describe those factors which have some influence on the Operators' attitude towards the simulator training and in the quality of the simulator training.

On site simulators seem to be an advantage in terms of operating costs and convenience. Operating staff close by so they are more readily available for training sessions.

2. a) During simulator training sessions, what factors (time, communications, etc.) influencing the interactions between Control Room Operators and other Plant Personnel (Operations Department outside of Control Room Personnel, Maintenance or Instrumentation, and Control Departments, Technical Support Centre, etc.) are simulated?

Role players respond in real time when practical. Task completion is usually an estimation by instructors based on their operating experience.

b) Do these other Plant Personnel participate in the training sessions? Describe the present training format pertaining to involvement of non Control Room Personnel in simulator training sessions and explain why this format is used.

Non control room staff interactions are role played by simulator instructors.
3. What environmental conditions (normal and emergency lighting, humidity, noise, vibrations, sounds generated by equipments, etc.) that could be experienced by the reference plants, are usually simulated in the Simulator Rooms? Describe the use of such effects at your simulator centre and explain why they are, or are not, incorporated into simulator training sessions.

Sound effects for steam line break scenarios used at some stations. Emergency lighting modelled at most stations.

4. Do Control Room Operators receive simulator training for operations outside the Control Room, for example: operations from Remote Shutdown Panels?

Describe this type of training as it exists at your Simulator Centre and explain why it is, or is not, used in training sessions.

No. Remote shutdown panels are not simulated. Most controls that are unique to emergency control centres are operated during routine testing. Many controls identical to main control room which are trained on in the simulator.

5. a) How frequently are the changes taking place in plant (plant design changes, procedures changes, etc.) incorporated to the replica or full-scope simulator? Describe any process or mechanism in place at your Simulator Centre to incorporate changes to the replica or full-scope simulator.

Generally changes are made promptly to the simulator when changes are implemented in the reference station. Some major changes requiring major outages at the simulator are delayed until there is a break in the training schedule to accommodate such an outage.

b) Do simulator model modifications require separate approval while the simulator is being used for training?

Yes. Simulator changes are evaluated by instructors before approval for use.

6. a) Identify the members of the Control Room Shift Team (Reactor Operators, Turbine Operators, Shift Supervisors, etc.) and indicate the time (in hours) dedicated to simulator training by each member in their initial training programme. Specify, when applicable, the time spent with each type of simulator.

Average time between 200 and 300 hours for all authorised staff.

b) Indicate the time (in hours) dedicated to simulator training by each member of the Control Room Shift Team in their continuous training programme. Specify, when applicable, the time spent with each type of simulator.

All training completed on full scope replica simulators. 40-80 hours per year for authorised staff on full scope simulator.

c) What is the minimum time, if any, required by the Regulatory Body?

Not currently specified by the regulator.
7. a) Indicate the percentage of simulator training time by the different Members of the Control Room Shift Team devoted to i) normal, ii) abnormal and iii) emergency conditions in their initial training programme.

On average about one third of time spent in each of the areas. Some stations spend more time on abnormal event training.

b) Indicate the percentage of simulator training time by the different Members of the Control Room Shift Team devoted to i)normal ii) abnormal and iii) emergency conditions in their continuous training programme.

Amount of time spent on training in each category varies from station to station. primarily largest amount of time is spent on emergency training as normal events are typically completed during routine day to day activities.

c) What are the minimum percentages, if any, required by the Regulatory Body?

Not currently specified by the regulator.

8. What is the role and the policy of the Regulatory Body regarding the use of simulators for Control Room Operators licensing and training?

Initial authorisation requires the successful completion of a simulator based examination administered by the Regulatory Body.

9. a) What standards (ANSI/ANS 3.5, IAEA, etc.) are simulators built to and maintained?

ANSI not followed. Utilities feel the standards of their simulators exceed those of the ANSI standard in most areas.

b) What exceptions are typically taken to the standard?

ANSI not followed. Utilities feel the standards of their simulators exceed those of the ANSI standard in most areas.

c) What types of simulators are used that are not included in industry standards?

N/A

10. a) Describe the role of part-task simulators in your current training programs.

N/A

b) Describe the role of special-purpose (analytic) simulators in your current training programs.

N/A
11. Have the current operator training programs been conditioned by the availability and capabilities of the simulator(s) or, alternatively, has(ve) the simulator(s) been specified and acquired after analysing and designing the training programs? Explain.

Simulators introduced after the training programme was well established (operation of stations before obtaining simulators). Training, when simulators became available, was ultimately influenced by simulator capabilities. As simulator modelling and capabilities were upgraded and enhanced this was reflected in the training programmes.

12. What extensions of simulator training are envisaged for the future?

None envisioned at the present time.

13. a) Based on your experience, describe the uses of the simulators for activities other than training (plant drills, procedures validation, design changes validation, testing programs, acquisition of human data, licensing activities, reference plant systems “tuning”, etc.).

In addition to those mentioned in the question:
- procedure validation
- commissioning mock ups
- human factors
- assessment of new or proposed control room installations

b) What is the involvement of Control Room Operators for those applications?

CROs are always involved in process.

14. What are the applications of simulator training for jobs other than Operations?

Training demonstrations for technical staff.

SECTION 3: Systematic Approach to Training: considerations regarding the use of simulators.

A) Training analysis.

1. Are job and task analysis (or any other type of task identification technique) used for establishing a list of task, performance standards, learning objectives and training methods?
   If yes, describe the technique used.

   Subject matter experts used to define job performance requirements.

2. a) What are the criteria that determine the limits or scope of the job analysis for the Control Room Operators?

   - Station Expectations
   - Station Documentation (e.g. Safety Reports)
   - Generic Expectations defined by regulator
b) From your point of view, what should the role of risk-based criteria be for determining such limits or scope? Explain your answers.

PRA/PSA still being developed for most plants. Generally, the feeling is that events should only be used if identified in the Safety Report and Analysis.

3. Are there any special requirements for Job and Task Analysis which are imposed by the possibility of associated simulator training?

No.

B) Training programme design.

1. What are the criteria for specifying simulator training rather than another training setting (classroom, laboratory, workshop, on-the-job, etc.)?

- Demonstration of master of skills required
- Performance based training
- Impractical to train in station

2. What are the criteria for selecting different types of simulator (full-scope, replica, part-task, basic principles, concept, special-purpose)?

Only use full scope replica simulator.

3. a) What are the criteria for selecting a replica simulator?

Seen to be best available tool for training skills in many different areas and practice of integration of those skills. No specific standards. Strive for as high as achievable.

b) What are the fidelity requirements?

No specific standards. Strive for as high as achievable.

4. What are the specific pre-requisites for operators undertaking simulator training?

Completion of science fundamentals and system knowledge training.

5. Does the possibility of simulator training impose any constraints on the definition of learning objectives?

No.

C) Training programme development.

1. In the case of non-replica simulators, is it necessary to take parallel training actions, and if so, what kind?

Explain your answer.

N/A. Use only replica full scope simulator.
2. Do you use specific procedures for the training simulator, actual plant procedures or a combination of both? Explain your answer and give reasons for the choice.

Actual plant procedures used to ensure candidate is familiar with plant process procedures. Simulate real life conditions as much as possible.

3. What are the criteria for selecting normal, abnormal and emergency scenarios to be trained with simulators? Are they risk-based criteria? Explain your answer.

- degree of difficulty
- complexity of upset
- consequence of error
- how often situation encountered (i.e. is it part of day to day routines or is it never done e.g. training on LOCAs as opposed to changing over duty of equipment)

4. How are lesson plans and support documentation developed for simulator training?

Developed to:
- exercise on a specific procedure
- demonstrate a system's response to an upset
Developed according to:
- station documentation
- course objectives
- operating experience

D) Training programme implementation.

1. What selection, initial training, and continuing training is arranged for simulator instructors?

- Must be previously authorised personnel.
- Simulator and classroom training skills, technical writing skills.
- SAT workshops.
- Communication skills training.

Some have taken INPO course.

2. What are the arrangements for instructor monitoring of, and feedback to, trainees during simulator sessions?

- Feedback immediately after simulator training session completed.
- INPO course promotes feedback sessions.

3. a) What specific training modes such as simulator freeze, playback, running at higher speed than real time, activity recording, video recording, etc. is made use of during initial training?

All of the listed features are used, in addition to history of parameter trends.
b) What specific training modes such as simulator freeze, playback, running at higher speed than real time, activity recording, video recording, etc. is made use of during continuous training?

Same as above.

4. What limits of simulation impede planned training sessions or examination scenarios?
   - Reactor regulating/flux modelling limited.
   - Lack of fidelity on some parameters or modelling of scenarios.

E) Trainee assessment.

1. a) What methods and procedures are used for initial trainee assessment during and after simulator sessions?

   Primarily subjective assessment by instructors (Subject Matter Experts). Beginning to use Evaluation Guides modelled after regulatory examination guides.

b) What methods and procedures are used for continuous trainee assessment during and after simulator sessions?

   Primarily subjective assessment by instructors or senior line management (Subject Matter Experts).

2. List and describe the main areas or groups of skills and knowledge of the trainee assessed in training simulators (for example: “control board awareness, event diagnosis, immediate actions / entry-level actions, subsequent actions, control board manipulations, use of procedures / technical specifications / reference data, communications, supervisory ability, team skills” (IAEA-TECDOC-525)). Identify, when applicable, the types of simulator used for addressing each one.

   Areas in which trainee assessment done include:
   - Monitoring
   - Actions Taken Without Reference to Procedures
   - Diagnosis/Decision making
   - Procedure Compliance
   - Communication and Crew Interaction Skills
   - Technical Knowledge

   Full scope replica simulator used in assessments.

3. Describe the ranking of importance, if any, given to the main areas or groups of skills and knowledge taken into account for a trainee assessment.

   No ranking done (for regulatory exams, candidates must pass all competency areas).
4. a) Based on your experience, describe difficulties you have had for assessing the individual skills and knowledge of a trainee while operating within a whole Control Room Shift Team during simulator sessions.

Consequences of weak performance by a team member can be difficult to assess if stronger team members compensate for shortcomings of weaker one.

b) Describe the measures adopted to overcome these difficulties.

Use of role players in key areas and restriction on duties and scripting of actions force candidates to perform activities and they can be better judged individually.

5. a) Based on your experience, describe influences on trainees performance during simulator sessions resulting from the attendance of personnel such as utility managers, regulatory body inspectors, etc.

Some utilities feel this raises the stress level, others have no concern.

b) Based on your experience, describe influences on trainees performance during simulator sessions resulting from the attendance of personnel such as utility managers, regulatory body inspectors, etc.

Instructor is seen as “normal” part of simulator control room and accepted as such, therefore little stress is induced.

6. a) Are training simulator examinations used in order to grant initial license to operators? Explain.

Yes. Trainees must successfully pass a Regulatory Simulator Based exam.

b) Are training simulator examinations used for requalification? Explain.

Yes. Exam done by utility on an annual basis. Process audited by regulator.

7. How is examination integrity preserved during the examination/scenario preparation period?

- Utility personnel involved sign a confidentiality agreement letter.
- Utility personnel involved are removed from training environment.
- Password protection on simulator scenarios.
- Removal of transfer links from simulator to other facilities (e.g. Simulator Services, offsite, normally monitor performance of simulator).

8. What performance monitoring or data acquisition features of the simulator are used during simulator examinations?

Initial: TAM, audio and video recordings, history trends, examiner notes.
Continuing: history trends, TAM, examiner notes.
F) Training programme evaluation.

1. Describe the approach used for evaluating the simulator training programme and main results.

   • Success rate on in-house and regulatory simulator based examination.
   • Trainee feedback, line management observation, audits.
   • Performance of trainees on the job after completion of training.

2. What programme is in place for validation and continuous verification of the simulator performance?

   No formal validation plan – typically reliant on instructor and authorised staff input.

3. What types of performance discrepancies are most frequently identified by operators during training sessions?

   Fidelity issues, majority are very minor.

4. What types of performance discrepancies are most frequently identified by examiners or inspectors?

   • models of some scenarios not available (e.g. loss of instrument air)
   • minor modelling problems

SECTION 4: Use of operating experience for operator training with simulators.

1. How is operational experience feedback incorporated into the design of simulator training programs (experience reviewed, schedule, people involved)?

   Station, other Canadian utilities and external events (through INPO) are reviewed by training staff and programmes revised as required.

2. Has your organisation developed any kind of programme by which simulator operator training is correlated with real operating events? Explain.

   No, except for Significant Event Report follow-up actions.

SECTION 5: Specific topics on Operator training with simulators.

A) Team training techniques.

1. a) Are job and task analyses used for defining the role and responsibilities of the Members of the Control Room Shift Teams and, in general, of the various levels of staff who are charged with operation of the plant? Explain your answer.

   No. Roles and responsibilities have been documented, defined and improved over time but not based on formal JTA.
b) Are job and task analyses used for establishing performance standards, learning objectives and training methods for Team skills training? Explain your answer.

No.

2. List and describe Team skills (communication, management of resources, team co-operation, team leadership, feedback, conflict resolution, team decision-making, etc.) which are trained using simulators. Identify, when applicable, the types of simulator used for training each one.

Communication, management of resources, team co-operation, team leadership, feedback and team decision making are trained on replica simulator.

3. Are any guides used for conducting and evaluating Team skills training simulations? Explain your answer.

Evaluations Guides used by utility staff for assessment vary in the degree of detail. Level of detail on Evaluation Guides affects the level of subjectivity in the assessment.

4. Based on your experience, describe advantages and disadvantages of Team training with the participation of the same (usual) Members every time or with changes in the Shift Team compositions.

Advantages:
- better overall handling of event
- better communication
- less conflict between members
- standardised approach to upset allows interchange of authorised staff with no major disturbance to team approach

Disadvantages:
- some teamwork disturbance when new member shows up
- team sometimes “works around” new member as opposed to involving them

5. Are simulator sessions used for the optimisation of control Room Team Shifts taking into account the characteristics (aptitudes, attitudes, ...) of each Operator? In other words, are simulator sessions used for deciding which Members are going to constitute each Shift Team? Explain your answer.

No. Flexibility of authorised staff being able to cover on any shift is a requirement.

6. Are there any licensing examinations applied to the whole Control Room Shift Team in addition to the individual licensing examinations? Explain.

No.
B) Training for stress.

1. **Is any part of the simulator training programme specifically devoted to train Control Room Operators to operate under stress?**
   **Explain you answer.**

   No specific programme in place. Some “unofficial” training done in the past. Post event discussions with instructors help alleviate stress. Stress level highest before and during regulatory simulator based exam.

2. **Are stress levels induced and measured during simulator training sessions?**
   **If yes, describe the methods and results.**

   No.

3. **Based on your experience describe any measures adopted during simulator training to counter stress.**

   As candidates become familiar with unit upset response, stress level diminishes.
   - instructor feedback after simulator sessions
   - some stations provide “generic” stress handling training

C) The theoretical basis underlying training.

1. **Are any models of human behaviour being used in designing and implementing training programmes?**
   **If yes:**
   i) refer to or describe the models,
   ii) indicate the areas in which these models are being applied (for example: signal detections, decision-making, etc.)
   iii) give the main results.

   Not currently used.

D) Habits acquired during training sessions with simulators.

1. **Describe, based on your experience, undesirable habits which could be acquired by trainees during training sessions with simulators (for example: due to limited number of simulated scenarios, due to lack of physical or functional fidelity, due to the use of conservative codes for simulation instead of best estimate codes, etc.) and discuss their potential consequences on safety.**

   - training based solely on the use of procedures which are assumed to work in all cases
   - issues of fidelity in terms of parameter direction, magnitude of parameter deviation, and timing of the parameter deviation
   - support staff assumed to perform actions without error.

   Trainees respond too quickly, missing indications and procedural steps.
   Trainees develop a ‘mind set’ resulting in misdiagnosis.
   Trainees don’t use procedures.
2. Describe, based on your experience, any measures adopted to avoid acquisition of those undesirable habits or to prevent use of them.

Symptom based procedures which consider equipment failures and/or human error. Insert failures that occasionally take the candidate down different procedural paths. Give trainees a variety of events, especially new/unseen events.

E) Simulator training on normal and emergency conditions during shutdown and low power operation.

1. What use is made of simulators for Control Room Operator training in normal, abnormal and emergency conditions during shutdown and low power operation (simulated scenarios, trained skills, training techniques, ...)?

Very little shutdown training using simulator events. Training at low power mostly limited to start up and shutdown activities.

2. What are the criteria (risk-based criteria, deterministic criteria, results of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?

Based generally on degree of difficulty, number of actions, complexity, unit configuration, operating experience/events. Rapid response of operators less likely required for shutdown reactor.

3. Are job and task analysis (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on shutdown and low power operation? Explain.

No.

4. What are your plans for the future in this area?

Improvements to simulators ongoing consideration.

F) Simulator training on severe accidents.

1. What use is made of simulators for Control Room Operator training in severe accidents (simulated scenarios, trained skills, training techniques, ...)?

Severe accident analyses have not been completed on CANDU reactors and consequently the simulators are not modelled to simulate these conditions. Some aspects of severe accident response are covered in the Symptom Based procedure (Critical Safety Parameter Monitoring and Restoration Guide). Training is limited to the capability of plant systems to deal with an accident scenario.

2. What are the criteria (risk-based criteria, deterministic criteria, result of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?

Events analysed in the station Safety Report. Analysis ongoing.
3. Are job and task analysis (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on severe accidents.
   Explain.

   Some JTA done. JTA identified need for training on accident scenarios.

4. What are your plans for the future in this area?

   Continue to train on existing scenarios. Assessment when analysis completed.

G) Simulator training on accidents caused by fires, floods, earthquakes, etc.

1. What use is made of simulators for Control Room Operator training in accidents caused by fires, floods, earthquakes, etc. (simulated scenarios, trained skills, training techniques,...)?

   Severe accident analyses have not been completed on CANDU reactors and consequently the simulators are not modelled to simulate these conditions.
   Some aspects of severe accident response is covered in the Symptom Based procedure (Critical Safety Parameter Monitoring and Restoration Guide). Training is limited to the capability of plant systems to deal with an accident scenario.
   Fires or flooding in areas used as initiating cause for equipment failures (e.g. circuit breaker catching fire or pump lost due to flooding in area).

2. What are the criteria (risk-based criteria, deterministic criteria, result of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?

   Simulator not used.

3. Are job and task analyses (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on accidents caused by fires, floods, earthquakes, etc.?
   Explain.

   No.

4. What are your plans for the future in this area?

   None.
QUESTIONNAIRE

SECTION 0: Organisation/s replying to the questionnaire

1. Name of Organisation/s.
   Ontario Hydro

2. Contact Person/s.
   Ron Dymond
   Training Superintendent
   Pickering NGSA

   Brian Berndt
   Training Superintendent
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   Gordon Chester
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3. Address and contact information (telephone, fax).
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   675 Sandy Beach Road
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   Ron Dymond, ext. 3096
   Brian Berndt, ext. 3003
   Gordon Chester, ext. 3097

SECTION 1: General Information (related to the whole country)

1. Number of nuclear reactors (Units) in operation.
   21

2. Number of Sites with at least one Unit in operation.
   7

3. Number of full-scope (replica and no replica) simulators used for operator training.
   7
4. Number of replica simulators used for operator training.
   0

5. Number of part-task simulators used for operator training.
   0

6. Number of basic principles simulators used for operator training.
   0

7. Number of concept simulators used for operator training.
   0

8. Number of special-purpose simulators used for operator training.
   0

9. For how many Units is the training done on replica training simulators?
   22

10. For how many Units is the training done on full-scope (replica and no replica) training simulators.
    Same as Question 9.

**IMPORTANT QUESTION**

Are your answers to the subsequent sections (2 to 5) of the questionnaire related to a specific Organisation or Training Centre in your Country?

Yes _X_ No__ (Mark your answer with an X)

If yes, indicate the name of the Organisation or Training Centre and describe briefly the simulation facility referred to in answer to the question below (i.e. located on-site or off-site, type of simulator/s, sample photograph, reference NPP/s, NPP/s which receive training in this facility, size and composition of the simulator instructional and support staff, etc.) and, also, describe this/these NPP/s (i.e. type (PWR, BWR, etc.), vendor, start of operation, degree of automation, Operators which constitute the Control Room Shift Team, sample photograph of the control room/s, etc.).

Ontario Hydro
Ontario Hydro has five separate stations, each site consisting of four generating units. The control panels for all four units at each station are contained in one common control room. The training facilities housing the simulators for the five stations are in two separate geographical locations.

The Eastern Nuclear Training Centre (ENTC), serving the eastern end of the province of Ontario, holds separate full scope replica simulators for the four Pickering NGSA units, the four Pickering NGSB units and the four Darlington NGSA units (only one complete unit from each station is simulated as the units at each station are identical). Included in the simulator package are
Common Services panels which includes things like electrical distribution, High Pressure Emergency Injection System and Emergency Power Generators. The Training facility is located less than 1 kilometre from the Pickering generating station site.

Particulars:
ENTC located on the Pickering site (< 1 km from Pickering stations, and approximately 25 km from the Darlington site)
Houses full scope replica simulators for Pickering NGSA, Pickering NGSB, and Darlington NGSA
Instructional staff – 8 per station
Support staff – 8 per station
All stations CANDU design
PNGSA (started operation 1971, simulator in service date 1976)
PNGSB (started operation 1982, simulator in service date 1984)
Darlington (started operation 1990, simulator in service date 1989)
All control rooms are highly automated.
Control Room Team: (Steady state operation)

Pickering NGS A&B
• One Authorised Nuclear Operator per unit (Control Room Operator i.e. four per station)
• One “unauthorised” Operator for Common Services (no formal separate panel in MCR like other stations) and one “unauthorised” Operator on Fuel Handling machines.
• One Shift Operating Supervisor per station (i.e. 4 units plus auxiliary systems and fuel handling) plus one Shift Superintendent per station. SOS has lesser approval authority than Shift Superintendent.

Darlington NGSA
• One Authorised Nuclear Operator per unit (Control Room Operator i.e. four per station)
• One “unauthorised” Operator on Common Services panel and one “unauthorised” Operator on Fuel Handling machines.
• One Shift Supervisor or one Shift Superintendent per pair of units (Shift team consists of one each). Both equal in approval authority, Superintendent senior person on shift.

SECTION 2: Current practices with simulators closely related to operator training.

1. Based on your experience, describe advantages and disadvantages of the location of the Simulation Centre with regard to the plant: on-site versus off-site. Specifically, describe those factors which have some influence on the Operators’ attitude towards the simulator training and in the quality of the simulator training.

   • limited travel time and expense
   • instructors have easy access to station to maintain currency
   • easy to have station personnel on loan to training simulator to maintain currency

2. a) During simulator training sessions, what factors (time, communications, etc.) influencing the interactions between Control Room Operators and other Plant Personnel (Operations Department outside of Control Room Personnel, Maintenance or Instrumentation, and Control Departments, Technical Support Centre, etc.) are simulated?

Factors such as time and communications with other work groups role played by the simulator instructors (e.g. with field personnel, labs engineering staff).
b) Do these other Plant Personnel participate in the training sessions?  
Describe the present training format pertaining to involvement of non Control  
Room Personnel in simulator training sessions and explain why this format is  
used.

The operators who supervise field activities, sometimes participate in simulator exercises.  
Most times it is role-playing by instructors.

3. What environmental conditions (normal and emergency lighting, humidity, noise,  
vibrations, sounds generated by equipments, etc.) that could be experienced by the  
reference plants, are usually simulated in the Simulator Rooms?  
Describe the use of such effects at your simulator centre and explain why they are, or  
are not, incorporated into simulator training sessions.

Steam line break sound effects are simulated – used during steam line break events (emergency  
lighting at DNGS simulator only).

4. Do Control Room Operators receive simulator training for operations outside the  
Control Room, for example: operations from Remote Shutdown Panels?  
Describe this type of training as it exists at your Simulator Centre and explain why it  
is, or is not, used in training sessions.

There is no simulator for Remote Shutdown Panels (Unit Emergency Control Centre). Training  
on the use of these panels is done on the job since most controls can be operated during routine  
testing, e.g. Filter Air Discharge System.

5. a) How frequently are the changes taking place in plant (plant design changes,  
procedures changes, etc.) incorporated to the replica or full-scope simulator?  
Describe any process or mechanism in place at your Simulator Centre to  
incorporate changes to the replica or full-scope simulator.

On a routine continual basis. Simulator involved in Engineering Changes documentation  
process. Direct discussion with the station staff.

b) Do simulator model modifications require separate approval while the simulator  
is being used for training?

Instructor acceptance prior to use in training.

6. a) Identify the members of the Control Room Shift Team (Reactor Operators,  
Turbine Operators, Shift Supervisors, etc.) and indicate the time (in hours)  
dedicated to simulator training by each member in their initial training  
programme.  
Specify, when applicable, the time spent with each type of simulator.

Control Room Operator (CRO) – 200 hrs/trainee  
Shift Operating Supervisor (SOS – in additional to ANO hours above) – 32 hrs.  
Shift Supervisors (SS) – 200 hrs.

All time spent on full scope replica simulator.
b) Indicate the time (in hours) dedicated to simulator training by each member of the Control Room Shift Team in their continuous training programme. Specify, when applicable, the time spent with each type of simulator.

ANO – 40 hrs/yr
SOS – 40 hrs/yr
SS – 40 hrs/year

All time spent on full scope replica simulator.

c) What is the minimum time, if any, required by the Regulatory Body?

Not currently specified by the regulator.

7. a) Indicate the percentage of simulator training time by the different Members of the Control Room Shift Team devoted to i) normal, ii) abnormal and iii) emergency conditions in their initial training programme.

Normal – 33%
Abnormal – 33%
Emergency – 33%

b) Indicate the percentage of simulator training time by the different Members of the Control Room Shift Team devoted to i) normal ii) abnormal and iii) emergency conditions in their continuous training programme.

Normal – 10%
Abnormal – 20%
Emergency – 70%

c) What are the minimum percentages, if any, required by the Regulatory Body?

Not currently specified by the regulator.

8. What is the role and the policy of the Regulatory Body regarding the use of simulators for Control Room Operators licensing and training?

Initial authorisation requires the passing of a Regulator Simulator Based Exam. Requalification Testing requires the passing of 3 in-house Simulator Based Exams in a 2 year period by each authorised person.

9. a) What standards (ANSI/ANS 3.5, IAEA, etc.) are simulators built to and maintained?

Greater than ANSI 3.5?

b) What exceptions are typically taken to the standard?

?

c) What types of simulators are used that are not included in industry standards?

?
10. a) Describe the role of part-task simulators in your current training programs.
   
   No part-task simulators.

   b) Describe the role of special-purpose (analytic) simulators in your current training programs.
   
   No special-purpose simulators.

11. Have the current operator training programs been conditioned by the availability and capabilities of the simulator(s) or, alternatively, has(ve) the simulator(s) been specified and acquired after analysing and designing the training programs? Explain.

   Programme had been initially conditioned by the availability and capabilities of the simulator, however over the years has been modified after analysing and designing the training programme.

12. What extensions of simulator training are envisaged for the future?

   None.

13. a) Based on your experience, describe the uses of the simulators for activities other than training (plant drills, procedures validation, design changes validation, testing programs, acquisition of human data, licensing activities, reference plant systems “tuning”, etc.).

   • procedure validation
   • special workplan practice (e.g. neutronic commissioning testing upon replacement of incore flux detectors)
   • human factors assessment of new control room installation (e.g. Safety Parameter Display System)
   • plant drills

   b) What is the involvement of Control Room Operators for those applications?

   CROs have participated in all the above – preferable approach.

14. What are the applications of simulator training for jobs other than Operations?

   Engineering staff training.
SECTION 3: Systematic Approach to Training: considerations regarding the use of simulators.

A) Training analysis.

1. Are job and task analysis (or any other type of task identification technique) used for establishing a list of task, performance standards, learning objectives and training methods? If yes, describe the technique used.

   Peer/expert review evaluation.

2. a) What are the criteria that determine the limits or scope of the job analysis for the Control Room Operators?

   Regulator imposed objectives.

   b) From your point of view, what should the role of risk-based criteria be for determining such limits or scope? Explain your answers.

   Risk based (i.e. PRA/PSA) being developed for most plants, therefore not yet applied to training programme.

3. Are there any special requirements for Job and Task Analysis which are imposed by the possibility of associated simulator training?

   No.

B) Training programme design.

1. What are the criteria for specifying simulator training rather than another training setting (classroom, laboratory, workshop, on-the-job, etc.)?

   Performance based. All controls are typically covered on the panel.

2. What are the criteria for selecting different types of simulator (full-scope, replica, part-task, basic principles, concept, special-purpose)?

   Only use full scope replica simulator.

3. a) What are the criteria for selecting a replica simulator?

   Only use full scope replica simulators.

   b) What are the fidelity requirements?

   Not quantified, subjective operator and instructor acceptance.

4. What are the specific pre-requisites for operators undertaking simulator training?

   Complete all field training (NO3 qualified) and science fundamentals (Generals).
5. Does the possibility of simulator training impose any constraints on the definition of learning objectives?

No.

C) Training programme development.

1. In the case of non-replica simulators, is it necessary to take parallel training actions, and if so, what kind?
   Explain your answer.

   N/A. Use only replica full scope simulator.

2. Do you use specific procedures for the training simulator, actual plant procedures or a combination of both?
   Explain your answer and give reasons for the choice.

   Actual plant procedures used to ensure candidate is familiar with plant process/procedures.

3. What are the criteria for selecting normal, abnormal and emergency scenarios to be trained with simulators? Are they risk-based criteria?
   Explain your answer.

   Based on the respective determination as documented in station procedures, i.e. non-standard section in Operating Manual, Emergency Operating Procedures. These are in turn based on plant Safety Analysis. This constitutes a form of risk based criteria.

4. How are lesson plans and support documentation developed for simulator training?

   Lesson plans based on course objectives, operating documentation, operating experience.

D) Training programme implementation.

1. What selection, initial training, and continuing training is arranged for simulator instructors?

   Instructors must be previously authorised personnel. Additional training given in the areas of Instructional Skills. Continuing training includes maintaining update of plant changes through reading of procedure revisions and plant visits.

2. What are the arrangements for instructor monitoring of, and feedback to, trainees during simulator sessions?

   Instructors must complete INPO Advances Simulators Instructors Course, which deals with monitoring and feedback skills. This typically entails 1-3 instructors observing with subsequent feedback.
3. **a)** What specific training modes such as simulator freeze, playback, running at higher speed than real time, activity recording, video recording, etc. is made use of during initial training?

Simulator freeze, running at higher speed than real time, playback, activity recording, video recording used during initial training.

**b)** What specific training modes such as simulator freeze, playback, running at higher speed than real time, activity recording, video recording, etc. is made use of during continuous training?

Simulator freeze used during continuous training.

4. **What limits of simulation impede planned training sessions or examination scenarios?**

Model limitations, e.g. reactor regulating/flux models.

E) **Trainee assessment.**

1. **a)** What methods and procedures are used for initial trainee assessment during and after simulator sessions?

Regulator Simulator Based Assessment Procedure (OCD-ST6), NGD Procedure 78, Subject matter expert.

**b)** What methods and procedures are used for continuous trainee assessment during and after simulator sessions?

NGD Procedure 78 (consequence based), Senior Line Management assessment.

2. **List and describe the main areas or groups of skills and knowledge of the trainee assessed in training simulators (for example: “control board awareness, event diagnosis, immediate actions / entry-level actions, subsequent actions, control board manipulations, use of procedures / technical specifications / reference data, communications, supervisory ability, team skills” (IAEA-TECDOC-525)). Identify, when applicable, the types of simulator used for addressing each one.**

Competency areas include:
- Monitoring
- Actions taken without reference to procedures
- Diagnosis/decision making
- Procedure compliance
- Communication and crew interaction skills
- Technical knowledge

Full scope replica simulator.

3. **Describe the ranking of importance, if any, given to the main areas or groups of skills and knowledge taken into account for a trainee assessment.**

No specific ranking.
4. a) Based on your experience, describe difficulties you have had for assessing the individual skills and knowledge of a trainee while operating within a whole Control Room Shift Team during simulator sessions.

In a team assessment environment, weak individuals can be helped by stronger individuals.

b) Describe the measures adopted to overcome these difficulties.

Use of role players with scripted actions/responses.

5. a) Based on your experience, describe influences on trainees performance during simulator sessions resulting from the attendance of personnel such as utility managers, regulatory body inspectors, etc.

Attendance of managers, regulatory staff increases the stress of trainees affecting their performance.

b) Based on your experience, describe influences on trainees performance during simulator sessions resulting from the attendance of personnel such as utility managers, regulatory body inspectors, etc.

Instructor can be in the instructors’ booth (observatory) and on the simulator main floor. Communication primarily involves feedback to candidates on their performance.

6. a) Are training simulator examinations used in order to grant initial license to operators? Explain.

Yes, trainees must successfully pass a Regulator Simulator Based exam.

b) Are training simulator examinations used for requalification? Explain.

Yes, each currently authorised person must successfully pass 3 simulator based exams over a 2-year period.

7. How is examination integrity preserved during the examination/scenario preparation period?

Security maintained by confidential preparation rooms and simulator room. Random testing used during continuous training.

8. What performance monitoring or data acquisition features of the simulator are used during simulator examinations?

- alarm summaries
- Training Action Monitor (TAM)
- video/audio tape recorders
- trend/chart recorders
F) Training programme evaluation.

1. Describe the approach used for evaluating the simulator training programme and main results.
   - Success rate on in-house and Regulatory simulator based on examination.
   - Plant events attributed to simulator training deficiencies.
   - Course evaluation/feedback forms.

2. What programme is in place for validation and continuous verification of the simulator performance?
   No formal validation plan – typically reliant on instructor and authorised staff input. Some comparison of in plant data.

3. What types of performance discrepancies are most frequently identified by operators during training sessions?
   Small design changes, transient response on some systems, e.g. boiler level control.

4. What types of performance discrepancies are most frequently identified by examiners or inspectors?
   Can’t model some “loss of services” scenarios well, e.g. Loss of Instrument Air, Loss of Class III Electrical Power.

SECTION 4: Use of operating experience for operator training with simulators.

1. How is operational experience feedback incorporated into the design of simulator training programs (experience reviewed, schedule, people involved)?
   Significant Event Reports are routed to all instructors to review their applicability into their course material. External events are reviewed via CANNET, INPO sources. For example the Salem-1 event was covered by Training Superintendent during the recent Refresher Training session.

2. Has your organisation developed any kind of programme by which simulator operator training is correlated with real operating events?
   Explain.
   No, except for Significant Event Follow-up actions.
SECTION 5: Specific topics on Operator training with simulators.

A) Team training techniques.

1. a) Are job and task analyses used for defining the role and responsibilities of the Members of the Control Room Shift Teams and, in general, of the various levels of staff who are charged with operation of the plant? Explain your answer.

   No, however roles and responsibilities of the CR team are defined in plant procedures, (e.g. Pickering Operations Department Procedure-3 “Control Room Response to Abnormal Incidents”).

   b) Are job and task analyses used for establishing performance standards, learning objectives and training methods for Team skills training? Explain your answer.

   No.

2. List and describe Team skills (communication, management of resources, team cooperation, team leadership, feedback, conflict resolution, team decision-making, etc.) which are trained using simulators. Identify, when applicable, the types of simulator used for training each one.

   “Effective Communication” and “Decision Making” courses part of the initial and continuing training programmes. These are based on INFO courses. The INFO “Control Room Teamwork Development” course is being examined for possible delivery to authorised staff. Plant specific simulator is/would be used for training each of these courses.

3. Are any guides used for conducting and evaluating Team skills training simulations? Explain your answer.

   Team skills are evaluated by Production manager during Requalification Testing – subjective guide.

4. Based on your experience, describe advantages and disadvantages of Team training with the participation of the same (usual) Members every time or with changes in the Shift Team compositions.

   Due to the possibility of having different teams within the control room due to vacation, sickness and other absences, it is important that each shift crew conduct simulator training with different persons. This is accomplished during Refresher Training where each shift crew is divided in half. Half the crew is in the simulator, half the crew is in the classroom receiving lectures. Members are routinely rotated within this crew split. In addition, days authorised staff are distributed amongst the different crews.

5. Are simulator sessions used for the optimisation of control Room Team Shifts taking into account the characteristics (aptitudes, attitudes, ...) of each Operator? In other words, are simulator sessions used for deciding which Members are going to constitute each Shift Team? Explain your answer.

   No, each simulator session is generally the same with no influence on staff members.
6. Are there any licensing examinations applied to the whole Control Room Shift Team in addition to the individual licensing examinations? Explain.

No.

B) Training for stress.

1. Is any part of the simulator training programme specifically devoted to train Control Room Operators to operate under stress? Explain your answer.

There is a certain degree of stress imposed by having plant management and Regulatory staff performing assessments. Also, scenarios are routinely developed which are new to the candidates – increase complexity.

2. Are stress levels induced and measured during simulator training sessions? If yes, describe the methods and results.

No.

3. Based on your experience describe any measures adopted during simulator training to counter stress.

Numerous unknown/unseen events. Good/easy to use operating procedures (e.g. Emergency Operating Procedures). Following procedures tends to overcome stress effects. Feedback given to trainees promptly following training/testing exercises.

C) The theoretical basis underlying training.

1. Are any models of human behaviour being used in designing and implementing training programmes? If yes:
   i) refer to or describe the models,
   ii) indicate the areas in which these models are being applied (for example: signal detections, decision-making, etc.)
   iii) give the main results.

No, however, the INPO “Control Room Teamwork Development” course is being examined for designing future training programmes. The course is based on the premises:
- people behave differently
- behavioural differences affect team performance
- changes in behaviour can occur from experience
- teamwork strengths and challenges can be experienced during exercises, critiques, and discussions and used to identify potential changes to further improve teamwork.
D) Habits acquired during training sessions with simulators.

1. **Describe, based on your experience, undesirable habits which could be acquired by trainees during training sessions with simulators** (for example: due to limited number of simulated scenarios, due to lack of physical or functional fidelity, due to the use of conservative codes for simulation instead of best estimate codes, etc.) and discuss their potential consequences on safety.

   - Trainees respond too quickly, missing indications and procedural steps.
   - Trainees don’t use procedures. All paths of a procedure may not be exercised sufficiently. This is particularly true for additional malfunctions from the main line event. Sometimes there is the argument that ‘this will never happen’.
   - Trainees develop a ‘mind set’ resulting in misdiagnosis. Even though the simulated models may not be accurate (this may come about from things such as using the conservative codes from safety analysis instead of best estimate codes) the operator still has to respond to what he sees. For example, the timing may be different for certain size pipe ruptures, but this will be transparent to the operator in the real control room. All possible analysed deviations should be practised, e.g. Steam Main Break with and without losses of electrical power. Operators sometimes have the undesirable habit of expecting a response, therefore not following every step in a procedure (for failures that have a low probability of occurring) or not monitoring more than one indication when making a decision.

2. **Describe, based on your experience, any measures adopted to avoid acquisition of those undesirable habits or to prevent use of them.**

   - Insert failures that occasionally take the candidate down different procedural paths.
   - Insert failures that require confirmation of more than one indication.
   - Give trainees a variety of events, especially new/unseen events.

E) Simulator training on normal and emergency conditions during shutdown and low power operation.

1. **What use is made of simulators for Control Room Operator training in normal, abnormal and emergency conditions during shutdown and low power operation (simulated scenarios, trained skills, training techniques, ...)?**

   Training scenarios are developed for low power operation, e.g. Low Pressure ECI operation with reactor depressurised for maintenance, special training for outage activities, shutdown heat sink training. ‘Shutdown’ training less than ‘at power’ training due to limited modelling capability.

2. **What are the criteria (risk-based criteria, deterministic criteria, results of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?**

   Based generally on degree of difficulty, number of actions, something new, complexity, unit being in a certain (shutdown) configuration for an extended period of time, or operating experience/events. Rapid response of operators less likely required for shutdown reactor.
3. Are job and task analysis (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on shutdown and low power operation? Explain.

   No.

4. What are your plans for the future in this area?

   None at this time.

F) Simulator training on severe accidents.

1. What use is made of simulators for Control Room Operator training in severe accidents (simulated scenarios, trained skills, training techniques, ...)?

   Severe accident analysis has not been completed on CANDU reactors. Some aspects of severe accident response is covered in the Symptom Based procedure (Critical Safety Parameter Monitoring and Restoration Guide). Routine training is given on this procedure.

2. What are the criteria (risk-based criteria, deterministic criteria, result of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?

   Still under review by analysis.

See above.

3. Are job and task analysis (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on severe accidents. Explain.

   Assessment when analysis completed.

4. What are your plans for the future in this area?

   G) Simulator training on accidents caused by fires, floods, earthquakes, etc.

1. What use is made of simulators for Control Room Operator training in accidents caused by fires, floods, earthquakes, etc. (simulated scenarios, trained skills, training techniques,...)?

   A Common Mode Event procedure exists which deals with accidents caused by fires, floods, earthquakes, etc. Most actions are performed in the Unit Emergency Control Centre therefore not practised in the simulator. Classroom and field training given in this area.

2. What are the criteria (risk-based criteria, deterministic criteria, result of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?

   See above.
3. Are job and task analyses (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on accidents caused by fires, floods, earthquakes, etc.? Explain.

See above.

4. What are your plans for the future in this area?

See above.
QUESTIONNAIRE

SECTION 0: Organisation/s replying to the questionnaire

1. Name of Organisation/s.
   Ontario Hydro

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SECTION 1: General Information (related to the whole country)

1. Number of nuclear reactors (Units) in operation.
   21

2. Number of Sites with at least one Unit in operation.
   7

3. Number of full-scope (replica and no replica) simulators used for operator training.
   7

4. Number of replica simulators used for operator training.
   0

5. Number of part-task simulators used for operator training.
   0
6. Number of basic principles simulators used for operator training.
   0

7. Number of concept simulators used for operator training.
   0

8. Number of special-purpose simulators used for operator training.
   0

9. For how many Units is the training done on replica training simulators?
   22

10. For how many Units is the training done on full-scope (replica and no replica) training simulators.
    Same as Question 9.

IMPORTANT QUESTION

Are your answers to the subsequent sections (2 to 5) of the questionnaire related to a specific Organisation or Training Centre in your Country?

Yes   X   No   __   (Mark your answer with an X)

If yes, indicate the name of the Organisation or Training Centre and describe briefly the simulation facility referred to in answer to the question below (f.i. located on-site or off-site, type of simulator/s, sample photograph, reference NPP/s, NPP/s which receive training in this facility, size and composition of the simulator instructional and support staff, etc.) and, also, describe this/these NPP/s (f.i. type (PWR, BWR, etc.), vendor, start of operation, degree of automation, Operators which constitute the Control Room Shift Team, sample photograph of the control room/s, etc.).

There are 22 nuclear generating units of various capacities operating in Canada. They are owned and operated by provincial utilities. Ontario Hydro owns twenty and New Brunswick Power and Hydro-Quebec own one each.

Ontario Hydro
Ontario Hydro has five separate stations, each site consisting of four generating units. The control panels for all four units at each station are contained in one common control room. The training facilities housing the simulators for the five stations are in two separate geographical locations.

The Western Nuclear Training Centre (WNTC), serving the western end of the province of Ontario, houses separate full scope replica simulators for the four Bruce NGSA units and the four Bruce NGSB units. Only one complete unit from each station is simulated as the units at each station are identical. Included in the simulator package are Common Services panels which includes things like electrical distribution, High Pressure Emergency Injection System and Emergency Power Generators which are common to all four units. The Training facility is located within approximately 1.5 kilometres of the generating station site.
Particulars:
WNTS is located on site (~ 1.5 km from Bruce stations)
Simulators for Bruce NGSA and Bruce NGSB (full scope replica)
Instructional staff – 6 per station
Support staff – 11 per station
All stations are CANDU design
Bruce A (started operation 1976, simulator in service date 1983)
Bruce B (started operation 1984, simulator in service date 1986)
All control rooms are highly automated
Control Room Team: (Steady state operation)
  Bruce A & B:
    One Authorised Nuclear Operator per unit (Control Room Operator, i.e. four per station).
    One “unauthorised” Operator on Common Services panel and one “unauthorised” Operator on
    Fuel Handling machines.
    One Shift Operating Supervisor per station (4 units plus auxiliary systems and fuel handling)
    plus one Shift Superintendent per station. SOS has lesser approval authority than Shift
    Superintendent and can be replaced by a Shift Supervisor who has the same approval
    authority as the Shift Superintendent but is a junior person.

SECTION 2: Current practices with simulators closely related to operator training.

1. Based on your experience, describe advantages and disadvantages of the location of
   the Simulation Centre with regard to the plant: on-site versus off-site. Specifically,
   describe those factors which have some influence on the Operators’ attitude towards
   the simulator training and in the quality of the simulator training.
   – no disadvantages
   – good communication links to station
   – encourages line management involvement

2. a) During simulator training sessions, what factors (time, communications, etc.)
    influencing the interactions between Control Room Operators and other Plant
    Personnel (Operations Department outside of Control Room Personnel,
    Maintenance or Instrumentation, and Control Departments, Technical Support
    Centre, etc.) are simulated?

    Instructor role plays external communication, generally in real time.

    b) Do these other Plant Personnel participate in the training sessions?
    Describe the present training format pertaining to involvement of non Control
    Room Personnel in simulator training sessions and explain why this format is
    used.

    No (see part a)). Actual task performance not required so sue of actual field staff would be
    inefficient use of manpower. “Apparent” task completion input into simulator.
3. What environmental conditions (normal and emergency lighting, humidity, noise, vibrations, sounds generated by equipments, etc.) that could be experienced by the reference plants, are usually simulated in the Simulator Rooms? Describe the use of such effects at your simulator centre and explain why they are, or are not, incorporated into simulator training sessions.

Only lighting is simulated. Lighting is modelled and is the most visible aspect of some scenarios. Other factors are only minor enhancements in the training environment and don’t justify the expense.

4. Do Control Room Operators receive simulator training for operations outside the Control Room, for example: operations from Remote Shutdown Panels? Describe this type of training as it exists at your Simulator Centre and explain why it is, or is not, used in training sessions.

No simulator training (not simulated).

5. a) How frequently are the changes taking place in plant (plant design changes, procedures changes, etc.) incorporated to the replica or full-scope simulator? Describe any process or mechanism in place at your Simulator Centre to incorporate changes to the replica or full-scope simulator.

On a routine continual basis. Simulator involved in Engineering Changes documentation process. Direct discussion with the station staff.

b) Do simulator model modifications require separate approval while the simulator is being used for training?

Instructor acceptance prior to use in training.

6. a) Identify the members of the Control Room Shift Team (Reactor Operators, Turbine Operators, Shift Supervisors, etc.) and indicate the time (in hours) dedicated to simulator training by each member in their initial training programme. Specify, when applicable, the time spent with each type of simulator.

<table>
<thead>
<tr>
<th>Role</th>
<th>Initial Training Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRO</td>
<td>~300 hours</td>
</tr>
<tr>
<td>SS</td>
<td>~300 hours</td>
</tr>
<tr>
<td>SOS</td>
<td>~24 hours</td>
</tr>
<tr>
<td>SCPO</td>
<td>~40 hours</td>
</tr>
</tbody>
</table>

All time spent on full scope replica simulator.

b) Indicate the time (in hours) dedicated to simulator training by each member of the Control Room Shift Team in their continuous training programme. Specify, when applicable, the time spent with each type of simulator.

<table>
<thead>
<tr>
<th>Role</th>
<th>Continuous Training Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRO, SS, SOS</td>
<td>60 hours each year</td>
</tr>
<tr>
<td>SCPO</td>
<td>2-4 hours each year</td>
</tr>
</tbody>
</table>

All time spent on full scope replica simulator.
c) **What is the minimum time, if any, required by the Regulatory Body?**

Not currently specified by the regulator.

7. a) **Indicate the percentage of simulator training time by the different Members of the Control Room Shift Team devoted to i) normal, ii) abnormal and iii) emergency conditions in their initial training programme.**

   - Normal - 33%
   - Abnormal - 33%
   - Emergency - 33%

b) **Indicate the percentage of simulator training time by the different Members of the Control Room Shift Team devoted to i) normal ii) abnormal and iii) emergency conditions in their continuous training programme.**

   - Abnormal - 25%
   - Emergency - 75%

c) **What are the minimum percentages, if any, required by the Regulatory Body?**

Not currently specified by the regulator.

8. **What is the role and the policy of the Regulatory Body regarding the use of simulators for Control Room Operators licensing and training?**

   Initial authorisation requires the successful completion of a simulator based examination administered by the Regulatory Body in addition to successful completion of utility training and testing.

9. a) **What standards (ANSI/ANS 3.5, IAEA, etc.) are simulators built to and maintained?**

   Minimum standard of ANSI 3.5 in practice at a high standard.

b) **What exceptions are typically taken to the standard?**

   Routine benchmarking tests are not done.

c) **What types of simulators are used that are not included in industry standards?**

   N/A

10. a) **Describe the role of part-task simulators in your current training programs.**

    N/A

b) **Describe the role of special-purpose (analytic) simulators in your current training programs.**

    N/A
11. Have the current operator training programs been conditioned by the availability and capabilities of the simulator(s) or, alternatively, has(ve) the simulator(s) been specified and acquired after analysing and designing the training programs? Explain.

Simulators specified after original training programme developed. Programme has then evolved around the capability and availability of the simulator.

12. What extensions of simulator training are envisaged for the future?

None.

13. a) Based on your experience, describe the uses of the simulators for activities other than training (plant drills, procedures validation, design changes validation, testing programs, acquisition of human data, licensing activities, reference plant systems “tuning”, etc.).

Used for all. Most common uses are procedures validation, design changes validation, testing programmes, licensing activities.

b) What is the involvement of Control Room Operators for those applications?

CROs used to provide station experience factor where required e.g. procedure validation, drills.

14. What are the applications of simulator training for jobs other than Operations?

Demos for technical and design staff.

SECTION 3: Systematic Approach to Training: considerations regarding the use of simulators.

A) Training analysis.

1. Are job and task analysis (or any other type of task identification technique) used for establishing a list of task, performance standards, learning objectives and training methods? If yes, describe the technique used.

Subject Matter Experts (SMEs) used to do JTA and evaluate training requirements. Requirements are reviewed by job incumbents and approved.

2. a) What are the criteria that determine the limits or scope of the job analysis for the Control Room Operators?

– Station expectation.
– Station documents (e.g. Safety Report, OMs)
b) From your point of view, what should the role of risk-based criteria be for determining such limits or scope? Explain your answers.

Only if used by the Safety Report and Analysis.

3. Are there any special requirements for Job and Task Analysis which are imposed by the possibility of associated simulator training?

Not aware of any.

B) Training programme design.

1. What are the criteria for specifying simulator training rather than another training setting (classroom, laboratory, workshop, on-the-job, etc.)?

   - Criticality of the tasks
   - Mastery of basis control room skills to be demonstrated
   - Impractical to perform in station

2. What are the criteria for selecting different types of simulator (full-scope, replica, part-task, basic principles, concept, special-purpose)?

   Only use full scope replica simulator.

3. a) What are the criteria for selecting a replica simulator?

   N/A

b) What are the fidelity requirements?

   No specific standards. Maintain as high a level of fidelity as possible.

4. What are the specific pre-requisites for operators undertaking simulator training?

   Completion of science fundamentals and system knowledge training.

5. Does the possibility of simulator training impose any constraints on the definition of learning objectives?

   No.

C) Training programme development.

1. In the case of non-replica simulators, is it necessary to take parallel training actions, and if so, what kind?

   Explain your answer.

   N/A. Use only replica full scope simulator.
2. Do you use specific procedures for the training simulator, actual plant procedures or a combination of both? Explain your answer and give reasons for the choice.

Actual plant procedures.

3. What are the criteria for selecting normal, abnormal and emergency scenarios to be trained with simulators? Are they risk-based criteria? Explain your answer.

All emergency scenarios are done in initial training. For normal/abnormal degree of difficulty, consequence of error, part of starting or shutdown activity.

4. How are lesson plans and support documentation developed for simulator training?

Prepared by instructors based on station documentation (Op. manuals, training manuals).

D) Training programme implementation.

1. What selection, initial training, and continuing training is arranged for simulator instructors?

Authorised CRO/SOS or SS.
Instructional techniques, SAT workshops, simulator instruction, people skills, technical writing.

2. What are the arrangements for instructor monitoring of, and feedback to, trainees during simulator sessions?

Instructor dedicated to monitoring and generally immediate critique after training session.

3. a) What specific training modes such as simulator freeze, playback, running at higher speed than real time, activity recording, video recording, etc. is made use of during initial training?

Freeze, activity recording, video, history of trends.

b) What specific training modes such as simulator freeze, playback, running at higher speed than real time, activity recording, video recording, etc. is made use of during continuous training?

Freeze, activity recording, history of trends.

4. What limits of simulation impede planned training sessions or examination scenarios?

Xenon transient events are generally limited.
E) Trainee assessment.

1. a) What methods and procedures are used for initial trainee assessment during and after simulator sessions?

   Instructor monitored. Use of assessment guide to record performance. Performance judged against station expectations.

   b) What methods and procedures are used for continuous trainee assessment during and after simulator sessions?

   Same as a). See Nuclear Generating Division Policy 78.

2. List and describe the main areas or groups of skills and knowledge of the trainee assessed in training simulators (for example: “control board awareness, event diagnosis, immediate actions / entry-level actions, subsequent actions, control board manipulations, use of procedures / technical specifications / reference data, communications, supervisory ability, team skills” (IAEA-TECDOC-525)). Identify, when applicable, the types of simulator used for addressing each one.

   - Monitoring
   - Actions taken without reference to procedures
   - Diagnosis/decision making
   - Procedure compliance
   - Communication and crew interaction skills
   - Technical knowledge

   Full scope replica simulator.

3. Describe the ranking of importance, if any, given to the main areas or groups of skills and knowledge taken into account for a trainee assessment.

   No ranking done. Must pass all competency areas.

4. a) Based on your experience, describe difficulties you have had for assessing the individual skills and knowledge of a trainee while operating within a whole Control Room Shift Team during simulator sessions.

   Weak performance can be masked by other team members.

   b) Describe the measures adopted to overcome these difficulties.

   Initial – use of role players to ensure individual is required to perform.
   Continuing – one-on-one evaluation of each team member.

5. a) Based on your experience, describe influences on trainees performance during simulator sessions resulting from the attendance of personnel such as utility managers, regulatory body inspectors, etc.

   Higher stress level and greater nervousness. Less “fluid” performance initially by most candidates.
b) Based on your experience, describe influences on trainees performance during simulator sessions resulting from the attendance of personnel such as utility managers, regulatory body inspectors, etc.

Trainee is conditioned to instructor presence. Instructors seen as mentors and as someone who is there to help the trainee.

6. a) Are training simulator examinations used in order to grant initial license to operators? Explain.

Yes. Must pass both utility and regulator conducted exams at end of training.

b) Are training simulator examinations used for requalification? Explain.

Yes. Exam done by utility on an annual basis.

7. How is examination integrity preserved during the examination/scenario preparation period?

Detailed procedures covering all aspects, e.g. password protected computer logs, offices and simulator doors locked, windows blanked.

8. What performance monitoring or data acquisition features of the simulator are used during simulator examinations?

Initial – TAM, video, history trends, examiner notes. Continuing – history trends, TAM, examiner notes.

F) Training programme evaluation.

1. Describe the approach used for evaluating the simulator training programme and main results.

Trainee feedback, line management observation, audits. Results – success rate of trainees.

2. What programme is in place for validation and continuous verification of the simulator performance?

No formal process. Based on feedback of trainees and instructors. Occasional comparison with station events.

3. What types of performance discrepancies are most frequently identified by operators during training sessions?

No specified pattern of faults identified.

4. What types of performance discrepancies are most frequently identified by examiners or inspectors?

Minor modelling problems of infrequently used malfunctions.
SECTION 4: Use of operating experience for operator training with simulators.

1. How is operational experience feedback incorporated into the design of simulator training programs (experience reviewed, schedule, people involved)?

Station and external events (through INPO) are reviewed by training staff and programmes revised as required. Station OPEX groups also provide training recommendations based on their review.

2. Has your organisation developed any kind of programme by which simulator operator training is correlated with real operating events?

No formal programme.

SECTION 5: Specific topics on Operator training with simulators.

A) Team training techniques.

1. a) Are job and task analyses used for defining the role and responsibilities of the Members of the Control Room Shift Teams and, in general, of the various levels of staff who are charged with operation of the plant? Explain your answer.

Generally no. Some JTAs in progress will modify the roles and responsibilities.

b) Are job and task analyses used for establishing performance standards, learning objectives and training methods for Team skills training?

Yes. JTAs for CRO/SS used to help establish team skills such as approach to upset. No documented link of the training to a JTA.

2. List and describe Team skills (communication, management of resources, team co-operation, team leadership, feedback, conflict resolution, team decision-making, etc.) which are trained using simulators. Identify, when applicable, the types of simulator used for training each one.

Communication, management of resources, team co-operation, team leadership, feedback and team decision making are trained on replica simulator.

3. Are any guides used for conducting and evaluating Team skills training simulations?

Yes. Evaluation sheets include standards for the team skills.
4. Based on your experience, describe advantages and disadvantages of Team training with the participation of the same (usual) Members every time or with changes in the Shift Team compositions.

Advantages:
– better overall handling of event
– better communication
– less conflict of members

Disadvantage:
– teamwork breakdown when new member shows up
– team “works around” new member as opposed to involving them
– non-verbal communication methods developed which are foreign to any new members

5. Are simulator sessions used for the optimisation of control Room Team Shifts taking into account the characteristics (aptitudes, attitudes, ...) of each Operator? In other words, are simulator sessions used for deciding which Members are going to constitute each Shift Team?
Explain your answer.

No. Flexibility of authorised staff being able to cover on any shift is a requirement.

6. Are there any licensing examinations applied to the whole Control Room Shift Team in addition to the individual licensing examinations?
Explain.

No.

B) Training for stress.

1. Is any part of the simulator training programme specifically devoted to train Control Room Operators to operate under stress?
Explain you answer.

No specific programmes, but the nature of scenario design introduces realistic job condition (including stress).

2. Are stress levels induced and measured during simulator training sessions?
If yes, describe the methods and results.

No.

3. Based on your experience describe any measures adopted during simulator training to counter stress.

– generic stress handling training given to candidates
– frequent testing and practising to build up candidate confidence
– instructor feedback with candidate to build confidence
C) The theoretical basis underlying training.

1. Are any models of human behaviour being used in designing and implementing training programmes?
   If yes:
   i) refer to or describe the models,
   ii) indicate the areas in which these models are being applied (for example: signal detections, decision-making, etc.)
   iii) give the main results.

   No models. Based on common sense and experience.

D) Habits acquired during training sessions with simulators.

1. Describe, based on your experience, undesirable habits which could be acquired by trainees during training sessions with simulators (for example: due to limited number of simulated scenarios, due to lack of physical or functional fidelity, due to the use of conservative codes for simulation instead of best estimate codes, etc.) and discuss their potential consequences on safety.

   The need to demonstrate individual skills sometimes forces application of skills in inappropriate situation. Skill demonstration is a necessary part of performance based testing but care must be taken to ensure the proper priorities are maintained (e.g. SS forced to investigate specifics problem using system Flowsheets, when keeping unit overview is more appropriate).

   • over focus on use of proceduralised events
   • so therefore crew not conditioned to think about what they are doing
   • newly authorised staff not participating as fully as they should in the team (i.e. initial training is more individually focused)

2. Describe, based on your experience, any measures adopted to avoid acquisition of those undesirable habits or to prevent use of them.

   • conscious effort made to ensure individual skills are demonstrated but done in a situation where proper priorities are maintained
   • clarifying station documented expectation on roles and responsibilities
   • starting to use more non-proceduralised events
   • more focus on the rational of procedures so crews recognise when the procedure is not appropriate

   iii) greater feedback in this area by instructor during refresher training

E) Simulator training on normal and emergency conditions during shutdown and low power operation.

1. What use is made of simulators for Control Room Operator training in normal, abnormal and emergency conditions during shutdown and low power operation (simulated scenarios, trained skills, training techniques, ...)?

   Very little shutdown training using simulator events are too slow-moving. No normal unit start-up and shutdown preparation.
2. What are the criteria (risk-based criteria, deterministic criteria, results of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?

Criteria used don’t support the use of simulator.

3. Are job and task analysis (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on shutdown and low power operation? Explain.

No.

4. What are your plans for the future in this area?

Improvements to simulator (e.g. start-up instrumentation) to enhance approach to critical training.

F) Simulator training on severe accidents.

1. What use is made of simulators for Control Room Operator training in severe accidents (simulated scenarios, trained skills, training techniques, ...)?

Extensive use to practice handling events that threaten the core (e.g. LOCA, loss of pressure control).

2. What are the criteria (risk-based criteria, deterministic criteria, result of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?

Events analysed in the station Safety Report.

3. Are job and task analysis (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on severe accidents. Explain.

JTA identified need for training on accident scenarios.

4. What are your plans for the future in this area?

Continue to train on existing scenarios.

G) Simulator training on accidents caused by fires, floods, earthquakes, etc.

1. What use is made of simulators for Control Room Operator training in accidents caused by fires, floods, earthquakes, etc. (simulated scenarios, trained skills, training techniques,...)?

These accidents are used as a cause of equipment malfunction (e.g. fire in a CB) or are a result of an accident scenario (e.g. flooding due to Service Water pipe break).
2. What are the criteria (risk-based criteria, deterministic criteria, result of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?

These scenarios have no impact on C/R operation that are not already trained in other scenarios.

3. Are job and task analyses (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on accidents caused by fires, floods, earthquakes, etc.? Explain.

No.

4. What are your plans for the future in this area?

None.
QUESTIONNAIRE

SECTION 0: Organisation/s replying to the questionnaire

1. Name of Organisation/s.
   New Brunswick Power

2. Contact Person/s.
   Gordon Chester
   Training Superintendent

3. Address and contact information (telephone, fax).
   Point Lepreau Generating Station
   Box 10
   Lepreau, New Brunswick
   Canada
   E0G 2H0
   Tel: 1-506-659-2220 (ext. 6473)
   Fax: 1-506-659-2107

SECTION 1: General Information (related to the whole country)

1. Number of nuclear reactors (Units) in operation.
   21

2. Number of Sites with at least one Unit in operation.
   7

3. Number of full-scope (replica and no replica) simulators used for operator training.
   7

4. Number of replica simulators used for operator training.
   0

5. Number of part-task simulators used for operator training.
   0

6. Number of basic principles simulators used for operator training.
   0
7. Number of concept simulators used for operator training.
   0

8. Number of special-purpose simulators used for operator training.
   0

9. For how many Units is the training done on replica training simulators?
   22

10. For how many Units is the training done on full-scope (replica and no replica) training simulators.
    Same as Question 9.

**IMPORTANT QUESTION**

Are your answers to the subsequent sections (2 to 5) of the questionnaire related to a specific Organisation or Training Centre in your Country?

Yes   X     No

(Mark your answer with an X)

If yes, indicate the name of the Organisation or Training Centre and describe briefly the simulation facility referred to in answer to the question below (i.e. located on-site or off-site, type of simulator/s, sample photograph, reference NPP/s, NPP/s which receive training in this facility, size and composition of the simulator instructional and support staff, etc.) and, also, describe this/these NPP/s (i.e. type (PWR, BWR, etc.), vendor, start of operation, degree of automation, Operators which constitute the Control Room Shift Team, sample photograph of the control room/s, etc.).

New Brunswick Power

**Point Lepreau Training Centre** is located on the same site as the generating station in the province of New Brunswick. This is a single unit station. The simulator is a full scope replica simulator.

- Instruction staff 3
- Support staff 7
- Other trainees and Operational staff used as needed.

Unit is a CANDU design

Pt. Lepreau (Started operation 1983, simulator in service 1993)

Control Room Team: (Steady state operation)
- One Control Room Operator
- One second level Operator
- One Shift Supervisor
SECTION 2: Current practices with simulators closely related to operator training.

1. Based on your experience, describe advantages and disadvantages of the location of the Simulation Centre with regard to the plant: on-site versus off-site. Specifically, describe those factors which have some influence on the Operators’ attitude towards the simulator training and in the quality of the simulator training.

No experience on which to draw on to compare advantages/disadvantages of on-site vs. off-site facility.

2. a) During simulator training sessions, what factors (time, communications, etc.) influencing the interactions between Control Room Operators and other Plant Personnel (Operations Department outside of Control Room Personnel, Maintenance or Instrumentation, and Control Departments, Technical Support Centre, etc.) are simulated?

During training of overall plant response events, normal communications and time are simulated. Often the time simulation is a best guess as to the duration it would take a field operator to perform a specific action. Communications are normal. The presence of field operators and other support staff are often simulated.

b) Do these other Plant Personnel participate in the training sessions? Describe the present training format pertaining to involvement of non Control Room Personnel in simulator training sessions and explain why this format is used.

The defined minimum shift complement is simulated if not available. This includes other than the normal/upset control room response team. During continuing training all crew operators are available. During initial operator training the normal control room team are available during the latter stages of the training programme.

The complete operational crew are released for training at the same time – hence all operators are available during the continuing training programme.

3. What environmental conditions (normal and emergency lighting, humidity, noise, vibrations, sounds generated by equipments, etc.) that could be experienced by the reference plants, are usually simulated in the Simulator Rooms? Describe the use of such effects at your simulator centre and explain why they are, or are not, incorporated into simulator training sessions.

None of the effects mentioned are simulated. This may become more of an issue as operational crews gain more experience.

4. Do Control Room Operators receive simulator training for operations outside the Control Room, for example: operations from Remote Shutdown Panels? Describe this type of training as it exists at your Simulator Centre and explain why it is, or is not, used in training sessions.

No. Operations at the remote shutdown panels is actually trained in the plant. This is done via mock exercises.
5. a) How frequently are the changes taking place in plant (plant design changes, procedures changes, etc.) incorporated to the replica or full-scope simulator? Describe any process or mechanism in place at your Simulator Centre to incorporate changes to the replica or full-scope simulator.

Initially a significant number of changes occurred. Currently changes in the plant are uncommon. Procedures continue to change albeit at a reduced rate. Procedural changes are made promptly in the simulator. Plant changes requiring a modelling or hardware changes in the simulator are assessed for training significance; if important they are implemented on a priority basis, on the judgement of the simulator instructors.

b) Do simulator model modifications require separate approval while the simulator is being used for training?

Yes, all changes are evaluated prior to being put into the training configuration.

6. a) Identify the members of the Control Room Shift Team (Reactor Operators, Turbine Operators, Shift Supervisors, etc.) and indicate the time (in hours) dedicated to simulator training by each member in their initial training programme. Specify, when applicable, the time spent with each type of simulator.

Normal Operation: 1 SS, 1 CRO, 1 PPOII (second level operator)
Upset Condition: 1 additional CRO qualified operator + 1 additional PPOII (second level operator)

The number of hours is estimated to be: SS/CRO – 300 hours
Second level operators – 50 hours

All time spent on full scope replica simulator.

b) Indicate the time (in hours) dedicated to simulator training by each member of the Control Room Shift Team in their continuous training programme. Specify, when applicable, the time spent with each type of simulator.

SS/CRO 80 hours per year. This includes 1 SS and 2 CROs at the same training session.
Second level operators 40 hours per year. Generally includes three operators at the same training session. All time spent on full scope replica simulator.

c) What is the minimum time, if any, required by the Regulatory Body?

Not currently specified by the regulator.
7. a) Indicate the percentage of simulator training time by the different Members of the Control Room Shift Team devoted to i) normal, ii) abnormal and iii) emergency conditions in their initial training programme.

<table>
<thead>
<tr>
<th></th>
<th>SS</th>
<th>CRO</th>
<th>PPOII</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>10%</td>
<td>10%</td>
<td>10%</td>
</tr>
<tr>
<td>Abnormal</td>
<td>60%</td>
<td>60%</td>
<td>50%</td>
</tr>
<tr>
<td>Emergency</td>
<td>30%</td>
<td>30%</td>
<td>50%</td>
</tr>
</tbody>
</table>

b) Indicate the percentage of simulator training time by the different Members of the Control Room Shift Team devoted to i) normal ii) abnormal and iii) emergency conditions in their continuous training programme.

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<tr>
<th></th>
<th>SS</th>
<th>CRO</th>
<th>PPOII</th>
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</thead>
<tbody>
<tr>
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<tr>
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<tr>
<td>Emergency</td>
<td>20%</td>
<td>20%</td>
<td>60%</td>
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</tbody>
</table>

c) What are the minimum percentages, if any, required by the Regulatory Body?

Not currently specified by the regulator.

8. What is the role and the policy of the Regulatory Body regarding the use of simulators for Control Room Operators licensing and training?

SS and CRO candidates are required to pass a simulator performance based examination administered by the regulator – hence the need for a simulator. In-house continuing training and requalification testing (audited by the regulator) is a requirement – hence the need for a simulator.

9. a) What standards (ANSI/ANS 3.5, IAEA, etc.) are simulators built to and maintained?

ANSI 3.5 was used as a guide in the original specification. Currently developing an in-house validation procedure.

b) What exceptions are typically taken to the standard?

In-house procedure has not been full developed.

c) What types of simulators are used that are not included in industry standards?

No other training simulator, other than the plant replica simulator.

10. a) Describe the role of part-task simulators in your current training programs.

Not used.
b) Describe the role of special-purpose (analytic) simulators in your current training programs.

Analytical models are often used to confirm specific parameter response seen on the replica full scope simulator (but not for training).

11. Have the current operator training programs been conditioned by the availability and capabilities of the simulator(s) or, alternatively, has(ve) the simulator(s) been specified and acquired after analysing and designing the training programs? Explain.

Conditioned on the availability of the replica full scope simulator. Original training involved plant walk-around, mock exercises in the reference station.

12. What extensions of simulator training are envisaged for the future?

Too early for us to predict at this time. However, it may be used in the delivery of training to other work groups i.e. Technical Unit, safety and Compliance Personnel, etc.

13. a) Based on your experience, describe the uses of the simulators for activities other than training (plant drills, procedures validation, design changes validation, testing programs, acquisition of human data, licensing activities, reference plant systems “tuning”, etc.).

Procedure development, verification & validation. Pre-assessment of some design changes.

b) What is the involvement of Control Room Operators for those applications?

Procedure development and validation.

14. What are the applications of simulator training for jobs other than Operations?

Currently being considered.

SECTION 3: Systematic Approach to Training: considerations regarding the use of simulators.

A) Training analysis.

1. Are job and task analysis (or any other type of task identification technique) used for establishing a list of task, performance standards, learning objectives and training methods?
   If yes, describe the technique used.

Use of subject matter experts (SMEs) to define broad job performance requirements (JPRs). Learning objectives are then derived from the JPRs, and then the most appropriate training methods are selected.
2. a) What are the criteria that determine the limits or scope of the job analysis for the Control Room Operators?

As per Question 1. above. Station defined expectations for control room staff. Generic requirements specified by the regulator.

b) From your point of view, what should the role of risk-based criteria be for determining such limits or scope? Explain your answers.

Suggest the probability of events be used to limit the required defined scope of simulation (i.e. design basic accidents and assumptions therein).

3. Are there any special requirements for Job and Task Analysis which are imposed by the possibility of associated simulator training?

Have not considered a job and task analysis as being necessary.

B) Training programme design.

1. What are the criteria for specifying simulator training rather than another training setting (classroom, laboratory, workshop, on-the-job, etc.)?

Within the scope of simulation. A function normally performed from the reference plant control room.

2. What are the criteria for selecting different types of simulator (full-scope, replica, part-task, basic principles, concept, special-purpose)?

Only use full scope replica simulator.

3. a) What are the criteria for selecting a replica simulator?

Only available training simulator (reference Question 1. within this section).

b) What are the fidelity requirements?

Our procedure is currently being developed.

4. What are the specific pre-requisites for operators undertaking simulator training?

Normally required to have completed all defined training for the 3rd level operator (PPOI) position. This includes basic science fundamentals, basic system training, safety training, and plant familiarity training (equipment location, system layout, hazardous environments and hazards associated with specific equipment and/or systems).

5. Does the possibility of simulator training impose any constraints on the definition of learning objectives?

No constraints; objectives are differently focused i.e. on performance standards and expectations.
C) Training programme development.

1. In the case of non-replica simulators, is it necessary to take parallel training actions, and if so, what kind?
   Explain your answer.

   N/A. Use only replica full-scope simulator.

2. Do you use specific procedures for the training simulator, actual plant procedures or a combination of both?
   Explain your answer and give reasons for the choice.

   Actual plant procedures. They, in conjunction with other station documents, define the standard of performance requirement of the operator. Also the simulator response closely replicates the plant for most events. Where secondary malfunctions result in procedure breakdown or no procedure exists, it is expected that operational staff suggest possible corrective actions based on indications and their understanding of fundamentals. The SS in this case approves the corrective action prior to implementation.

3. What are the criteria for selecting normal, abnormal and emergency scenarios to be trained with simulators? Are they risk-based criteria?
   Explain your answer.

   Normal:
   Frequency, complexity, potential consequences if performed in error, requested by operations management, feedback from unplanned events etc.

   Abnormal:
   Response time to mitigate severe consequences complexity, etc.

   Emergency:
   Events which have plant wide implications, generic heat sink procedure, and critical safety parameter monitoring and corrective actions.

4. How are lesson plans and support documentation developed for simulator training?

   Lesson plans are primarily developed to exercise a specific procedure, demonstrate system performance or a specific function. The lesson plan in this case identifies the planned exercise and any malfunction(s) required to demand the use of the specific procedure. Also key points of the procedure are identified as simulator freeze points where the instructor points out response or questions the trainee to confirm an understanding and to explain his/her response to observed indications.

D) Training programme implementation.

1. What selection, initial training, and continuing training is arranged for simulator instructors?

   Classroom training and practical exercise to learn the fundamentals of training.
   • Previously authorised as a CRO or SS.
   • Review of all station and other utility unplanned events.
   • Advanced simulator instructor course developed by INPO.
• Update technical training on an as needed basis.
Continuing training programme which focuses on the enhancement of training skills. The course is delivered yearly. Content is based on observed feedback from students, other instructors, supervisors and line management.

2. What are the arrangements for instructor monitoring of, and feedback to, trainees during simulator sessions?

There are no special accommodations. The instructor is visibly present in the simulator control room. Instructors have their own special techniques. They know the students and they know what best works for them.

3. a) What specific training modes such as simulator freeze, playback, running at higher speed than real time, activity recording, video recording, etc. is made use of during initial training?

All of the listed features are used; the extent of their use is, for the most part, a judgement call by the simulator instructor. Typically video is used for comprehensive events, after several days of training. Primarily used to provide feedback and the opportunity for the trainees to self-critique their performance. Speed-up factors are not used to enhance training, but rather they are used as a time saving measure to quickly establish a new training configuration.

b) What specific training modes such as simulator freeze, playback, running at higher speed than real time, activity recording, video recording, etc. is made use of during continuous training?

Same as per a) above.

4. What limits of simulation impede planned training sessions or examination scenarios?

Please note the following are possible impediments:
- Known problems which have not yet been maintained or tested.
- Lack of fidelity on some parameters for some specific events.
- Event may be outside the scope of simulation.

E) Trainee assessment.

1. a) What methods and procedures are used for initial trainee assessment during and after simulator sessions?

Fully scripted simulator guides (SEGs). They detail all the expected actions of the trainees including:
- indications observed
- immediate actions to be taken without procedures
- required operational procedures
- details of actions taken to perform the procedure
- minimum expected communications between trainees
- management defined performance expectations, etc.
b) What methods and procedures are used for continuous trainee assessment during and after simulator sessions?

As per a) above.

2. List and describe the main areas or groups of skills and knowledge of the trainee assessed in training simulators (for example: “control board awareness, event diagnosis, immediate actions / entry-level actions, subsequent actions, control board manipulations, use of procedures / technical specifications / reference data, communications, supervisory ability, team skills” (IAEA-TECDOC-525)). Identify, when applicable, the types of simulator used for addressing each one.

Event diagnosis, communications, panel skills, use normal, abnormal, and emergency procedures, team skills, immediate actions prior to consultation, system response to various events, prioritisation, etc.
In all cases the training is done on the replica full scope simulator.

3. Describe the ranking of importance, if any, given to the main areas or groups of skills and knowledge taken into account for a trainee assessment.

Event diagnosis, initial actions without a procedure, prioritisation, panel skills, emergency, abnormal and normal procedures, and teamwork skills.

4. a) Based on your experience, describe difficulties you have had for assessing the individual skills and knowledge of a trainee while operating within a whole Control Room Shift Team during simulator sessions.

Teamwork; there is often a tendency for senior control staff not to involve or make effective use of other support team members. Prioritisation – assessing the more important of competing priorities.

b) Describe the measures adopted to overcome these difficulties.

All staff were trained in a team work skills course developed by INPO. The important elements of teamwork and prioritisation are reinforced during each team training session.

5. a) Based on your experience, describe influences on trainees performance during simulator sessions resulting from the attendance of personnel such as utility managers, regulatory body inspectors, etc.

This has not been perceived as a problem.

b) Based on your experience, describe influences on trainees performance during simulator sessions resulting from the attendance of personnel such as utility managers, regulatory body inspectors, etc.

To date this has not been reported nor perceived as a problem.
6. a) Are training simulator examinations used in order to grant initial license to operators? Explain.
Yes; developed and administered by the regulator with the support of experienced utility staff. Once involved with the regulator utility staff are not permitted further involvement in the training process.

b) Are training simulator examinations used for requalification? Explain.
About to become a regulatory requirement.

7. How is examination integrity preserved during the examination/scenario preparation period?
Examination are developed by the regulator and utility staff in total isolation from the trainees or other utility staff. They, and other support if required, must sign an oath of secrecy.

8. What performance monitoring or data acquisition features of the simulator are used during simulator examinations?
Training action monitory (TAM), normal annunciation printouts, prints from CRT displays, audio and video recordings, graphical chart recorders, manually recorded information.

F) Training programme evaluation.

1. Describe the approach used for evaluating the simulator training programme and main results.
Standard forms which solicit feedback from students, other instructors, line management, etc.

2. What programme is in place for validation and continuous verification of the simulator performance?
Currently in the process of developing a validation procedure. Current activities include:
• All changes are independently assessed by a qualified instructor prior to being incorporated into the training configuration.
• Planned events are assessed prior to all scheduled training activities.
• Standardised procedure to maintain documentation current with the reference plant. Audited on a scheduled periodic basis.
• All trainees are encouraged to point out and report any observed discrepancies.
• Standardised procedure which ensures simulator staff are aware of all initiated or pending plant changes, which could impact the simulator.
• Data received from any plant event is used to assess the fidelity of the simulator.

3. What types of performance discrepancies are most frequently identified by operators during training sessions?
Fidelity issues.
4. **What types of performance discrepancies are most frequently identified by examiners or inspectors?**

   Generally, instructors are very astute at recognising most any discrepancy or abnormal behaviour.

**SECTION 4: Use of operating experience for operator training with simulators.**

1. **How is operational experience feedback incorporated into the design of simulator training programs (experience reviewed, schedule, people involved)?**

   Feedback from all sources is assessed to determine if programme changes would make training more effective. The party providing the feedback is notified as to the results of the assessment and any planned changes. This includes formal feedback, real operational data, or trainee experiences.

2. **Has your organisation developed any kind of programme by which simulator operator training is correlated with real operating events? Explain.**

   As previously stated all plant upsets (events) are reviewed to determine if the lack of or appropriateness of training was a contributing factor. Programme changes are implemented if appropriate.

**SECTION 5: Specific topics on Operator training with simulators.**

A) **Team training techniques.**

1. a) **Are job and task analyses used for defining the role and responsibilities of the Members of the Control Room Shift Teams and, in general, of the various levels of staff who are charged with operation of the plant? Explain your answer.**

   As previously stated we do not subscribe to the theory that a detailed job and task analysis is a necessary requirement.

   b) **Are job and task analyses used for establishing performance standards, learning objectives and training methods for Team skills training? Explain your answer.**

   As previously stated we do not subscribe to the theory that a detailed job and task analysis is a necessary requirement.

2. **List and describe Team skills (communication, management of resources, team cooperation, team leadership, feedback, conflict resolution, team decision-making, etc.) which are trained using simulators. Identify, when applicable, the types of simulator used for training each one.**

   All of the items listed are trained. Again we use only a replica full scope simulator.
3. **Are any guides used for conducting and evaluating Team skills training simulations? Explain your answer.**

We use Job Performance Measures (JPMs) to assess key skills requirements. Generally JPMs are used on an individual basis. Team skills requirements are identified in SEGs and are assessed by observers during a comprehensive event, and are subsequently reviewed with the team using the audio/video tapes from the event.

4. **Based on your experience, describe advantages and disadvantages of Team training with the participation of the same (usual) Members every time or with changes in the Shift Team compositions.**

Quality performance is more observable when the team has extensive experience working together.

5. **Are simulator sessions used for the optimisation of control Room Team Shifts taking into account the characteristics (aptitudes, attitudes, ...) of each Operator? In other words, are simulator sessions used for deciding which Members are going to constitute each Shift Team? Explain your answer.**

No; but as per Question 4., individuals who work together on a regular basis tend to know each others’ strengths and weaknesses. In this way it is more likely that senior staff (SS & CRO) will involve and delegate specific responsibilities to more junior team members.

6. **Are there any licensing examinations applied to the whole Control Room Shift Team in addition to the individual licensing examinations? Explain.**

No.

**B) Training for stress.**

1. **Is any part of the simulator training programme specifically devoted to train Control Room Operators to operate under stress? Explain you answer.**

We have on occasion involved specialists to talk about stress management and ways to control or minimise stress, but this is not recognised as part of the formal simulator training programme. Many of the events upon which simulator training is provided are in and of themselves stressful. Therefore in an indirect sense the issue of stress is dealt with. Also post event discussions are dealt with in a facilitative manner. In this way the issue of stress is openly discussed with constructive suggestions being put forward. This approach is observed to be effective for most in-house training.

Trainee stress is observed to be a problem just prior to an during simulator based examinations. This is believed to be due to the concern of failure, after having completed an extensive training programme. Failure has the potential to impact individuals’ long-term career plans.

2. **Are stress levels induced and measured during simulator training sessions? If yes, describe the methods and results.**

Inducted and dealt with as per Question 1.
3. Based on your experience describe any measures adopted during simulator training to counter stress.

As per Question 1 above.

C) The theoretical basis underlying training.

1. Are any models of human behaviour being used in designing and implementing training programmes?
   If yes:
   i) refer to or describe the models,
   ii) indicate the areas in which these models are being applied (for example: signal detections, decision-making, etc.)
   iii) give the main results.

   Not used.

D) Habits acquired during training sessions with simulators.

1. Describe, based on your experience, undesirable habits which could be acquired by trainees during training sessions with simulators (for example: due to limited number of simulated scenarios, due to lack of physical or functional fidelity, due to the use of conservative codes for simulation instead of best estimate codes, etc.) and discuss their potential consequences on safety.

Three issues appear to pose the greatest threat:
   • training based solely on the use of procedures which are assumed to work in all cases.
   • issues of fidelity in terms parameter direction, magnitude of parameter deviation, and timing of the parameter deviation.
   • support staff assumed to perform actions error-free.

Each could result in the trainee acquiring a false sense of security. For example, in a real life event the following may result:
   • the trainee may become totally frustrated if a procedure fails to work in real life.
   • the event could be misdiagnosed.
   • support staff can make an error leading to total confusion, etc.

2. Describe, based on your experience, any measures adopted to avoid acquisition of those undesirable habits or to prevent use of them.

   • symptom based procedures which consider equipment failures and/or human error
   • defence in depth where the CRO complies with procedures for the diagnosed event. The SS follows a second totally independent procedure which has him/her monitor critical safety parameter trends and which provides all possible options available to reverse an unacceptable trend. In this case the SS must be aware of actions taken by the CRO and only specify an alternate course of action (exercise an option) when it is clear that CRO procedure is not going to be effective
E) Simulator training on normal and emergency conditions during shutdown and low power operation.

1. What use is made of simulators for Control Room Operator training in normal, abnormal and emergency conditions during shutdown and low power operation (simulated scenarios, trained skills, training techniques, ...)?

Most training at low power (to date) involved start-up, shutdown, plant stabilisation following an event which resulted in a low power condition, partial draining and refilling of the primary coolant system.

2. What are the criteria (risk-based criteria, deterministic criteria, results of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?

Simulation availability, and they are relatively complex operations involving a lot of intervention with a number of systems.

3. Are job and task analysis (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on shutdown and low power operation?

Explain.

Primarily based on observed operational difficulty and errors that are known to have occurred in the industry.

4. What are your plans for the future in this area?

Plan to expand training in this area. Unable to be specific at this time.

F) Simulator training on severe accidents.

1. What use is made of simulators for Control Room Operator training in severe accidents (simulated scenarios, trained skills, training techniques, ...)?

Training is limited to the capability of plant systems to deal with an accident scenario, consistent with the scope of simulation capability.

2. What are the criteria (risk-based criteria, deterministic criteria, result of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?

The limitation is governed by the extent of our emergency, generic heat sink, and CSP monitoring and recovery procedures; again consistent with the scope of simulation capability.

3. Are job and task analysis (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on severe accidents.

Explain.

As per Question 2. above.
4. What are your plans for the future in this area?

No plans at this time.

G) Simulator training on accidents caused by fires, floods, earthquakes, etc.

1. What use is made of simulators for Control Room Operator training in accidents caused by fires, floods, earthquakes, etc. (simulated scenarios, trained skills, training techniques,...)?

Training is provided, but it does not involve the use of the simulator.

2. What are the criteria (risk-based criteria, deterministic criteria, result of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?

Simulator not used.

3. Are job and task analyses (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on accidents caused by fires, floods, earthquakes, etc.? Explain.

Simulator not used.

4. What are your plans for the future in this area?

No plans at this time.
QUESTIONNAIRE

SECTION 0: Organisation/s replying to the questionnaire

1. Name of Organisation/s.
   Finnish Centre for Radiation and Nuclear Safety

2. Contact Person/s.
   Dr. Ilari Aro

3. Address and contact information (telephone, fax).
   Finnish Centre for Radiation and Nuclear Safety
   P.O. Box 14, FIN-00881 Helsinki, Finland
   Tel: +358 0 7598 8296
   Telefax: +358 0 7598 8382

SECTION 1: General Information

1. Number of nuclear reactors (Units) in operation.
   4

2. Number of Sites with at least one Unit in operation.
   2

3. Number of full-scope (replica and no replica) simulators used for operator training.
   2

4. Number of replica simulators used for operator training.
   2

5. Number of part-task simulators used for operator training.
   0

6. Number of basic principles simulators used for operator training.
   0

7. Number of concept simulators used for operator training.
   0
8. Number of special-purpose simulators used for operator training.

0

9. For how many Units is the training done on replica training simulators?

4

10. For how many Units is the training done on full-scope (replica and no replica) training simulators.

4

IMPORTANT QUESTION

Are your answers to the subsequent sections (2 to 5) of the questionnaire related to a specific Organisation or Training Centre in your Country?

Yes ___ No X ___ (Mark your answer with an X)

If yes, indicate the name of the Organisation or Training Centre and describe briefly the simulation facility referred to in answer to the question below (i.e. located on-site or off-site, type of simulator/s, sample photograph, reference NPP/s, NPP/s which receive training in this facility, size and composition of the simulator instructional and support staff, etc.) and, also, describe this/these NPP/s (i.e. type (PWR, BWR, etc.), vendor, start of operation, degree of automation, Operators which constitute the Control Room Shift Team, sample photograph of the control room/s, etc.).

Answer is NO, because there are two specific training centres situated at the NPP sites of the TVO NPP in Olkiluoto and at the Loviisa NPP in Loviisa. Both training centres or training units of NPP organisations have staff of about ten persons and there are full-scope replica simulators in both of these training centres. The NPP personnel is used to give training concerning their specific fields of activity and expertise.

SECTION 2: Current practices with simulators closely related to operator training.

1. Based on your experience, describe advantages and disadvantages of the location of the Simulation Centre with regard to the plant: on-site versus off-site. Specifically, describe those factors which have some influence on the Operators’ attitude towards the simulator training and in the quality of the simulator training.

Advantages of the training centre situated at the NPP site are obvious. Short distance provides an opportunity to use plant personnel in training activities and provides better possibilities for instructors to be aware of operational and plant modifications. Operators benefit because there are no need for time consuming travelling and therefore training sessions can be relatively short at one time e.g. one day free/individual simulator exercise times can be reserved in addition to the longer annual training courses. All every day contacts are easily manageable. The operators who have done both types of training (onsite and earlier offsite in another country) prefer plant/site specific simulators. Training can be very practically oriented when quick and precise information on operational practices and needs can be given to the training centre staff.
2. a) During simulator training sessions, what factors (time, communications, etc.) influencing the interactions between Control Room Operators and other Plant Personnel (Operations Department outside of Control Room Personnel, Maintenance or Instrumentation, and Control Departments, Technical Support Centre, etc.) are simulated?

Instructors play different positions e.g. in maintenance and an operator can make phone calls to these persons who are important for the simulator exercise. In some exercises Safety Engineer on Duty take part in the exercise and comes to the simulator control room as a participant.

b) Do these other Plant Personnel participate in the training sessions?
Describe the present training format pertaining to involvement of non Control Room Personnel in simulator training sessions and explain why this format is used.

For the Safety Engineers on Duty regular simulator training is organised annually; amount is less than for operators. Also other staff such as plant managers and some other technical staff have received some simulator training mainly for understanding their specific activities in relation to the operators. E.g. even the regulatory inspectors who inspect operations and participate in licensing examinations have received some simulator training.

3. What environmental conditions (normal and emergency lighting, humidity, noise, vibrations, sounds generated by equipments, etc.) that could be experienced by the reference plants, are usually simulated in the Simulator Rooms?
Describe the use of such effects at your simulator centre and explain why they are, or are not, incorporated into simulator training sessions.

So far I do not know of any additional environmental effects. This year one of the power companies plan to have exercises with smoke to simulate fire cases.

4. Do Control Room Operators receive simulator training for operations outside the Control Room, for example: operations from Remote Shutdown Panels?
Describe this type of training as it exists at your Simulator Centre and explain why it is, or is not, used in training sessions.

Operations from Remote Shutdown Panels is included in training either at the plant or simulator depending on the plant and simulator structure. The nature of exercise depends on the panel activities and local control activities needed in the particular plant case. The simulators or plants are not particularly advanced in this respect.

5. a) How frequently are the changes taking place in plant (plant design changes, procedures changes, etc.) incorporated to the replica or full-scope simulator?
Describe any process or mechanism in place at your Simulator Centre to incorporate changes to the replica or full-scope simulator.

Practices concerning plant modifications differ somewhat in the two training centres. One training centre tries to provide plant modifications also in the simulator immediately after the NPP outage before the autumns’ simulator course. Another training centre follows US ANSI standard practices. Modifications in the plant take place almost annually; some of them have bigger effect on training some only minor effects. Modifications are also done often in different years in the two twin units which means that some of the operators of the
two twin units may get the training before the modification while the operators of other unit
get the training after the modification.

b) Do simulator model modifications require separate approval while the simulator
is being used for training?

If you mean regulatory approval the answer is no.

6. a) Identify the members of the Control Room Shift Team (Reactor Operators,
Turbine Operators, Shift Supervisors, etc.) and indicate the time (in hours)
dedicated to simulator training by each member in their initial training
programme.
Specify, when applicable, the time spent with each type of simulator.

There are three licensed operator positions in the NPP's: shift supervisor, reactor operator,
turbine operator. They have 9-10 weeks initial simulator training. The length of the day is a
normal working day that is the total amount of hours is 10 x 5 x 7.5 hours = 375 hours.
Hopefully this gives an idea of the amount of initial simulator training. Sometimes it is not
so easy to calculate the exact hands on time because there are also some discussions and
summaries included in time.

b) Indicate the time (in hours) dedicated to simulator training by each member of
the Control Room Shift Team in their continuous training programme.
Specify, when applicable, the time spent with each type of simulator.

Amount of continuing simulator training is 9-10 days annually. Practices in the two
training centres vary somewhat. If we present amount in hours one power company has
9 x 7.5 hours = 67 hours and the other 10 x 6 hours = 60 hours.

c) What is the minimum time, if any, required by the Regulatory Body?

Regulatory YVL Guide 1.6 handling the operator licensing does not specify the exact
amount of simulator training needed but the above practices reflect the regulatory
requirement level.

7. a) Indicate the percentage of simulator training time by the different Members of
the Control Room Shift Team devoted to i) normal, ii) abnormal and iii)
emergency conditions in their initial training programme.

Amount of initial simulator training for normal operation is 65-75% and for incidents and
accidents 25-35% depending on the training centre.

b) Indicate the percentage of simulator training time by the different Members of
the Control Room Shift Team devoted to i) normal ii) abnormal and iii)
emergency conditions in their continuous training programme.

Amount of continuing simulator training in one Training Centre for normal operation is
about 20% and for incidents and accidents about 80%. Abnormal and emergency conditions
are not separated from each other. Practices in the two training centres differ somewhat. In
the other training centre guidelines do not specify times for simulating normal operation,
abnormal occurrences or emergencies. This training centre seems to have a strategy to
start-up or shut down the plant and during that time there are all kinds of small deviations
from expected behaviour and one or two bigger incidents/accidents. The other training
centre has the PSA based list of incidents and accidents which should be covered during specified intervals. Operating experiences are taken into account and these events or interesting deviations are covered in simulator training. In summary the simulator training programme attempts to be formulated as interesting and useful for operators and it reflects normal operation with small deviations and emergencies. Feedback from operators affects the simulator programme.

c) **What are the minimum percentages, if any, required by the Regulatory Body?**

Regulatory body does not specify the exact requirements concerning times specified in each type of simulator training. In inspections the content of training is now and then reviewed and if a lack of a certain type of accident training is found out a remark is made.

8. **What is the role and the policy of the Regulatory Body regarding the use of simulators for Control Room Operators licensing and training?**

The role and policy is clearly defined in the regulatory YVL Guides 1.6 and 1.7 of which the first handles operator licensing and the second training and qualifications of NPP personnel. Simulator training on the full-scope replica simulator is required as a part of initial and continuing training programmes. The recent requirement from 1995 presents also that the individual simulator tests/examinations are needed for licensing the operator for the first time and participation in shift team tests/examinations are needed for relicensing the operator (a license is valid for three years).

9. a) **What standards (ANSI/ANS 3.5, IAEA, etc.) are simulators built to and maintained?**

ANSI / ANS 3.5 is a reference standard for the simulators.

b) **What exceptions are typically taken to the standard?**

Particular exceptions have not been specifically mentioned.

c) **What types of simulators are used that are not included in industry standards?**

Question is unclear.

10. a) **Describe the role of part-task simulators in your current training programs.**

There is a role concerning severe accident simulation. For this a separate simulator is needed.

b) **Describe the role of special-purpose (analytic) simulators in your current training programs.**

The plant analyser APROS will have some role. At the moment that role is unclear.
11. Have the current operator training programs been conditioned by the availability and capabilities of the simulator(s) or, alternatively, has(ve) the simulator(s) been specified and acquired after analysing and designing the training programs? Explain.

The simulator specification is to cover normal operation, incidents and design basis accidents. That is what the training programme covers. Concerning the accidents beyond design basis e.g. severe accidents other tools and training forms are needed.

12. What extensions of simulator training are envisaged for the future?

Simulators are currently used in emergency preparedness exercises. In this field there is probably some room for development. Severe accident simulation needs further work.

13. a) Based on your experience, describe the uses of the simulators for activities other than training (plant drills, procedures validation, design changes validation, testing programs, acquisition of human data, licensing activities, reference plant systems “tuning”, etc.)

One of the training centres clearly states that the simulator is a training simulator, not a design tool. Of course certain operational improvements in practices and procedures can be found during training and these findings can be used for developing practices. Also procedures can be tested, etc. For plant design purposes a plant analyser is needed. Human operator data has been collected for PSA purposes.

b) What is the involvement of Control Room Operators for those applications?

Operators are the persons who find these shortages which need improvement.

14. What are the applications of simulator training for jobs other than Operations?

Simulator training has been given to the certain technical staff also for improving their understanding of operations and operator interface.

SECTION 3: Systematic Approach to Training: considerations regarding the use of simulators.

A) Training analysis.

1. Are job and task analysis (or any other type of task identification technique) used for establishing a list of task, performance standards, learning objectives and training methods? If yes, describe the technique used.

Job and task analysis technique is not specifically used. A systematic approach is tried to be used.
2. a) What are the criteria that determine the limits or scope of the job analysis for the Control Room Operators?

Limits for operators are normal operation, incidents and design basis accidents as well as beyond design basis accidents such as severe accidents. Starting point for training is to cover all these activities.

b) From your point of view, what should the role of risk-based criteria be for determining such limits or scope? Explain your answers.

One of the training centres has used PSA results to identify the incidents and accidents of importance for continuing simulator training. This classification determines how often the incident is repeated in simulator.

3. Are there any special requirements for Job and Task Analysis which are imposed by the possibility of associated simulator training?

See nº1.

B) Training programme design.

1. What are the criteria for specifying simulator training rather than another training setting (classroom, laboratory, workshop, on-the-job, etc.)?

See nº1 in A). Criteria is a need of practical hands on training, if it can be done at the simulator or at the plant.

2. What are the criteria for selecting different types of simulator (full-scope, replica, part-task, basic principles, concept, special-purpose)?

There is only one type except severe accident simulator.

3. a) What are the criteria for selecting a replica simulator?

It is a replica full-scope simulator.

b) What are the fidelity requirements?

4. What are the specific pre-requisites for operators undertaking simulator training?

To be or currently is a control room operator.

5. Does the possibility of simulator training impose any constraints on the definition of learning objectives?

No.
C) Training programme development.

1. In the case of non-replica simulators, is it necessary to take parallel training actions, and if so, what kind? Explain your answer.
   Not applicable in Finland.

2. Do you use specific procedures for the training simulator, actual plant procedures or a combination of both? Explain your answer and give reasons for the choice.
   Actual plant procedures are used.

3. What are the criteria for selecting normal, abnormal and emergency scenarios to be trained with simulators? Are they risk-based criteria? Explain your answer.
   This question has already been answered. See earlier answers.

4. How are lesson plans and support documentation developed for simulator training?
   Lesson plans and support documentation is developed on the basis of need.

D) Training programme implementation.

1. What selection, initial training, and continuing training is arranged for simulator instructors?
   Simulator instructors are former shift supervisors or operators.

2. What are the arrangements for instructor monitoring of, and feedback to, trainees during simulator sessions?
   There are questionnaires distributed to the participants to get feedback from training including instructor assessment.

3. a) What specific training modes such as simulator freeze, playback, running at higher speed than real time, activity recording, video recording, etc. is made use of during initial training?
   These methods can be and are used during training on the basis of instructors’ need.

   b) What specific training modes such as simulator freeze, playback, running at higher speed than real time, activity recording, video recording, etc. is made use of during continuous training?
4. What limits of simulation impede planned training sessions or examination scenarios?

Beyond design basis accident limits.

E) Trainee assessment.

1. a) What methods and procedures are used for initial trainee assessment during and after simulator sessions?

After certain periods tests are provided to evaluate trainee performance.

b) What methods and procedures are used for continuous trainee assessment during and after simulator sessions?

Feedback is given after incidents and accidents how shift team handled the situation.

2. List and describe the main areas or groups of skills and knowledge of the trainee assessed in training simulators (for example: “control board awareness, event diagnosis, immediate actions / entry-level actions, subsequent actions, control board manipulations, use of procedures / technical specifications / reference data, communications, supervisory ability, team skills” (IAEA-TECDOC-525)). Identify, when applicable, the types of simulator used for addressing each one.

For the operator licensing evaluations regulatory requirement has been to cover the IAEA-TECDOC-525 parameters. The training centres are still developing their practices to assess trainees.

3. Describe the ranking of importance, if any, given to the main areas or groups of skills and knowledge taken into account for a trainee assessment.

See nº2.

4. a) Based on your experience, describe difficulties you have had for assessing the individual skills and knowledge of a trainee while operating within a whole Control Room Shift Team during simulator sessions.

Response for a) and b). Certainly there are difficulties to separate individuals’ performance from the whole teams’ performance. Regulatory body requires team tests and not to identify individual contribution.

b) Describe the measures adopted to overcome these difficulties.

Response for a) and b). Certainly there are difficulties to separate individuals' performance from the whole teams' performance. Regulatory body requires team tests and not to identify individual contribution.
5. a) Based on your experience, describe influences on trainees performance during simulator sessions resulting from the attendance of personnel such as utility managers, regulatory body inspectors, etc.

When a regulatory inspector follows the training operators know of his presence but cannot see the regulator because the regulator tries not to cause disturbance. Operators probably try their best.

b) Based on your experience, describe influences on trainees performance during simulator sessions resulting from the attendance of personnel such as utility managers, regulatory body inspectors, etc.

Instructors try not to disturb the training but do their part in activity. I have not seen problems in this respect. Feedback is given after the training; this probably solves the problem if any instructors tend to be overinvolved.

6. a) Are training simulator examinations used in order to grant initial license to operators? Explain.

Yes. See earlier answers.

b) Are training simulator examinations used for requalification? Explain.

The training centres develop their practices in this field at the moment.

7. How is examination integrity preserved during the examination/scenario preparation period?

Unclear question.

8. What performance monitoring or data acquisition features of the simulator are used during simulator examinations?

See nº6. b). Simulator recording mainly, video recording can be used.

F) Training programme evaluation.

1. Describe the approach used for evaluating the simulator training programme and main results.

Operators’ comments are an important part for further development. There are regulatory requirements that everything should be refreshed every three years. Operating experience feedback should be covered. These are some of the features used in training evaluations.

2. What programme is in place for validation and continuous verification of the simulator performance?

After modifications certain tests are run and results compared with earlier results.
3. **What types of performance discrepancies are most frequently identified by operators during training sessions?**

Mistakes or illogical things in procedures is a typical matter found sometimes.

4. **What types of performance discrepancies are most frequently identified by examiners or inspectors?**

There are discrepancies but it is difficult to say which ones are “most frequently” found.

**SECTION 4: Use of operating experience for operator training with simulators.**

1. **How is operational experience feedback incorporated into the design of simulator training programs (experience reviewed, schedule, people involved)?**

Interesting and useful operating experience that is incidents or deviations from expected behaviour are taken into account in simulator training if their nature is such that the incident suits for simulator training. There are no rules as to how fast, etc. it should be handled. There are training support groups either operations management or specific group for giving advice on operator training matters. External experience comes through the dedicated operating experience feedback group.

2. **Has your organisation developed any kind of programme by which simulator operator training is correlated with real operating events? Explain.**

Simulators are situated at NPP sites. Instructors are former operators. There are everyday contacts between operations and training staff. Certainly all important operation events are transferred to the simulator training programme. When event investigations and root cause analyses are done after some incident “lack of training” is one of the subjects considered.

**SECTION 5: Specific topics on Operator training with simulators.**

A) Team training techniques.

1. a) **Are job and task analyses used for defining the role and responsibilities of the Members of the Control Room Shift Teams and, in general, of the various levels of staff who are charged with operation of the plant? Explain your answer.**

Job and task analyses are not carried out in Finland in US sense. Persons including operators have their work descriptions so they know their duties and responsibilities.
b) Are job and task analyses used for establishing performance standards, learning objectives and training methods for Team skills training? Explain your answer.

See n°1 a). Training aims to give good performance in individuals’ own position. During an emergency specific tasks may be given to various persons among the control room operators in one of the NPP’s. This may cause some variations among different shift teams.

2. List and describe Team skills (communication, management of resources, team co-operation, team leadership, feedback, conflict resolution, team decision-making, etc.) which are trained using simulators. Identify, when applicable, the types of simulator used for training each one.

During initial training the role of team skills training is probably not so much emphasised as during continuing training because during initial training there is no real team. During continuing training the shift team forms also a training team; then instructors can concentrate on developing team skills.

3. Are any guides used for conducting and evaluating Team skills training simulations? Explain your answer.

There are no Finnish standards or guides. Probably instructors are familiarised themselves with the available international information such as IAEA documents etc. There are some Finnish research projects going on to develop these practices between NPP and research organisation VTT.

4. Based on your experience, describe advantages and disadvantages of Team training with the participation of the same (usual) Members every time or with changes in the Shift Team compositions.

Same shifts are normally used also in training mainly because of practical reasons. It might be a good idea to offer a model to other shift teams if some shift is exceptionally good in their performance doing some specific matter. Maybe video recording offers a good means for this.

5. Are simulator sessions used for the optimisation of control Room Team Shifts taking into account the characteristics (aptitudes, attitudes, ...) of each Operator? In other words, are simulator sessions used for deciding which Members are going to constitute each Shift Team? Explain your answer.

Simulator is one of the places where one can see how team work is going on during normal operations and emergencies. It is not the aim of the training to develop such shift changes. Of course if it appears that some people not at all match with each other something must be done. Probably this same matter has already appeared during everyday work in the NPP control room. So co-operation between operations management and training instructors might be useful in this respect.

6. Are there any licensing examinations applied to the whole Control Room Shift Team in addition to the individual licensing examinations? Explain.

Yes. This question has already been answered. See previous answers.
B) Training for stress.

1. Is any part of the simulator training programme specifically devoted to train Control Room Operators to operate under stress?
   Explain you answer.

   Now and then some incidents are planned in such a way that also stress is created from the point of view that there is a lot to do and very little time or another incident takes place immediately after the initial incident. This kind of stress situations I know.

2. Are stress levels induced and measured during simulator training sessions?
   If yes, describe the methods and results.

   Not that I know of.

3. Based on your experience describe any measures adopted during simulator training to counter stress.

   Qualitative estimation might have been carried out.

C) The theoretical basis underlying training.

1. Are any models of human behaviour being used in designing and implementing training programmes?
   If yes:
   i) refer to or describe the models,
   ii) indicate the areas in which these models are being applied (for example: signal detections, decision-making, etc.)
   iii) give the main results.

   There is some research work going on between NPP and research centres to develop practices from the human point of view. There are a couple of psychologists involved. What the results are so far and how these are implemented in training is unclear for the moment. The final report has not yet been delivered to the regulatory body so obviously the work is still going on.

D) Habits acquired during training sessions with simulators.

1. Describe, based on your experience, undesirable habits which could be acquired by trainees during training sessions with simulators (for example: due to limited number of simulated scenarios, due to lack of physical or functional fidelity, due to the use of conservative codes for simulation instead of best estimate codes, etc.) and discuss their potential consequences on safety.

   This response applies for nº1 and nº2. We have in this country some undesirable habits received when the training has been given in another type of simulator (not replica) in another country. Nowadays there are replica simulators in use.
2. Describe, based on your experience, any measures adopted to avoid acquisition of those undesirable habits or to prevent use of them.

This response applies for n°1 and n°2. We have in this country some undesirable habits received when the training has been given in another type of simulator (not replica) in another country. Nowadays there are replica simulators in use.

E) Simulator training on normal and emergency conditions during shutdown and low power operation.

1. **What use is made of simulators for Control Room Operator training in normal, abnormal and emergency conditions during shutdown and low power operation (simulated scenarios, trained skills, training techniques, ...)?**

Start-ups and shutdown belong to simulator training routines. Small incidents and deviations are normally included during these periods in one of the training centres.

2. **What are the criteria (risk-based criteria, deterministic criteria, results of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?**

In well performing NPP there is only one annual start-up and one annual shutdown. So these normal routines should be trained at simulator with small deviations. Instructor can put an emergency situations also during these operational plant states; that is then emergency training.

3. **Are job and task analysis (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on shutdown and low power operation? Explain.**

Many outage activities are such that one cannot practice them with the simulator. Start-ups and shutdowns one can. One training centre has a list of PSA incidents to be taken into account during continuing training. Outage PSA results are probably not yet included in this list.

4. **What are your plans for the future in this area?**

Future plans are reflected in answers to above.

F) Simulator training on severe accidents.

1. **What use is made of simulators for Control Room Operator training in severe accidents (simulated scenarios, trained skills, training techniques, ...)?**

There are symptom based emergency operating procedures for beyond design basis accidents. These can be practised at simulator to a certain point. There is in one of the training centres severe accident PC-simulator for e.g. core melt accident. This has been used in operator training.
2. **What are the criteria (risk-based criteria, deterministic criteria, result of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?**

   Severe accident management is an essential part of emergency management in Finland required to be taken into account in old units and especially in new NPP’s constructed in Finland.

3. **Are job and task analysis (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on severe accidents. Explain.**

   Job and task analysis is not used in Finland in US sense. Systematic approach is tried to be applied.

4. **What are your plans for the future in this area?**

   Future plans are reflected in above answers.

G) **Simulator training on accidents caused by fires, floods, earthquakes, etc.**

1. **What use is made of simulators for Control Room Operator training in accidents caused by fires, floods, earthquakes, etc. (simulated scenarios, trained skills, training techniques,...)?**

   One training centre is using artificial smoke in 1996 to train shutdown of NPP in fire case.

2. **What are the criteria (risk-based criteria, deterministic criteria, result of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?**

   There is no specific criteria for the matter.

3. **Are job and task analyses (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on accidents caused by fires, floods, earthquakes, etc.? Explain.**

   These kind of events are practised outside simulator in the simulated manner. Fire brigade exercises are normal routine.

4. **What are your plans for the future in this area?**

   No specific plans.
QUESTIONNAIRE

Important Remark: In EDF, the training centres depend on “training groups”. The teams using simulators for operators training belong to the “Operating training institute”. In the management department (a centralised division in charge of nuclear power plant management aspects) some experts supervise the training process. This document was prepared taking into account communications from EDF on subject and two interviews with an expert of the management department. The answers were written by the ETF members.

SECTION 0: Organisation/s replying to the questionnaire

1. Name of Organisation/s.

2. Contact Person/s.

3. Address and contact information (telephone, fax).

SECTION 1: General Information (related to the whole country)

1. Number of nuclear reactors (Units) in operation.

Response applicable to nº1 and nº2. 54 NPP reactors are in operation in France on 17 sites. Four new reactors are under construction on two different sites.

2. Number of Sites with at least one Unit in operation.

Response applicable to nº1 and nº2. 54 NPP reactors are in operation in France on 17 sites. Four new reactors are under construction on two different sites.

3. Number of full-scope (replica and no replica) simulators used for operator training.

12 simulators are used as full scope simulators for training. A new one should be delivered in 1998 by Thompson.

<table>
<thead>
<tr>
<th>Date put into service</th>
<th>Location</th>
<th>Reference Facility</th>
<th>Series</th>
</tr>
</thead>
<tbody>
<tr>
<td>1977</td>
<td>Bugey</td>
<td>Bugey 2</td>
<td>CP0, PWR 900</td>
</tr>
<tr>
<td>1980</td>
<td>Bugey</td>
<td>Tricastin 1</td>
<td>CP1, PWR 900</td>
</tr>
<tr>
<td>1983</td>
<td>Bugey</td>
<td>Saint-Laurent B1</td>
<td>CP2, PWR 900</td>
</tr>
<tr>
<td>1984</td>
<td>Caen</td>
<td>Saint-Laurent B1</td>
<td>CP2, PWR 900</td>
</tr>
<tr>
<td>1984</td>
<td>Paluel</td>
<td>Paluel 1</td>
<td>P4, PWR 1300</td>
</tr>
<tr>
<td>1985</td>
<td>Paluel</td>
<td>Paluel 1</td>
<td>P4, PWR 1300</td>
</tr>
<tr>
<td>1986</td>
<td>Paluel</td>
<td>Gravelines B1</td>
<td>CP1, PWR 900</td>
</tr>
<tr>
<td>1990</td>
<td>Bugey</td>
<td>Paluel 1</td>
<td>P4, PWR 1300</td>
</tr>
<tr>
<td>1990</td>
<td>Bugey</td>
<td>None</td>
<td>SSC, PWR 1400</td>
</tr>
<tr>
<td>1995</td>
<td>Cattenom</td>
<td>Paluel 1</td>
<td>P4, PWR 1300</td>
</tr>
<tr>
<td>1995</td>
<td>Gravelines</td>
<td>Gravelines B1</td>
<td>CP1, PWR 900</td>
</tr>
<tr>
<td>1998</td>
<td>Chooz</td>
<td>Chooz 1</td>
<td>N4, PWR 1400</td>
</tr>
</tbody>
</table>
4. **Number of replica simulators used for operator training.**

11 simulators represent 5 reference nuclear power plants. Today, 5 plants have their replica. Bugey 2, Tricastin 1, Saint Laurent 1, Paluel 1, Gravelines 1. Chooz will have its replica in 1998. For example, in Paluel, four plants are in operation, built on the same design. The full scope is the exact replica of Paluel 1. All the modifications done on the plant are studied to be reported or not on the simulator. During training, people used documents coming from this plant. This simulator looks like the three other units, but not with the same level of detail.

5. **Number of part-task simulators used for operator training.**

22 part task simulators:
- 8 simulators of Reactor chemical and volume control system (RVC)
  
Adjustment of the primary system’s pressure, water volume and boron concentration: the systems simulated are volume control, and water and boron makeup.
- 7 simulators of Turbine generator:
  
Simulation of the turbine and its adjustment, and of the AC generator and its excitation. Simulators exist in CP1 and CP2 turbine generator versions.
- 8 simulators of Reactor control:
  
Fine-tuned simulation of the reactor, of its adjustment and steam bypass, and a more rough and ready simulation of the primary system, steam generator, and turbine. Control simulators allow the grey procedure to be simulated.

Their characteristics are the following:

<table>
<thead>
<tr>
<th></th>
<th>RCV</th>
<th>GTA</th>
<th>GTA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Computer</strong></td>
<td>1 MITRA 225</td>
<td>1 MITRA 225</td>
<td>2 MITRA 225</td>
</tr>
<tr>
<td><strong>Addressing</strong></td>
<td>16 bits</td>
<td>16 bits</td>
<td>16 bits</td>
</tr>
<tr>
<td><strong>Memory capacity</strong></td>
<td>64 kwords</td>
<td>64 kwords</td>
<td>2 x 64 kwords</td>
</tr>
<tr>
<td><strong>Input/Output</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>448 binary outputs</td>
<td>360 binary outputs</td>
<td>805 binary outputs</td>
</tr>
<tr>
<td></td>
<td>80 continuous outputs</td>
<td>88 continuous outputs</td>
<td>96 continuous outputs</td>
</tr>
<tr>
<td></td>
<td>576 binary inputs</td>
<td>358 binary inputs</td>
<td>605 binary inputs</td>
</tr>
<tr>
<td></td>
<td>64 continuous inputs</td>
<td>2 continuous inputs</td>
<td>15 continuous inputs</td>
</tr>
</tbody>
</table>

6. **Number of basic principles simulators used for operator training.**

The neutronic aspects of operating are illustrated during training on a small research reactor: Siloette reactor in Grenoble. It is a small-scale simulator into which the main systems have been modelled without trying to replicate a reference nuclear power plant perfectly. Systems of less importance (ventilation, auxiliary steam, etc.) are ignored. The major systems are modelled according to their nuclear and thermohydraulic aspects alone. Conventional nuclear island systems are sometimes highly simplified. Similarly, neither the process’s logic nor the signal redundancies are simulated, nor are auxiliaries like the oil pumps.

It includes:
- a 32-bit SEL 32-87 digital computer which solves the various simulation equations in real time;
- a desk allowing the trainee to interact with the computer and observe its responses; since the desk has few controls and displays, the trainee’s attention is kept on the important parameters;
- continuous recorders allowing the progress of certain magnitudes to be followed;
- a plotter providing printouts of numerous variables’ curves after the simulation;
- an interactive console allowing the instructors to programme the simulated reactor’s characteristics or alter certain parameters during the simulation;
- an electronic bay for digital to analog conversion between the computer and the desk and back.

The trainee is given the information in various ways; on the blackboard, at the desk, on computer or on printouts. The simulator desk has 20 inputs and 40 analog outputs allowing the main internal and external variables involved in the industrial process to be viewed.
The field of simulation ranges from hot shutdown to full power. Two modes exist:
1) Hot standby “zero power operation.
Reactor power is zero and primary temperature 286 ºC. Only the reactor is simulated. The simulation allows the reactor kinetics to be studied in both sub- and super-critical states. At simulation startoff, the reactor is at a low, stable power, calculated from the source level of the required initial reactivity. Given the low power level, the Doppler and xenon effects are not taken into consideration.
2) Power operation, with turbine running
The accepted power variations range from several percent to 100% of normal power. The entire nuclear power plant is simulated. All temperature effects and the xenon effect are taken into consideration.

7. Number of concept simulators used for operator training.

One simulator SIPA is used for precise accidental simulation.
SIPA is a computer system comprising:
- ALGAE (Atelier de Génie Logiciel Adapté aux Études Évolutives: developmental research software engineering workshop);
- PWR configurations;
- the simulator per se.
The simulated configuration is calculated at each instant, viewed on MMI images controlled by the trainee, according to the various malfunctions or failures introduced by the instructor. The configuration is the result of the calculation modules plus the values calculated at instant X projected onto a plant diagram background. It may then be done on the simulator.
ALGAE is a set of software tools installed on the engineering network (one server and five stations), separate from the training network. It allows:
- the simulation modules of a thermohydraulic or instrumentation and control system to be manufactured automatically, based on the graphic capture of a system;
- the already existing “manual” codes, such as CATHARE-SIMU, to be integrated into the post-accident simulator standards;
- automatic and/or manual modules to be assembled into an assembly representative of a power reactor;
- figures to be designed for the MMI required for executing the simulation;
- the software modules and figures to be transferred to the CRAY super computer and the training network for simulation;
Being modular, ALGAE is a flexible, user-friendly and up-gradable tool allowing new modules to be designed.
The remote CRAY super computer is hooked up to the SIPA post-accident simulator via high speed line (1 Mbits/s), and calculates physical parameters in real time. Data exchange is managed by a local “master computer”. In addition, a SIPA-KKT telephone link to the crisis centre allows for a complete crisis drill with the control team of the putatively accident-hit unit and the Paris crisis teams.
The man-machine interface is not a control room as in a full-scope simulator, but consists in workstations which run graphics programmes and contain the educational unit. The interactive, up-gradable interface is very flexible and has the important feature of being able to represent any PWR whatsoever. By presenting the results in a wide range of illustrative graphs, it helps thinking and in understanding physical behaviour.
Controls and results are presented by conventional computer tools (workstations, screen, keyboard, mouse, etc.). Transients can be managed and the results presented for better
interpretation of the physics. The user has a “slow” function for in-depth analysis of specific phenomena, a “fast” function for slow transients, and a “simulation freeze” for examining the reactor at a given moment or going back to an earlier stage of the scenario and altering its progress (malfunctions, operator interventions, etc...).

Progress is as follows: starting from an initial simulation state of pre-set parameters, the trainees position and alter the mechanical states (opening or closing of valves) in the order recommended in the procedures. The simulation calculates the parameter changes and inputs information into the images presented to the trainees.

SIPA uses a powerful calculation code, allowing for real-time operations simulation of a wide variety of accidents.

The simulator consists of various parts:

1) The main control station:
   Consisting of four workstations, converting real control desks into image form.

2) Data processing and safety panels:
   KKTs combine the different operational control aids on the various French series. The systems conform to reality in terms both of equipment and programmes.

3) Teaching station:
   It represents the hydraulic behaviour, especially two-phase, in real time. It displays images which are sorts of X rays of the primary and secondary systems, up to and including the steam header, and all their components (core, vessel, piping, pumps, pressuriser, steam generators, etc.). The parameters' values are refreshed every second, and the images, like a cartoon, every tenth of a second. The teaching station illustrates the state of flow in each component of the system. In two-phase, it displays the homogeneous flow with bubbles - of which a) the number increases with void fraction and b) the movement is a function of flow - , as well as the co- and counter-current laminar flow, and the bubbles rising in the vessel and in the steam generator shell side, etc. Fuel temperature is represented by colours ranging from dark red at low temperatures to bright red at the highest. Another image illustrates the boron concentration in transients. The teaching station is designed to illustrate the reactor’s thermohydraulic phenomena as representatively as possible. It has no equivalent anywhere, neither on real units (too few sensors), nor on other present-day simulators. Its two workstations purvey highly suggestive images of the boiler’s private parts (the things you can do with X ray vision!).

4) A so-called instructor workstation:
   Of the same type as the main control station, it is used not only to run the training or research session (freeze, return, fast forward, etc.), but also to create all sorts of incident (specific breaks and routine malfunctions)
   - Field of simulation
     Since the main point is to provide an understanding of the phenomena’s physics rather than a real representation of a control room, a higher degree of physical exactitude is required than on training simulators.
   - Modelling
     SIPA includes models of the 900 and 1300 MW REPs, including the primary and secondary systems and all other system required for describing the behaviour of a reactor during an accident up to core degradation.
     Each type of SIPA reactor includes some 35 systems, among the main ones are:
     - the systems connected to the primary system, such as chemical and volume control, residual heat removal, water and boron supply, etc...
     - the secondary system with normal and standby steam generator supply, bypasses, turbine and atmosphere, and a simplified turbine model;
     - the safeguard systems, such as steam generator safety injection, spraying and supply;
     - the protection system;
     - the instrumentation and control required for procedure application;
     - data processing and the safety panel;
     - a simplified representation of electrical distribution (6.6 kV and 380 V) for simulating power
losses, standby diesel generator set, etc.;
- a model of the containment, calculating the temperature and pressure and, in the sumps, temperature and level.

• Physics
The situations simulated range from “solid” cold state with vessel closed and vented, to full power and accident conditions.
It includes boron and activity calculations. The physics simulated also cover:
- breaks of piping of up to 30 cm diameter on one or more of the primary system’s loops, no matter where;
- feedwater pipe breaks
- steam generator tube ruptures, up to 120 tubes on one or more steam generators;
- combinations of steam generator tube rupture with steam tube break or breaks in the primary system;
- incidental transients with or without emergency stop.
The accidents can be simulated no matter what the reactor state. Nine breaks can be simulated at the same time and the failure of no matter what component may be superposed onto the accident situations.

• Computer-assisted instruction (CAI)
Computer-assisted instruction can be used for general training purposes, for safety, plant familiarity, relay circuitry, equipment, procedures, feedback, etc. Its main use lies in knowledge acquisition, keeping it fresh and evaluating it, and for completing training for diplomas. It is also a useful tool for the staff in general (Ref. 8).
Certain applications are considered as coming under the realm of simulators. This applies to the programmes on the low working range of the RRA, water movements, fuel removal, and steam bubble formation.

8. Number of special-purpose simulators used for operator training.

On each site, one simulator Sepia shows different purposes (20 simulators in total).
The workstation runs the following applications:
- basic principles of a 900 MW PWR;
- steam generator tube rupture accidents;
- normal and accidental operation of a PWR (MicroREP 900 and 1300);
- the SEPIA expert system which analyses trainee behaviour.
The simulator has been installed on the 17 sites in 1993 and 1994, and may be used on a “self service” basis 24 hours a day. Since the beginning of the year, all sites are now equipped with all versions. Every year, statistics are drawn up for each site: extent to which the tool is used, breakdown of the four programme types, time distribution, etc. The site using the tool most is Cattenom: 1800 hours per annum. Saint Laurent, on the other hand, only uses it for 400 hours.
The rate of use depends essentially on how much the managers can motivate staff to use it, and on training being an integral part of the management method. According to site, the tool is located either near to the control rooms, or in a training room or resources centre.

• Physical characteristics
The simulator includes a workstation and three screens: the model station - which performs the model resolution in real time, excluding data transfer - and two operator graphic screens (reactor and secondary operators).
Since the man-machine interface (MMI) is user friendly, operators without special computer skills can use the simulator without prior training.
Use is explained in a 15-page, on-line guide which the operator may consult interactively at any time.
The images are also as realistic as possible. They present an overview of the nuclear power plant’s various systems in an immediately-identifiable manner.
Physical similarity to existing plants is done through images on the workstation screen alone.
The operator’s work consists in carrying out the proper operational procedure through operations on the valves, whose positions are given on the circuit diagrams, while monitoring the physical parameters on the graphs displayed on the screens next to the circuits.

• Basic principle
The application allows personnel to train themselves in running a unit during normal operating phases. It allows users to gain a deeper understanding of certain thermohydraulic, nuclear or adjustment phenomena, and of primary-secondary interactions.

• Steam generator tube ruptures
Developed for the 1300 MW series, this application allows operators to train themselves on steam generator tube rupture accidents. The field of simulation ranges from cold shutdown state to operating at 100% power. A 900-MW version was used as backup in creating MicroREP 900. The scope of operations in the steam generator tube rupture simulator is fairly broad. It may be used for:
- a) small-break type procedures (IRCP8) which can be compensated by the load system flow;
- b) procedures such as those for breakage of several tubes (A3) where the safety injection is automatically turned on.

As for any type of accident automatically turning on the safety injection, the choice of procedure is guided by the overall procedure (A0) displayed on the screen.

The operator or instructor may choose the starting state, equipment outage, and size of tube break or, for trial runs, leave the simulator to choose at random. Consistency between starting state and equipment outage is checked.

• MicroREP 900 and 1300
Other than the basic functions of PWR operations, the applications also allow operators to train themselves on monitoring the procedures used in incident or accident control. The field of simulation covers all cases of steam generator tube rupture and small breaks on the primary system leading to a loss of coolant accident (LOCA). The accidents may be cumulated with equipment outage.

• SEPIA system
SEPIA allows the operators’ operational control - be it during a steam generator tube rupture or loss of coolant accident (LOCA) - to be analysed at a later stage. During the incident or accident control training session, a large number of parameters are entered into the expert system. After comparing the scenario being run with the standard procedures, SEPIA gives the operators the results so they can see the differences. By means of a curve module, it allows changes to the plant’s physical parameters during the incident or accident to be viewed. With its course module, it can also provide detailed explanations as to the physical phenomena governing the plant’s operation during the incident or accident phases.

• Modelling steam generator tube ruptures
Modelling is done in real time. For the steam generator primary system and shell side, a two-phase model is used. It has 31 control volumes for the primary system (vessel, four loops and pressuriser) and 21 volumes for the steam generator shell side. According to volume, the models are homogeneous or separate-phase.

Additional systems modelling is single-phase.

The phenomena simulated are as follows: dryout of the pressuriser brace, steam bubble beneath the dome, vaporisation in the steam generator tubes, natural circulation, de-watering or filling steam generators, etc.

The graphic editor displays images in less than three seconds, whereas the operators’ response time is less than one second.

Two hundred instrumentation and control actuators are modelled.

The control instruments used in the nuclear power plant - back-lighted rotary push-button switches, push-buttons, auto-manual control stations, setpoint stations, turbine control plate, etc. - are all faithfully reproduced on the screen. Their functioning and response times are also reproduced.
9. For how many Units is the training done on replica training simulators?

10. For how many Units is the training done on full-scope (replica and no replica) training simulators.

Response applicable to n°9 and n°10. The units can train their operators on one, two or three simulators. Types of training can be different on each simulator. If simulators are in different locations, the closer simulator is chosen, if it is available.

<table>
<thead>
<tr>
<th>Series</th>
<th>Location</th>
<th>Units concerned</th>
<th>Number of units</th>
</tr>
</thead>
<tbody>
<tr>
<td>CP0, PWR 900</td>
<td>1 simulator in Bugey</td>
<td>Fessenheim (2)</td>
<td>6 units</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bugey (4)</td>
<td></td>
</tr>
<tr>
<td>CP1, PWR 900</td>
<td>1 simulator in Bugey</td>
<td>Blayais (4)</td>
<td>12 units</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tricastin (4)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dampierre (4)</td>
<td></td>
</tr>
<tr>
<td>CP2, PWR 900</td>
<td>1 simulator in Bugey</td>
<td>Chinon (4), Cruas (4)</td>
<td>16 units</td>
</tr>
<tr>
<td></td>
<td>1 simulator in Caen</td>
<td>Saint Laurent (2)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gravelines (6)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tricastin (4)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dampierre (4)</td>
<td></td>
</tr>
<tr>
<td>P4, PWR 1300</td>
<td>2 simulators in Paluel</td>
<td>Paluel (4), Flamanville (2)</td>
<td>10 units</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Saint Alban (2)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Penly (2)</td>
<td></td>
</tr>
<tr>
<td>P'4, PWR 1300</td>
<td>1 simulator in Cattenom</td>
<td>Nogent (2), Belleville (2)</td>
<td>10 units**</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Golfech (2)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cattenom (4)</td>
<td></td>
</tr>
<tr>
<td>S3C</td>
<td>1 simulator* in Bugey</td>
<td>Chooz</td>
<td>2 units</td>
</tr>
</tbody>
</table>

* This simulator was built to study different options for the N4 control room, so it is quite different.
** This kind of plant is very similar to P4 and people can be trained on the three simulators, replica of P4.

IMPORTANT QUESTION

Are your answers to the subsequent sections (2 to 5) of the questionnaire related to a specific Organisation or Training Centre in your Country?

Yes  _X_  No__  (Mark your answer with an X)

If yes, indicate the name of the Organisation or Training Centre and describe briefly the simulation facility referred to in answer to the question below (f.i. located on-site or off-site, type of simulator/s, sample photograph, reference NPP/s, NPP/s which receive training in this facility, size and composition of the simulator instructional and support staff, etc.) and, also, describe this/these NPP/s (f.i. type (PWR, BWR, etc.), vendor, start of operation, degree of automation, Operators which constitute the Control Room Shift Team, sample photograph of the control room/s, etc.).

The operational control team consists of:
- a team manager, in charge of production and safety in real time on a pair of units;
- a technical supervisor, in charge of the technical supervision of operational control operations;
- a reactor operation, who runs the primary part of the plant (reactor, main primary system and associated systems);
- a steam-water operator, who runs the secondary part of the plant and controls reactor cooling;
- field operatives, who carry out the manoeuvres on equipment directly. These people are not present during training on simulators.

Operational control functions with six team managers per shift per two units.
Permanent monitoring of parameters important to safety devolves upon the team managers who come under the management college of the operational control department. Through individual
interviews, the responsibility they shoulder in training their operators, the persons they put forward for work authorisation, and their presence on site, they can play a major role in building a safety culture in their teams.

Technical supervisors co-ordinate all operational control operations and supervises certain systems in particular. They must ensure:
- that the work carried out by each team member is done efficiently and in line with the operational control strategy for the sequence in progress;
- that certain key actions are carried out properly, both in the control room and on the equipment directly (co-ordination);
- the operational control strategy fits the situation in hand, by applying certain tests inherent in the procedure.

If required, they request a change of procedure or sequence, in co-ordination with the other team members.

SECTION 2: Current practices with simulators closely related to operator training.

1. Based on your experience, describe advantages and disadvantages of the location of the Simulation Centre with regard to the plant: on-site versus off-site. Specifically, describe those factors which have some influence on the Operators’ attitude towards the simulator training and in the quality of the simulator training.

Advantages of centralisation
- Cost-effectiveness (operators from 5 sites use one simulator).
- Increased pedagogical expertise of instructors.
- Coherence across all training sessions for the whole team of operators.
- Ease of integration of experience gained: a single analysis is made.
- The training service is independent and has a certain weight vis-à-vis operational departments.
- Agents undergoing training are not disturbed.

Disadvantages of centralisation
- Management participation is limited.
- Instructors are distanced from trainees’ workplaces.
- Instructors are less reactive to individual team requirements.

2. a) During simulator training sessions, what factors (time, communications, etc.) influencing the interactions between Control Room Operators and other Plant Personnel (Operations Department outside of Control Room Personnel, Maintenance or Instrumentation, and Control Departments, Technical Support Centre, etc.) are simulated?

Throughout the training sessions, communications and disturbances from other people are not simulated.

b) Do these other Plant Personnel participate in the training sessions? Describe the present training format pertaining to involvement of non Control Room Personnel in simulator training sessions and explain why this format is used.

In general, only operators are present in full-scope simulator training sessions. However, during the operator continuous training course, some sites involve field agents. A telephone link is set up between the simulator and the site. This allows for the transmission of the
local action orders required by procedures. They are simulated on the premises by the agents together with the instructor. When actions are completed, information output is telephoned to operators. Timescales for actions are therefore unknown.

3. What environmental conditions (normal and emergency lighting, humidity, noise, vibrations, sounds generated by equipments, etc.) that could be experienced by the reference plants, are usually simulated in the Simulator Rooms? Describe the use of such effects at your simulator centre and explain why they are, or are not, incorporated into simulator training sessions.

The lighting is the same and the noise of the source lines is reproduced during divergence. It would not appear that indicators such as those mentioned are perceptible in actual control rooms.

4. Do Control Room Operators receive simulator training for operations outside the Control Room, for example: operations from Remote Shutdown Panels? Describe this type of training as it exists at your Simulator Centre and explain why it is, or is not, used in training sessions.

Emergency shutdown panel
This is a reduced-scale control panel (identical to the one in the unit simulated), allowing the pant to be brought to fail-safe position when the main control room must be evacuated. The emergency shutdown panel is in fact located in the electrical equipment room. This allows for direct access to the circuit breaker cells of many equipment items whose control is not shown on the emergency shutdown panel. Since this cannot be done on a simulator, cell manipulation is done from the instructor desk. A training is scheduled during each initial training session and in each continuous training.

5. a) How frequently are the changes taking place in plant (plant design changes, procedures changes, etc.) incorporated to the replica or full-scope simulator? Describe any process or mechanism in place at your Simulator Centre to incorporate changes to the replica or full-scope simulator.

Each site is associated with a reference site. All modifications to the site are analysed by central departments, together with the departments in charge of these modifications and the training department. The committee decides whether or not to include these modifications onto the simulator. If the modification affects something which is simulated and influences training operations, a decision is then made to modify the simulator. Sometimes, the modification is postponed, if simulation capacity limits are reached, and awaits the simulator up-dating programme.

b) Do simulator model modifications require separate approval while the simulator is being used for training?

For acceptance of the modification or production of the up-dating programme, the manufacturer proposes a programme which is then validated by utility. It is produced by instructors and a site team. Results are analysed by the EDF department specialised in simulators, by comparison with code responses (such as CATHARE).
6. a) **Identify the members of the Control Room Shift Team (Reactor Operators, Turbine Operators, Shift Supervisors, etc.) and indicate the time (in hours) dedicated to simulator training by each member in their initial training programme.**
Specify, when applicable, the time spent with each type of simulator.

The picture in Annex 1 shows the training programme for each. All members of the team, the operator, supervisor, team manager, undergo the same initial training. Initial training of all the members consists first in **four** theory modules, A, B, C, and D, each lasting **three weeks** (**12 weeks**). This is followed by four further modules, M1, M2, M3 and M4, each lasting two weeks (**8 weeks**).

Half of every day during these eight weeks is spent in the classroom, the other half on the simulator (session lasting at least 3 hours).

• **Description of these modules**

A, B, C, D Modules
Each theory training module lasts three weeks: two in the classroom and one on the function simulator. Module A deals with the secondary system and simulation is done on the turbine generator function simulator. Module B is devoted to the primary system and additional systems, with simulation on the reactor chemical and volume control system. Module C looks at neutronics and simulation is done on the control simulator. Prior to module D, there is a week of practical work at the Grenoble nuclear research centre on the Siloette reactor and on the basic-principle simulator. Module D deals with safety and transients, and simulation is also done on the control simulator. For the modules to be done in the order, A, B, C and D, the week spent on the function simulator includes one day on normal operating, and four days on incidents. The above stages are a pre-requisite for training in the four M modules. Each M module lasts two weeks. One week of safety training is inserted between modules 1 & 2, and 2 & 3. Module 4 may be done before module 3. Training on the multi-function simulator may be done after module 2.

Module 1: Normal operations
The trainees come under a single instructor in groups of four on fullscope simulators. They must:
- gain a good understanding of the plant’s normal operations;
- see the interactions between the main systems;
- understand the logical or analogical relay circuitry;
- locate and decode the information;
- find out which of the parameters are important to watch during the various phases of normal operations.

The operators can put their knowledge to practice by starting up the plant, which consists in moving the systems from the cold state to the hot, without supplying electricity, then gradually push the plant up to full power. The operators must then cope with low-amplitude transients and power supply variations.

The simulated operations are for example:
- bubble formation;
- divergence;
- the RRA shifting to low working range (and maintenance);
- power variations on the CRES programme;
- putting the RRA into service and connecting it;
- emptying the reactor pool to the vessel mating surface;
- moving from hot shutdown to intermediate to residual heat removal conditions.

Module 2: Incident functioning
The objective of this second phase is to train operators to cope with upset functioning by events of increasing seriousness, but still within the realm of incidents. Training concentrates on diagnosis first of all.
On fullscope simulators, the main incidents dealt with are:
- minor incidents affecting the plant very slowly;
- load transients related to the main electricity network;
- triggering the turbine and reactor emergency shutdown.
The instructor may choose from a thousand or so different incidents.
Module 3: Accident operations
Training is entirely devoted to nuclear safety. The operators are trained to cope with
accidents on fullscope simulators. They are taught to diagnose correctly, to ensure the
safety systems run smoothly, and to take the steps bringing the situation back to the safest
possible. The main accidents involved are as follows:
- small and large breaks in the primary system;
- steam generator tube rupture;
- breaks in the pressuriser vapour phase;
- steam generator output piping rupture;
- reactor excursion;
- switching onto the emergency shutdown panel.
Module 4: Loss of source
This training is completed by a proficiency course in operational control upset by source
losses. The objective is to train operators to control source losses and think about how the
procedures are used.
• Training rhythm
The M modules are more spaced out in time than modules A, B, C and D. They are
completed by other compulsory training, on safety in particular, or optional training.
For operational control personnel, the first main training phase does not start until some
ten months or one year in the field. Before starting in-depth training, seeing what actually
happens on site first is useful. Similarly, to allow the trainees to digest the knowledge, skills
and proper behaviour, the basic training phase should not be too fast. For example, two
years are considered too short for an engineer of Msc+ level (approx. equivalent to French
educational level of five years’ university) to reach module 2. The ideal length of time would
be two and a half to four years. All this training is essentially geared towards the individual
staff understanding how the plant functions under different situations, and using the
procedures.

b) Indicate the time (in hours) dedicated to simulator training by each member of
the Control Room Shift Team in their continuous training programme.
Specify, when applicable, the time spent with each type of simulator.

Every year, each member is sent on a two-week trial runs for “recycling”. It essentially
consists in teamwork or modules geared towards refreshing knowledge in all operational
fields.
SEPIA simulators were used for 12,300 hours on the 54 sites in 1994, i.e. approximately 40
hours per team on average.
However, statistics show that usage is highly diverse, depending on the directions given by
management.
On those sites where management will is strongly demonstrated, time spent is longer.
Times of highest usage vary between sites, but on average, use is made as much by night as
by day. Programmes linked to steam generators tubes breakage and to basic principles are
the most frequently used in this application.

c) What is the minimum time, if any, required by the Regulatory Body?

EDF defines its requirements, the safety authority gives its opinion if no recommendations
are made. The operator is responsible for training and authorisations.
7. a) Indicate the percentage of simulator training time by the different Members of the Control Room Shift Team devoted to i) normal, ii) abnormal and iii) emergency conditions in their initial training programme.

In initial training:
  i) normal: 2 weeks, 1/4 time  
  ii) abnormal: 2 weeks, 1/4 time  
  iii) emergency conditions: 4 weeks, 1/2 time

b) Indicate the percentage of simulator training time by the different Members of the Control Room Shift Team devoted to i) normal ii) abnormal and iii) emergency conditions in their continuous training programme.

In continuous training:
  i) and ii), normal and abnormal, 25%  
  iii) emergency conditions 75%

c) What are the minimum percentages, if any, required by the Regulatory Body?

  Same as n°6 c).

8. What is the role and the policy of the Regulatory Body regarding the use of simulators for Control Room Operators licensing and training?

During inspection tours, checks are made that large scale modifications have indeed been taken into account on the equipment and procedures used, that agents have been properly trained in accordance with the programme and that they have undergone continuous training courses.

9. a) What standards (ANSI/ANS 3.5, IAEA, etc.) are simulators built to and maintained?

The EDF specialist simulators departments has defined its own grid. It has compared its acceptance standard with standard ANSI/ANS 3.5. The characteristics required are the same, with only a very few differences.

Scenarios tested in France are generally more complex. Lessons learnt from code perfecting are entered onto the simulators. For example: the temperature of the pressure maintaining device was previously considered to be uniform. Temperature stratifications are now simulated in the pressure maintaining device.

b) What exceptions are typically taken to the standard?

There are no unacceptable simulators according to the EDF grid. Less powerful simulators, such as MICRO-REP, have their using scope limited to the ranges within which responses are correct.

EDF does not train operators with false responses. All responses are validated by a known code.

c) What types of simulators are used that are not included in industry standards?
10. a) **Describe the role of part-task simulators in your current training programs.**

They precise the knowledge on the function simulated by the part task simulator.

b) **Describe the role of special-purpose (analytic) simulators in your current training programs.**

They are used in the training programs of management people.

11. **Have the current operator training programs been conditioned by the availability and capabilities of the simulator(s) or, alternatively, has(ve) the simulator(s) been specified and acquired after analysing and designing the training programs? Explain.**

EDF firstly analyses training requirements. If simulators are limited, teaching is given in classrooms (U₁ and H procedure).

12. **What extensions of simulator training are envisaged for the future?**

The use of the procedure using the staged approach requires more powerful computer tools in order to extend the range simulation.

The projected purchase of 13 simulators is being studied, based on the analysis of requirements and the analysis of the competence which EDF wish to develop.

Technically, the simulators to be installed around the year 2000 should meet the following specifications:
- simulation of shutdown states
- use of CATHARE code
- pedagogical interface showing the physical effect of operator actions.

13. a) **Based on your experience, describe the uses of the simulators for activities other than training (plant drills, procedures validation, design changes validation, testing programs, acquisition of human data, licensing activities, reference plant systems “tuning”, etc.).**

Other activities are also performed on the simulators, “Plant drills”, procedure validation, change of procedure validation, test code programmes, acquisition of data linked to human reliability.

Operators obtain their authorisation during units M₁, M₂ and M₃ and authorisation is not subject to any separate exercise.

b) **What is the involvement of Control Room Operators for those applications?**

Operators volunteer to participate.

14. **What are the applications of simulator training for jobs other than Operations?**

Safety engineers and performance engineers follow the same units as operators. These same agents and teams participating in the internal emergency plan are trained on SIPA.

Automation experts and chemists are trained on operational simulators.

MICRO-REP from SEPIA is available to everyone on site.
SECTION 3: Systematic Approach to Training: considerations regarding the use of simulators.

A) Training analysis.

By way of introduction, it should be mentioned that the questions are based implicitly on the logic of the TEC DOC 525 memo. This memo should evolve towards a wider approach to training. EDF is involved to prepare a new report.

1. Are job and task analysis (or any other type of task identification technique) used for establishing a list of task, performance standards, learning objectives and training methods?
   If yes, describe the technique used.

   The EDF approach is rather more directed towards an analysis of operator competence, allowing us to take into account ideas such as the questioning of attitude and communication requirements strongly recommended by INSAG4. This approach produces job references which define: the context of the job, its tasks, the rules applicable to it, the proposed training programme.

2. a) What are the criteria that determine the limits or scope of the job analysis for the Control Room Operators?

   Training is based on normal procedures, incidents or accidents, as experienced in the operators’ work. These procedures are constantly evolving depending on feedback from experience, remarks made by operators as to their pertinence and with the comments of the instructors using them.
   One may consider that this process allows a better definition of the work undertaken by operators and the tasks which they perform.
   Competence analysis also reveals the large scale scope for accidental sequences, such as:
   - taking information, correlating and interpreting it,
   - choosing the correct instruction, communicating,
   - achieving the result.

   b) From your point of view, what should the role of risk-based criteria be for determining such limits or scope? Explain your answers.

   Probability studies on safety are based on the same procedures as those used in training. Those operator actions which are important for safety are identified in the studies covering the human factor.
   During training sessions, the accent is put on these actions. During the initial operator training sessions, the assessment grid takes account of the seriousness of the failure to perform or delay in performing such actions in accident conditions.

3. Are there any special requirements for Job and Task Analysis which are imposed by the possibility of associated simulator training?

   This question has no meaning within our system.
B) Training programme design.

1. **What are the criteria for specifying simulator training rather than another training setting (classroom, laboratory, workshop, on-the-job, etc.)?**

   See following answer.

2. **What are the criteria for selecting different types of simulator (full-scope, replica, part-task, basic principles, concept, special-purpose)?**

   With full-scope simulators, the environment is not designed to allow the operator to concentrate on physical phenomena and understand their interactions. The data needed are often hidden behind the computer calculations and are not presented to the operator. For trainees of limited basic operational training, this sort of simulator is complex because there is simply too much information.

   To help develop thinking, a representation of magnitudes more complex than those found in actual control rooms may prove useful.

   If we wish to train a team in individual or co-ordinated gestures, the visual similarity between the model and reality must be perfect.

   A full-scope simulator is not always needed. It was estimated that 75 to 80% of training needs could be satisfied by representing only 25 to 30% of the control room.

   The simulator must allow operators to build proper pictures in their minds. One of the main stumbling blocks to overcome is the difference between the physical phenomena which occur in a reactor and their representation on a control panel. Consequently, using full-scope simulators could even be harmful, because the man-machine interface remains the same when the operation goes from the training centre to the actual control room. Hence, specific simulators, which get away from the usual representation and force the operator to look at the control systems in a different light are very useful.

   A basic-principle simulator is used at the start of operational control technique learning:

   - to give the operators a basic understanding of a reactor's operating principles and the main control loops within a few days;
   - to improve future operators' mental representations of physical phenomena.

   For nuclear power plant managers, having them understand the main physical phenomena may be enough. This is where basic-principle simulators are used for training.

   To improve understanding of physical phenomena and how the more difficult elementary systems function, a basic-principle or a part-task simulator with exercises in normal or incident operating conditions is used.

   For persons whose work requires extensive skills in a given system, part-task simulators may be used.

   Using part-task simulators is a good idea to allow operators observe the physical phenomena and changes to the various parameters which go along with the functioning of a system, and learn the corresponding operating instructions.

   Full-scope simulators are used during the basic training phase to allow the operational control staff to understand the physical phenomena better, to study the systems as a whole, and to work under normal, accident and incident conditions.

   Full-scope simulators are used during the on-going annual training to put entire operational control team sin realistic accident situations.

   The objective is to train the operator in environments representing the actual control room as best as possible. The operator can experiment with the main systems' interactions, the influence and role of the auxiliary systems, and the influence and role of the other team members.

   Training on full-scope simulators is geared towards operating procedures and their corresponding actions. SIPA is used to help move operators from reflex reactions (acquired with traditional simulators) to thinking about the physical phenomena, or to complete the safety
engineers’ or plant managers’ training by an in-depth understanding of the complex phenomena involved in a possible accident. The objective is to help operators understand things better and make the right decisions in the event of incident.

3. **a) What are the criteria for selecting a replica simulator?**

   See nº2.

   **b) What are the fidelity requirements?**

   The performances expected from simulation are specified in terms of maximum limit between the theoretical value and the value calculated under identical conditions.
   Under continuous operating conditions, the overall values must be specified within ± 0.5%.
   The difference between the other parameters and the theoretical values must not exceed 1%.
   During transients, deviations must be lower than 10% and the tolerance on the time between the start of a transient and the appearance of an extreme parameter is 20%.
   Under exceptional transient conditions, deviations must be lower than 20% of the variation of the value in question. Time tolerance is the same as for normal transients.
   In all simulated transients, the curves must be the same as those recorded in real life.

4. **What are the specific pre-requisites for operators undertaking simulator training?**

   In the training plans for each staff category, simulator training sessions are preceded by operational training. This allows the various systems making up the nuclear power plant to be seen individually, and the plant’s operating conditions to be analysed. Following this, the interactions between the various systems while the plant is actually running are studied. The operators then digest the plant’s general instructions and normal operating procedures.

5. **Does the possibility of simulator training impose any constraints on the definition of learning objectives?**

   See nº4.

C) **Training programme development.**

   **1. In the case of non-replica simulators, is it necessary to take parallel training actions, and if so, what kind?**
   Explain your answer.

   There is very little difference between control rooms and the replica in the training unit, so no particular action is taken.

   **2. Do you use specific procedures for the training simulator, actual plant procedures or a combination of both?**
   Explain your answer and give reasons for the choice.

   The procedures are those used in the reference site. All accident procedures are available in the simulation unit and may form part of a scenario. Training for normal operation is based on operational procedures.
3. **What are the criteria for selecting normal, abnormal and emergency scenarios to be trained with simulators? Are they risk-based criteria?**
   Explain your answer.

For normal operations, actions which occur rarely during the year will be simulated (pocket formation in pressure maintenance device, etc.) or those actions which require particular dexterity.

For incidental operations, scenarios are chosen from among experience feedback from sites, including the most frequent events.

For accident operations, operators are trained in the most frequently occurring scenario if it has been shown by safety probability studies that it is the most probable - or in a scenario which is even more serious. RTGV are frequently studied.

4. **How are lesson plans and support documentation developed for simulator training?**

   Teaching documents include:
   - the course's aims and objectives,
   - the session's analytical schedule and its performance over time,
   - all scenarios studied on the simulator, showing the part looked at in the classroom.

   In the simulation unit, the following are available:
   - normal and accident instructions,
   - alarm sheets,
   - installation plans,
   - automation plans
   - manufacturer's operational rules.

D) **Training programme implementation.**

1. **What selection, initial training, and continuing training is arranged for simulator instructors?**

   Most instructors are staff with long experience in operational control. After some four or five years, they return to their teams.
   What basic and further training the instructors are given depends on their past. It includes subjects like education theory, quality assurance, safety, radiological protection, etc.
   For training directly related to doing the job - requiring a good knowledge of plant operation - the instructors recruited will have at least four year's experience in a nuclear power plant, and teaching aptitudes.
   In 1991, over half the instructors were young recruits with no prior experience in a nuclear power plant. The training department decided to stop recruiting in this way. But it looks that it is not so easy to do.
   Basic training instructors are given six weeks of training in education theory spread out over six to eight months. They are trained on simulators during about two months.

2. **What are the arrangements for instructor monitoring of, and feedback to, trainees during simulator sessions?**

   The instructor can do the following on the full-scope simulator:
   - **Initialise the simulator**
     This involves setting the simulation in the required starting conditions for a given exercise, i.e. representing the plant in a pre-determined situation.
   Instructors have a library of about sixty cases, covering core conditions at the start, middle and
end of its life. Similarly, other starting conditions may easily be created.

**Supervising the exercise session**

Supervision can be done in two ways:

From their desks, by pressing a button, the instructors can display a page recapitulating the main thirty parameters.

If they prefer to work alongside the trainees, a remote-controlled unit allows them to access the most important functions on their desks without having to go there.

**Inserting malfunctions**

The instructor can insert 160 malfunctions, representing the most common incidents observed in the unit, and a few of lesser probability but greater seriousness, such as the rupture of a steam pipe.

All malfunctions can be inserted as are or subject to certain prior conditions.

Malfunctions may be binary (stopping of a pump) or variable (leak, the rate of which may be chosen).

Example: the instructor wishes to provoke a mass defect on the main transformer when power reaches 500 MW; the malfunction is preselected, and the criterion of 500 MW assigned. The instructor then stands by the trainees to watch their reactions during the power rise when the malfunction occurs.

A special directory page allows all malfunctions present at a given moment to be viewed.

**Simulation of the auxiliary operators’ work**

For equipment which must be manoeuvred on the equipment directly, the auxiliary operator must be called in. When the trainee sends in a call over the intercom or telephone from the control room or emergency shutdown panel, the instructor plays the part of auxiliary operator on the simulator. Some 120 commands spread over four screen pages may be executed from the desk. The time the various manoeuvres take was averaged over a set of simulated interventions in a normal unit.

**Using the simulator for teaching**

The instructor has a range of teaching aids to ensure the trainee derives the greatest benefit from the session:

Freezing the phenomena: at the press of a button, the instructor can interrupt the progress of the simulated unit to make a comment or give advice;

Fast forward: if the phenomena are slow and result in tedious (and expensive) waiting around, the rate of development can be increased by a factor of eight;

Slow motion: to allow the trainees to observe and understand upset sequences better, the simulator speed can be decreased by a factor of four. Nevertheless, the phenomena must then be watched again at normal speed;

Replay: for sequences of interest, the instructor can replay what happened over the past ten minutes in two-minute blocks. This allows the trainees to understand the mistakes they made better;

Revision: if the instructor thinks the trainee is having difficulty or not reacting correctly, the unit condition can be memorised at the press of a button, and the simulator reinitialised at the same point later on, without disturbing the exercise in progress. If the instructor considers the situation to be of particular interest, it can be memorised and stored in the simulator’s library of starting conditions.

**The exercise**

During the exercise, the instructor observes the team’s behaviour and takes notes for the debriefing phase held afterwards. These are used along with the operational documents to analyse the simulation and help explain the differences between ideal operational control and what the team actually did. This phase is often done in the form of a group discussion. Alongside this, once the operational control has been corrected, and given the omissions or errors observed, the instructor may then give more basic revision (e.g. of the physics) on the blackboard or with other teaching aids.
3. a) What specific training modes such as simulator freeze, playback, running at higher speed than real time, activity recording, video recording, etc. is made use of during initial training?

The full scope can be used with these different modes: simulators freeze, playback, running at higher speed than real time. Video recording is used for collective training.

b) What specific training modes such as simulator freeze, playback, running at higher speed than real time, activity recording, video recording, etc. is made use of during continuous training?

4. What limits of simulation impede planned training sessions or examination scenarios?

Given the little time the six teams have available after shifts, holidays, replacements, etc. are subtracted, team training is reaching saturation point. One of the objectives for the new organisation is to allow more time for it. The computer may break down when parameters near an upper limit for calculations. In its current state, the computerised room (S3C) does not allow one to monitor easily the actions undertaken by operators.

E) Trainee assessment.

1. a) What methods and procedures are used for initial trainee assessment during and after simulator sessions?

EDF authorises its operators after their initial training. There is no examination during continuous training sessions. Authorisation may be withdrawn; a decision such as this is made by the operator’s hierarchical superiors, based on information supplied by instructors. At the end of the training unit, covering normal and accident operations, operators take an examination. The have to follow through several scenarios. Instructors have a highly specific grid for each scenario. Every accident scenario is covered. This grid is broken down into elementary actions, corresponding to the six abilities which are to be tested in the operator. Fifteen to twenty actions characterise each ability (taking account of information, respecting obligatory conditions, checking information, communicating, obtaining the result).

Action is marked: fulfilled or un-fulfilled, by the two examiners who assess. For each ability, the score must be 80%. Actions demonstrated have varying weight, depending on their eventual consequences. They are classified into three safety categories, in accordance with considerations linked to leakages produced or the probability of core melt-through. An action considered to be a serious deviation means that 5 points are lost, therefore making the score achieved insufficient. Therefore authorisation is not granted. Several small scale erroneous actions lead to a similar result.
2. List and describe the main areas or groups of skills and knowledge of the trainee assessed in training simulators (for example: “control board awareness, event diagnosis, immediate actions / entry-level actions, subsequent actions, control board manipulations, use of procedures / technical specifications / reference data, communications, supervisory ability, team skills” (IAEA-TECDOC-525)). Identify, when applicable, the types of simulator used for addressing each one.

See above.

3. Describe the ranking of importance, if any, given to the main areas or groups of skills and knowledge taken into account for a trainee assessment.

See above. It should be added that the scenario must be performed within a given time limit. If the operator has not finished the scenario, activities are not undertaken. Therefore he may say that he has not understood or does not know how to do something in order to avoid losing time and losing assessed actions. The actions with which he has been assisted are counted as not having been performed, but the ability to confess one's difficulties receives a positive mark.

4. a) Based on your experience, describe difficulties you have had for assessing the individual skills and knowledge of a trainee while operating within a whole Control Room Shift Team during simulator sessions.

b) Describe the measures adopted to overcome these difficulties.

The observation grid assigns individual actions to each of the players. The examiner notes whether the action has been correctly performed by the person responsible for it. If another person dictates the action to him, it is considered not to have been undertaken, and similarly if another person completes the action. This method is difficult to implement, needs one examiner for each assessed person. The acceptable threshold for co-operation is difficult to define.

5. a) Based on your experience, describe influences on trainees performance during simulator sessions resulting from the attendance of personnel such as utility managers, regulatory body inspectors, etc.

Regulatory body inspectors are not present. In 70% of assessments, the team manager is present to attend the final assessments, a fact which is appreciated by the operators themselves.

b) Based on your experience, describe influences on trainees performance during simulator sessions resulting from the attendance of personnel such as utility managers, regulatory body inspectors, etc.

The trainees' instructors during their course are not those who assess them. Two other instructors oversee the examination. If they give assistance during an action, the action is considered not to have been completed in the analysis grid.

6. a) Are training simulator examinations used in order to grant initial license to operators? Explain.

The initial license is not re-assessed during training on simulators, see n°1 (Trainees assessment).
b) Are training simulator examinations used for requalification? Explain.

Question not understood.

7. How is examination integrity preserved during the examination/scenario preparation period?

Numerous scenarios can be offered. Instructors do not know which scenario will be chosen by the examiners.

8. What performance monitoring or data acquisition features of the simulator are used during simulator examinations?

See above.

F) Training programme evaluation.

1. Describe the approach used for evaluating the simulator training programme and main results.

The EDF training programme is assessed during internal audits and surveillance tours made by inspectors. OSART and international experience feedback also cause the programme to evolve.

2. What programme is in place for validation and continuous verification of the simulator performance?

Simulator performances are checked when each modification is made. The frequency of modifications is around once a year, or at the maximum, every 2 years.

3. What types of performance discrepancies are most frequently identified by operators during training sessions?

Differences between site performances and those on the simulators are listed and corrected where possible. Trainees most often draw attention to defects in accident procedures used (ergonomics or logic) which are then modified.

4. What types of performance discrepancies are most frequently identified by examiners or inspectors?

13% of operators fail their examination. In general, due to lack of preparation or because they have been trained on a much too intensive cursus.

SECTION 4: Use of operating experience for operator training with simulators.

1. How is operational experience feedback incorporated into the design of simulator training programs (experience reviewed, schedule, people involved)?

Using feedback in training consists in:
- modifying, adapting and enriching existing training in terms of technical content or teaching
quality, according to requests of the various parties involved (nuclear power plants, training centres, central departments, etc.);
- creating new actions identified from feedback as lacking.

Different feedbacks are performed:
1) Effects of technical alterations to plants on simulators and training
When a standard unit of simulator reference is altered, the corresponding training literature is also changed. The alteration is always tested on the full-scope simulator first (Ref. 17).
2) Repercussions of operational control incidents and equipment damage on training
The training centres are advised of significant events occurring in France or elsewhere. The human factor involved in the events is analysed and may then be included in the courses. Every year, some two to three hundred events are analysed. The lessons learned are integrated into the training programmes.
The central departments and the nuclear power plants and, on occasions, the manufacturers, hold routine meetings in the form of “committees” or “colloquia”. Each site's experience and any relevant lessons from studies and analyses are pooled, and all the nuclear power plants are advised of the actions undertaken. For example, operational control supervisors meet twice a year at the “operations” colloquium chaired by the Operations Analysis Division. The sites may thus decide on specific training matters and put them forward to the Training Division for consideration, either for inclusion in existing training courses, or as new ones. In-depth analysis reports, in particular the “2nd-level” reports of the Operations Analysis and Human Factors divisions, are sent to the nuclear power plants. Following the central departments' analysis of requirements in matters of post-accident or accident operational control, various modules were set up in 1987: recycling, trial runs, and loss of source training. Further to certain incidents of general nature, the central departments wrote a number of “practical guidebooks”. They are sent to the nuclear power plants and may act as backup to local training.
3) Feedback between training centres and nuclear power plants
Training centres must also provide answers to nuclear power plants' requests for new training. Although many of the requests are specific or ad hoc, they are all attentively examined, since they may also represent new needs as yet poorly identified, and thus either ignored or only superficially dealt with in existing training.
4) Feedback between central departments and training centres
The point of the twice-yearly meeting of the Operations Analysis Division and nuclear training centre managers is to take stock of any repercussions feedback may have on training. Feedback from training centres to the central departments does have weak spots, for example the information on anomalies in normal operating rules highlighted during the training sessions. Theoretically, discussion with training centres to formalise the effect of feedback from simulator sessions on all fields of operational control (including documents and training) have begun. The training centres use incident analysis reports to build up incident libraries in the simulators. One of the twice-yearly training courses on recycling is based on these incidents.
5) The use of operator experience in designing and up-grading training
Because of their professional experience, the trainees represent a vast storehouse of knowledge. In addition, in the special environment of training, far from the hassle of work (the boss, time, etc.), they can talk to the instructors more freely about the dysfunctions they see on shift. In 1991, however, this fund of feedback was poorly mined. Neither the instructors nor, especially, the training centres themselves knew how to spread the word back up the central departments or the nuclear power plants.
6) PSA tests about human performances are performed with instructors, they can by themselves highlight some particular actions. In the future, the results of the test will be presented and discussed with instructors.
2. **Has your organisation developed any kind of programme by which simulator operator training is correlated with real operating events? Explain.**

The events file held by EDF and IPSN shows up training deficiencies. These events are analysed and the information is sent to the training centre. The training department may decide to modify training. As a synthesis of these analyses, every year the training department sends to each centre the directives and training programme for continuous training courses in order to make up for any gaps detected.

**SECTION 5: Specific topics on Operator training with simulators.**

**A) Team training techniques.**

Basic training is followed by a period of trial runs where the operational control team made up must cope with incident situations of rare or very rare occurrence. The main emphasis is on teamwork using actual plant procedures, taking account of the organisational roles scheduled under accident situations. The trial runs occur in two phases. The first is done on simulator and lasts for three hours. The team made up is recorded on video and watched by two observers. At times, take-over by the plant manager and the safety engineer is included in the simulation. This is followed by a three-hour debriefing phase to determine who did what. The aim is to explain the operators' thinking vis à vis the scenario dynamics and explain any deviations. It shows how the team is organised, how everybody does their job and keeps the others informed, and how decisions are made.

1. **a) Are job and task analyses used for defining the role and responsibilities of the Members of the Control Room Shift Teams and, in general, of the various levels of staff who are charged with operation of the plant? Explain your answer.**

   As for operators, analysis of the competence of the supervisor and of the team manager is the object of a report which defines, amongst other things, their roles and responsibilities, their training.

   **b) Are job and task analyses used for establishing performance standards, learning objectives and training methods for Team skills training? Explain your answer.**

   Same: initial analysis of competence.

2. **List and describe Team skills (communication, management of resources, team co-operation, team leadership, feedback, conflict resolution, team decision-making, etc.) which are trained using simulators. Identify, when applicable, the types of simulator used for training each one.**

   Supervisors and team managers are trained on simulators in a similar manner to operators. A training unit is used for the whole team which is repeated every year. Two sessions were organised when team organisation was modified.
3. Are any guides used for conducting and evaluating Team skills training simulations? Explain your answer.

The teaching guide is much shorter. Its objective is to develop communications, “leadership” and the decision-making quality. Two instructors supervise a unit such as this. One observes group behaviour, the other, individual behaviour.

4. Based on your experience, describe advantages and disadvantages of Team training with the participation of the same (usual) Members every time or with changes in the Shift Team compositions.

No answer.

5. Are simulator sessions used for the optimisation of control Room Team Shifts taking into account the characteristics (aptitudes, attitudes, ...) of each Operator? In other words, are simulator sessions used for deciding which Members are going to constitute each Shift Team? Explain your answer.

Control Room Team Shifts are not altered further to the results of training on the simulator.

6. Are there any licensing examinations applied to the whole Control Room Shift Team in addition to the individual licensing examinations? Explain.

No examinations.

B) Training for stress.

1. Is any part of the simulator training programme specifically devoted to train Control Room Operators to operate under stress? Explain you answer.

Before replying to this question, it is necessary to define what stress means; two definitions can be given:
- stress is linked to the impression of having no further solutions in any given situation, of being stuck, or “not knowing what to do”,
- stress is linked to an overload of actions and information which one must face.
The use of a symptom based procedure, limits by its very logic, the stress effect outlined in the first definition.
The overload of actions and informations are not simulated in the training.
We summarise here a small communication performed by EDF on this subject:
The working atmosphere in the control room is recreated through its resemblance with an existing plant and the use of real time. If we wish to generate inner calm and self-confidence - vital if operators are to put the best of their metal facilities to the task in hand - these conditions are essential.
Looking at the things in a control room which create stress conditions, we saw two phenomena: first, the unexpected arrival of an upset situation; and second, the situation as it plays itself through.
The unexpected arrival causes a mental block in the operator, generally very briefly, followed, as it to compensate it, by intense cerebral activity used to make the diagnosis.
By training operators to face up to incidents on the simulator, they get used to them and this
has a de-dramatising effect on the real-life situation. It slightly increases the speed of both data capture and seeking the correlations needed to understand the dysfunction's cause(s). Observations have shown that, after efficient training, diagnosis is both better and faster. Put into the real world, because the operator is reassured by being able to make faster and well-founded diagnoses, it results in a more confident operational control. They quickly move from an unknown situation perceived as dangerous, to one familiar and hence controllable. Intensive training allows operators to assess the plant better incident or accident situations, and understand their own reactions better as well. The increase in inner calm and self-confidence comes from their feeling of having full control over their plant.

2. **Are stress levels induced and measured during simulator training sessions?**
   **If yes, describe the methods and results.**

   Scenarios are used however, which may be stressful within this first definition: a series of incidents, numerous procedural changes or changes in action logic. Sessions do not reproduce situation of overload linked to information or disturbances by other individuals.

3. **Based on your experience describe any measures adopted during simulator training to counter stress.**

   No measures.

C) **The theoretical basis underlying training.**

1. **Are any models of human behaviour being used in designing and implementing training programmes?**
   **If yes:**
   i) refer to or describe the models,
   ii) indicate the areas in which these models are being applied (for example: signal detections, decision-making, etc.)
   iii) give the main results.

   - Error typology of Reason
   - “Human reliability in PSH” model, RASMUSSEN and SWAIN.3
   - Model linked to Piaget’s “Scheme Theorie”

D) **Habits acquired during training sessions with simulators.**

1. **Describe, based on your experience, undesirable habits which could be acquired by trainees during training sessions with simulators (for example: due to limited number of simulated scenarios, due to lack of physical or functional fidelity, due to the use of conservative codes for simulation instead of best estimate codes, etc.) and discuss their potential consequences on safety.**

   No undesirable habits detected by EDF. For memory, in one event (IRS 1074, Flamanville 1989: Uncovering of pressuriser heaters during steam bubble formation) during the bubble formation, the operator was waiting a small pic in the flat temperature signal. He learned during his simulator training that a small pic appears and is correlated to the end of the bubble formation. But this is true in a 900 MW plant, and untrue in this particular 1300 MW plant. The pressuriser levels were false (first main cause), this small waited pic never came during operating, so the operator never understood that
the pressuriser was empty and didn’t stop the pressuriser heaters; they were destroyed. This was shown by a precise human factor analysis. After this event, the training centres changed their training on this point.

2. **Describe, based on your experience, any measures adopted to avoid acquisition of those undesirable habits or to prevent use of them.**

   No answer.

**E)** Simulator training on normal and emergency conditions during shutdown and low power operation.

1. **What use is made of simulators for Control Room Operator training in normal, abnormal and emergency conditions during shutdown and low power operation (simulated scenarios, trained skills, training techniques, ...)?**

   Simulators only simulate accidental conditions up until the phase connecting the cooling system on shutdown. There is no simulator training on shutdown states. There is an EAO Software which describes dumping problems during shutdown states and the safety risks involved during these dumping phases. It is used very little.
   Some difficult transients in this phase have been identified, special documents have been written for teams to prepare with more details these operating.

2. **What are the criteria (risk-based criteria, deterministic criteria, results of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?**

   No answer.

3. **Are job and task analysis (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on shutdown and low power operation? Explain.**

   No answer.

4. **What are your plans for the future in this area?**

   The future simulators should be representative for shutdown period.

**F)** Simulator training on severe accidents.

1. **What use is made of simulators for Control Room Operator training in severe accidents (simulated scenarios, trained skills, training techniques, ...)?**

   Training in severe accidents is not undertaken on a full-scope simulator.
   Teams receive training in the classroom during a one-week course, on outside accidents.
   Crisis teams are trained on SIPA in the understanding of these accidents and test decision-making procedures currently being developed.
   Crisis exercises test the means available to the teams. The scenarios used are prepared on SIPA. Events proposed are coherent with physical codes used and with PSA scenario. Each site carries out an exercise such as this every two years. One team is involved in this exercise.
2. What are the criteria (risk-based criteria, deterministic criteria, result of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?

No answer.

3. Are job and task analysis (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on severe accidents. Explain.

No answer.

4. What are your plans for the future in this area?

No answer.

G) Simulator training on accidents caused by fires, floods, earthquakes, etc.

1. What use is made of simulators for Control Room Operator training in accidents caused by fires, floods, earthquakes, etc. (simulated scenarios, trained skills, training techniques, ...)?

There is training on the backup panels which could be used in cases such as these. Exercises linked to fire are performed either using learning lorries, or during training in a special fire training centre which trains in physical actions (movement within the premises, firefighting, etc.).

2. What are the criteria (risk-based criteria, deterministic criteria, result of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?

3. Are job and task analyses (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on accidents caused by fires, floods, earthquakes, etc.? Explain.

4. What are your plans for the future in this area?
QUESTIONNAIRE

SECTION 0: Organisation/s replying to the questionnaire

1. Name of Organisation/s.

   Gesellschaft für Anlagen- und Reaktorsicherheit
   KSG Kraftwerks-Simulator-Gesellschaft mbH
   GfS Gesellschaft für Simulatorschulung mbH

2. Contact Person/s.

   See nº3.

3. Address and contact information (telephone, fax).

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SECTION 1: General Information (related to the whole country)

1. Number of nuclear reactors (Units) in operation.

   20 units in operation
   14 PWR
   6 BWR
2. **Number of Sites with at least one Unit in operation.**

15 sites  
2 sites with two PWR  
1 site with two BWR (twin units)  
2 sites with one PWR and one BWR

3. **Number of full-scope (replica and no replica) simulators used for operator training.**

16 simulators (including 1 functional trainer):  
6 in operation  
10 under construction  
(refer to the info brochure of the German Simulator Training Centre)

4. **Number of replica simulators used for operator training.**

15 simulators (including those under construction)

5. **Number of part-task simulators used for operator training.**

0

6. **Number of basic principles simulators used for operator training.**

0

7. **Number of concept simulators used for operator training.**

0

8. **Number of special-purpose simulators used for operator training.**

1 glass model run by NIS Ingenieur Gesellschaft mbH on the Biblis site

9. **For how many Units is the training done on replica training simulators?**

18 units

10. **For how many Units is the training done on full-scope (replica and no replica) training simulators.**

20 units

**IMPORTANT QUESTION**

Are your answers to the subsequent sections (2 to 5) of the questionnaire related to a specific Organisation or Training Centre in your Country?

Yes _X_ No _ ___ (Mark your answer with an X)

If yes, indicate the name of the Organisation or Training Centre and describe briefly the simulation facility referred to in answer to the question below (f.i. located on-site or off-site, type of simulator/s, sample photograph, reference NPP/s, NPP/s which receive...
training in this facility, size and composition of the simulator instructional and support staff, etc.) and, also, describe this/these NPP/s (f.i. type (PWR, BWR, etc.), vendor, start of operation, degree of automation, Operators which constitute the Control Room Shift Team, sample photograph of the control room/s, etc.).

All following answers are related to the German Simulator Training Centre (Kraftwerks-Simulator-Gesellschaft mbH and Gesellschaft für Simulatorschulung mbH Deilbachtal 173, 45242 Essen). For additional information about the Simulator Centre refer to the info brochure.

SECTION 2: Current practices with simulators closely related to operator training.

1. Based on your experience, describe advantages and disadvantages of the location of the Simulation Centre with regard to the plant: on-site versus off-site. Specifically, describe those factors which have some influence on the Operators’ attitude towards the simulator training and in the quality of the simulator training.

   Advantages of on-site simulators:
   Simulator is available in short term.

   Disadvantages of on-site simulators:
   Plant operation has preference against simulator operation. This may cause disturbances of the training e.g. by consultation of trainees. The trainees are trained under the same relationships and restrictions like during normal shift work.

   Advantages of off-site simulators (training centre):
   A training centre can be highly competent regarding training methodology. More staff is available for hardware support and software support. Training experience made in one simulator or for one NPP can improve training for other simulators and/or NPP. There is a high motivational factor for the trainees: the business trip to the centre is a well accepted interruption of daily work (highlight of the year) and they can interchange experience with trainees from other plants (trained at the centre at the same time).

   Disadvantages of off-site simulators:
   The trip may be time and money consuming. The trainees are not available for questions or problem solving on site.

2. a) During simulator training sessions, what factors (time, communications, etc.) influencing the interactions between Control Room Operators and other Plant Personnel (Operations Department outside of Control Room Personnel, Maintenance or Instrumentation, and Control Departments, Technical Support Centre, etc.) are simulated?

   In German NPP, the necessity for interactions with other departments of the plant for the purpose of operating the plant is very limited. If necessary, the instructor plays the role of the respective departments.

   b) Do these other Plant Personnel participate in the training sessions? Describe the present training format pertaining to involvement of non Control Room Personnel in simulator training sessions and explain why this format is used.

   During regular training no other plant personnel participates. In some very rare cases, emergency drills have been performed with staff from other departments including the use of simulators.
3. What environmental conditions (normal and emergency lighting, humidity, noise, vibrations, sounds generated by equipments, etc.) that could be experienced by the reference plants, are usually simulated in the Simulator Rooms? Describe the use of such effects at your simulator centre and explain why they are, or are not, incorporated into simulator training sessions.

In the German training centre only normal and emergency lighting are implemented.

4. Do Control Room Operators receive simulator training for operations outside the Control Room, for example: operations from Remote Shutdown Panels? Describe this type of training as it exists at your Simulator Centre and explain why it is, or is not, used in training sessions.

Three different types of additional panels exist (not at all simulators):
- remote shutdown panel (located in the emergency control room in the plants)
- emergency diesel generator control panel
- transformer control panel

5. a) How frequently are the changes taking place in plant (plant design changes, procedures changes, etc.) incorporated to the replica or full-scope simulator? Describe any process or mechanism in place at your Simulator Centre to incorporate changes to the replica or full-scope simulator.

Modifications regarding procedure changes are immediately implemented, i.e. each change in the operating manual is respected in training. Hardware modifications are implemented within one year, if the hardware modification is relevant to the training programme.

b) Do simulator model modifications require separate approval while the simulator is being used for training?

Simulator modifications do not need any approval by the authorities.

6. a) Identify the members of the Control Room Shift Team (Reactor Operators, Turbine Operators, Shift Supervisors, etc.) and indicate the time (in hours) dedicated to simulator training by each member in their initial training programme. Specify, when applicable, the time spent with each type of simulator.

All licensed control room operators, i.e. shift supervisor, deputy shift supervisor, and reactor operators receive minimum 7 weeks (BWR) or 8 weeks (PWR), respectively, initial training. The training amount is 20 hours a week at the fullscope simulator.

b) Indicate the time (in hours) dedicated to simulator training by each member of the Control Room Shift Team in their continuous training programme. Specify, when applicable, the time spent with each type of simulator.

BWR operators spent minimum 1 week per year (20 hours in control room) for refresher training at the simulator centre. PWR operators are trained 4 weeks within 3 years.

c) What is the minimum time, if any, required by the Regulatory Body?

The minimum times required by the regulatory bodies are mentioned above. Utilities use on average 15% to 40% more training time.
7. a) **Indicate the percentage of simulator training time by the different Members of the Control Room Shift Team devoted to i) normal, ii) abnormal and iii) emergency conditions in their initial training programme.**

    The percentage of different operation conditions is equal for all shift members. During initial training the percentages are:
    i) normal operation: 25%
    ii) abnormal operation: 15%
    iii) emergency conditions: 60%

b) **Indicate the percentage of simulator training time by the different Members of the Control Room Shift Team devoted to i) normal ii) abnormal and iii) emergency conditions in their continuous training programme.**

    The percentage of different operation conditions is equal for all shift members. During initial training the percentages are:
    i) normal operation: 10%
    ii) abnormal operation: 10%
    iii) emergency conditions: 80%

c) **What are the minimum percentages, if any, required by the Regulatory Body?**

    There are no time limits required by the regulatory bodies.

8. **What is the role and the policy of the Regulatory Body regarding the use of simulators for Control Room Operators licensing and training?**

    Simulator training is not used for the licensing of operators in Germany. The regulatory bodies have defined minimum simulator training times as well as basic training subjects. The requirements for simulator specifications are very general.

9. a) **What standards (ANSI/ANS 3.5, IAEA, etc.) are simulators built to and maintained?**

    In Germany, there are own standards above ANSI/ANS 3.5.

b) **What exceptions are typically taken to the standard?**

    There are no exceptions to the standard.

c) **What types of simulators are used that are not included in industry standards?**

    There are no further simulators used during regular operator training.

10. a) **Describe the role of part-task simulators in your current training programs.**

    Not applicable to Germany.

b) **Describe the role of special-purpose (analytic) simulators in your current training programs.**

    Not applicable to Germany.
11. Have the current operator training programs been conditioned by the availability and capabilities of the simulator(s) or, alternatively, has(ve) the simulator(s) been specified and acquired after analysing and designing the training programs? Explain.

New simulators (at least all of the nineties) have been specified and designed according to the requirements of the training programme. In case of non-plant specific simulators, the explanation of the differences between simulator and NPP are part of the training. Therefore, it can be stated that the current operator training programme takes the leading role and simulators are designed or modified according to the needs.

12. What extensions of simulator training are envisaged for the future?

It is planned to implement beyond design basis accidents in more detail than nowadays. This causes improvements in the simulation software.

13. a) Based on your experience, describe the uses of the simulators for activities other than training (plant drills, procedures validation, design changes validation, testing programs, acquisition of human data, licensing activities, reference plant systems “tuning”, etc.).

To a limited extent, simulators are used or have been used for:
- procedure validation
- design change validation
- emergency drills
- research on operator behaviour

b) What is the involvement of Control Room Operators for those applications?

In some cases these tasks have been performed by normal shifts.

14. What are the applications of simulator training for jobs other than Operations?

Simulator training is also used for operation managers, other technical personnel, in some plants for roundsmen, but also, with special programmes, for personnel of regulatory bodies and consultant organisations.

SECTION 3: Systematic Approach to Training: considerations regarding the use of simulators.

A) Training analysis.

1. Are job and task analysis (or any other type of task identification technique) used for establishing a list of task, performance standards, learning objectives and training methods?
If yes, describe the technique used.

A systematic approach (but not JTA according to INPO standard) is used as follows to determine training objectives and goals:
- All possible operation scenarios are listed. These are based on the operation manual, beyond design basis accident procedures (emergency operating manual), other operational
requirements, and the simulator malfunction list.
- Each task is checked, whether it is relevant to training.
- For each scenario the global training goals are derived.
- For each scenario the “didactic half-time” is defined, i.e. the repetition frequency of training modules is determined (e.g. once a year, any two years, etc.).
- Within the training course preparation the objectives and the target behaviour are defined in detail for each individual person of the shifts.

2. a) **What are the criteria that determine the limits or scope of the job analysis for the Control Room Operators?**

   The operational procedures are the main basis for the criteria to determine scope and limits of the job analysis.

b) **From your point of view, what should the role of risk-based criteria be for determining such limits or scope? Explain your answers.**

   In the training centre no risk-based criteria are used. The criteria are based on the psychological structure of the operation scenario from the operator's individual point of view.

3. **Are there any special requirements for Job and Task Analysis which are imposed by the possibility of associated simulator training?**

   In Germany, there are no specific requirements.

**B) Training programme design.**

1. **What are the criteria for specifying simulator training rather than another training setting (classroom, laboratory, workshop, on-the-job, etc.)?**

   Simulator training reflects the real control room conditions (esp. operator tasks, team work, etc.) much better than any other training setting. The advantage against on-the-job training is mainly the training of rare events like design basis accidents. Generally, it can be stated that it is relevant for all operating scenarios if they are:
   - stressful,
   - complicated,
   - sensitive, or
   - infrequent
   from the operator’s point of view.

2. **What are the criteria for selecting different types of simulator (full-scope, replica, part-task, basic principles, concept, special-purpose)?**

   In the German simulator centre only full-scope simulators are available. Therefore, this question is not applicable to the German situation.

3. a) **What are the criteria for selecting a replica simulator?**

   Main criteria for selecting replica simulators is the training of
   - knowledge-based objectives (plant specific response) and
   - skill based objectives (control room design specific behaviour)
   at the same time. The latter ones can only be transferred to the real plant in sufficient
quality, if the control room of the simulator and the control room of the plant are more or less identical.

b) **What are the fidelity requirements?**

The overall fidelity requirement is that there should be seen no discrepancy in the lay-out as well as in the process response between the simulator and the real plant by an experienced operator.

4. **What are the specific pre-requisites for operators undertaking simulator training?**

The training is strongly influenced by the individual knowledge of the trainee (see answer to question 3-A-1). No generic answer can be given here. There are of course significant differences between initial training and refresher training. The general requirements on operator education (schools, apprenticeship, experience on-the-job etc.) are part of a federal regulation.

5. **Does the possibility of simulator training impose any constraints on the definition of learning objectives?**

Due to some restrictions of the simulator, in limited areas a few training objectives cannot be fulfilled. These objectives are covered by an extension of other training means and media.

C) **Training programme development.**

1. **In the case of non-replica simulators, is it necessary to take parallel training actions, and if so, what kind? Explain your answer.**

In case of non-replica simulators a classroom preparation is performed before the beginning of simulator training. These session last about 2 to 3 days.

2. **Do you use specific procedures for the training simulator, actual plant procedures or a combination of both? Explain your answer and give reasons for the choice.**

During simulator training only actual plant procedures are used.

3. **What are the criteria for selecting normal, abnormal and emergency scenarios to be trained with simulators? Are they risk-based criteria? Explain your answer.**

The selection criteria for normal, abnormal and emergency scenarios are based on the operation manual and design basis accidents, respectively. Please, refer to the answers to the questions 3-b-1 and 3-a-1/2.

4. **How are lesson plans and support documentation developed for simulator training?**

Please refer to attachment 1.
D) Training programme implementation.

1. **What selection, initial training, and continuing training is arranged for simulator instructors?**

The selection of instructors is based on personality, ability and knowledge of the candidate. The initial training is shown in attachment 2. The amount of refresher training is 4 weeks a year including 2 weeks as a participant of a shift in an NPP.

2. **What are the arrangements for instructor monitoring of, and feedback to, trainees during simulator sessions?**

During simulator training sessions the instructor is always available to monitor the trainees permanently and to give feedback to the trainees if requested. There exists a formal system to assess the trainees.

3. **a) What specific training modes such as simulator freeze, playback, running at higher speed than real time, activity recording, video recording, etc. is made use of during initial training?**

During initial training the following simulator features are used:
- simulator freeze,
- playback,
- running faster than real time etc.
but activity recording and video recording are not used.

b) **What specific training modes such as simulator freeze, playback, running at higher speed than real time, activity recording, video recording, etc. is made use of during continuous training?**

During continuous training (duration of scenarios 4 hours) these features are not used if possible.

4. **What limits of simulation impede planned training sessions or examination scenarios?**

Training sessions are tested before they are implemented in the simulator training programme. Therefore, there are no limits (except those of the simulator itself) in planned training sessions.

E) Trainee assessment.

1. a) **What methods and procedures are used for initial trainee assessment during and after simulator sessions?**

The trainees are assessed during initial training as follows:
- About 40 overall assessment objectives have been defined and agreed upon by the simulator centre.
- In course preparation (see 3-c-4) all training goals are defined in detail and referred to the overall assessment objectives. They serve as comparative objectives for assessment.
- The instructor of the simulation centre and a representative of the NPP (partly) observe the trainees and come to an agreement about the findings.
- On the last day of a training course (mostly on Fridays) instructor, plant observer and
trainee (6-eyes) have an assessment discussion about the assessment results.
- There is a formal documentation of the overall results for plant supervisors.

b) What methods and procedures are used for continuous trainee assessment during and after simulator sessions?

For refresher training the same methods are used as for initial training.

2. List and describe the main areas or groups of skills and knowledge of the trainee assessed in training simulators (for example: “control board awareness, event diagnosis, immediate actions / entry-level actions, subsequent actions, control board manipulations, use of procedures / technical specifications / reference data, communications, supervisory ability, team skills” (IAEA-TECDOC-525)). Identify, when applicable, the types of simulator used for addressing each one.

The main areas of trainee assessment during simulator training are:
- Knowledge
  - knowledge of operational basics
  - knowledge of procedures and rules
  - knowledge of control panels
  - knowledge of plant systems
- Plant systems
  - normal operations
  - disturbances without scram
  - malfunctions with scram
- Performance (behaviour) in the control room
  - use of information
  - decision making process
  - work attitudes
  - Leadership of shift supervisor

3. Describe the ranking of importance, if any, given to the main areas or groups of skills and knowledge taken into account for a trainee assessment.

There is no ranking of importance because all areas are significant.

4. a) Based on your experience, describe difficulties you have had for assessing the individual skills and knowledge of a trainee while operating within a whole Control Room Shift Team during simulator sessions.

The assessment method is well developed, therefore there are no specific difficulties to utilise them during simulator training. It seems to be more difficult to introduce the assessment method in the plants because there is not good acceptance.

b) Describe the measures adopted to overcome these difficulties.

The trainees are informed in advance about all aspects of the assessment method.

5. a) Based on your experience, describe influences on trainees performance during simulator sessions resulting from the attendance of personnel such as utility managers, regulatory body inspectors, etc.

The attendance of further persons (e.g. from the NPP) is normal, therefore no special influence can be detected.
b) Based on your experience, describe influences on trainees performance during simulator sessions resulting from the attendance of personnel such as utility managers, regulatory body inspectors, etc.

The instructor is in the simulator control room and can give immediate feedback, answers questions and may add further explanations (see answer to questions 3-d-2).

6. a) Are training simulator examinations used in order to grant initial license to operators?
   Explain.

In Germany training simulator examinations are not used to grant the initial license.

b) Are training simulator examinations used for requalification?
   Explain.

In Germany training simulator experiences are not used for requalifications.

7. How is examination integrity preserved during the examination/scenario preparation period?

This question is not applicable to the German situation.

8. What performance monitoring or data acquisition features of the simulator are used during simulator examinations?

This question is not applicable to the German situation.

F) Training programme evaluation.

1. Describe the approach used for evaluating the simulator training programme and main results.

The training programme evaluation is performed by yearly sessions between the simulator centre and each plant. Also, once a year an evaluation of the performance of the simulator centre takes place among all utilities.

2. What programme is in place for validation and continuous verification of the simulator performance?

Twice a year, software modifications of the simulator are implemented to reflect plant changes and detected discrepancies (formalised system). The modification is tested against a number of standard transients.

3. What types of performance discrepancies are most frequently identified by operators during training sessions?

Due to the long experience, generally only minor details are identified.

4. What types of performance discrepancies are most frequently identified by examiners or inspectors?

Due to the long experience, generally only minor details are identified.
SECTION 4: Use of operating experience for operator training with simulators.

1. How is operational experience feedback incorporated into the design of simulator training programs (experience reviewed, schedule, people involved)?

   The training programme is discussed with the plants. Therefore, operating experience of the plant can be implemented into the training programme (please, refer to attachment 1). The operating managers of the NPP visit very often the simulator centre to discuss the latest operating experiences. Additionally, the instructors share the operating experience of the plants during their two weeks retraining at the NPP.

2. Has your organisation developed any kind of programme by which simulator operator training is correlated with real operating events? Explain.

   The simulation centre receives information from German and international (WANO, UNIPEDE, INPO) operation experience information systems. The training programs must also comprise relevant plant incidents.

SECTION 5: Specific topics on Operator training with simulators.

A) Team training techniques.

1. a) Are job and task analyses used for defining the role and responsibilities of the Members of the Control Room Shift Teams and, in general, of the various levels of staff who are charged with operation of the plant? Explain your answer.

   The allocation of task is defined by the plant operation management and directly supported by the simulator training.

   b) Are job and task analyses used for establishing performance standards, learning objectives and training methods for Team skills training? Explain your answer.

   Team skills have been defined by working groups comprising all NPP and the simulator centre.

2. List and describe Team skills (communication, management of resources, team cooperation, team leadership, feedback, conflict resolution, team decision-making, etc.) which are trained using simulators. Identify, when applicable, the types of simulator used for training each one.

   In Germany only full-scope simulators are used for operator training in the German simulator centre. During training the team skills addressed in the questions are considered.

3. Are any guides used for conducting and evaluating Team skills training simulations? Explain your answer.

   In Germany, there are no specific team skill simulations. The team skills are trained during normal simulator sessions.
4. Based on your experience, describe advantages and disadvantages of Team training with the participation of the same (usual) Members every time or with changes in the Shift Team compositions.

In Germany both types of training (normal shift and different shift members) are performed. It is accepted that both types are necessary.

5. Are simulator sessions used for the optimisation of control Room Team Shifts taking into account the characteristics (aptitudes, attitudes, ...) of each Operator? In other words, are simulator sessions used for deciding which Members are going to constitute each Shift Team?

Explain your answer.

It is not within the task of the simulator centre to optimise shift team compositions. The composition of a shift team is only in the responsibility of the NPP.

6. Are there any licensing examinations applied to the whole Control Room Shift Team in addition to the individual licensing examinations?

Explain.

In Germany the simulator training is not used for operator licensing examination.

B) Training for stress.

1. Is any part of the simulator training programme specifically devoted to train Control Room Operators to operate under stress?

Explain you answer.

There is no specific training programme devoted to train the shift under stress. Stress may occur during complex training scenarios.

2. Are stress levels induced and measured during simulator training sessions?

If yes, describe the methods and results.

In Germany, there are no specific stress levels induced or measured during simulator training sessions.

3. Based on your experience describe any measures adopted during simulator training to counter stress.

The simulator centre has developed in co-operation with the plants technical operating procedures to limit stressful situations, like the “flood of information” during complex events. The specified actions of the shift following a scram are one example.
C) The theoretical basis underlying training.

1. Are any models of human behaviour being used in designing and implementing training programmes?
   If yes:
   i) refer to or describe the models,
   ii) indicate the areas in which these models are being applied (for example: signal detections, decision-making, etc.)
   iii) give the main results.

Please refer to the answers on the taxonomy in the chapter on training programme design (3-b).

D) Habits acquired during training sessions with simulators.

1. Describe, based on your experience, undesirable habits which could be acquired by trainees during training sessions with simulators (for example: due to limited number of simulated scenarios, due to lack of physical or functional fidelity, due to the use of conservative codes for simulation instead of best estimate codes, etc.) and discuss their potential consequences on safety.

For most of the plants replica or near-replica simulators are used for training. There are no undesirable habits identified up to now due to simulator training in the German simulator centre.

2. Describe, based on your experience, any measures adopted to avoid acquisition of those undesirable habits or to prevent use of them.

The use of replica simulators and the development of an appropriate training programme avoids the acquisition of bad habits.

E) Simulator training on normal and emergency conditions during shutdown and low power operation.

1. What use is made of simulators for Control Room Operator training in normal, abnormal and emergency conditions during shutdown and low power operation (simulated scenarios, trained skills, training techniques, ...)?

The training programme covers all operating conditions from cold shutdown to full power. This includes as well open vessel scenarios and mid-loop-operation. (A physical simulation may not always be possible at older simulators.)

2. What are the criteria (risk-based criteria, deterministic criteria, results of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?

Because these scenarios are part of the normal training programme the same criteria are used as described in the previous chapters.
3. Are job and task analysis (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on shutdown and low power operation? Explain.

Because these scenarios are part of the normal training programme the same analysis methods are used as described in the previous chapters.

4. What are your plans for the future in this area?

There are no specific plans for modifications in the future.

F) Simulator training on severe accidents.

1. What use is made of simulators for Control Room Operator training in severe accidents (simulated scenarios, trained skills, training techniques, ...)?

Severe accidents are trained as far as the simulator is able to simulate the scenarios. Most of the simulators will in the future (1997) be able to simulate primary and secondary feed and bleed scenarios.

2. What are the criteria (risk-based criteria, deterministic criteria, result of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?

Severe accidents for which emergency procedures have been developed by the plant are incorporated in the training, if actions have to be taken within the first hours after an accident under the responsibility of the shift.

3. Are job and task analysis (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on severe accidents. Explain.

Because severe accidents are part or will be part of the training programme the same criteria are used as described in the previous chapters.

4. What are your plans for the future in this area?

Most of the simulators will in the future (1997) be able to simulate primary and secondary feed and bleed scenarios.

G) Simulator training on accidents caused by fires, floods, earthquakes, etc.

1. What use is made of simulators for Control Room Operator training in accidents caused by fires, floods, earthquakes, etc. (simulated scenarios, trained skills, training techniques,...)?

In the German simulator centre no earthquake and flood scenarios are trained. The detection of fires is part of the training programme.
2. **What are the criteria (risk-based criteria, deterministic criteria, result of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?**

   Please refer to the previous chapters.

3. **Are job and task analyses (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on accidents caused by fires, floods, earthquakes, etc.? Explain.**

   Please refer to the previous chapters.

4. **What are your plans for the future in this area?**

   There are no specific modifications of the simulators planned with respect to fires, floods and earthquakes.
QUESTIONNAIRE

Fundamental Concept of Operator Training

In order to ensure safety and stable operation of nuclear power stations in Japan, the operators of nuclear power stations are to learn advanced operational techniques and skills, and be of superior quality according to the long-range programme of training system from the following viewpoint.

1) Training outside of the utility companies
To acquire operational techniques and skills using simulators at BWR Operator Training Centre Corporation (BTC) and Nuclear Power Training Centre (NTC).

2) Training inside of the utility companies
a. To acquire, maintain and improve operational techniques and skills by training
Practical use of equipment such as full-scope (replica) simulators, compact simulators, CAIs using computers, equipment (pumps and valves, etc., for maintenance training) at Maintenance Training Centre and so on within the utility companies, in order to provide effective training.

b. To acquire operational techniques and skills by practice (On the Job Training)

Answers to questionnaire:
These answers were obtained from surveys conducted at BTC and NTC regarding simulator training.

BTC
(Member of Shift Team)
• Shift Supervisor
• Assistant Shift Supervisor
• Shift Foreman
• Assistant Shift Foreman
• Main Control Operator
• Assistant Operator

(Training Course)
Continuous Training
Initial Training
Senior Operator Training (6 days)
Refresher-III (9 days)
Refresher-II (9 days)
Refresher-I (10 days)
Initial Training (Phase I, II, III) (15 weeks)
Crew Training (1 Day)

NTC
(Member of Shift Team)
• Shift Supervisor
• Assistant Shift Supervisor
• Senior Reactor Operator
• Reactor Operator
• Turbine and Generator Operator
• Auxiliary Operator

(Training Course)
Continuous Training
Initial Training
Supervisor Retraining (5 days)
Senior Retraining (10 days)
Normal Retraining (10 days)
Initial Training (Phase I, II, III) (22 weeks)
Shift Team (1 Day)
SECTION 0: Organisation/s replying to the questionnaire

1. Name of Organisation/s.
   Institute of Human Factors
   Nuclear Power Engineering Corporation

2. Contact Person/s.
   Tomihiko Furuta

3. Address and contact information (telephone, fax).
   Fujita Kanko Toranomon Bldg., 6F
   17-1, 3-Chome Toranomon, Minato-Ku
   Tokyo 105, Japan
   Phone: +81 (3) 5470-5525
   Facsimile: +81 (3) 5470-5544

SECTION 1: General Information (related to the whole country)

1. Number of nuclear reactors (Units) in operation.
   49

2. Number of Sites with at least one Unit in operation.
   16

3. Number of full-scope (replica and no replica) simulators used for operator training.
   8

4. Number of replica simulators used for operator training.
   8

5. Number of part-task simulators used for operator training.

6. Number of basic principles simulators used for operator training.

7. Number of concept simulators used for operator training.
8. Number of special-purpose simulators used for operator training.

9. For how many Units is the training done on replica training simulators?
   48*

10. For how many Units is the training done on full-scope (replica and no replica) training simulators.
    48*

   * (Note) Tokai (GCR) station is excluded.

IMPORTANT QUESTION

Are your answers to the subsequent sections (2 to 5) of the questionnaire related to a specific Organisation or Training Centre in your Country?

Yes  X  No  ___ (Mark your answer with an X)

If yes, indicate the name of the Organisation or Training Centre and describe briefly the simulation facility referred to in answer to the question below (f.i. located on-site or off-site, type of simulator/s, sample photograph, reference NPP/s, NPP/s which receive training in this facility, size and composition of the simulator instructional and support staff, etc.) and, also, describe this/these NPP/s (f.i. type (PWR, BWR, etc.), vendor, start of operation, degree of automation, Operators which constitute the Control Room Shift Team, sample photograph of the control room/s, etc.).

Please see following pages for tables.
### Outline of the Training Centre (1/3 and 2/3)

<table>
<thead>
<tr>
<th>BTC [BWR Operator Training Centre Corporation] – FUKUSHIMA Centre</th>
</tr>
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<tbody>
<tr>
<td><strong>Simulator 1</strong></td>
</tr>
<tr>
<td>1. Location (On-site or Off-site)</td>
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<tr>
<td>2. Type of Simulator</td>
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<tr>
<td>3. Reference Nuclear Power Station</td>
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<tr>
<td>4. Nuclear Power Station used for training facilities</td>
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<td>5. Simulator Training Staff and the Assistants</td>
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<td>6. Others</td>
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<td><strong>Simulator 2</strong></td>
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<td>1. Location (On-site or Off-site)</td>
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<td>2. Type of Simulator</td>
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<td>4. Nuclear Power Station used for training facilities</td>
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<td>5. Simulator Training Staff and the Assistants</td>
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<td><strong>Simulator 3</strong></td>
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<tr>
<td>1. Location (On-site or Off-site)</td>
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<td>2. Type of Simulator</td>
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<td>3. Reference Nuclear Power Station</td>
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<td>4. Nuclear Power Station used for training facilities</td>
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<td>5. Simulator Training Staff and the Assistants</td>
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<td><strong>BTC [BWR Operator Training Centre Corporation] – NIGATA Centre</strong></td>
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<td><strong>Simulator 4</strong></td>
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<td>1. Location (On-site or Off-site)</td>
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<td>2. Type of Simulator</td>
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<td>3. Reference Nuclear Power Station</td>
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<td>4. Nuclear Power Station used for training facilities</td>
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<td>5. Simulator Training Staff and the Assistants</td>
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<td><strong>Simulator 5</strong></td>
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<td>1. Location (On-site or Off-site)</td>
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<td>2. Type of Simulator</td>
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<td>3. Reference Nuclear Power Station</td>
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<td>4. Nuclear Power Station used for training facilities</td>
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<td>5. Simulator Training Staff and the Assistants</td>
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Outline of the Training Centre (3/3)

<table>
<thead>
<tr>
<th>Simulator 1</th>
<th>1. Location (On-site or Off-site)</th>
<th>Off-site</th>
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<tbody>
<tr>
<td></td>
<td>2. Type of Simulator</td>
<td>Replica</td>
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<tr>
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<td>3. Reference Nuclear Power Station</td>
<td>Commonwealth Edison Company Zion Station No. 1 (Equivalent to Mihama Station No. 1)</td>
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<td>4. Nuclear Power Station used for training facilities</td>
<td>Shown in the attached list of power stations.</td>
</tr>
<tr>
<td></td>
<td>5. Simulator Training Staff and the Assistants</td>
<td>Five staff instructors from the Management Department and Training Department</td>
</tr>
<tr>
<td></td>
<td>6. Others</td>
<td>Total Staffs in NTC Staff instructors 19 Assistants 13</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Simulator 2</th>
<th>1. Location (On-site or Off-site)</th>
<th>Off-site</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2. Type of Simulator</td>
<td>Replica</td>
</tr>
<tr>
<td></td>
<td>3. Reference Nuclear Power Station</td>
<td>Kansai Electric Power Company Takahama Station No. 3</td>
</tr>
<tr>
<td></td>
<td>4. Nuclear Power Station used for training facilities</td>
<td>Shown in the attached list of power stations.</td>
</tr>
<tr>
<td></td>
<td>5. Simulator Training Staff and the Assistants</td>
<td>Nine staff instructors</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Simulator 3</th>
<th>1. Location (On-site or Off-site)</th>
<th>Off-site</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2. Type of Simulator</td>
<td>Replica</td>
</tr>
<tr>
<td></td>
<td>3. Reference Nuclear Power Station</td>
<td>Kansai Electric Power Company Ohi Station No. 3</td>
</tr>
<tr>
<td></td>
<td>4. Nuclear Power Station used for training facilities</td>
<td>Shown in the attached list of power stations.</td>
</tr>
<tr>
<td></td>
<td>5. Simulator Training Staff and the Assistants</td>
<td>Five staff instructors from the Management Department and Training Department</td>
</tr>
</tbody>
</table>

List of Nuclear Power Stations (BWR) (1/2)

<table>
<thead>
<tr>
<th>Name of Station</th>
<th>Simulator Number</th>
<th>Output (x 10MW)</th>
<th>Vendor</th>
<th>Date of Start of Operation</th>
<th>Level of Automation</th>
<th>Structure of Operation Shift</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tokai daini</td>
<td>1, 3</td>
<td>110.0</td>
<td>General Electric/Hitachi</td>
<td>1978-11-28</td>
<td>1</td>
<td>1 unit 1 centre (8 operators)</td>
</tr>
<tr>
<td>Tsuruga No. 1</td>
<td>1, 3</td>
<td>35.7</td>
<td>General Electric</td>
<td>1970-3-14</td>
<td>1</td>
<td>1 unit 1 centre (8 operators)</td>
</tr>
<tr>
<td>Onagawa No. 1</td>
<td>1, 3</td>
<td>52.4</td>
<td>Toshiba</td>
<td>1984-6-1</td>
<td>2</td>
<td>2 units 1 centre (13 operators)</td>
</tr>
<tr>
<td>Onagawa No. 2</td>
<td>2, 4</td>
<td>82.5</td>
<td>Toshiba</td>
<td>1995-7-28</td>
<td>3</td>
<td>ditto</td>
</tr>
<tr>
<td>Fukushima Daiiichi No. 1</td>
<td>1, 3</td>
<td>46.0</td>
<td>General Electric</td>
<td>1971-3-26</td>
<td>1</td>
<td>2 units 1 centre (11 operators) ditto</td>
</tr>
<tr>
<td>No. 2</td>
<td>1, 3</td>
<td>78.4</td>
<td>General Electric/ Toshiba</td>
<td>1974-7-18</td>
<td>1</td>
<td>ditto</td>
</tr>
<tr>
<td>No. 3</td>
<td>1, 3</td>
<td>78.4</td>
<td>Toshiba</td>
<td>1976-3-27</td>
<td>1</td>
<td>ditto</td>
</tr>
<tr>
<td>No. 4</td>
<td>1, 3</td>
<td>78.4</td>
<td>Hitachi</td>
<td>1978-10-12</td>
<td>1</td>
<td>ditto</td>
</tr>
<tr>
<td>No. 5</td>
<td>1, 3</td>
<td>78.4</td>
<td>Toshiba</td>
<td>1978-4-18</td>
<td>1</td>
<td>ditto</td>
</tr>
<tr>
<td>No. 6</td>
<td>1, 3</td>
<td>110.0</td>
<td>General Electric/ Toshiba</td>
<td>1979-10-24</td>
<td>1</td>
<td>ditto</td>
</tr>
</tbody>
</table>
### List of Nuclear Power Stations (BWR) (1/2) (cont’d)

<table>
<thead>
<tr>
<th>Name of Station</th>
<th>Simulator Number</th>
<th>Output (x 10MW)</th>
<th>Vendor</th>
<th>Date of Start of Operation</th>
<th>Level of Automation</th>
<th>Structure of Operation Shift</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fukushima-Daini</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. 1</td>
<td>2, 4</td>
<td>110.0</td>
<td>Toshiba</td>
<td>1982-4-20</td>
<td>1</td>
<td>2 units 1 centre (10 operators)</td>
</tr>
<tr>
<td>No. 2</td>
<td>2, 4</td>
<td>110.0</td>
<td>Hitachi</td>
<td>1984-2-3</td>
<td>1</td>
<td>ditto</td>
</tr>
<tr>
<td>No. 3</td>
<td>2, 4</td>
<td>110.0</td>
<td>Toshiba</td>
<td>1985-6-21</td>
<td>2</td>
<td>ditto</td>
</tr>
<tr>
<td>No. 4</td>
<td>2, 4</td>
<td>110.0</td>
<td>Hitachi</td>
<td>1987-8-25</td>
<td>2</td>
<td>ditto</td>
</tr>
<tr>
<td>Kashiwazaki-Kariha</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. 1</td>
<td>2, 4</td>
<td>110.0</td>
<td>Toshiba</td>
<td>1985-9-18</td>
<td>2</td>
<td>1 unit 1 centre (7 operators)</td>
</tr>
<tr>
<td>No. 2</td>
<td>2, 4</td>
<td>110.0</td>
<td>Toshiba</td>
<td>1990-9-28</td>
<td>2</td>
<td>1 unit 1 centre (6 operators)</td>
</tr>
<tr>
<td>No. 3</td>
<td>2, 4</td>
<td>110.0</td>
<td>Toshiba</td>
<td>1993-8-11</td>
<td>3</td>
<td>ditto</td>
</tr>
<tr>
<td>No. 4</td>
<td>2, 4</td>
<td>110.0</td>
<td>Hitachi</td>
<td>1994-8-11</td>
<td>3</td>
<td>ditto</td>
</tr>
<tr>
<td>No. 5</td>
<td>2, 4</td>
<td>110.0</td>
<td>Hitachi</td>
<td>1990-4-10</td>
<td>2</td>
<td>ditto</td>
</tr>
<tr>
<td>Hamaoka</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. 1</td>
<td>1, 3</td>
<td>54.0</td>
<td>Toshiba/Hitachi</td>
<td>1976-3-17</td>
<td>1</td>
<td>2 units 1 centre (13 operators)</td>
</tr>
<tr>
<td>No. 2</td>
<td>1, 3</td>
<td>84.0</td>
<td>Toshiba/Hitachi</td>
<td>1978-11-29</td>
<td>1</td>
<td>ditto</td>
</tr>
<tr>
<td>No. 3</td>
<td>2, 4</td>
<td>110.0</td>
<td>Toshiba/Hitachi</td>
<td>1987-8-28</td>
<td>2</td>
<td>1 unit 1 centre (6 operators)</td>
</tr>
<tr>
<td>No. 4</td>
<td>2, 4</td>
<td>113.7</td>
<td>Toshiba/Hitachi</td>
<td>1993-9-3</td>
<td>2</td>
<td>ditto</td>
</tr>
<tr>
<td>Shika</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. 1</td>
<td>2, 4</td>
<td>54.0</td>
<td>Hitachi</td>
<td>1993-7-30</td>
<td>1</td>
<td>1 unit 1 centre (8 operators)</td>
</tr>
<tr>
<td>Shimane</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. 1</td>
<td>1, 3</td>
<td>46.0</td>
<td>Hitachi</td>
<td>1974-3-29</td>
<td>1</td>
<td>2 units 1 centre (13 operators)</td>
</tr>
<tr>
<td>No. 2</td>
<td>1, 3</td>
<td>82.0</td>
<td>Hitachi</td>
<td>1989-2-10</td>
<td>2</td>
<td>ditto</td>
</tr>
</tbody>
</table>

### List of Nuclear Power Stations (BWR) (2/2)

Sample: detailed list of structure of operation shift (Tokyo Electric Power Company)

<table>
<thead>
<tr>
<th></th>
<th>1) 1 unit 1 centre (7 operators)</th>
<th>2) 2 units 1 centre (11 operators)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shift Supervisor</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Assistant Shift Supervisor</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Shift Foreman</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Assistant Shift Foreman</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Main Control Operator</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Assistant Operator</td>
<td>2</td>
<td>4</td>
</tr>
</tbody>
</table>
### List of Nuclear Power Stations (PWR) (1/2)

<table>
<thead>
<tr>
<th>Name of Station</th>
<th>Simulator Number</th>
<th>Output (x 10MW)</th>
<th>Vendor</th>
<th>Date of Start of Operation</th>
<th>Level of Automation</th>
<th>Structure of Operation Shift</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tsuruga No. 2</td>
<td>2</td>
<td>116.0</td>
<td>Mitsubishi</td>
<td>1987-2-17</td>
<td>2</td>
<td>1 unit 1 centre (8 operators)</td>
</tr>
<tr>
<td>Tomari No. 1</td>
<td>2</td>
<td>57.9</td>
<td>Mitsubishi</td>
<td>1989-6-22</td>
<td>2</td>
<td>2 units 1 centre (13 operators) ditto</td>
</tr>
<tr>
<td>No 2</td>
<td>2</td>
<td>57.9</td>
<td>Mitsubishi</td>
<td>1991-4-12</td>
<td>2</td>
<td>ditto</td>
</tr>
<tr>
<td>Mihama No. 1</td>
<td>2, 3</td>
<td>34.0</td>
<td>Westinghouse</td>
<td>1970-11-28</td>
<td>1</td>
<td>2 units 1 centre (12 operators) ditto</td>
</tr>
<tr>
<td>No. 2</td>
<td>2, 3</td>
<td>50.0</td>
<td>Westinghouse</td>
<td>1972-7-25</td>
<td>1</td>
<td>ditto</td>
</tr>
<tr>
<td>No. 3</td>
<td>2, 3</td>
<td>82.6</td>
<td>Mitsubishi</td>
<td>1976-12-1</td>
<td>1</td>
<td>1 unit 1 centre (9 operators)</td>
</tr>
<tr>
<td>Takahama No. 1</td>
<td>2, 3</td>
<td>82.6</td>
<td>Westinghouse</td>
<td>1974-11-14</td>
<td>1</td>
<td>2 units 1 centre (12 operators) ditto</td>
</tr>
<tr>
<td>No. 2</td>
<td>2, 3</td>
<td>82.6</td>
<td>Mitsubishi</td>
<td>1975-11-14</td>
<td>1</td>
<td>ditto</td>
</tr>
<tr>
<td>No. 3</td>
<td>2, 3</td>
<td>87.0</td>
<td>Mitsubishi</td>
<td>1985-1-17</td>
<td>2</td>
<td>ditto</td>
</tr>
<tr>
<td>No. 4</td>
<td>2, 3</td>
<td>87.0</td>
<td>Mitsubishi</td>
<td>1985-6-5</td>
<td>2</td>
<td>ditto</td>
</tr>
<tr>
<td>Ohi No. 1</td>
<td>1, 2, 3</td>
<td>117.5</td>
<td>Westinghouse</td>
<td>1979-3-27</td>
<td>1</td>
<td>ditto</td>
</tr>
<tr>
<td>No. 2</td>
<td>1, 2, 3</td>
<td>117.5</td>
<td>Westinghouse</td>
<td>1979-12-5</td>
<td>1</td>
<td>ditto</td>
</tr>
<tr>
<td>No. 3</td>
<td>2, 3</td>
<td>118.0</td>
<td>Mitsubishi</td>
<td>1991-12-18</td>
<td>3</td>
<td>ditto</td>
</tr>
<tr>
<td>No. 4</td>
<td>2, 3</td>
<td>118.0</td>
<td>Mitsubishi</td>
<td>1993-2-2</td>
<td>3</td>
<td>ditto</td>
</tr>
<tr>
<td>Ikata No. 1</td>
<td>2</td>
<td>56.6</td>
<td>Mitsubishi</td>
<td>1977-9-30</td>
<td>1</td>
<td>2 units 1 centre (14 operators) ditto</td>
</tr>
<tr>
<td>No. 2</td>
<td>2</td>
<td>56.6</td>
<td>Mitsubishi</td>
<td>1982-3-19</td>
<td>1</td>
<td>1 unit 1 centre (8 operators)</td>
</tr>
<tr>
<td>No. 3</td>
<td>3</td>
<td>89.0</td>
<td>Mitsubishi</td>
<td>1994-12-15</td>
<td>3</td>
<td>ditto</td>
</tr>
<tr>
<td>Genkai No. 1</td>
<td>2, 3</td>
<td>55.9</td>
<td>Mitsubishi</td>
<td>1975-10-15</td>
<td>1</td>
<td>2 units 1 centre (14 operators) ditto</td>
</tr>
<tr>
<td>No. 2</td>
<td>2, 3</td>
<td>55.9</td>
<td>Mitsubishi</td>
<td>1981-3-30</td>
<td>1</td>
<td>1 unit 1 centre (8 operators)</td>
</tr>
<tr>
<td>No. 3</td>
<td>3</td>
<td>118.0</td>
<td>Mitsubishi</td>
<td>1994-3-18</td>
<td>3</td>
<td>ditto</td>
</tr>
<tr>
<td>Sendai No. 1</td>
<td>2, 3</td>
<td>89.0</td>
<td>Mitsubishi</td>
<td>1984-7-4</td>
<td>2</td>
<td>2 units 1 centre (14 operators) ditto</td>
</tr>
<tr>
<td>No. 2</td>
<td>2, 3</td>
<td>89.0</td>
<td>Mitsubishi</td>
<td>1985-11-28</td>
<td>2</td>
<td>ditto</td>
</tr>
</tbody>
</table>

### List of Nuclear Power Stations (PWR) (2/2)

Sample: detailed list of structure of operation shift (Kansai Electric Power Company)

<table>
<thead>
<tr>
<th>Shift</th>
<th>1) 1 unit 1 centre (9 operators)</th>
<th>2) 2 units 1 centre (12 operators)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shift Supervisor</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Assistant Shift Supervisor</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Senior Reactor Operator</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Reactor Operator</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Turbine and Generator Operator</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Auxiliary Operator</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>
Level of Automation

(BWR)

<table>
<thead>
<tr>
<th>Items</th>
<th>Grouping of Automation Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>vacuum increment (mode 1 ~4)</td>
<td>x</td>
</tr>
<tr>
<td>turbine start-up, connection, load increment</td>
<td>o</td>
</tr>
<tr>
<td>feed water pump start-up, switching</td>
<td>x</td>
</tr>
<tr>
<td>SJAЕ start-up, switching</td>
<td>x</td>
</tr>
<tr>
<td>ground seal plant (4S)</td>
<td>x</td>
</tr>
<tr>
<td>MSH (Moisture Separation Heater) start-up</td>
<td>x</td>
</tr>
<tr>
<td>cleaning operation of condenser tube cleaning unit</td>
<td>o</td>
</tr>
</tbody>
</table>

(PWR)

<table>
<thead>
<tr>
<th>Items</th>
<th>Grouping of Automation Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>RCS heating and cooling</td>
<td>x</td>
</tr>
<tr>
<td>turbine rotation increment and load increment</td>
<td>x</td>
</tr>
<tr>
<td>turbine movement main feed water pump start-up</td>
<td>o</td>
</tr>
<tr>
<td>start of use of high pressure air suction</td>
<td>x</td>
</tr>
<tr>
<td>MSH start-up</td>
<td>x</td>
</tr>
<tr>
<td>feed water switching</td>
<td>x</td>
</tr>
<tr>
<td>automatic turning of turbine</td>
<td>x</td>
</tr>
<tr>
<td>ALR automatic load regulator</td>
<td>x</td>
</tr>
<tr>
<td>cleaning operation of condenser tubes cleaning unit</td>
<td>o</td>
</tr>
<tr>
<td>operation of boron recovery unit</td>
<td>o</td>
</tr>
<tr>
<td>operation of waste water evaporation unit</td>
<td>o</td>
</tr>
</tbody>
</table>

1) Level of automation
   1: Basically, automation is not adopted in connection with operations.
   2: Plant start-up operation is partially automated.
   3: In addition to level 2, the main operation of the major equipment is automated.

2) Automation levels are somewhat different for different plants. Therefore, the above tables indicate examples of a typical plant.

SECTION 2: Current practices with simulators closely related to operator training.

1. Based on your experience, describe advantages and disadvantages of the location of the Simulation Centre with regard to the plant: on-site versus off-site. Specifically, describe those factors which have some influence on the Operators’ attitude towards the simulator training and in the quality of the simulator training.

   • Both BTC and NTC are off-site.
   • Off-site location does not have any influence on the attitude of the operators towards the simulator training or on the quality of the simulator training.
   • The advantages and disadvantages of an off-site location are as follows:
     • Advantages:
       • Operators can concentrate on the training free from office works or daily works.
       1) The level of the operators’ skill for various sites or utilities is equalised.
       2) The training and evaluation can be performed strictly unaffected by site conditions.
       3) Technologies and information are easily exchanged among the sites or the utilities.

• Disadvantages:
  1) In case the training centre is far from the site, travelling between the training centre and the site becomes necessary and involves cost and time.

2. a) During simulator training sessions, what factors (time, communications, etc.) influencing the interactions between Control Room Operators and other Plant Personnel (Operations Department outside of Control Room Personnel, Maintenance or Instrumentation, and Control Departments, Technical Support Centre, etc.) are simulated?

   Telephones and paging are used for notification or direction on simulation to the outside (MITE, prefecture, city, etc.), the company management staff, the maintenance department and to the assistant operators. Notice and direction are given by the instructors. In case the response time has significant influences on the training (e.g. reporting of radiation dose measurement results during SGTR), the time actually required is considered.

b) Do these other Plant Personnel participate in the training sessions? Describe the present training format pertaining to involvement of non Control Room Personnel in simulator training sessions and explain why this format is used.

   • Other plant personnel don’t participate directly in the training. However, assistant operators who operate and monitor the equipment at the site do participate in the training.
   • For some training course (e.g. Crew Training), a director of the operation department or a chief reactor technical staff participates in the telephone-response training, etc.
   • The training situation is the same as that of power stations. Therefore, the training procedures are based on the procedures used for the power stations.

3. What environmental conditions (normal and emergency lighting, humidity, noise, vibrations, sounds generated by equipments, etc.) that could be experienced by the reference plants, are usually simulated in the Simulator Rooms? Describe the use of such effects at your simulator centre and explain why they are, or are not, incorporated into simulator training sessions.

   • Simulation items:
     The lighting, changes (flicker) caused by troubles in the grid systems or start-up of large auxiliary equipment, or alarm sound for changes of in the reaction rate (example of NTC) (Note), etc. are simulated.
     The above simulation is effective for training to improve the capability to recognise and judge a particular phenomenon.
   
   • Non-simulation items:
     Humidity, noise and vibrations are not simulated because of the following reasons:
     Temperature and humidity in the centre’s unit are maintained at a constant level without change.
     Air-conditioning units or control panels may generate noises. However, the noise level is low. Vibration is not generated in any case other than an earthquake. Vibration caused by earthquake is not simulated.

(Note) In PWR plants, when the reaction rate changes (when diluted), an alarm (electronic) sounds.
4. Do Control Room Operators receive simulator training for operations outside the Control Room, for example: operations from Remote Shutdown Panels? Describe this type of training as it exists at your Simulator Centre and explain why it is, or is not, used in training sessions.

- The following items are simulated as operations outside of the control room:
  1) Site Operation Panel
  2) Remote Shutdown Panel
     EP Panel (PWR)
     RSS Panel (BWR)
     EP: Evacuation Panel
     RSS: Remote Shutdown System
- Simulator training for operations outside of the control room is carried out.
- This training is necessary because operations outside of the centre’s unit is required in case operations at the centre’s unit are not possible and operations on the site panel are performed during normal operations.
- The courses include the Crew Training Course (BTC), the Operator Co-operation Course (NTC), etc.

5. a) How frequently are the changes taking place in plant (plant design changes, procedures changes, etc.) incorporated to the replica or full-scope simulator? Describe any process or mechanism in place at your Simulator Centre to incorporate changes to the replica or full-scope simulator.

   1) Procedure of Simulator Modification
      Plant modification plan of the utilities and the manufacturers
      Review of simulator modification requirements within BTC and NTC
      (Large scale modification)
      Authorisation in the discussion committee of the utilities
      Decision about the date and execution
      (Small scale modification)
      Approval within BTC and NTC
      Execution any time
   2) Changes in the procedures
      • Changes in procedures for model plants are incorporated by obtaining the revised procedures when changes are made.
      • Changes in other than model plants are incorporated by obtaining the changed procedures periodically.

   b) Do simulator model modifications require separate approval while the simulator is being used for training?

   1) Large scale changes in the models will be made after the changes are notified to the utilities. The approval for the changes is obtained from the utilities (Training Centre Management Committee) and the Thermal and Nuclear Power Plant Engineering Society (as assignee facilities for approval of Operation Supervisor and actual skill tests) prior to the changes. The results of any model change in the simulator must be reported to the power authorities after they are authorised by BTC/NTC and filed with the Thermal/Nuclear Power Generation Technology Association together with the data.
   2) Other small changes will be done by BTC and NTC. The results will be reported to the utilities.
6. a) Identify the members of the Control Room Shift Team (Reactor Operators, Turbine Operators, Shift Supervisors, etc.) and indicate the time (in hours) dedicated to simulator training by each member in their initial training programme. Specify, when applicable, the time spent with each type of simulator.

- Shift Team Member Structure
  (Example of Tokyo Electric Power Company)
  - Shift Supervisor
  - Assistant Shift Supervisor
  - Shift Foreman
  - Assistant Shift Foreman
  - Main Control Operator
  - Assistant Operator
  (Example of Kansai Electric Power Company)
  - Shift Supervisor
  - Assistant Shift Supervisor
  - Senior Reactor Operator
  - Reactor Operator
  - Turbine and Generator Operator
  - Auxiliary Operator

(Note) Designations and structure of shift members are different for different utilities.

- Initial Training Programme Duration (in hours)

<table>
<thead>
<tr>
<th>Training Course</th>
<th>Training Hours</th>
<th>Main Trainees</th>
</tr>
</thead>
<tbody>
<tr>
<td>BTC Training Course (Phase 1, 2, 3)</td>
<td>208</td>
<td>640</td>
</tr>
<tr>
<td>NTC Initial Training Course (Phase I, II, III)</td>
<td>140</td>
<td>880</td>
</tr>
</tbody>
</table>

b) Indicate the time (in hours) dedicated to simulator training by each member of the Control Room Shift Team in their continuous training programme. Specify, when applicable, the time spent with each type of simulator.

- Continued Training Programme Duration (in hours)

<table>
<thead>
<tr>
<th>Course</th>
<th>Simulator Training (Hours)</th>
<th>Total Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>BTC</td>
<td>Retraining-I</td>
<td>48</td>
</tr>
<tr>
<td></td>
<td>Retraining-II</td>
<td>48</td>
</tr>
<tr>
<td></td>
<td>Retraining-III</td>
<td>52</td>
</tr>
<tr>
<td></td>
<td>Senior Operator Training</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>Crew Training</td>
<td>8</td>
</tr>
<tr>
<td>NTC</td>
<td>General</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>Senior Class</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>Supervisor I</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>Supervisor II</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>Shift Operator Co-operation I</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Shift Operator Co-operation II</td>
<td>16</td>
</tr>
</tbody>
</table>
c) What is the minimum time, if any, required by the Regulatory Body?

- The Regulatory Body does not make any request at the time of simulator training of operators.
- However, the operators are required to participate in the “Simulator Training for Senior Operators” for making application for and renewal of qualification as Operating Supervisors.
  For BTC: “Senior Class Staff Training Course”
  For NTC: “Supervisor Course” or “Senior Class Staff Course”

7. a) Indicate the percentage of simulator training time by the different Members of the Control Room Shift Team devoted to i) normal, ii) abnormal and iii) emergency conditions in their initial training programme.

- Time allocation for Initial Training Programme (Simulator Training Time)

<table>
<thead>
<tr>
<th>Simulator Training (Hours)</th>
<th>BTC</th>
<th>NTC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal Operation</td>
<td>50% (108 hrs.)</td>
<td>60% (84 hrs.)</td>
</tr>
<tr>
<td>Abnormal Operation</td>
<td>20% (40 hrs.)</td>
<td>20% (28 hrs.)</td>
</tr>
<tr>
<td>Emergency Case</td>
<td>30% (60 hrs.)</td>
<td>20% (28 hrs.)</td>
</tr>
<tr>
<td>Total</td>
<td>100% (208 hrs.)</td>
<td>Total</td>
</tr>
</tbody>
</table>

b) Indicate the percentage of simulator training time by the different Members of the Control Room Shift Team devoted to i) normal ii) abnormal and iii) emergency conditions in their continuous training programme.

- Time allocation for Continued Training Programme (Simulator Training Hours)

<table>
<thead>
<tr>
<th>Course</th>
<th>BTC Retraining</th>
<th>NTC General</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal Operation</td>
<td>15% (7-9 hrs.)</td>
<td>50% (16 hrs.)</td>
</tr>
<tr>
<td>Abnormal Operation</td>
<td>20% (9-11 hrs.)</td>
<td>35% (11 hrs.)</td>
</tr>
<tr>
<td>Emergency Case</td>
<td>65% (32-44 hrs.)</td>
<td>15% (5 hrs.)</td>
</tr>
<tr>
<td>Crew Training</td>
<td>10% (3 hrs.)</td>
<td>20% (4 hrs.)</td>
</tr>
<tr>
<td></td>
<td>30% (2.5 hrs.)</td>
<td>10% (0.5 hrs.)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Course</th>
<th>BTC</th>
<th>NTC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supervisor I</td>
<td>25% (4 hrs.)</td>
<td>25% (4 hrs.)</td>
</tr>
<tr>
<td>Supervisor II</td>
<td>20% (4 hrs.)</td>
<td>25% (4 hrs.)</td>
</tr>
<tr>
<td>Shift Operator Co-operation I</td>
<td>50% (4 hrs.)</td>
<td>25% (2 hrs.)</td>
</tr>
<tr>
<td>Shift Operator Co-operation II</td>
<td>25% (4 hrs.)</td>
<td>25% (2 hrs.)</td>
</tr>
</tbody>
</table>

8. What is the role and the policy of the Regulatory Body regarding the use of simulators for Control Room Operators licensing and training?

The operators of nuclear power plants in Japan have been trained and given practical experiences executed under the independent safety schemes of the utility companies since the
commencement of operation of a commercial nuclear power reactor in 1966. Their contents are equivalent to the training and practice in Europe and the United States. However, from the Example of the Three Mile Island accident, it is recognised that the necessity of long-term development of highly capable operators should be discussed. Then the matter of introduction of the qualification licensing system for operators was discussed. The amendment of the ministerial ordinance in Dec. 1980 stipulates that the operation supervisors who operate actual power reactors should be qualified persons with effect from June 1, 1982. The purpose of the practical operation skill examination is to judge whether an applicant has professional skills to perform actions required under troubled conditions as an operation supervisor. The examination is conducted using simulators by the practical operation skill examiner assigned by the assigned organisation prior to the examination.

9. a) **What standards (ANSI/ANS 3.5, IAEA, etc.) are simulators built to and maintained?**

   “ANSI/ANS 3.5” is used as a standard.

b) **What exceptions are typically taken to the standard?**

   Not particularly.

c) **What types of simulators are used that are not included in industry standards?**

   None. Simulation model is used at the training centre. No other types of simulators are used.

10. a) **Describe the role of part-task simulators in your current training programs.**

   Not used.

b) **Describe the role of special-purpose (analytic) simulators in your current training programs.**

   No special-purpose simulator is used.

11. **Have the current operator training programs been conditioned by the availability and capabilities of the simulator(s) or, alternatively, has(ve) the simulator(s) been specified and acquired after analysing and designing the training programs? Explain.**

   The training programmes and the capabilities of the simulators are related to each other significantly. The reasons are:
   1) The training programmes are prepared within the capabilities of the simulators, and
   2) On the other hand, when necessary, capabilities of the simulators will be upgraded so as to facilitate the running of the training programmes.

   In the case of NTC, No. 1 simulator is used mainly for the initial training, and No. 2 and No. 3 simulators are used for retraining. Because of the following reasons, the simulators are used in different ways based on the respective capability of the simulators and the purposes of the training:

   • The model plant for No. 2 and No. 3 simulators is a new generation plant. The simulator is modified for accommodating two-phase flow (liquids phase, vapour, non-condensing gas)
models built, which can be applied for training on accidents that are not considered in the design stage.

- The model plant of No. 1 simulator is an old generation plant. The automation in the plant is not advanced. Therefore, this simulator is suitable for learning the principle and the functions of a plant. The No. 1 simulator does not contain a two-phase flow model. However, for the initial training course where the advanced training on operation under accidental conditions are not required, this simulator has enough performance capability.

12. **What extensions of simulator training are envisaged for the future?**

The utilities are preparing the following future training extensions plan:

- Training on plant shutdown (Mid-loop operations of PWR) conditions (ensuring measures for maintaining reactor core cooling capabilities during plant shut-down), and
- Training on severe accident.

13. a) **Based on your experience, describe the uses of the simulators for activities other than training (plant drills, procedures validation, design changes validation, testing programs, acquisition of human data, licensing activities, reference plant systems “tuning”, etc.).**

Uses of simulators for activities other than training are as follows:

1) For qualification and actual skill examination for operation supervisors, and Actual skill examination using the simulators;
2) For research on human factors
   - Co-operation in experiments and data acquisitions as in the utilities’ co-operative research “Research on human factors that affect the safety of BWR” using simulators;
3) For confirming the changes in the operation procedures by actually operating the simulators (e.g. Family training); and
4) For special training of design engineers, test operation personnel and operation/management experts (MITI).

b) **What is the involvement of Control Room Operators for those applications?**

1) Uses for qualification and actual skill examinations for operation supervisors applied in actual skill examinations
2) Utilities co-operative research “Research on human factors that affect the safety of BWR”, etc.
3) For confirmation of the changes in the operation procedures, the operators confirm their adequacy by operating the simulators.

14. **What are the applications of simulator training for jobs other than Operations?**

Personnel other than the operators are given operational experience, and the behaviour is studied as a special training.

1) Senior specialists for nuclear power operation (liaison officers of MITI)
2) Engineers of the plant manufacturers
SECTION 3: Systematic Approach to Training: considerations regarding the use of simulators.

A) Training analysis.

1. **Are job and task analysis** (or any other type of task identification technique) **used for establishing a list of task, performance standards, learning objectives and training methods?**
   If yes, describe the technique used.

   - The job and the task of the operators are clearly defined in each utility and site. Currently, they are not analysed, and there is no need for their analysis.
   - The objectives of training of operators is to make them execute the job and perform the task adequately.

   (Note) “Job and task analysis” is interpreted as “the analysis of what the operator's job and task mean”

2. **a) What are the criteria that determine the limits or scope of the job analysis for the Control Room Operators?**

   - Outline of the scope of the job of the operators:
     - Operation Supervisors (Shift Supervisors):
       Monitoring of overall operations, and giving direction to as well as supervision of operators
     - Assistant Shift Supervisor:
       Assisting the operation Supervisors and providing guidance and support to the operators
     - Controller Operator:
       Monitoring and operation of the reactor, turbine and the generator
     - Assistant Controller (Assistant Operator):
       Patrolling of the site and the operation of the auxiliary equipment

   **b) From your point of view, what should the role of risk-based criteria be for determining such limits or scope? Explain your answers.**

   The risk criteria are not used to determine the scope of the job (job items) of operators.

3. **Are there any special requirements for Job and Task Analysis which are imposed by the possibility of associated simulator training?**

   At the training centre, the training is carried out for a “mixed team” of utility – trainees who have the same level of knowledge. During the training of the “mixed team”, the training is carried out by interchanging the role of operation-parts (reactor side, turbine side, the role of a chief, etc.). For the co-operative work of the operation-part, “basic teamwork activity” as of the actual shift team is required. Therefore, for carrying out the training, the trainees are required to perform “basic teamwork activity” according to the skill level of the trainees.

   (Note) Mixed Team – In all training courses other than Crew Training or Shift Staff Co-operation Course, an operation activity team is formed with 3 ~ 4 trainees for simulator training, and each trainee performs each individual operation part during the training.
B) Training programme design.

1. **What are the criteria for specifying simulator training rather than another training setting (classroom, laboratory, workshop, on-the-job, etc.)?**

   Settings of other trainings also have their own advantages. However, the simulation training in which the whole behaviour of a plant is simulated provides the best advantage to the trainees to learn the operation procedures and gain higher capabilities of recognition, judgement, action and countermeasures when the situation occurs. That is to say, it is the most suitable training for appreciating the whole plant behaviour and identifying the actions necessary.

2. **What are the criteria for selecting different types of simulator (full-scope, replica, part-task, basic principles, concept, special-purpose)?**

   There are replica simulators in BTC and NTC for the following reasons:
   1) According to these questionnaires, simulators used in the training are full scope replica (they have model plants) simulators. In a replica, there are all design data necessary for the manufacture of the replica and correct tuning is possible using test operation data. The replica precisely simulates the actual plant.
   2) Operators are required to act under various normal, abnormal and emergency situations. The replica simulator is necessary to revive these conditions.

3. **a) What are the criteria for selecting a replica simulator?**

   Various types of new/old plants are being operated at nuclear power stations. Typical plants are selected for generation of each simulator control panel.

   **b) What are the fidelity requirements?**

   When a simulator is constructed, the main control panels are simulated precisely based on a model plant. As for transient phenomena, simulator validity tests are carried out comparing with the safety analysis/start-up test data. It is confirmed that ANSI/ANS-3.5 standard is satisfied.

4. **What are the specific pre-requisites for operators undertaking simulator training?**

   Simulator training for operators are carried out mainly based on the following:
   1) Initial training
      When training programmes are established, it is decided in consultation with the organisation that sends the trainees, that the trainees to be qualified for application for training must have less operational experience and have not gained knowledge and technologies on plants, such as basic theories and general outlines of the plant equipment or operations. For making application, the personnel are to be selected by the organisations that send the trainees.
   2) Retraining
      For being qualified for application for the training programme, when developed, it is decided through discussion with the party sending the trainees that they must “be central control room operator or engaged in a similar job” and “have the knowledge/skill equivalent to or higher than that obtained at the end of another training course (to be taken prior to this training course)”. For making application, the personnel are to be selected by the organisations that send the trainees.
5. Does the possibility of simulator training impose any constraints on the definition of learning objectives?

1) As the start-up/shut-down or operational conditions may be less realistic during simulations, the trainees are instructed to have actual images as to how the equipment works at the site when they operate the simulators.
2) Grading-up of training, etc. (e.g. severe accidents and mid-loop operation of PWR plant) are being considered. For this, there must be a balance between the cost for modification of the simulators and training needs/effects.
3) For giving a better understanding of the contents of the training, various facilities are also used. The following is an example, for understanding the situation well, parameters used for the training are put into a computer for visualisation of the plant behaviour. These are shown again in the classroom.

C) Training programme development.

1. In the case of non-replica simulators, is it necessary to take parallel training actions, and if so, what kind?
   Explain your answer.

   Replica simulators.

2. Do you use specific procedures for the training simulator, actual plant procedures or a combination of both?
   Explain your answer and give reasons for the choice.

   Basically, it is the same as the actual plant.

3. What are the criteria for selecting normal, abnormal and emergency scenarios to be trained with simulators? Are they risk-based criteria?
   Explain your answer.

   In order to achieve the training objectives, the situations assumed in the procedures for actual plants and considered for the design are covered, and the accidents actually experienced in domestic or overseas plants are reflected to adapt the following scenarios as the effective ones.
   1) Normal conditions:
      All procedures for plant start-up/shutdown are covered. The training is focused on the main operational items and the whole operation sequences of plant start-up/shutdown processes are also covered.
   2) Abnormal conditions:
      All abnormal situations assumed in procedures in actual plants are picked up, and the training is given for measures against failures, etc. of the main equipment/control systems.
   3) Emergency conditions:
      The training is imparted for taking the basic actions when a plant is tripped or for actions for a plant-trip because of multiple accidents.

   These can not be called risk-bases. However, referring to domestic or international accident experiences, etc., more realistic scenarios are considered.
4. **How are lesson plans and support documentation developed for simulator training?**

The following lesson plans and instruction support materials are prepared for each training course.

1) Training execution standard:
   The objectives of the simulator training/class room training, textbooks, the execution procedures and comments are written for each training course.

2) Training time schedule:
   Training items are specified for each day of the training courses.

3) Simulator training guidelines:
   The items of training are mentioned for each day of training corresponding to the training time schedule.

4) Simulator training menu:
   Corresponding to the training guidelines, the scenarios to be used, the time schedule, notes for instructors, etc. are described.

5) Simulator training (Test)
   Support seat: Check-sheets including actions the trainees need to take corresponding to the test scenarios

6) Training results report:
   Evaluation results of the final training examinations are sent to the employer of the trainees.

D) Training programme implementation.

1. **What selection, initial training, and continuing training is arranged for simulator instructors?**

   - Instructors include assignees from the utilities/plant manufacturers and “proper” instructors directly employed by the training centre.
   - Assigned instructor
     1) The utilities select the assignees from among those who have experience as shift managers or equivalent experience.
        The plant manufacturers select the assignees from among those who have experience in construction, test operation, design or equivalent fields and have professional knowledge, skills and experiences for providing instruction to operators covering overall nuclear power stations.
     2) After initial three months' training (observation of the training, good understanding of simulator operations, etc.), they are qualified as instructors.
     3) Mutual technological exchanges among the training instructors (OJT)
   - Proper instructors
     1) After being employed, they are trained by the plant manufacturers (to provide experiences in design department and test operations).
     2) After the training at the training centre (observation of training, understanding of simulator operations and training with a senior instructor), they are assigned as instructors.
     3) Mutual technological exchanges among the training instructors (OJT) and refreshment through shift training at the nuclear power stations.
2. What are the arrangements for instructor monitoring of, and feedback to, trainees during simulator sessions?

- Monitoring of the equipment
  1) ITV equipment: to clearly observe the operation behaviours of the trainees from the instructor room far from the control panels and to give adequate directions to the trainees
  2) Record of operation history: operation history can be reviewed on line, and hard copies are used for reviewing after the operation
  3) Event trend graphics: to show the major changes in the plant parameters and to review the relationships among plant behaviours and operations
  4) Interview: to ascertain the situations or the impressions of the trainees during the review after the operation
- Feedback
  Instructors monitor the operation conditions and the situation of the plants, during simulator training, and evaluate the performances of the trainees based thereon.

3. a) What specific training modes such as simulator freeze, playback, running at higher speed than real time, activity recording, video recording, etc. is made use of during initial training?

b) What specific training modes such as simulator freeze, playback, running at higher speed than real time, activity recording, video recording, etc. is made use of during continuous training?

Response applicable to both 3. a) and b).

The modes of the main training in initial training/continued training are as follows:
1) Simulator freeze: Confirmation of behaviours at freeze during the training (repetition of run and freeze)
2) Setting-back: Repeat after the operation and adjustment of procedures
3) Replay: After operations, simulator behaviours are replayed to confirm the events
4) Video: The action of the trainees action are recorded for review in the classroom
5) Operation history/trend graphics: Used for review after the actions or for discussions at the classroom

4. What limits of simulation impede planned training sessions or examination scenarios?

Not particularly.

E) Trainee assessment.

1. a) What methods and procedures are used for initial trainee assessment during and after simulator sessions?

b) What methods and procedures are used for continuous trainee assessment during and after simulator sessions?

Response applicable to both 1. a) and b).

(BTC)
Trainees are evaluated in both the initial training and the continued training according to the following procedures:
1) Evaluation during the training
Instructors observe the trainees by the training monitor, etc. during the training, and evaluate as to whether their actions are adequate. The evaluations are fed back to the trainees at any time.

2) Evaluation at the end of the training
At the end of the training, the trainees are evaluated by “written examinations” and “operational tests”.
At the “operational test”, a total of three including a manager-class staff and chief/sub-chief instructors evaluate the trainees.
After the examinations, discussion is made among the three evaluators on the evaluation of each trainee.

(NTC)
1) For the initial training:
- During the training:
  A chief instructor evaluates the performances of the training. Trainees take the first written examinations in the middle of the training.
- At the end of the training:
  Trainees take an overall practical-skill examination. A chief instructor evaluates the results.
  Trainees take overall written examinations. A chief instructor makes an overall evaluation, combining the above individual evaluations.

2) For the evaluation of the retraining:
- Two instructors including a chief and a deputy chief instructors evaluate the performances during normal operation, abnormal transient changes and accidental situations.
- For a specific accident event, the differences from the action-performances during standard events are evaluated by a computer system for improved performance.

2. List and describe the main areas or groups of skills and knowledge of the trainee assessed in training simulators (for example: “control board awareness, event diagnosis, immediate actions / entry-level actions, subsequent actions, control board manipulations, use of procedures / technical specifications / reference data, communications, supervisory ability, team skills” (IAEA-TECDOC-525)).
Identify, when applicable, the types of simulator used for addressing each one.

1) Initial training/re-training
   <operational actions>
   - correct and quick actions
   - understanding of the operational procedures
   - corresponding action (corresponding ability)
   - monitoring of the related parameters (multiple-monitoring)
   - measures corresponding to alarms
   - finding of causes
   - understanding of the site and the follow-up
   - judgement and prediction of the site
   - priority and timing
   <operational attitudes>
   - prudence
   - calmness
   - positiveness and subjecthood
   - consciousness about safety assurance
   - teamwork (co-operation, responses, reactions)
• pointing-out and announcement
• communication and reporting

2) Senior-class staffs or supervisor training
• monitoring of related parameters (multiple monitoring)
• measures corresponding to alarms
• findings of the causes
• understanding and follow-up of the site
• priority and timing
• judgement of the situation
• judgement/prediction of measures and results
• leadership
• direction and order
• information acquisition
• prudence
• calmness
• positiveness and subjecthood
• consciousness about safety assurance
• action and attitude of directing correspondence
• communication and reporting

3. Describe the ranking of importance, if any, given to the main areas or groups of skills and knowledge taken into account for a trainee assessment.

Not particularly.

4. a) Based on your experience, describe difficulties you have had for assessing the individual skills and knowledge of a trainee while operating within a whole Control Room Shift Team during simulator sessions.

b) Describe the measures adopted to overcome these difficulties.

Response applicable to both 4. a) and b).

In the shift-team training, instructors do not evaluate individual skills of each trainee.

5. a) Based on your experience, describe influences on trainees performance during simulator sessions resulting from the attendance of personnel such as utility managers, regulatory body inspectors, etc.

There are no major differences in the performances.

b) Based on your experience, describe influences on trainees performance during simulator sessions resulting from the attendance of personnel such as utility managers, regulatory body inspectors, etc.

An instructor room is surrounded by semi-transparent glasses and the trainees can not see the inside. Contacts to assistant operators, managers and outside personnel are made by telephone or paging. It is observed that instructors do not affect the performances of trainees. Instructors do not support the trainees unless they face a deadlock.
6. a) Are training simulator examinations used in order to grant initial license to operators? Explain.

There is no official licensing system except for operation supervisors.

b) Are training simulator examinations used for requalification? Explain.

Simulator examinations are used for training to renew the operation supervisor’s qualification.

7. How is examination integrity preserved during the examination/scenario preparation period?

As to practical-skill examinations for operation supervisors' qualification, the examination items are disclosed just prior to the examinations. Therefore, it is impossible for the examines and the instructors to know the contents of the examination.

8. What performance monitoring or data acquisition features of the simulator are used during simulator examinations?

Confirmation during operational examinations is carried out in the following ways:

- Direct observation of the conversations and actions of the trainees
- Monitoring of the plant conditions through CRTs, etc.
- In some cases, “operation history” records functions are used.

F) Training programme evaluation.

1. Describe the approach used for evaluating the simulator training programme and main results.

- Evaluation results of the trainees
- Opinions of the assigned instructors
- The training programme and the results are evaluated based on opinions of the trainees (listening to discussion at a review meeting and through questionnaires). The opinions of the employer of the trainees are included in the evaluation of the simulator training programmes.

2. What programme is in place for validation and continuous verification of the simulator performance?

- Simulator evaluation results as the qualifications of the operators and the assigned practical-skill examination facilities are transferred to the qualifying organisation “Thermal and Nuclear Power Plant Engineering Society” and given the assignment.
- In case of a major modification to the simulators, the result of simulator performance confirmation after the modification is reported to the Thermal and Nuclear Power Plants Engineering Society.
- The simulator facilities are maintained periodically, and the performances and the functions are checked.
3. **What types of performance discrepancies are most frequently identified by operators during training sessions?**

There are no significant discrepancies, however there are the following examples where the trainees find their mistakes by themselves:
- Operation of a wrong switch adjacent to the correct one unconsciously and so on (trainees find the mistake fairly quickly).
- The correct operation could not be made without knowing that the situation became worse (later on, the trainees find out the fact because of worse situation).
- Wrung judgement of operations that results in unexpected progress in the situation (trainees find out the fact later on because of worse situation).

4. **What types of performance discrepancies are most frequently identified by examiners or inspectors?**

There are no significant discrepancies, however there are examples as follows where errors are found by the examiners during the examinations:
- Late judgement because of lack of information about the situation
- Wrong announcement to the trainees
- Lack of information exchanges because of inadequacy of transferred information or because of transmission of information when the receiver is not in a suitable condition to receive the information.

SECTION 4: Use of operating experience for operator training with simulators.

1. **How is operational experience feedback incorporated into the design of simulator training programs (experience reviewed, schedule, people involved)?**

- As for domestic and overseas operational experiences, particularly the information related to troubles are obtained.
  - Examples:
    1) Nuclear Power Experiences (USA)
    2) Operation management Annual Report (MITI)
    3) Information directly obtained from individual domestic nuclear power stations
- The training centre continuously develops training scenarios based on this trouble information, so that significant events can be simulated by the simulators.
- The menu of the training scenarios covered in each training course is periodically renewed reflecting the latest trouble trend.
- If any fault is found in the training scenarios in any training course, modifications are made in each occasion.

2. **Has your organisation developed any kind of programme by which simulator operator training is correlated with real operating events? Explain.**

The incidences that actually occurred are reflected in the training programmes in order to revive, principally, the same or similar events in the training. If there is no adequate malfunction mode, a new programme is developed when necessary.

Example:
- 1) Events related to stability of reactor
  - Malfunctions were developed after the incidences happened in overseas operations and they were included in the training scenarios of different training courses.
2) Events related to system stability
   After some events happened domestically, the training is focused on these scenarios in the
   seasons when electricity demand shows high peaks every year.
3) Events related to the damages to the re-circulation pumps (BTC)
   The training programme was modified for various training courses focusing on the judgement
   of the incidents at early stages when only minor signs appear.

SECTION 5: Specific topics on Operator training with simulators.

A) Team training techniques.

1. a) Are job and task analyses used for defining the role and responsibilities of the
   Members of the Control Room Shift Teams and, in general, of the various levels of
   staff who are charged with operation of the plant? Explain your answer.

   Operators' job and tasks are defined in each utility and nuclear power station.

   b) Are job and task analyses used for establishing performance standards, learning
   objectives and training methods for Team skills training?
   Explain your answer.

   Operational roles of the shift team operators are defined in individual operation manual
   (procedures). The training programmes of the training centre are so established that the
   required operational skills can be developed and maintained by the related operation
   manual.

2. List and describe Team skills (communication, management of resources, team
   co-operation, team leadership, feedback, conflict resolution, team decision-making,
   etc.) which are trained using simulators. Identify, when applicable, the types of
   simulator used for training each one.

   Team skills to be given training on, during the training courses at the training centre are listed
   below:
   • Teamwork;
   • Communication and Reporting;
   • Leadership (direction and supervision); and
   • Uses of resources

   Types of simulators used in the training centre are replica simulators.

3. Are any guides used for conducting and evaluating Team skills training simulations?
   Explain your answer.

   In a certain utility company, the tam skill training (e.g. crew training) is managed and
   evaluated based on some guideline. The guideline defines the following terms:
   • Training objectives;
   • Training items and the contents of the training;
   • Training scheme;
   • Preparation of a training plan;
   • Evaluation at the end of the training; and
   • Preparation and submission of the training report
4. Based on your experience, describe advantages and disadvantages of Team training with the participation of the same (usual) Members every time or with changes in the Shift Team compositions.

- Team training (same members)
  
  **Advantages:**
  1) Direction and ordering system or the role of each operator becomes clear
  2) The shift supervisor can confirm the capability and characters of his staff. Crew members can be more aware of one another’s capabilities and characters.
  
  **Disadvantages:**
  While the role of each staff becomes clear, they can perform only their own jobs.

- Team training (in case of change in composition)
  
  **Advantage:**
  Operators can develop a good understanding of the roles of others because the operators can play their roles with the change of their jobs (part) (particularly, this is suited to the younger generations)
  
  **Disadvantage:**
  As the capability of each individual is not confirmed, the operational actions are affected by the capability of each individual.

5. Are simulator sessions used for the optimisation of control Room Team Shifts taking into account the characteristics (aptitudes, attitudes, ...) of each Operator? In other words, are simulator sessions used for deciding which Members are going to constitute each Shift Team? Explain your answer.

Not used directly. An operational team consists of an adequate number of members so that the capability of each operation team is balanced in terms of experience, skills, daily attitude and adequacy. In some cases, the training results are referred to at the time of deciding the compositions, but they are not used as a basis.

6. Are there any licensing examinations applied to the whole Control Room Shift Team in addition to the individual licensing examinations? Explain.

There is no licensing examination applicable to all the shift teams of a centre control room. In Japan, there is a national licensing examination for the operation supervisors.

B) Training for stress.

1. Is any part of the simulator training programme specifically devoted to train Control Room Operators to operate under stress? Explain your answer.

   - Time stress:
     When operators perform actions after the event happens, the actions are required to be delayed or hastened on directions from outside.
   
   - Lighting stress:
     When a fault in the electricity grid system is added to the main events, it becomes dark.
   
   - Event combining stress:
     Main independent faults are caused sequentially. Main events have the potential to exist in sub-events, etc.
2. Are stress levels induced and measured during simulator training sessions? 
If yes, describe the methods and results.

During the training, communications with site operators or the outside are simulated by
instructors. The behaviours at that time are thought to have the effects of increasing the stress.
Any plan of quantitative “measurement” of stress level is not executed. However, instructors
always monitor the behaviours of the trainees and observe the stress levels to provide guidance.

3. Based on your experience describe any measures adopted during simulator training
to counter stress.

The following are the guidelines for guidance for training on measures to counter stress:
• Put priority on grasping the pant situations rather than quick actions under accident
conditions.
• Make trainees point out and announce each operation for calm and assured implementation
of the actions.
• Make trainees avoid concentrating work loads on themselves

C) The theoretical basis underlying training.

1. Are any models of human behaviour being used in designing and implementing
training programmes? 
If yes:
   i) refer to or describe the models,
   ii) indicate the areas in which these models are being applied (for example:
signal detections, decision-making, etc.)
   iii) give the main results.

• Rasmussen’s human action model (divided into three levels of skills/rules/knowledge) is
taken into consideration.
• The guidelines of the training are reflected in the guidance.
• The following items are defined as evaluation items of operation performance examinations.
   1) Ensured and quick operation, pointing-out and announcement: skill base
   2) Understanding of operation procedures: rule base
   3) Consciousness about multiple monitoring to maintain safety, judgement of the situation:
      knowledge base

D) Habits acquired during training sessions with simulators.

1. Describe, based on your experience, undesirable habits which could be acquired by
trainees during training sessions with simulators (for example: due to limited
number of simulated scenarios, due to lack of physical or functional fidelity, due to
the use of conservative codes for simulation instead of best estimate codes, etc.) and
discuss their potential consequences on safety.

• As to the accuracy of the simulation, it is confirmed that it meets ANSI standards. The
simulator is thought to have enough accuracy to affect the plant safety.
• Three types of simulators that reflect the plant design generations are installed in the
training centre so that the trainees can have simulator training, simulating their plants. In
case there are some differences in detailed items among plants, efforts are made to get the
trainees understand the meaning of the differences. However, as the differences are minor, it
is thought that they do not have any influence on the plant safety.
2. Describe, based on your experience, any measures adopted to avoid acquisition of those undesirable habits or to prevent use of them.

Three types of simulators that reflect the plant design generations are installed in the training centre so that the trainees can have simulator training, simulating their plants. In case there are some differences in detailed items among plants, efforts are made to get the trainees understand the meaning of the differences. However, as the differences are minor, it is thought that they do not have any influence on the plant safety.

E) Simulator training on normal and emergency conditions during shutdown and low power operation.

1. What use is made of simulators for Control Room Operator training in normal, abnormal and emergency conditions during shutdown and low power operation (simulated scenarios, trained skills, training techniques, ...)?

- During normal shutdown process of plant, 30-50 intermediary conditions are registered as initial conditions of the simulators. These interim conditions are registered to repeat implementations of the principal operation of the main items (critical operation of a reactor, turbine start-up, generator parallel alignment, change of water feed pump, etc.). It is also possible to continuously execute the start-up and shutdown operations from a cool thermal shutdown condition to an operation condition with a unit capacity.
- For normal start-up and shutdown processes, the training is conducted reflecting the operation experiences based on acquired trouble information. Example: The operations significant for criticality management, such as maintaining and monitoring of sub criticality and recriticality operation (example of BWR) are focused in each training course.

2. What are the criteria (risk-based criteria, deterministic criteria, results of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?

For shutdown condition and normal and emergency conditions under low power operations it is standard to conduct skill training using simulators on operation items described in operation manuals of the actual plants.

3. Are job and task analysis (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on shutdown and low power operation? Explain.

The training centre establishes the training programmes in such a way that normal operations can be executed according to operation manuals, and actions during trouble can be implemented.

4. What are your plans for the future in this area?

The future extension plan is as follows: Mid-loop operation at shutdown (PWR)
F) Simulator training on severe accidents.

1. **What use is made of simulators for Control Room Operator training in severe accidents (simulated scenarios, trained skills, training techniques, ...)?**

   Currently, the training mode for severe accident is not prepared. Current training covers prediction-based and event-based procedures under accidental conditions with more events than those considered in the design and in the training for preventing core from melting.

2. **What are the criteria (risk-based criteria, deterministic criteria, result of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?**

   The simulator training for severe accidents is being discussed along with its necessity in the utilities.

3. **Are job and task analysis (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on severe accidents. Explain.**

   Not used.

4. **What are your plans for the future in this area?**

   Utility companies are discussing on the severe accident training including its necessity.

G) Simulator training on accidents caused by fires, floods, earthquakes, etc.

1. **What use is made of simulators for Control Room Operator training in accidents caused by fires, floods, earthquakes, etc. (simulated scenarios, trained skills, training techniques, ...)?**

   - Manuals for fire are prepared at the power stations. The training centre establishes the training programmes in such a way that the training on action can be executed base on the manuals. Especially, the fire events in actual plants are used as training scenarios.
   - For floods, the training is prepared assuming a tidal wave. For instance, training scenarios assuming that the entire coolant of the condensers and the auxiliary equipment are lost due to a tidal wave.
   - Earthquakes are used as event-cause for many “multi-malfunctions” at various levels. For instance, by assuming that the safety functions are lost due to earthquakes, many training scenarios (training applied ERG/EPG, etc.) under accidental conditions are prepared.

   EOP: Emergency Operating Procedure
   EPG: Emergency Procedure Guideline

2. **What are the criteria (risk-based criteria, deterministic criteria, result of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?**

   Training on fires, floods and earthquakes, etc. is executed, because training under various conditions are necessary.
3. Are job and task analyses (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on accidents caused by fires, floods, earthquakes, etc.? Explain.

   Not used.

4. What are your plans for the future in this area?

   It is considered that actions during fires, floods or earthquakes should be perfect. However, the implementation of simulator training faces difficulties in determining the assumed sizes, etc. and there exists no break-down planning at the present.
QUESTIONNAIRE

SECTION 0: Organisation/s replying to the questionnaire

1. Name of Organisation/s.
   Korea Atomic Energy Research Institute

2. Contact Person/s.
   B.S. Sim

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SECTION 1: General Information (related to the whole country)

1. Number of nuclear reactors (Units) in operation.
   10

2. Number of Sites with at least one Unit in operation.
   4

3. Number of full-scope (replica and no replica) simulators used for operator training.
   3

4. Number of replica simulators used for operator training.
   2

5. Number of part-task simulators used for operator training.
   0

6. Number of basic principles simulators used for operator training.
   1

7. Number of concept simulators used for operator training.
   0
8. Number of special-purpose simulators used for operator training.

0

9. For how many Units is the training done on replica training simulators?

All 10 units.

10. For how many Units is the training done on full-scope (replica and no replica)
training simulators.

All 10 units.

IMPORTANT QUESTION

Are your answers to the subsequent sections (2 to 5) of the questionnaire related to a specific Organisation or Training Centre in your Country?

Yes  X  No__ (Mark your answer with an X)

If yes, indicate the name of the Organisation or Training Centre and describe briefly the simulation facility referred to in answer to the question below (f.i. located on-site or off-site, type of simulator/s, sample photograph, reference NPP/s, NPP/s which receive training in this facility, size and composition of the simulator instructional and support staff, etc.) and, also, describe this/these NPP/s (f.i. type (PWR, BWR, etc.), vendor, start of operation, degree of automation, Operators which constitute the Control Room Shift Team, sample photograph of the control room/s, etc.).

• Nuclear Training Centre at Kori site
  Simulator #1, PWR type
  Simulator #2, PWR type – reference plant: Young Kwang #3, #4
• UlJin site
  Simulator #3 PWR type – reference plant: UlJin #1, #2
• Kaeri site
  Compact Nuclear Simulator, PWR type – reference plant: Kori #3, #4

SECTION 2: Current practices with simulators closely related to operator training.

1. Based on your experience, describe advantages and disadvantages of the location of the Simulation Centre with regard to the plant: on-site versus off-site. Specifically, describe those factors which have some influence on the Operators’ attitude towards the simulator training and in the quality of the simulator training.

Advantages and disadvantages are unknown.
2. a) During simulator training sessions, what factors (time, communications, etc.) influencing the interactions between Control Room Operators and other Plant Personnel (Operations Department outside of Control Room Personnel, Maintenance or Instrumentation, and Control Departments, Technical Support Centre, etc.) are simulated?

No (instructors play other plant personnel).

b) Do these other Plant Personnel participate in the training sessions? 
Describe the present training format pertaining to involvement of non Control Room Personnel in simulator training sessions and explain why this format is used.

No; non applicable.

3. What environmental conditions (normal and emergency lighting, humidity, noise, vibrations, sounds generated by equipments, etc.) that could be experienced by the reference plants, are usually simulated in the Simulator Rooms? Describe the use of such effects at your simulator centre and explain why they are, or are not, incorporated into simulator training sessions.

No; non applicable.

4. Do Control Room Operators receive simulator training for operations outside the Control Room, for example: operations from Remote Shutdown Panels? Describe this type of training as it exists at your Simulator Centre and explain why it is, or is not, used in training sessions.

No.

5. a) How frequently are the changes taking place in plant (plant design changes, procedures changes, etc.) incorporated to the replica or full-scope simulator? Describe any process or mechanism in place at your Simulator Centre to incorporate changes to the replica or full-scope simulator.

Unknown.

b) Do simulator model modifications require separate approval while the simulator is being used for training?

No.

6. a) Identify the members of the Control Room Shift Team (Reactor Operators, Turbine Operators, Shift Supervisors, etc.) and indicate the time (in hours) dedicated to simulator training by each member in their initial training programme. Specify, when applicable, the time spent with each type of simulator.

5 members, about 4-6 months.
b) Indicate the time (in hours) dedicated to simulator training by each member of the Control Room Shift Team in their continuous training programme. Specify, when applicable, the time spent with each type of simulator.

8 weeks/year.

c) What is the minimum time, if any, required by the Regulatory Body?

The minimum time is not specified.

7. a) Indicate the percentage of simulator training time by the different Members of the Control Room Shift Team devoted to i) normal, ii) abnormal and iii) emergency conditions in their initial training programme.

i) normal: 50%
ii) and iii) abnormal and emergency: 50%

b) Indicate the percentage of simulator training time by the different Members of the Control Room Shift Team devoted to i) normal ii) abnormal and iii) emergency conditions in their continuous training programme.

i) normal: 20%
ii) abnormal: 30%
iii) emergency: 50%

c) What are the minimum percentages, if any, required by the Regulatory Body?

It is not specified.

8. What is the role and the policy of the Regulatory Body regarding the use of simulators for Control Room Operators licensing and training?

For licensing reactor operator for the first time, individual simulator tests are required.

9. a) What standards (ANSI/ANS 3.5, IAEA, etc.) are simulators built to and maintained?

b) What exceptions are typically taken to the standard?

c) What types of simulators are used that are not included in industry standards?

10. a) Describe the role of part-task simulators in your current training programmes.
b) Describe the role of special-purpose (analytic) simulators in your current training programmes.

Kaeri has a plant analyser, however it is not used for operator training.

11. Have the current operator training programmes been conditioned by the availability and capabilities of the simulator(s) or, alternatively, has(ve) the simulator(s) been specified and acquired after analysing and designing the training programmes? Explain.

Unclear question.

12. What extensions of simulator training are envisaged for the future?

Each site will have at least one simulator.

13. a) Based on your experience, describe the uses of the simulators for activities other than training (plant drills, procedures validation, design changes validation, testing programmes, acquisition of human data, licensing activities, reference plant systems “tuning”, etc.).

   e.g. procedures validation.

b) What is the involvement of Control Room Operators for those applications?

   Reviewer.

14. What are the applications of simulator training for jobs other than Operations?

   For improving the qualifications of technical staff, simulator training is a useful method.

SECTION 3: Systematic Approach to Training: considerations regarding the use of simulators.

A) Training analysis.

1. Are job and task analysis (or any other type of task identification technique) used for establishing a list of task, performance standards, learning objectives and training methods?

   If yes, describe the technique used.

   No; these techniques are not used in Korea.

2. a) What are the criteria that determine the limits or scope of the job analysis for the Control Room Operators?

   Unclear question.
b) From your point of view, what should the role of risk-based criteria be for determining such limits or scope? Explain your answers.

Unclear question.

3. Are there any special requirements for Job and Task Analysis which are imposed by the possibility of associated simulator training?

To identify any special requirements, operator interview (or questionnaire) is recommended.

B) Training programme design.

1. What are the criteria for specifying simulator training rather than another training setting (classroom, laboratory, workshop, on-the-job, etc.)?

The important criteria is a feedback of practical operating experience.

2. What are the criteria for selecting different types of simulator (full-scope, replica, part-task, basic principles, concept, special-purpose)?

It depends on the purpose and scope of the training.

3. a) What are the criteria for selecting a replica simulator?

Unclear question.

b) What are the fidelity requirements?

Unclear question.

4. What are the specific pre-requisites for operators undertaking simulator training?

A good knowledge of plant systems.

5. Does the possibility of simulator training impose any constraints on the definition of learning objectives?

No.

C) Training programme development.

1. In the case of non-replica simulators, is it necessary to take parallel training actions, and if so, what kind? Explain your answer.

No; replica simulators are used to train operators in Korea.

2. Do you use specific procedures for the training simulator, actual plant procedures or a combination of both? Explain your answer and give reasons for the choice.

Reference (or actual) plant procedures are used. For realistic training, these are recommended.
3. **What are the criteria for selecting normal, abnormal and emergency scenarios to be trained with simulators? Are they risk-based criteria? Explain your answer.**

   It depends on a designed training programme.

4. **How are lesson plans and support documentation developed for simulator training?**

   Instructors have developed them on the basis of training experience.

**D) Training programme implementation.**

1. **What selection, initial training, and continuing training is arranged for simulator instructors?**

   Unclear question.

2. **What are the arrangements for instructor monitoring of, and feedback to, trainees during simulator sessions?**

   - Eye observation is used for monitoring of a trainee.
   - Interview (or discussion) is done during training (or after training).

3. a) **What specific training modes such as simulator freeze, playback, running at higher speed than real time, activity recording, video recording, etc. is made use of during initial training?**

   Those methods are often used.

b) **What specific training modes such as simulator freeze, playback, running at higher speed than real time, activity recording, video recording, etc. is made use of during continuous training?**

   Those methods are often used.

4. **What limits of simulation impede planned training sessions or examination scenarios?**

   The types of malfunctions. More various malfunctions should be developed.

**E) Trainee assessment.**

1. a) **What methods and procedures are used for initial trainee assessment during and after simulator sessions?**

   Expert judgement of instructors is often used for assessment.

b) **What methods and procedures are used for continuous trainee assessment during and after simulator sessions?**

   Expert judgement of instructors is used.
2. List and describe the main areas or groups of skills and knowledge of the trainee assessed in training simulators (for example: “control board awareness, event diagnosis, immediate actions / entry-level actions, subsequent actions, control board manipulations, use of procedures / technical specifications / reference data, communications, supervisory ability, team skills” (IAEA-TECDOC-525)). Identify, when applicable, the types of simulator used for addressing each one.

Event diagnosis, supervisory ability, immediate actions; full-scope (or replica) training.

3. Describe the ranking of importance, if any, given to the main areas or groups of skills and knowledge taken into account for a trainee assessment.

1) event diagnosis
2) immediate actions
3) subsequent actions

4. a) Based on your experience, describe difficulties you have had for assessing the individual skills and knowledge of a trainee while operating within a whole Control Room Shift Team during simulator sessions.

Criteria (or basis) for assessing a trainee is not obvious.

b) Describe the measures adopted to overcome these difficulties.

Expert judgement is used.

5. a) Based on your experience, describe influences on trainees performance during simulator sessions resulting from the attendance of personnel such as utility managers, regulatory body inspectors, etc.

Unnatural actions are often induced.

b) Based on your experience, describe influences on trainees performance during simulator sessions resulting from the attendance of personnel such as utility managers, regulatory body inspectors, etc.

These are often obstruct natural actions of trainees.

6. a) Are training simulator examinations used in order to grant initial license to operators? Explain.

Yes; see nº8, Section 2.

b) Are training simulator examinations used for requalification? Explain.

No; however, licensed operators should participate in periodic education programmes for requalification. A licensed qualification is valid for five years.
7. How is examination integrity preserved during the examination/scenario preparation period?

Question unclear.

8. What performance monitoring or data acquisition features of the simulator are used during simulator examinations?

Video recording and simulator recording are often used.

F) Training programme evaluation.

1. Describe the approach used for evaluating the simulator training programme and main results.

Operator interview is used. Their comments are useful for the training programme development.

2. What programme is in place for validation and continuous verification of the simulator performance?

Instructors run training simulators and evaluate test results.

3. What types of performance discrepancies are most frequently identified by operators during training sessions?

Situation awareness or mistakes are induced frequently.

4. What types of performance discrepancies are most frequently identified by examiners or inspectors?

Perhaps diagnostic failures of trainees.

SECTION 4: Use of operating experience for operator training with simulators.

1. How is operational experience feedback incorporated into the design of simulator training programs (experience reviewed, schedule, people involved)?

Similar malfunctions are activated during simulator training.

2. Has your organisation developed any kind of programme by which simulator operator training is correlated with real operating events? Explain.

No; however instructors’ feedback important plant events in simulator training programme.
SECTION 5: Specific topics on Operator training with simulators.

A) Team training techniques.

1. a) Are job and task analyses used for defining the role and responsibilities of the Members of the Control Room Shift Teams and, in general, of the various levels of staff who are charged with operation of the plant? Explain your answer.

Those analysis are not carried out in Korea.

b) Are job and task analyses used for establishing performance standards, learning objectives and training methods for Team skills training?

Explain your answer.

No; see n°1 a).

2. List and describe Team skills (communication, management of resources, team cooperation, team leadership, feedback, conflict resolution, team decision-making, etc.) which are trained using simulators. Identify, when applicable, the types of simulator used for training each one.

Question unclear.

3. Are any guides used for conducting and evaluating Team skills training simulations? Explain your answer.

We do not have any guides.

4. Based on your experience, describe advantages and disadvantages of Team training with the participation of the same (usual) Members every time or with changes in the Shift Team compositions.

Good communication between team members will be done.

5. Are simulator sessions used for the optimisation of control Room Team Shifts taking into account the characteristics (aptitudes, attitudes, ...) of each Operator? In other words, are simulator sessions used for deciding which Members are going to constitute each Shift Team?

Explain your answer.

No; the purpose of training simulator is to improve the qualification of operators.

6. Are there any licensing examinations applied to the whole Control Room Shift Team in addition to the individual licensing examinations?

Explain.

No; to get a license, each operator should pass training simulator examinations.
B) Training for stress.

1. Is any part of the simulator training programme specifically devoted to train Control Room Operators to operate under stress? Explain you answer.

Operators’ stress can be induced through the control of the level of malfunctions.

2. Are stress levels induced and measured during simulator training sessions? If yes, describe the methods and results.

No; those have not approached yet.

3. Based on your experience describe any measures adopted during simulator training to counter stress.

We have no special experience.

C) The theoretical basis underlying training.

1. Are any models of human behaviour being used in designing and implementing training programmes? If yes:
   i) refer to or describe the models,
   ii) indicate the areas in which these models are being applied (for example: signal detections, decision-making, etc.)
   iii) give the main results.

No.

D) Habits acquired during training sessions with simulators.

1. Describe, based on your experience, undesirable habits which could be acquired by trainees during training sessions with simulators (for example: due to limited number of simulated scenarios, due to lack of physical or functional fidelity, due to the use of conservative codes for simulation instead of best estimate codes, etc.) and discuss their potential consequences on safety.

None that I know of.

2. Describe, based on your experience, any measures adopted to avoid acquisition of those undesirable habits or to prevent use of them.

None that I know of.
E) Simulator training on normal and emergency conditions during shutdown and low power operation.

1. **What use is made of simulators for Control Room Operator training in normal, abnormal and emergency conditions during shutdown and low power operation (simulated scenarios, trained skills, training techniques, ...)?**

Various malfunctions are activated by instructors.

2. **What are the criteria (risk-based criteria, deterministic criteria, results of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?**

Question unclear.

3. **Are job and task analysis (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on shutdown and low power operation? Explain.**

No; these analyses are not carried out in Korea.

4. **What are your plans for the future in this area?**

None that I know of.

F) Simulator training on severe accidents.

1. **What use is made of simulators for Control Room Operator training in severe accidents (simulated scenarios, trained skills, training techniques, ...)?**

Full-scope simulators, which simulate various severe incidents/accidents, are used for training.

2. **What are the criteria (risk-based criteria, deterministic criteria, result of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?**

Question unclear.

3. **Are job and task analysis (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on severe accidents. Explain.**

No; these analyses are not carried out in Korea.

4. **What are your plans for the future in this area?**

None that I know of.
G) Simulator training on accidents caused by fires, floods, earthquakes, etc.

1. What use is made of simulators for Control Room Operator training in accidents caused by fires, floods, earthquakes, etc. (simulated scenarios, trained skills, training techniques,...)?

   These kinds of accidents are not simulated on Korean full-scope simulators.

2. What are the criteria (risk-based criteria, deterministic criteria, result of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?

   Question unclear.

3. Are job and task analyses (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on accidents caused by fires, floods, earthquakes, etc.?

   Explain.

   These analyses are not carried out in Korea.

4. What are your plans for the future in this area?

   None that I know of.
QUESTIONNAIRE

SECTION 0: Organisation/s replying to the questionnaire

1. Name of Organisation/s.
   Tecnatom, S.A.

2. Contact Person/s.
   Mr. Alain Cardoso

3. Address and contact information (telephone, fax).
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   Madrid
   Tel: 34-1-651.67.00
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SECTION 1: General Information (related to the whole country)

1. Number of nuclear reactors (Units) in operation.
   Nine (9).

2. Number of Sites with at least one Unit in operation.
   Seven (7).

3. Number of full-scope (replica and no replica) simulators used for operator training.
   Two (2) in Tecnatom (Spain) and two (2) abroad (USA and Brazil).

4. Number of replica simulators used for operator training.
   One (1).

5. Number of part-task simulators used for operator training.
   None (0).

6. Number of basic principles simulators used for operator training.
   None (0).

7. Number of concept simulators used for operator training.
   None (0).
8. Number of special-purpose simulators used for operator training.

Four (4) Interactive Graphic Simulators (SGIs).

9. For how many Units is the training done on replica training simulators?

One (1).

10. For how many Units is the training done on full-scope (replica and no replica) training simulators.

Nine (9).

IMPORTANT QUESTION

Are your answers to the subsequent sections (2 to 5) of the questionnaire related to a specific Organisation or Training Centre in your Country?

Yes   X     No

(Mark your answer with an X)

If yes, indicate the name of the Organisation or Training Centre and describe briefly the simulation facility referred to in answer to the question below (f.i. located on-site or off-site, type of simulator/s, sample photograph, reference NPP/s, NPP/s which receive training in this facility, size and composition of the simulator instructional and support staff, etc.) and, also, describe this/these NPP/s (f.i. type (PWR, BWR, etc.), vendor, start of operation, degree of automation, Operators which constitute the Control Room Shift Team, sample photograph of the control room/s, etc.).

- Organisation off-site. Centralised for all the Spanish utilities.
- Type of simulators:
  1 BWR full scope simulator
  1 PWR full scope simulator
  1 Fossil fuel plant conceptual simulator
  4 Interactive Graphic Simulators (SGIs)
- Reference plants:
  Cofrentes NPP - full scope and SGI
  Almaraz NPP - full scope and SGI
  Ascó NPP - SGI
  José Cabrera NPP - SGI
  Vandellós NPP - SGI (development undergoing)
- NPPs being trained in simulators
  • Spanish PWRs: Almaraz NPP (2 Units) Ascó NPP (2 Units), Vandellós II NPP (1 Unit), José Cabrera NPP (1 Unit).
  • Brasil PWR: Angra 1 NPP (1 Unit).
  • Spanish BWR: Cofrentes NPP (1 Unit).
- Tecnatom technical personnel involved in simulator activities:
  • Training
    BWR instructors: 12
    PWR instructors: 29
    Conventional electrical power plant instructors: 10
  • Training development/updating and innovation
    R & D personnel: 7
    Simulator maintenance personnel: 11
- BWR: The initial vendor was Singer Link. 1979. Currently S3 Technology.
- PWR: The initial vendor was Singer Link. 1979. Currently S3 Technology.
- Activities performed on Simulators
  Upgrading and updating by Tecnatom, S.A. on both simulators:
  • Configuration control system
  • Advanced neutronic and thermohydraulic modelling
  • Functional and physical fidelity updating
- Degree of automation:
  • Advanced instructor system
  • Simulator automatic acceptance test system

Main features of the NPPs which receive training in TECNATOM

<table>
<thead>
<tr>
<th>NAME</th>
<th>TYPE</th>
<th>MWs</th>
<th>FIRST POWER</th>
<th>VENDOR</th>
<th>SIMULATOR TYPE</th>
<th>OPERATION PERSONNEL SHIFT ARRANGEMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Almaraz 1</td>
<td>PWR (3 loops)</td>
<td>930</td>
<td>05/81</td>
<td>Westinghouse</td>
<td>Full scope</td>
<td>1 SS / 1 ASS / 1 RO / 1 TO *</td>
</tr>
<tr>
<td>Almaraz 2</td>
<td>PWR (3 loops)</td>
<td>930</td>
<td>10/83</td>
<td>Westinghouse</td>
<td>Full scope</td>
<td>1 ASS / 1 RO / 1 TO *</td>
</tr>
<tr>
<td>Angra 1 (Brazil)</td>
<td>PWR (2 loops)</td>
<td>657</td>
<td>04/82</td>
<td>Westinghouse</td>
<td>Full scope</td>
<td></td>
</tr>
<tr>
<td>Ascó 1</td>
<td>PWR (3 loops)</td>
<td>930</td>
<td>08/83</td>
<td>Westinghouse</td>
<td>Full scope</td>
<td>1 SS / 1 ASS / 1 RO / 1 TO</td>
</tr>
<tr>
<td>Ascó 2</td>
<td>PWR (3 loops)</td>
<td>930</td>
<td>10/85</td>
<td>Westinghouse</td>
<td>Full scope</td>
<td>1 ASS / 1 RO / 1 TO **</td>
</tr>
<tr>
<td>José Cabrera</td>
<td>PWR (1 loop)</td>
<td>160</td>
<td>07/68</td>
<td>Westinghouse</td>
<td>Full scope</td>
<td>1 SS / 1 ASS / 1 RO / 1 TO</td>
</tr>
<tr>
<td>Vandellós</td>
<td>PWR (3 loops)</td>
<td>1.004</td>
<td>12/87</td>
<td>Westinghouse</td>
<td>Full scope</td>
<td>1 SS / 1 ASS / 1 RO / 1 TO</td>
</tr>
<tr>
<td>Cofrentes</td>
<td>BWR-6</td>
<td>990</td>
<td>10/84</td>
<td>General Electric</td>
<td>Full scope SGI</td>
<td>1 SS/ASS / 2 RO/TO</td>
</tr>
</tbody>
</table>

* Almaraz 1 SS for both units
** Ascó 1 SS and 1 ASS for both units

SS = Shift supervisor
ASS = Assistant to shift supervisor
RO = Reactor operator
TO = Turbine operator

SECTION 2: Current practices with simulators closely related to operator training.

1. Based on your experience, describe advantages and disadvantages of the location of the Simulation Centre with regard to the plant: on-site versus off-site. Specifically, describe those factors which have some influence on the Operators’ attitude towards the simulator training and in the quality of the simulator training.

Simulation centre on-site.
Advantages:
- Wider use of simulator.
  • Different personnel from operation (engineering, maintenance, I&C, staff, etc.)
  • Additional use of simulator - different from training - analysis use.
- No time lost due to control room operator displacement.
Disadvantages:
- More expensive than a centralised one (building auxiliary services, HW & SW personnel not working with the economy of scale factor).
- Human factor. For RO/SRO personnel not changing the environment for training (same place no happening).

Simulation centre off-site.

Advantages:
- Economy due to the scale factor in the area of simulator maintenance HW & SW building services.
- Centralised services in the development of training material and a better exchange of experiences amongst other Control room operators.

Disadvantages:
- Time consuming for operator displacement
- More difficulty, and time consuming, of the simulator use none operating personnel.

2. a) During simulator training sessions, what factors (time, communications, etc.) influencing the interactions between Control Room Operators and other Plant Personnel (Operations Department outside of Control Room Personnel, Maintenance or Instrumentation, and Control Departments, Technical Support Centre, etc.) are simulated?

The instructor is the person in charge of performing the different jobs at any time the operating personnel requires (Operation Manager, Plant's auxiliaries, chemistry, Health Physics personnel, Instrumentation, charge dispatch, etc.). For this purpose, the communications are activated when necessary, and as many times as necessary, being performed as if it was actual operation. The instructor performs his job trying to approach actual actuation time, even though this time is lower to real ones due to simulator training and other factors, as filling task forms (formats), which are not done in real actions, in order not to lose so much time of training on simulator.

b) Do these other Plant Personnel participate in the training sessions?
Describe the present training format pertaining to involvement of non Control Room Personnel in simulator training sessions and explain why this format is used.

In the simulator sessions the only ones to participate are the Control Room Operation Team.

3. What environmental conditions (normal and emergency lighting, humidity, noise, vibrations, sounds generated by equipments, etc.) that could be experienced by the reference plants, are usually simulated in the Simulator Rooms? Describe the use of such effects at your simulator centre and explain why they are, or are not, incorporated into simulator training sessions.

We have simulated the normal and emergency lighting in the Almaraz and Cofrentes NPP simulators, and in the PWR simulator also the sound of the opening of safety relief valves and the audio count rate of the nuclear instrumentation (source range).

The normal and emergency lighting simulates the same light conditions that in the NPP in the different operational NPP status. We consider necessary the simulation of this effect because this affects directly the performance of the operator tasks (operation upon the panels, reading of procedures, etc.).

The sound of the opening of the safety relief valves can be heard from the control room and
we think that it is convenient.

We have simulated the alarm sound (in the case of the Cofrentes simulator equal level and type of alarm sounds are simulated).

Other sounds and effects are not included in the simulator environment because they are not present in the control room.

4. **Do Control Room Operators receive simulator training for operations outside the Control Room, for example: operations from Remote Shutdown Panels?**

   Describe this type of training as it exists at your Simulator Centre and explain why it is, or is not, used in training sessions.

   No, there is a training performed at the plant. A simulated way of panel operation is performed on the job position (Remote shutdown panel), as well as lective sessions in class room simulating the operations.

5. a) **How frequently are the changes taking place in plant (plant design changes, procedures changes, etc.) incorporated to the replica or full-scope simulator?**

   Describe any process or mechanism in place at your Simulator Centre to incorporate changes to the replica or full-scope simulator.

   As a general rule, the plant changes are incorporated in the simulator within the period of time stated in the ANSI-3.5 (24 months). For this reason we develop and approve a new simulation load (software and hardware) every year. The average time period between the plant modification and the implementation in the simulator is about 8-10 months.

   In some special cases, when the plant modification affects in an important way the plant operation we incorporate the plant changes in advance, in order to provide the proper training before the starting-up of the plant. An example of this was the implementation of the new steam generators in Almaraz NPP.

   The process to incorporate the plant changes in the simulator is regulated by the Simulator Control Management, which is specified in a set of procedures. The process starts systematically with the reception and analysis of the plant documentation. As a result of this analysis we generate the “Demanda de Trabajo” (similar to the Discrepancy Reports but for new modifications). In this document the scope of the modification is specified from the point of view of the simulator, in the SW and HW fields, and also the validation tests.

   b) **Do simulator model modifications require separate approval while the simulator is being used for training?**

   The implementation of the modifications in the simulators is carried out in a developed load, in parallel with the use of the official load for the training courses. After implementing all the modifications the approval phase is performed. This consists in a set of validation tests, according with the requirements of the ANSI-3.5 and our expertise.

6. a) **Identify the members of the Control Room Shift Team (Reactor Operators, Turbine Operators, Shift Supervisors, etc.) and indicate the time (in hours) dedicated to simulator training by each member in their initial training programme.** Specify, when applicable, the time spent with each type of simulator.

<table>
<thead>
<tr>
<th>Type</th>
<th>Trainees</th>
<th>Total hours</th>
<th>Simulator</th>
</tr>
</thead>
<tbody>
<tr>
<td>PWR</td>
<td>Supervisor</td>
<td>260</td>
<td>Full scope</td>
</tr>
<tr>
<td>BWR</td>
<td>Supervisor</td>
<td>260</td>
<td>Full scope</td>
</tr>
<tr>
<td>PWR</td>
<td>Reactor operator</td>
<td>260</td>
<td>Full scope</td>
</tr>
<tr>
<td>BWR</td>
<td>Reactor operator</td>
<td>260</td>
<td>Full scope</td>
</tr>
<tr>
<td>PWR</td>
<td>Turbine operator</td>
<td>80</td>
<td>Full scope</td>
</tr>
<tr>
<td>PWR</td>
<td>Supervisor/Reactor operator</td>
<td>*</td>
<td>SG1*</td>
</tr>
</tbody>
</table>

* Optional and there is not a fixed number of simulated hours.
b) **Indicate the time (in hours) dedicated to simulator training by each member of the Control Room Shift Team in their continuous training programme.** Specify, when applicable, the time spent with each type of simulator.

Between 20 and 40 hours of full scope simulator requalification in their respective job positions.

c) **What is the minimum time, if any, required by the Regulatory Body?**

> 20 hours simulator per year.

7. a) **Indicate the percentage of simulator training time by the different Members of the Control Room Shift Team devoted to i) normal, ii) abnormal and iii) emergency conditions in their initial training programme.**

For Supervisor and Reactor Operator:
- 8% Reactor Physics practice (Phase I).
- 30% Normal Operation and Control Room familiarisation.
- 45% Normal Operation and Malfunction.
- 17% Emergencies.

For Turbine Operator:
- 35% Normal Operation and Control Room Familiarisation.
- 33% Normal Operation and Malfunction.
- 32% Emergencies.

b) **Indicate the percentage of simulator training time by the different Members of the Control Room Shift Team devoted to i) normal ii) abnormal and iii) emergency conditions in their continuous training programme.**

The 50% is dedicated to Emergency Operations and the rest of it to normal operation and malfunctions. This section is variable depends a lot on the shift and the incidents or events occurred between the annual training period.

c) **What are the minimum percentages, if any, required by the Regulatory Body?**

It does not apply.

8. **What is the role and the policy of the Regulatory Body regarding the use of simulators for Control Room Operators licensing and training?**

Reactors Operator:
- Initial training: 120 hours simulator training.
- Retraining: 20 hours simulator training every year.

Supervisor:
- Initial training: 40 hours simulator training.
- Retraining: 20 hours simulator training each year.
9. a) **What standards (ANSI/ANS 3.5, IAEA, etc.) are simulators built to and maintained?**

   The two simulators that we have Almaraz NPP (full scope simulator), and the Cofrentes NPP (replica simulator) were built in base of the ANSI-3.5. In the case of the Almaraz NPP simulator the only exception to the ANSI standard is the physical fidelity, because the situation of the instrumentation on the panels is not the same as that in the control room. However the simulator has the same response as that of the plant.

   The criteria of maintenance and updating are those stated in the ANSI standard.

   We also follow the IAEA-TEDOC-685, although this document is not a standard but a guideline.

b) **What exceptions are typically taken to the standard?**

   The only exception to the standard is the above mentioned in the Almaraz NPP simulator.

c) **What types of simulators are used that are not included in industry standards?**

   In some training courses we use the Interactive Graphic Simulator which is a simulator with the same simulation models than the Cofrentes NPP, Almaraz NPP, Ascó NPP and José Cabrera NPP, but with a graphic interface instead of the panels.

10. a) **Describe the role of part-task simulators in your current training programs.**

   It does not apply.

b) **Describe the role of special-purpose (analytic) simulators in your current training programs.**

   The SGI (Interactive Graphic Simulator) are used to help the knowledge fixing once the systems have been studied. Additionally, it helps to analyse deeper the evolution of the critical parameters in accidents and malfunctions (specific courses completing initial training programmes).

11. **Have the current operator training programs been conditioned by the availability and capabilities of the simulator(s) or, alternatively, has(ve) the simulator(s) been specified and acquired after analysing and designing the training programs? Explain.**

   There is no restriction in the performance of the programme in the initial training course. During the Retraining Course some specific systems are not operated by operation personnel which own plant is not the simulator reference plant. The simulator performance is according to the US rules and standard and their associated normative requirements.

   On some occasions, new malfunctions were needed to incorporate and create some national or international events in order to prepare, for the CR team, the corresponding training. An additional validation was also needed using the transient response from the plant of the event.

12. **What extensions of simulator training are envisaged for the future?**

   Tecnatom, S.A. is planning to incorporate Plant’s Remote shutdown panel from outside the Control Room, Operation at mid-loop with the reactor vessel head withdrawn and models will be introduced in the near future, in the SGI, covering the severe accidents domain.
13. **a)** Based on your experience, describe the uses of the simulators for activities other than training (plant drills, procedures validation, design changes validation, testing programs, acquisition of human data, licensing activities, reference plant systems “tuning”, etc.).

Possible use of simulator other than training are the following:
1. Human factors enhancement
2. Emergency response drills
3. Design modifications pre-test
4. Operating procedures prevalidation
5. Testing of new control systems
6. Validation of operating support system (SPDS)
7. Public relations

**b)** What is the involvement of Control Room Operators for those applications?

1. Human factors enhancement.
   - Design of man-machine interface
   - Alarm systems graphic information display
   - Interface management and navigating strategies
   - Digital system maintenance tests
   - Study on human reliability as an integral part of PSA

2. Validation of the emergency scenario to perform during a drill.

3. Public relations
   - To show to the public “what a plant is like and how it is operated.”

14. **What are the applications of simulator training for jobs other than Operations?**

   - Manager Personnel training of other departments which activities are related with the Control Room in general.
   - Technical support personnel in emergencies training.
   - Engineering personnel to develop modifications and its tests.

**SECTION 3:** Systematic Approach to Training: considerations regarding the use of simulators.

**A)** Training analysis.

1. **Are job and task analysis (or any other type of task identification technique) used for establishing a list of task, performance standards, learning objectives and training methods?**
   **If yes, describe the technique used.**

   Yes, at Almaraz NPP a job and task analysis based in the principles of methodologies developed by INPO, and shown in their document “Training System Development - TSD” took place, equivalent in its philosophy to the one established by the OIEA in the document TEC.DOC.5-25 (Systematic Approach to Training - SAT). Other Spanish NPP’s, C.N. Cofrentes and C.N. Garoña have developed specific training programmes based on job analysis using table top expert approach.
2. a) **What are the criteria that determine the limits or scope of the job analysis for the Control Room Operators?**

The job analysis is done analysing the tasks performed in that particular job. The tasks are selected in accordance with the operation procedures and the opinion of job incumbers.

b) **From your point of view, what should the role of risk-based criteria be for determining such limits or scope? Explain your answers.**

It is convenient to take into account this kind of criteria as the results of an APS which unveils major risks at the plant and consequently a specific training on this major risks could be conservative. But we do not have activities in this area up to now.

3. **Are there any special requirements for Job and Task Analysis which are imposed by the possibility of associated simulator training?**

No special requirement has been followed. Tecnatom already had a full-scope simulator before performing the job and task analysis. However, those knowledge and abilities, that required the simulator setting as the most suitable, have been determined.

**B) Training programme design.**

1. **What are the criteria for specifying simulator training rather than another training setting (classroom, laboratory, workshop, on-the-job, etc.)?**

The adequate full-scope simulator setting is established in the knowledge and skills that required the following aspects:
- Training need with a high level of accuracy concerning the task to be developed.
- Possibility of potential problems diagnosis in abnormal situations.
- Training teams or teamwork.

2. **What are the criteria for selecting different types of simulator (full-scope, replica, part-task, basic principles, concept, special-purpose)?**

Those knowledge and skills needing only analysis and/or diagnosis have been introduced to the interactive graphic simulator (special purposes simulator).

3. a) **What are the criteria for selecting a replica simulator?**

The criteria followed for the simulator replica selection are training economic, strategic and of viability.

b) **What are the fidelity requirements?**

The functional fidelity requirements that we follow in the simulators are those specified in the ANSI-3.5, in normal, abnormal, and emergency situations. Regarding the physical fidelity we follow the ANSI requirements in the Cofrentes NPP simulator which is a replica simulator. For Almaraz NPP simulator we follow the functional fidelity requirement.
4. **What are the specific pre-requisites for operators undertaking simulator training?**

The prerequisites are the ones established in the Specific Training Plan for the Control Room Operators position:

*Plant's general orientation course:*
Enables the new incoming personnel to become familiar with the plant’s organisation, administration, practices, procedures, functional and hierarchy dependency lines and personnel protection basic concepts.

*Electric plants technologic fundaments:*
Acquire the fundamental knowledge of the different academic disciplines necessary to understand scientific and engineering aspects of a nuclear power plant.

*Nuclear power plants technology:*
Acquire the knowledge associated with the interface existing between each system of the plant and control room, as well as their detailed description.

*Operation preparation:*
Deepen into the knowledge directly related to the reactor.

Once this training is finished, a specific simulator training plan is established.

5. **Does the possibility of simulator training impose any constraints on the definition of learning objectives?**

No. The simulator is a training environment which allows the transfer of the learning objective. Some of them can only be transferred in a suitable way in such an environment.

C) **Training programme development.**

1. **In the case of non-replica simulators, is it necessary to take parallel training actions, and if so, what kind? Explain your answer.**

Yes, those tasks and knowledge/abilities identified without simulator training possibility (no-replica) are sown in their corresponding training plan, which have to be developed within anon-the-job training setting.

2. **Do you use specific procedures for the training simulator, actual plant procedures or a combination of both? Explain your answer and give reasons for the choice.**

For the simulator training, the plant’s specific procedures are used. The simulator has a controlled copy of reference plant procedures so they are permanently updated. The reason for that is the personnel need to be trained in/with their actual plant procedures and not in a “simulator procedures” environment. For NPP different from the reference plant, their current procedures are also used for general, failure and emergency operations.

3. **What are the criteria for selecting normal, abnormal and emergency scenarios to be trained with simulators? Are they risk-based criteria? Explain your answer.**

- All normal scenarios covered by procedures to take the plant from cold shutdown to 100% power and go back to cold shutdown.
- All abnormal scenarios covered by procedures and accordance with simulator configuration.
- Emergency scenarios to be more important by training aspects and also covered in the emergency procedures.

Risk based criteria are not used; we use Spanish and foreign nuclear plant accidents to include some specific scenarios.

4. **How are lesson plans and support documentation developed for simulator training?**

For each training session (daily) there is an instructor guide describing the following:
- Introduction (summary)
- Session objectives
- Procedures to be used
- Technical items to be reviewed
- Conduct simulator session guide
- Trainee assessment procedure
- Trainee assessment manual
- Trainee assessment report procedure

The trainees use the following reference plant documentation:
- Operation procedures
- Technical specification
- Alarm books
- P and D diagrams
- I and C diagrams
- Electrical diagrams

D) **Training programme implementation.**

1. **What selection, initial training, and continuing training is arranged for simulator instructors?**

   The selection of instructors in Tecnatom is similar to the method used by the plant for the operator selection in sense of the entry level required and the associated academic background. The initial training is the same than the one followed by a candidate to SRO. The continuing training consist of 4 weeks per year in the area of simulator, lecture sessions (academic and operating experience) and plant observations (outages, start-up...)

   The initial training programme for the instructor is the following:
<table>
<thead>
<tr>
<th>Course</th>
<th>Content overview</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 0</td>
<td>Thermodynamics&lt;br&gt;Heat transfer&lt;br&gt;Electric components&lt;br&gt;Mechanical components</td>
<td>4 weeks</td>
</tr>
<tr>
<td>Phase I</td>
<td>Nuclear reactor operation fundamentals&lt;br&gt;BWR/PWR reactor control</td>
<td>4 weeks</td>
</tr>
<tr>
<td>Phase I (simulator)</td>
<td>Reactor operation practices in BWR/PWR simulator</td>
<td>1 week</td>
</tr>
<tr>
<td>Phase II</td>
<td>BWR/PWR nuclear power plant technology</td>
<td>12 weeks</td>
</tr>
<tr>
<td>Plan visit</td>
<td>Walk-through to know the location of the main components on-site</td>
<td>4 weeks</td>
</tr>
<tr>
<td>R.P.</td>
<td>Health physics and radiation protection</td>
<td>2 weeks</td>
</tr>
<tr>
<td>Administrative</td>
<td>Plant administrative procedures and drawings reading</td>
<td>2 weeks</td>
</tr>
<tr>
<td>Human factors</td>
<td>Team work&lt;br&gt;Leader ship&lt;br&gt;Motivation&lt;br&gt;Communication&lt;br&gt;Diagnosis</td>
<td>1 week</td>
</tr>
<tr>
<td>Phase III (1)</td>
<td>BWR/PWR full scope simulator operation practices</td>
<td>8 weeks</td>
</tr>
<tr>
<td>Core damage mitigating</td>
<td>Advanced BWR/PWR thermohydraulic and core damage mitigating</td>
<td>4 weeks</td>
</tr>
<tr>
<td>Phase III (2)</td>
<td>Emergency procedures (EOP)&lt;br&gt;BWR/PWR simulator practices</td>
<td>4 weeks</td>
</tr>
<tr>
<td>OJT</td>
<td>Knowledge of location plant component and plant operation observation training</td>
<td>14 weeks</td>
</tr>
<tr>
<td>Instructor pedagogical</td>
<td>Adults and their training&lt;br&gt;Communication process&lt;br&gt;Training process&lt;br&gt;Teaching materials and media&lt;br&gt;Training evaluation</td>
<td>1 week</td>
</tr>
</tbody>
</table>

We have four levels of instructors and a promotion/growing training programme to go from one level to a higher one is also defined in our procedure.

The definition of each instructor level is:
A level instructor - Initial classroom course
B level instructor - Initial simulator course
B1 level instructor - Simulator course
C level instructor - Retraining course (include simulator)

We used to have an external support for the retraining activity in the pedagogical domain to get new or different/updated methods of teaching.

2. What are the arrangements for instructor monitoring of, and feedback to, trainees during simulator sessions?

   - Software of operation record to repeat the operations made in the simulator and to review by a hard copy the operations selected.
   - Parameters trend graphics. We can obtain a graphics of parameters trend in other to discuss their evolutions.
3. a) What specific training modes such as simulator freeze, playback, running at higher speed than real time, activity recording, video recording, etc. is made use of during initial training?

Freeze - the stopping of simulation during an exercise.
Playback - to repeat a simulation period once it was done.
Fast Time - the ability to vary the speed of the simulation.
Activity Recording - to store all activities done in the simulator control board.

b) What specific training modes such as simulator freeze, playback, running at higher speed than real time, activity recording, video recording, etc. is made use of during continuous training?

All mentioned in a) except Fast Time.

4. What limits of simulation impede planned training sessions or examination scenarios?

Because we have identified the limits of the simulation, and we take into consideration these when we develop the course programmes, we do not have this type of problem during the training sessions. Only HW failures in the simulators platform (computers, etc.) produce occasionally incidents during the training sessions.

Regarding the simulation limits, the limit for the primary loop, or nuclear supply steam system is the beginning of change of the fuel/core, geometry, detected by an “internal variable” which represents the fuel temperature.

E) Trainee assessment.

1. a) What methods and procedures are used for initial trainee assessment during and after simulator sessions?

The dynamic evaluation method (without stopping the simulation during the evaluation) is used, as well as the written exams in the lecture session. There are two types of dynamic evaluations, one every week and another one at the end of the course.

b) What methods and procedures are used for continuous trainee assessment during and after simulator sessions?

The dynamic evaluation method is used.

2. List and describe the main areas or groups of skills and knowledge of the trainee assessed in training simulators (for example: “control board awareness, event diagnosis, immediate actions / entry-level actions, subsequent actions, control board manipulations, use of procedures / technical specifications / reference data, communications, supervisory ability, team skills” (IAEA-TECDOC-525)). Identify, when applicable, the types of simulator used for addressing each one.

- Awareness
- Event diagnosis
- Immediate/entry-level actions
- Subsequent actions
- Desk and panel operations
- Technical specification and documentation
- Communication
- Supervisory skills
- Team skills
- Use of procedures

The full scope simulator is the only one used always.

3. **Describe the ranking of importance, if any, given to the main areas or groups of skills and knowledge taken into account for a trainee assessment.**

We do not make any ranking of importance about the list of the point 2. Referred to the tasks importance, a value considering negative consequences that would produce its wrong performance has been given:

1. It does not interfere in the plant’s operation.
2. It means a consequence in operation, but an unimportant one.
3. It means serious consequences and requires a substantial corrective action.
4. It means very critical expensive consequences and requires a long correction period.

4. a) **Based on your experience, describe difficulties you have had for assessing the individual skills and knowledge of a trainee while operating within a whole Control Room Shift Team during simulator sessions.**

Sometimes there are difficulties in assessing individual skills and knowledge, because it is not easy to separate the communications among the team members and the communications from one member team to another which are aimed toward helping individuals to pass the assessment.

b) **Describe the measures adopted to overcome these difficulties.**

To have more instructors present during the assessment.

5. a) **Based on your experience, describe influences on trainees performance during simulator sessions resulting from the attendance of personnel such as utility managers, regulatory body inspectors, etc.**

They affect greatly as they only interfere negatively in the evaluated personnel efficiency.

b) **Based on your experience, describe influences on trainees performance during simulator sessions resulting from the attendance of personnel such as utility managers, regulatory body inspectors, etc.**

During the first phase of initial training i.e. familiarisation with the control room and the normal operation the instructor is in the control room helping the new trainees in performing their duties. No malfunctions are introduced, then no need to work in the instructor console.

When the abnormal operation starts to be simulated the instructor pre-programmes the malfunctions and stays in the control room (but only observing) in order to assess the ability of diagnosis, team work and communication and only stops the session when the deviation from the training goals is important.

During emergency or retraining situations the instructor remains almost permanently in the instructor room and gets out only for the debriefing or in the event that the simulation is out of scope (beginning of a core meeting for example).

These strategies of instructor involvement obey clearly with the need of trainees first, a
need of instructor to be closer to trainees to better assess them and correct as early as possible in the second phase and finally to let them alone during emergency, because it reproduces as closely as possible a potential situation of emergency in which no “moral” support to the crew would be given during the first moments.

6. a) **Are training simulator examinations used in order to grant initial license to operators?**  
   **Explain.**
   Yes, by the Regulatory Authority there is an assessment in a simulator session.

   b) **Are training simulator examinations used for requalification?**  
   **Explain.**
   No, during the requalification on simulator a control room operator’s assessment is performed by two instructors and the result of it is detailed in a report to the plant manager.

7. **How is examination integrity preserved during the examination/scenario preparation period?**
   The inspectors panel for the operation license presents to follow in the simulator and one of these is selected just before it starts.

8. **What performance monitoring or data acquisition features of the simulator are used during simulator examinations?**
   - Software of operation record
   - Parameters trend graphics
   - Monitor sound speakers of students’ talks

F) **Training programme evaluation.**

1. **Describe the approach used for evaluating the simulator training programme and main results.**
   A filled format and a session’s evaluation criteria may be included.  
   This format includes the following aspects to evaluate:

   **Reactor Operator**
   1. **Level of knowledge and understanding about:**
      Technical  
      System and components  
      Operation and administrative procedures
   2. **Operator abilities:**
      Observation skills  
      To be alert to visual and acoustic indication during normal and abnormal plant conditions  
      Actuation as teamwork members  
      Use of auxiliary information device in the main control room
   3. **Response to unexpected and/or abnormal plant conditions:**
      Immediate actions quality  
      Symptom and situation analysis  
      Parameter control
Response quality

Operator
1 and 3 mentioned above and:
- Situation recognition
- Safety consideration
- Leadership
- Procedures use
- Use of auxiliary information device in the main control room

2. **What programme is in place for validation and continuous verification of the simulator performance?**

For the continuous verification of the simulator performance we carry out every year the 25% of the ATP’s (Acceptance Test Procedures), steady state tests, and real time tests. In addition to this, every new simulation load has to pass a set of tests including normal, abnormal and emergency evolutions, steady states, etc. These tests, their frequency, and their validation criteria are specified in the Simulator Configuration Management Procedures.

3. **What types of performance discrepancies are most frequently identified by operators during training sessions?**

The behaviour of steam generator level in some transients for PWR simulator and reactor level for BWR simulator.

4. **What types of performance discrepancies are most frequently identified by examiners or inspectors?**

There is not a certain type of error repeated during the exams. During the training session is the non-following of operating procedures.

**SECTION 4: Use of operating experience for operator training with simulators.**

1. **How is operational experience feedback incorporated into the design of simulator training programs (experience reviewed, schedule, people involved)?**

The NPP Training Manager asked for certain operational incidents to be included in the retraining simulator course. These incidents could be either from other NPP’s (i.e. INPO, SOER mainly) or from their own plant.

Before the simulator programme for retraining is completed, there is a meeting between the NPP Training Manager and the Shift Supervisor to include certain relevant operating experiences, either internal or external to the plant.

In the case of operating experiences from other NPP’s if they are in English, they are translated to Spanish and explained during lecture sessions. The teaching method varies depending on the type of event. In some cases the incident is fully scenified following the “role-playing” technique that promotes full participation and involvement of trainees.

If the operational experience is significative enough, the simulator software models are modified to reproduce similar conditions and trainees are trained in both training settings; classroom and simulator.
2. Has your organisation developed any kind of programme by which simulator operator training is correlated with real operating events? Explain.

This is not applicable for Tecnatom.

SECTION 5: Specific topics on Operator training with simulators.

A) Team training techniques.

1. a) Are job and task analyses used for defining the role and responsibilities of the Members of the Control Room Shift Teams and, in general, of the various levels of staff who are charged with operation of the plant? Explain your answer.

   Job and task analysis done in Almaraz has been used to define the role and responsibilities of the members of the Control Room Shift Team:
   - Reactor operator
   - Turbine operator
   - Shift supervisor assistant and
   - Shift supervisor

   Using the methodology described in section 3.a) “Training Analysis”, and we used this N for the rest of NPP.

b) Are job and task analyses used for establishing performance standards, learning objectives and training methods for Team skills training? Explain your answer.

   Section 3 describes the process used for establishing performance standards, learning objectives and training methods for team skills training.

2. List and describe Team skills (communication, management of resources, team cooperation, team leadership, feedback, conflict resolution, team decision-making, etc.) which are trained using simulators. Identify, when applicable, the types of simulator used for training each one.

   The team skills which are trained using simulators are:
   - Roles and responsibility assumption
   - Solving problems, decision-making
   - Co-ordination
   - Assertive behaviour
   - Leadership
   - Techniques of communication
   - Shift turnover.

   All these methods are trained on full scope simulator and sessions in classroom, lective and practical.
3. **Are any guides used for conducting and evaluating Team skills training simulations? Explain your answer.**

   For conducting team skills training simulations the instructor simulator sessions book is used. This instructor’s book contains, among other information, the proper team performance in response to the different situations. Additionally, among the evaluation criteria is one related to team work: Crew Interaction and Communication. Good communication is considered an essential part in teamwork and it is easy to evaluate in an objective manner. The three aspects assessed in the criteria of Crew Interaction and Communication are:
   - Team members make clear and understandable communications.
   - Every team member inside and outside the Control Room is well informed about the plant status.
   - Team members practice adequate communication feedback.

4. **Based on your experience, describe advantages and disadvantages of Team training with the participation of the same (usual) Members every time or with changes in the Shift Team compositions.**

   Usually control Room Team Shifts are trained with the participation of the same (usual) members every time; this approach has the advantage to be trained in exactly the same atmosphere as in real job and to consolidate team performance also during training. The main disadvantage is to maintain common weak points and also less potential for growth and boredom.

5. **Are simulator sessions used for the optimisation of control Room Team Shifts taking into account the characteristics (aptitudes, attitudes, ...) of each Operator? In other words, are simulator sessions used for deciding which Members are going to constitute each Shift Team? Explain your answer.**

   We do not know because the Plant Operational Manager is exclusively responsible for this decision.

6. **Are there any licensing examinations applied to the whole Control Room Shift Team in addition to the individual licensing examinations? Explain.**

   Regulatory body licensing examinations are individual, carried out through Control Room Shift Team Scenarios.

   **B) Training for stress.**

1. **Is any part of the simulator training programme specifically devoted to train Control Room Operators to operate under stress? Explain you answer.**

   There is a specific stress management training programme, before the commencement of simulator training. This stress management course is implemented in a classroom setting using lectures and practices.
2. Are stress levels induced and measured during simulator training sessions? 
If yes, describe the methods and results.

Although it is not intentionally foreseen, stress is induced during simulator training sessions by implementing, transients and emergency scenarios as close to reality as possible.

3. Based on your experience describe any measures adopted during simulator training to counter stress.

Strategies to manage stress during simulator training are:

1. Activities carried out prior to a particular event in order to reduce the level of stress:
   - Pay attention to the conditions of the plant.
   - Mentally go over the actions to be taken by the operator for mitigating an imagined event.
   - Determine and practice diagnosis techniques during the shift.
   - Reduce unnecessary noises in the Control Room.

2. Activities carried out at the beginning of an event in order to reduce the level of stress:
   - Follow the procedures.
   - Begin the emergency procedures again from the beginning when the team feels “lost” or when the action of an operator has deviated significantly from the procedure.
   - Continually apply diagnosis techniques and teamwork (good communication and positive participation).
   - Control the activities of the other members of the team to recognise possible stress symptoms.
   - Frequently go over the global situation and control the functioning of critical equipment.
   - Encourage a positive working atmosphere.

3. Activities carried out when stress is felt in order to diminish its effects:
   - Take your hands away from the panel, stand back and try to get a global vision of the situation and the corresponding responsibilities.
   - Breathe slowly and deeply.
   - Relax the muscles to reduce tension and to facilitate the circulation of the blood.
   - Speak quietly to yourself.
   - Speak to the supervisor or to a colleague about the feelings you are having when under stress or suffering from anxiety.
   - Look at problems as a team not individually.

C) The theoretical basis underlying training.

1. Are any models of human behaviour being used in designing and implementing training programmes? 
If yes:
   i) refer to or describe the models,
   ii) indicate the areas in which these models are being applied (for example: signal detections, decision-making, etc.)
   iii) give the main results.

i) Models of human behaviour:
   The following is a description of the models of human behaviour being used within simulator training programs.

Teamwork
   - Shift roles and responsibilities: for good team work the roles and responsibilities of each team member must be clearly defined. This avoids the individual responsibility of each member becoming diluted in the responsibility of the team.
   - Teamwork model: basic task which the control room team should perform in order to establish their teamwork, such as the strategic development of activities, assigning tasks,
solving problems and co-ordination.
- Assertive behaviour: assertiveness has been defined as the desire to inter-relate with others.

Leadership
- Leadership style: the basic qualities of a shift supervisor who is a true leader who will act effectively in the control room.
- The six principles for achieving effective supervision.
- The behaviour of leaders in accordance with basic motivation.

Communication
- Techniques of communication: to ensure correct verbal communication requires the knowledge and putting into practice of a series of communication techniques which have been seen to be successful in industry in general, including the use of the phonetic alphabet and communication feedback among others.
- Writer’s practical guide: aimed at providing a series of general recommendations which should be useful when having to make any kind of written communication.
- Shift turnover: the relieving of operation shifts in the control room is an important when the process of oral and written communication plays a principle role.

Diagnosis
- Attention to details: an alert and attentive attitude to detect minimum subtle changes which might cause a failure.
- Logical process of diagnosis: the stages which must basically be developed for effective diagnosis.

Self-checking
- Self-checking technique: tool utilised toward reducing the danger of inappropriate actions by helping personnel to concentrate their attention methodically on the details of the task they are carrying out.

Stress control
- Stress coping strategies: actions to accomplish before, during and after an abnormal or emergency situation occurs in the control room.

ii) Areas in which the models of human behaviour are being applied:
- Directing shift operations
- Crew interaction
- Communications
  • Shift communications during operations
  • Communications with other sections
  • Shift turnover
  • Written communications
- Control board operation
- Alarms interpretation and events diagnosis
- Emergencies response
All of the above are areas of trainee assessment during the simulator evaluation.

iii) Main results:
Although there is not a direct measure of training effectiveness on the application of such models of human behaviour, we have the following indirect feedback:
- Courses evaluation questionnaire (“happy sheet”): trainees find these kinds of human factors very useful and applicable to their job. Operating personnel agree that such models enhance human performance in the control room.
D) Habits acquired during training sessions with simulators.

1. Describe, based on your experience, undesirable habits which could be acquired by trainees during training sessions with simulators (for example: due to limited number of simulated scenarios, due to lack of physical or functional fidelity, due to the use of conservative codes for simulation instead of best estimate codes, etc.) and discuss their potential consequences on safety.

We have not detected undesirable habits which have been acquired by trainees during training sessions with simulators.

2. Describe, based on your experience, any measures adopted to avoid acquisition of those undesirable habits or to prevent use of them.

This does not apply.

E) Simulator training on normal and emergency conditions during shutdown and low power operation.

1. What use is made of simulators for Control Room Operator training in normal, abnormal and emergency conditions during shutdown and low power operation (simulated scenarios, trained skills, training techniques, ...)?

   Simulated scenarios:
   
   Shutdown
   - Normal: Cooldown from 291 to 60 ºC, Heatup from 60 to 291 ºC
   - Abnormal: Malfunctions associated to systems in service (RHR, RCS, CVC)
   - Emergency: Shutdown LOCA
   
   Low power operation
   - Normal: Reactor start-up, Reactor shutdown
   - Abnormal: Malfunctions associated to systems in service (SIN, dilution, boration, etc.)
   - Emergency: Reactor trip, spurious safety injection, LOCA, SGTR

   Training skills:
   - Same as in power operation.

   Training techniques:
   - Same as in power operation.

2. What are the criteria (risk-based criteria, deterministic criteria, results of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?

   Criteria supporting above: same as in power operation.

3. Are job and task analysis (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on shutdown and low power operation?

   Explain.

   Job and task analysis: same as in power operation.
4. What are your plans for the future in this area?

To incorporate in the scope of the simulator the mid loop and refuelling operations.

F) Simulator training on severe accidents.

1. What use is made of simulators for Control Room Operator training in severe accidents (simulated scenarios, trained skills, training techniques, ...)?

At the moment the simulators do not simulate severe accidents. It is not foreseen to supply full-scope simulators with this capacity, even though the possibility of introducing severe accidents simulation codes into the Interactive Graphic Simulators is being evaluated.

2. What are the criteria (risk-based criteria, deterministic criteria, result of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?

It does not apply to full-scope simulators. The possibility of simulating selected scenarios from the IPE's (criteria based on the risk) in the Interactive Graphic Simulator is being evaluated.

3. Are job and task analysis (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on severe accidents. Explain.

It will probably be used in the task analysis perfumed by INPO following the American industry approach represented by NEI. It seems that from this task and job analysis we do not obtain the necessity of training operators in the operation to introduce strategies on severe accidents management. However, it would be convenient to have some simulators which provide training for the evaluators and responsibles in decision making personnel.

4. What are your plans for the future in this area?

The Spanish industry plans concerning this area follow the NEI approach. It seems clear that the operators managing severe accidents training does not require full-scope simulators (it is even considered self-defeating in the operators' training, as the alignment of unusual systems may be required).

G) Simulator training on accidents caused by fires, floods, earthquakes, etc.

1. What use is made of simulators for Control Room Operator training in accidents caused by fires, floods, earthquakes, etc. (simulated scenarios, trained skills, training techniques,...)?

There are no activities in this area.

2. What are the criteria (risk-based criteria, deterministic criteria, result of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?

There are no activities in this area.
3. Are job and task analyses (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on accidents caused by fires, floods, earthquakes, etc.? Explain.

   There are no activities in this area.

4. What are your plans for the future in this area?

   There are no activities in this area.
TECNATOM:  PWR FULL-SCOPE SIMULATOR
TECNATOM: INTERACTIVE GRAPHIC SIMULATOR (SGI)
QUESTIONNAIRE

SECTION 0: Organisation/s replying to the questionnaire

1. Name of Organisation/s.
   KSU Nuclear Training and Safety Centre
   Box 1039
   S-611 29 Nyköping
   SWEDEN
   Telephone: +46 155 26 35 00
   Fax: +46 155 26 30 74

   SKI Swedish Nuclear Power Inspectorate
   S-106 58 Stockholm
   Telephone: +46 8 69 88 400
   Fax: +46 8 66 19 086

2. Contact Person/s.
   KSU - Mr. Lars Eriksson, Training Manager
   SKI - Mr. Patrik Lundell, Deputy Head, Department of Inspection

3. Address and contact information (telephone, fax).
   See above.

SECTION 1: General Information (related to the whole country)

1. Number of nuclear reactors (Units) in operation.
   12

2. Number of Sites with at least one Unit in operation.
   4

3. Number of full-scope (replica and no replica) simulators used for operator training.
   7

4. Number of replica simulators used for operator training.
   7

5. Number of part-task simulators used for operator training.
   Other simulators than replica or full-scope are situated on the plants and are mainly used for basic training.
6. **Number of basic principles simulators used for operator training.**

Other simulators than replica or full-scope are situated on the plants and are mainly used for basic training.

7. **Number of concept simulators used for operator training.**

Other simulators than replica or full-scope are situated on the plants and are mainly used for basic training.

8. **Number of special-purpose simulators used for operator training.**

Other simulators than replica or full-scope are situated on the plants and are mainly used for basic training.

9. **For how many Units is the training done on replica training simulators?**

11

10. **For how many Units is the training done on full-scope (replica and no replica) training simulators.**

12

SKI comment: On several utilities that are basic principal simulators, these are mainly used in basic training and when implementing new equipment or instructions. All utilities have concept simulators. We don’t believe that these are used routinely for training. There is no special purpose simulator although discussions have from time to time pointed out the wish among operators to have glass models and such of the main process. Since the KSU is the main information provider to this questionnaire and they only deal with full scope simulators the rest of the answers will be devoted to such simulators.

**IMPORTANT QUESTION**

Are your answers to the subsequent sections (2 to 5) of the questionnaire related to a specific Organisation or Training Centre in your Country?

Yes _X_ No __ (Mark your answer with an X)

If yes, indicate the name of the Organisation or Training Centre and describe briefly the simulation facility referred to in answer to the question below (f.i. located on-site or off-site, type of simulator/s, sample photograph, reference NPP/s, NPP/s which receive training in this facility, size and composition of the simulator instructional and support staff, etc.) and, also, describe this/these NPP/s (f.i. type (PWR, BWR, etc.), vendor, start of operation, degree of automation, Operators which constitute the Control Room Shift Team, sample photograph of the control room/s, etc.).

KSU, Nuclear Training and Safety Centre. Located in Studsvik, Nyköping about 250 km from the nearest nuclear power site.
SECTION 2: Current practices with simulators closely related to operator training.

1. Based on your experience, describe advantages and disadvantages of the location of the Simulation Centre with regard to the plant: on-site versus off-site. Specifically, describe those factors which have some influence on the Operators’ attitude towards the simulator training and in the quality of the simulator training.

   The advantages and disadvantages with simulator placement at centralised training centres versus on site have been studied by UNIPEDE, Nuclear Generation Study Committee, Nuclepers Working Group and the results are available in a recently issued report: Ref: 01004Ren9464 “Location of full scope nuclear power simulators”. The report may be ordered from:

   UNIPEDE Documentation - Sylvie QUEINNEC
   28, rue Jacques Ibert - 75858 PARIS CEDEX 17
   Tel: 33 1 40 42 60 65
   Fax: 33 1 40 42 60 52

   Having several simulators at a central training centre provides scale economy savings regarding maintenance and upgrading of the simulators as well as in the development of training methods and materials.

   Since training is the main activity at a training centre the first priorities of management and staff are professionally oriented to provide best quality training services without interferences or subordination to other activities.

   With on-site simulators trainee time and costs for travel and lodging will be saved and the operator’s social life is not affected by staying away from home during training periods.

   The operator’s attitude may vary, but the experience at KSU is that the operators in general think that the negative factors of travel is well compensated for by the professional training received.

   SKI comment: there have been some problems for the KSU to recruit qualified personnel as instructors. Since the most attractive people (historically the instructors at KSU have been preferred to be former operators or to have had some earlier experience of nuclear power operations) for this job are usually working at the plants and have family and housing there it has proven difficult to recruit enough personnel.

2. a) During simulator training sessions, what factors (time, communications, etc.) influencing the interactions between Control Room Operators and other Plant Personnel (Operations Department outside of Control Room Personnel, Maintenance or Instrumentation, and Control Departments, Technical Support Centre, etc.) are simulated?

   During the simulator session the instructors (normally there are two instructors for each session) play the role of “important” plant personnel external to the main control room.

   The operators have the use of a telephone list in which numbers and names correspond to those at their own plant. When the operator, in the simulator, calls a person outside the main control room, the call is connected to the instructor’s cabin where the instructor can see not only the number but also the name of the person the operator is calling.

   The instructor is then able, by means of an assigned PC, to carry out the operator’s order for example shut a valve which normally would have been done locally and by hand at the plant. The instructor can also implement the real times of different events; for example the right shutting time for a valve and so on.

   There is also the possibility of freezing the simulator at any moment in order to look at the
control room indications after a certain operation or at a given emergency condition.
You can also do a SNAP at any time during the simulator session in order to be able to go
back to this part and do the interesting or important manoeuvres once more. There is also a
possibility to go back in time during the session by steps of 1, 2, 5, 10 minutes and then
every 5 minutes (max. 60 min).

b) Do these other Plant Personnel participate in the training sessions?
Describe the present training format pertaining to involvement of non Control
Room Personnel in simulator training sessions and explain why this format is
used.

Instructors play the role of plant personnel external to the main control room.
In our latest simulators almost all local control rooms and equipments are accessible
through the instructor system. In such cases some field operators or maintenance staff take
part in the training working at an assigned PC in the instructor’s cabin.

3. What environmental conditions (normal and emergency lighting, humidity, noise,
vibrations, sounds generated by equipments, etc.) that could be experienced by the
reference plants, are usually simulated in the Simulator Rooms?
Describe the use of such effects at your simulator centre and explain why they are, or
are not, incorporated into simulator training sessions.

In most of the plant control rooms no noise or vibrations caused by plant equipment cold be
experienced and consequently only normal and emergency lighting is simulated.

4. Do Control Room Operators receive simulator training for operations outside the
Control Room, for example: operations from Remote Shutdown Panels?
Describe this type of training as it exists at your Simulator Centre and explain why it
is, or is not, used in training sessions.

No answer received from KSU.

SKI comment: NPPs with more sophisticated remote shutdown panels also have these in the
simulator, and are also training the procedures.

5. a) How frequently are the changes taking place in plant (plant design changes,
procedures changes, etc.) incorporated to the replica or full-scope simulator?
Describe any process or mechanism in place at your Simulator Centre to
incorporate changes to the replica or full-scope simulator.

b) Do simulator model modifications require separate approval while the simulator
is being used for training?

No answer received from KSU for 5. a) or 5. b).

SKI comment: The goal is to upgrade the simulator in regard to modifications in the plant
and changes in instructions and to give the operators training, before the plant is running
with the new equipment. This is not always possible due to tight schedules.
6. a) Identify the members of the Control Room Shift Team (Reactor Operators, Turbine Operators, Shift Supervisors, etc.) and indicate the time (in hours) dedicated to simulator training by each member in their initial training programme. Specify, when applicable, the time spent with each type of simulator.

b) Indicate the time (in hours) dedicated to simulator training by each member of the Control Room Shift Team in their continuous training programme. Specify, when applicable, the time spent with each type of simulator.

c) What is the minimum time, if any, required by the Regulatory Body?

No answer received from KSU for 6. a), 6. b), or 6. c).

SKI comment:

The basic simulator training is 4 to 5 weeks for turbine operators and another 3 weeks to become reactor operator. For shift supervisors there is another week specially devoted to his role as team leader and not so much focused on technique.

Retraining vary from 6 up to 10 days per year. The training is divided into two sessions, one in the spring and one in the fall.

The regulatory demand is a minimum of 5 days per year retraining in simulator, there is no specific demand for the basic training.

7. a) Indicate the percentage of simulator training time by the different Members of the Control Room Shift Team devoted to i) normal, ii) abnormal and iii) emergency conditions in their initial training programme.

b) Indicate the percentage of simulator training time by the different Members of the Control Room Shift Team devoted to i) normal ii) abnormal and iii) emergency conditions in their continuous training programme.

c) What are the minimum percentages, if any, required by the Regulatory Body?

KSU response to 7. a), 7. b), 7. c): No such statistics available, no requirements.

SKI comment:

There are no statistics about this but a best estimate would be the following table:

<table>
<thead>
<tr>
<th>Member/condition</th>
<th>Normal %</th>
<th>Abnormal %</th>
<th>Emergency %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turbine and reactor op. basic training</td>
<td>60</td>
<td>30</td>
<td>10</td>
</tr>
<tr>
<td>Shift supervisor basic training</td>
<td>10</td>
<td>60</td>
<td>30</td>
</tr>
<tr>
<td>Retraining</td>
<td>30</td>
<td>50</td>
<td>20</td>
</tr>
</tbody>
</table>

There are no requirements from the regulator about this, the requirement is that all training is based on planning by systematic methods, this would guarantee that the time spent on different conditions would be based on sound assumptions and analyses.
8. **What is the role and the policy of the Regulatory Body regarding the use of simulators for Control Room Operators licensing and training?**

The Regulatory Body specifies the use of full scope simulators for training of control room operators. Despite the lack of a licensing requirement, the Regulatory Body requires the instructors in co-operation with the plant operation management to assess the operators' competence.

SKI comment: There is a regulation requiring the licensee to verify the competence of the operators on a yearly basis. One part of this should be an evaluation of their performance in the simulator training. Exactly who or how this is to be done is not specified.

9. a) **What standards (ANSI/ANS 3.5, IAEA, etc.) are simulators built to and maintained?**

   Nearly the same as A/A 3.5.

b) **What exceptions are typically taken to the standard?**

   Due to old control rooms some equipment is not the same as at the plant.

c) **What types of simulators are used that are not included in industry standards?**

   Only full scope simulators at KSU.

10. a) **Describe the role of part-task simulators in your current training programs.**

   Not used at KSU.

b) **Describe the role of special-purpose (analytic) simulators in your current training programs.**

   Not used at KSU.

11. **Have the current operator training programs been conditioned by the availability and capabilities of the simulator(s) or, alternatively, has(ve) the simulator(s) been specified and acquired after analysing and designing the training programs? Explain.**

    First the training programmes are developed then the simulators are specified.

    SKI comment: This is an iterative process. The simulators are built from an estimate of what needs to be trained. But this has been experienced based estimations. The training has then been based on what the simulators can do. When a training need has been discovered in a “new field” the need has been valued against the cost and then maybe the simulators have been upgraded.

12. **What extensions of simulator training are envisaged for the future?**

    None decided.
13. a) Based on your experience, describe the uses of the simulators for activities other than training (plant drills, procedures validation, design changes validation, testing programs, acquisition of human data, licensing activities, reference plant systems “tuning”, etc.).

All the above mentioned.

b) What is the involvement of Control Room Operators for those applications?

Frequent.

SKI comment: It is important that the simulator experts and training experts are very active and give other groups at the plant information about what is possible to do with the simulators. It is important to have some kind of development department at the facilities for these issues. The KSU have not used its special role as the only full scale simulator centre in Sweden as well as they could, considering that they are the training and simulator experts. Therefore there is now little experience in this field.

14. What are the applications of simulator training for jobs other than Operations?

On ad hoc basis for managers, maintenance and regulatory body personnel.

SECTION 3: Systematic Approach to Training: considerations regarding the use of simulators.

A) Training analysis.

1. Are job and task analysis (or any other type of task identification technique) used for establishing a list of task, performance standards, learning objectives and training methods?
   If yes, describe the technique used.

   For operator training in some cases: Yes, with classical job and task analysis.
   For training of other staff categories: No. However, all courses are specified by observable and measurable objectives, though they are not always derived by job and task analysis.

2. a) What are the criteria that determine the limits or scope of the job analysis for the Control Room Operators?

   b) From your point of view, what should the role of risk-based criteria be for determining such limits or scope? Explain your answers.

   Response for 2. a) and 2. b): Not applicable at KSU.

   SKI comment: When the KSU states not applicable in the next questions, they mean that they haven’t done something or that they lack the competence to do so.

3. Are there any special requirements for Job and Task Analysis which are imposed by the possibility of associated simulator training?

   No.
B) Training programme design.

1. What are the criteria for specifying simulator training rather than another training setting (classroom, laboratory, workshop, on-the-job, etc.)?

   Not applicable at KSU.

2. What are the criteria for selecting different types of simulator (full-scope, replica, part-task, basic principles, concept, special-purpose)?

   Not applicable at KSU.

3. a) What are the criteria for selecting a replica simulator?

   b) What are the fidelity requirements?

   Response for 3. a) and 3. b): Not applicable at KSU.

4. What are the specific pre-requisites for operators undertaking simulator training?

   The training programme at the plans is designed for job positions at different levels and are also the basis for the different simulator training courses.

5. Does the possibility of simulator training impose any constraints on the definition of learning objectives?

   Simulator training does not impose any constraints on the definition of learning objectives. On the contrary, in simulator training it becomes possible to achieve more and higher objectives than with e.g. classroom training or OJT.

C) Training programme development.

1. In the case of non-replica simulators, is it necessary to take parallel training actions, and if so, what kind?
   Explain your answer.

2. Do you use specific procedures for the training simulator, actual plant procedures or a combination of both?
   Explain your answer and give reasons for the choice.

Response applicable to 1. and 2.

   As we do not have a replica simulator for unit Oskarshamn 2 (02) the 02-operators are trained in our Barsebäck (B1) simulator at which the layout is different from the 02 control room but according to the process is more or less compatible to 02.
   Before the 02 training starts we change to 02’s specific software (nuclear core and so on). As to the hardware some of the panels are replaced and we also have paper overlays to get the right system and component identification numbers. All changes in the B1-simulator for an 02 training session take about 10 minutes to activate.
   Since all units, except for 02, have replica simulators there is no specific simulator procedures and it is an advantage to train the use of the real plant procedures.
3. What are the criteria for selecting normal, abnormal and emergency scenarios to be trained with simulators? Are they risk-based criteria? Explain your answer.

Not applicable at KSU.

4. How are lesson plans and support documentation developed for simulator training?

Procedures and technical documentation received from each reference plant. Lesson plans and other training material produced at KSU.

D) Training programme implementation.

1. What selection, initial training, and continuing training is arranged for simulator instructors?

The simulator instructors are usually recruited from nuclear power plants and most of them are former operators. If not, they are given the operator training programme and operation practice at the reference plant.

The initial pedagogical training for instructors consists of four courses.

<table>
<thead>
<tr>
<th>Instructor course</th>
<th>Duration</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2 weeks</td>
<td>Learning theories and models. The adult student. Group dynamics.</td>
</tr>
<tr>
<td>2</td>
<td>2 weeks</td>
<td>The training process. Methods and media. Questioning techniques.</td>
</tr>
<tr>
<td>3</td>
<td>2 weeks</td>
<td>The simulator used as a training tool. Evaluation and follow-up of simulator sessions.</td>
</tr>
<tr>
<td>4</td>
<td>2 weeks</td>
<td>JTA. Writing objectives. Production of training aids and materials.</td>
</tr>
</tbody>
</table>

Except for the simulator retraining the simulator instructors follow the operator retraining at the reference plant. In each two year period the instructors should have at least 3 weeks of operation practice at the reference plant. Annually they get 3-5 days of pedagogical retraining.

2. What are the arrangements for instructor monitoring of, and feedback to, trainees during simulator sessions?

During theory lessons in classroom which precede the simulator training the instructors present the learning objectives and go through and discuss the simulator session coming up. (The main learning objectives for the course have been presented earlier during the introduction to the course).

After every simulator training session there is a follow-up in a classroom and the instructors can summarise the training session, discuss interesting events which happened during operation and answer possible questions from the trainees.

After the course every trainee fills in a “course judgement form” in which his point of view, regarding the contents and design of the course as well as the instructors way of conducting the course, are concluded.
3. a) What specific training modes such as simulator freeze, playback, running at higher speed than real time, activity recording, video recording, etc. is made use of during initial training?

b) What specific training modes such as simulator freeze, playback, running at higher speed than real time, activity recording, video recording, etc. is made use of during continuous training?

Response applicable to 3. a) and 3. b).

In the simulator we are, both during the basic training courses and the retraining courses, using the possibilities to freeze, running at higher speed than real time, take a snap, go back in time, set a real time for different events and implement malfunctions on various components.

A camera is used to record some interesting sequences, for example during an emergency passage, and together with the operators during the follow-up for example discuss the job position role in the shift team.

4. What limits of simulation impede planned training sessions or examination scenarios?

Normally none. However simulation beyond DBA is most possible in older simulators.

E) Trainee assessment.

1. a) What methods and procedures are used for initial trainee assessment during and after simulator sessions?

b) What methods and procedures are used for continuous trainee assessment during and after simulator sessions?

Response applicable to 1. a) and 1. b).

During the basic training courses both theoretical and practical examinations are given which have to passed by the trainee.

During the retraining course there are no job position examinations.

2. List and describe the main areas or groups of skills and knowledge of the trainee assessed in training simulators (for example: “control board awareness, event diagnosis, immediate actions / entry-level actions, subsequent actions, control board manipulations, use of procedures / technical specifications / reference data, communications, supervisory ability, team skills” (IAEA-TECDOC-525)). Identify, when applicable, the types of simulator used for addressing each one.

All the mentioned skills and knowledge are assessed in the full scope, replica simulators at KSU.

3. Describe the ranking of importance, if any, given to the main areas or groups of skills and knowledge taken into account for a trainee assessment.

The skills and knowledge are not ranked.
4. a) Based on your experience, describe difficulties you have had for assessing the individual skills and knowledge of a trainee while operating within a whole Control Room Shift Team during simulator sessions.

b) Describe the measures adopted to overcome these difficulties.

Response applicable to both 4. a) and 4. b).

It is difficult to make the assessment objective. To avoid subjectivity it is necessary to write measurable and observable objectives.

It is difficult to note all the action taken by all the shift members during a simulator scenario. Use of checklists (prepared in advance) on action to be taken by the operators and assignment of two instructors reduce these difficulties.

5. a) Based on your experience, describe influences on trainees performance during simulator sessions resulting from the attendance of personnel such as utility managers, regulatory body inspectors, etc.

b) Based on your experience, describe influences on trainees performance during simulator sessions resulting from the attendance of personnel such as utility managers, regulatory body inspectors, etc.

Response applicable to both 5. a) and 5. b).

As mentioned above the instructors sit in a cabin (with darkened windows) to supervise and guide the trainees throughout the training session in a way that the trainees, by means of written instructions, perform most of the work themselves.

SKI comment: The regulator, SKI, never visits simulator training to evaluate operators or the training itself. This may not be good, but this has been the tradition. Managers are often attending the simulator training of their operators. This is generally considered positive from the operators point of view. They appreciate when managers show some interest in their training. During recent inspections in this area SKI discovered that the operators do not feel like they are being evaluated by the managers although this is part of the reason the managers are there.

6. a) Are training simulator examinations used in order to grant initial license to operators?

Explain.

b) Are training simulator examinations used for requalification?

Explain.

For response to 6. a) and 6. b), see answer to question nº 8 in Section 2.

7. How is examination integrity preserved during the examination/scenario preparation period?

Not applicable.
8. **What performance monitoring or data acquisition features of the simulator are used during simulator examinations?**

   None.

F) **Training programme evaluation.**

1. **Describe the approach used for evaluating the simulator training programme and main results.**

   No answer received from KSU.

   SKI comment: There is usually a questionnaire distributed to the students after a training session. This mostly reflects some subjective attitudes among the operators and is seldom of any sue in evaluating the programmes. The evaluating is mostly performed by the instructors involved on an ad hoc basis. This is not the best way but it is the way it is done today.

2. **What programme is in place for validation and continuous verification of the simulator performance?**

   A yearly test that includes start up, shut down and some transients such as turbine trip and reactor scram.

3. **What types of performance discrepancies are most frequently identified by operators during training sessions?**

   No answer received from KSU.

4. **What types of performance discrepancies are most frequently identified by examiners or inspectors?**

   No answer received from KSU.

**SECTION 4: Use of operating experience for operator training with simulators.**

1. **How is operational experience feedback incorporated into the design of simulator training programs (experience reviewed, schedule, people involved)?**

2. **Has your organisation developed any kind of programme by which simulator operator training is correlated with real operating events? Explain.**

   Response applicable to both 1. and 2.

   Our simulator retraining programme takes place three or four days every spring and autumn of the year.
   The programme is the same for every shift team which means a retraining period of 10 weeks twice a year.
   The retraining programme is developed as a cyclic schedule which extends over a period of six years and contains about 130 selected operational parts. The cyclic schedule has been developed by persons from the nuclear power plant and KSU together.
The retraining period is normally performed after the principle; in the spring session: normal operations, and in autumn: abnormal and emergency operations. If necessary or possible the abnormal operational training is related to real events at the plant.

The contents of every retraining programme is decided and developed by representatives from the plant together with the KSU instructors.

SECTION 5: Specific topics on Operator training with simulators.

A) Team training techniques.

1. a) Are job and task analyses used for defining the role and responsibilities of the Members of the Control Room Shift Teams and, in general, of the various levels of staff who are charged with operation of the plant? Explain your answer.

b) Are job and task analyses used for establishing performance standards, learning objectives and training methods for Team skills training? Explain your answer.

Response applicable to both 1. a) and 1. b).

For operator training in some cases: Yes, with classical job and task analysis.
For training of other staff categories: No. However, all courses are specified by observable and measurable objectives, though they are not always derived by job and task analysis.

2. List and describe Team skills (communication, management of resources, team cooperation, team leadership, feedback, conflict resolution, team decision-making, etc.) which are trained using simulators. Identify, when applicable, the types of simulator used for training each one.

All the above mentioned team skills are trained in the full scope replica simulators at KSU.

3. Are any guides used for conducting and evaluating Team skills training simulations? Explain your answer.

Training material is prepared at KSU is used.

4. Based on your experience, describe advantages and disadvantages of Team training with the participation of the same (usual) Members every time or with changes in the Shift Team compositions.

The team members keep their original positions during simulator training at KSU.

5. Are simulator sessions used for the optimisation of control Room Team Shifts taking into account the characteristics (aptitudes, attitudes, ...) of each Operator? In other words, are simulator sessions used for deciding which Members are going to constitute each Shift Team? Explain your answer.

No, it is the decision of each utility.
6. Are there any licensing examinations applied to the whole Control Room Shift Team in addition to the individual licensing examinations? Explain.

There are no individual licensing examinations in the simulator; see question n° 8 in Section 2.

B) Training for stress.

1. Is any part of the simulator training programme specifically devoted to train Control Room Operators to operate under stress? Explain you answer.

No.

2. Are stress levels induced and measured during simulator training sessions? If yes, describe the methods and results.

No.

3. Based on your experience describe any measures adopted during simulator training to counter stress.

None.

SKI comment: All training could be said to be devoted to the training of the operators to operate under stress. This is since one of the main, and perhaps the only way to deal with acute stress in advance, is to as prepared as possible for the tasks that have to be performed under the influence of stress.

C) The theoretical basis underlying training.

1. Are any models of human behaviour being used in designing and implementing training programmes? If yes:
   i) refer to or describe the models,
   ii) indicate the areas in which these models are being applied (for example: signal detections, decision-making, etc.)
   iii) give the main results.

No.

SKI comment: There are never-ending efforts, it seems, to implement SAT in the development procedure, this might somehow reflect the view of human behaviour that is dominant within the industry.
D) Habits acquired during training sessions with simulators.

1. Describe, based on your experience, undesirable habits which could be acquired by trainees during training sessions with simulators (for example: due to limited number of simulated scenarios, due to lack of physical or functional fidelity, due to the use of conservative codes for simulation instead of best estimate codes, etc.) and discuss their potential consequences on safety.

2. Describe, based on your experience, any measures adopted to avoid acquisition of those undesirable habits or to prevent use of them.

Response applicable to 1. and 2.

Since our simulators are full scope, replica we have not noticed such habits.

SKI comment: When the R2 simulator recently was taken into use, it was discovered that operators had acquired undesirable habits after having being trained for many years on the R3 simulator. They were looking at the wrong instruments and going to the wrong panels. This has been dealt with, but it shows the problems with training in none replica simulators.

E) Simulator training on normal and emergency conditions during shutdown and low power operation.

1. What use is made of simulators for Control Room Operator training in normal, abnormal and emergency conditions during shutdown and low power operation (simulated scenarios, trained skills, training techniques, ...)?

2. What are the criteria (risk-based criteria, deterministic criteria, results of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?

Response applicable to both 1. and 2.

See the answer to n° 1 and n° 2 in Section 4.

SKI comment: There is no training done in shut down conditions. There have been plans on developing training programmes also for shut down conditions. There is little use of simulator training in shut down conditions, the difficulties during shut down are of course communication and the rather specialised was the different systems are used. The training needed is maybe best acquired in normal operating conditions but stressing the points that becomes increasingly difficult during shut down. Problems during shut down often evolve during a longer period of time or because of direct faults or problems in communication and organisation, these things are not very effectively dealt with in simulators.

3. Are job and task analysis (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on shutdown and low power operation? Explain.

See the answer to n° 1 in Section 3 A).
4. **What are your plans for the future in this area?**

No answer received from KSU.

**F) Simulator training on severe accidents.**

1. **What use is made of simulators for Control Room Operator training in severe accidents (simulated scenarios, trained skills, training techniques, ...)?**

No answer received from KSU.

2. **What are the criteria (risk-based criteria, deterministic criteria, result of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?**

No answer received from KSU.

3. **Are job and task analysis (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on severe accidents. Explain.**

   See answer to nº 1 Section 3 A).

4. **What are your plans for the future in this area?**

No answer received from KSU.

SKI comment: Some of the simulators are equipped with the possibility to run meltdown scenarios. The training benefit from these kind of scenarios must be considered low since the concept itself states that there is little left to do. In most retraining sessions Emergency Operating Procedures are being trained. In fact at some simulators the EOP sets the framework for the cyclic retraining programmes.

**G) Simulator training on accidents caused by fires, floods, earthquakes, etc.**

1. **What use is made of simulators for Control Room Operator training in accidents caused by fires, floods, earthquakes, etc. (simulated scenarios, trained skills, training techniques,...)?**

   No answer received from KSU.

2. **What are the criteria (risk-based criteria, deterministic criteria, result of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?**

   No answer received from KSU.
3. Are job and task analyses (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on accidents caused by fires, floods, earthquakes, etc.? Explain.

See answer to nº 1 Section 3 A).

4. What are your plans for the future in this area?

No answer received from KSU.

SKI comment: The simulators are not equipped to perform any advanced scenarios with fires, floods or earthquakes. The system failures caused by these initiators are not basically different from other catastrophe scenarios, the difference lays perhaps in the magnitude of the transient and the fact that it affects many systems at the same time. For instance the complexity of an accident involving fire is often accelerated.
SECTION 0: Organisation/s replying to the questionnaire

1. Name of Organisation/s.
   Leibstadt NPP

2. Contact Person/s.
   Niklaus Hugentobler, Training Manager

3. Address and contact information (telephone, fax).
   Kernkraftwerk Leibstadt AG
   CH-5325 Leibstadt
   +41-56-267 71 11

SECTION 1: General Information (related to the whole country)

1. Number of nuclear reactors (Units) in operation.
   5

2. Number of Sites with at least one Unit in operation.
   4

3. Number of full-scope (replica and no replica) simulators used for operator training.
   4

4. Number of replica simulators used for operator training.
   1 (2 - one NPP (Mühleberg) is just now (April 1995) in the phase of final testing of its (“reduced”) replica simulator. All further information on the Mühleberg simulator concerns the planned situation for training on site.)

5. Number of part-task simulators used for operator training.
   0

6. Number of basic principles simulators used for operator training.
   1 basic principles simulator (fundamental education) at the centralised Reactor School of the Paul Scherrer Institute
   1 compact simulator (plant specific training)
7. Number of concept simulators used for operator training.

0

8. Number of special-purpose simulators used for operator training.

1 (glass model)

9. For how many Units is the training done on replica training simulators?

1 (2 - One NPP (Mühleberg) is just now (April 1995) in the phase of final testing of its (“reduced”) replica simulator. All further information on the Mühleberg simulator concerns the planned situation for training on site.)

10. For how many Units is the training done on full-scope (replica and no replica) training simulators.

5

**IMPORTANT QUESTION**

Are your answers to the subsequent sections (2 to 5) of the questionnaire related to a specific Organisation or Training Centre in your Country?

Yes _X_  No__ (Mark your answer with an X)

If yes, indicate the name of the Organisation or Training Centre and describe briefly the simulation facility referred to in answer to the question below (f.i. located on-site or off-site, type of simulator/s, sample photograph, reference NPP/s, NPP/s which receive training in this facility, size and composition of the simulator instructional and support staff, etc.) and, also, describe this/these NPP/s (f.i. type (PWR, BWR, etc.), vendor, start of operation, degree of automation, Operators which constitute the Control Room Shift Team, sample photograph of the control room/s, etc.).

<table>
<thead>
<tr>
<th>NPP</th>
<th>GE-BWR6/Mark III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start of operation</td>
<td>1984</td>
</tr>
<tr>
<td>Degree of automation</td>
<td>High automation on safety relevant systems</td>
</tr>
<tr>
<td></td>
<td>High automation on secondary systems</td>
</tr>
<tr>
<td></td>
<td>30 min criterion applied</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Control room staff</th>
<th>1 shift supervisor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 deputy shift supervisor</td>
</tr>
<tr>
<td></td>
<td>1 senior reactor operator</td>
</tr>
<tr>
<td></td>
<td>1 reactor operator</td>
</tr>
<tr>
<td></td>
<td>4 field operators</td>
</tr>
<tr>
<td></td>
<td>1 picket-engineer (*) (shift technical advisor) on call at the plant</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Control room staff for simulator training</th>
<th>1 shift supervisor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 deputy shift supervisor</td>
</tr>
<tr>
<td></td>
<td>3 reactor operators</td>
</tr>
<tr>
<td></td>
<td>1 picket-engineer (shift technical advisor) (actual shift team)</td>
</tr>
</tbody>
</table>

| Instructors | 4 KKG instructors (KKL picket-engineers) |
Simulator  
Described is the actual (1996) situation.

On site support  
5 engineers (maintenance, upgrade)

*a Picket-Engineers are engineers who have completed the same career as Shift Supervisors 
(i.e. Plant Operator --> Reactor Operator --> Shift Supervisor). Additionally to that they have done special training on 
emergencies, severe accidents in classroom training and self study and an extensive simulator training. After their licensing 
examination they act as Shift Technical Advisors. The picket-engineer on duty (24 hours shift coverage) has to be at the site.

SECTION 2: Current practices with simulators closely related to operator training.

1. Based on your experience, describe advantages and disadvantages of the location of 
   the Simulation Centre with regard to the plant: on-site versus off-site. Specifically, 
describe those factors which have some influence on the Operators’ attitude towards 
the simulator training and in the quality of the simulator training.

   **On site advantages:**
   Availability, own time schedule, possibility to investigate events immediately, close link to 
classroom training (examples demonstrated at the simulator).

   **On site disadvantages:**
   Daily work too close, missed group dynamics (compared to having a team for one week abroad).

2. a) During simulator training sessions, what factors (time, communications, etc.) 
influencing the interactions between Control Room Operators and other Plant 
Personnel (Operations Department outside of Control Room Personnel, 
Maintenance or Instrumentation, and Control Departments, Technical Support 
Centre, etc.) are simulated?

   Simulated by instructor.

   b) Do these other Plant Personnel participate in the training sessions? 
   Describe the present training format pertaining to involvement of non Control 
Room Personnel in simulator training sessions and explain why this format is 
used.

   Not by now.

3. What environmental conditions (normal and emergency lighting, humidity, noise, 
vibrations, sounds generated by equipments, etc.) that could be experienced by the 
reference plants, are usually simulated in the Simulator Rooms? 
Describe the use of such effects at your simulator centre and explain why they are, or 
are not, incorporated into simulator training sessions.

   None.

4. Do Control Room Operators receive simulator training for operations outside the 
Control Room, for example: operations from Remote Shutdown Panels? 
Describe this type of training as it exists at your Simulator Centre and explain why it 
is, or is not, used in training sessions.

   Yes (RSD). Shutdown of plant from RSD according to emergency procedures.
5. a) How frequently are the changes taking place in plant (plant design changes, procedures changes, etc.) incorporated to the replica or full-scope simulator? Describe any process or mechanism in place at your Simulator Centre to incorporate changes to the replica or full-scope simulator.

Yearly upgrade package (changes take place during outage). Only training relevant design changes.

b) Do simulator model modifications require separate approval while the simulator is being used for training?

No changes during training. Changes are done independent of training, released after acceptance by the training department. There are two clearly distinct versions, the training version (approved), and the test version.

6. a) Identify the members of the Control Room Shift Team (Reactor Operators, Turbine Operators, Shift Supervisors, etc.) and indicate the time (in hours) dedicated to simulator training by each member in their initial training programme. Specify, when applicable, the time spent with each type of simulator.

Reactor operators: 160 hours.
Shift supervisors: 100 hours.

b) Indicate the time (in hours) dedicated to simulator training by each member of the Control Room Shift Team in their continuous training programme. Specify, when applicable, the time spent with each type of simulator.

20-40 hours per shift member per year.

c) What is the minimum time, if any, required by the Regulatory Body?

Not specified for training but for requalification of licensed personnel (once every 2 years).

7. a) Indicate the percentage of simulator training time by the different Members of the Control Room Shift Team devoted to i) normal, ii) abnormal and iii) emergency conditions in their initial training programme.

Normal: 70%
Emergency: 30%

b) Indicate the percentage of simulator training time by the different Members of the Control Room Shift Team devoted to i) normal ii) abnormal and iii) emergency conditions in their continuous training programme.

Normal: 20%
Emergency: 80%

c) What are the minimum percentages, if any, required by the Regulatory Body?

None.
8. What is the role and the policy of the Regulatory Body regarding the use of simulators for Control Room Operators licensing and training?

See nº6) c.

9. a) What standards (ANSI/ANS 3.5, IAEA, etc.) are simulators built to and maintained?

ANSI/ANS 3.5 is used as a basis by the vendor but additional extensive specification and test programmes.

b) What exceptions are typically taken to the standard?

Not applicable.

c) What types of simulators are used that are not included in industry standards?

Basic principles simulator (for fundamental education at the Reactor School of the Paul Scherrer Institute).

10. a) Describe the role of part-task simulators in your current training programs.

Not applicable.

b) Describe the role of special-purpose (analytic) simulators in your current training programs.

Not applicable.

11. Have the current operator training programs been conditioned by the availability and capabilities of the simulator(s) or, alternatively, has(ve) the simulator(s) been specified and acquired after analysing and designing the training programs? Explain.

No.

12. What extensions of simulator training are envisaged for the future?

Simulator is newly installed. Will be defined upon the gained experience.

13. a) Based on your experience, describe the uses of the simulators for activities other than training (plant drills, procedures validation, design changes validation, testing programs, acquisition of human data, licensing activities, reference plant systems “tuning”, etc.).

Procedure validation; additional future activities planned.

b) What is the involvement of Control Room Operators for those applications?

Not applicable today.
14. What are the applications of simulator training for jobs other than Operations?

Planned for emergency staff members; objectives defined later.

SECTION 3: Systematic Approach to Training: considerations regarding the use of simulators.

A) Training analysis.

1. **Are job and task analysis (or any other type of task identification technique) used for establishing a list of task, performance standards, learning objectives and training methods?**
   **If yes, describe the technique used.**

   Learning objectives have been designed according to the task requirements.
   - System and NPP knowledge.
   - Behaviour.

2. **a) What are the criteria that determine the limits or scope of the job analysis for the Control Room Operators?**

   Task requirements and learning objectives have been established by the Swiss Group of NPP Managers (GSKL).

   **b) From your point of view, what should the role of risk-based criteria be for determining such limits or scope? Explain your answers.**

   Scenarios with high risk are trained routinely.

3. **Are there any special requirements for Job and Task Analysis which are imposed by the possibility of associated simulator training?**

   Not applicable.

B) Training programme design.

1. **What are the criteria for specifying simulator training rather than another training setting (classroom, laboratory, workshop, on-the-job, etc.)?**

   Consolidate basic knowledge, complex operations with special needs for communication and handling.

2. **What are the criteria for selecting different types of simulator (full-scope, replica, part-task, basic principles, concept, special-purpose)?**

   Basic principles for basic training, full scope.
3. a) What are the criteria for selecting a replica simulator?

New operators with no experience from the initial start up phase. Increase skills also for normal operations.

b) What are the fidelity requirements?

ANSI/ANS 3.5
Elements necessary for the plants feedback to the operator were identified and incorporated. Critical parameters were defined which should give the operator a valuable representation of the status of the plant.

4. What are the specific pre-requisites for operators undertaking simulator training?

 Completed fundamental training at the Reactor School, systems training at the plant.

5. Does the possibility of simulator training impose any constraints on the definition of learning objectives?

No.

C) Training programme development.

1. In the case of non-replica simulators, is it necessary to take parallel training actions, and if so, what kind? Explain your answer.

   Not applicable.

2. Do you use specific procedures for the training simulator, actual plant procedures or a combination of both? Explain your answer and give reasons for the choice.

   Only actual plant specific procedures.

3. What are the criteria for selecting normal, abnormal and emergency scenarios to be trained with simulators? Are they risk-based criteria? Explain your answer.

   Abnormal, emergency: standard scenarios, events (own and others), plant modifications. Normal operations: feedback of shift supervisors, plant modifications.

4. How are lesson plans and support documentation developed for simulator training?

   Standard plant specific documentation procedure for training to develop training modules and lesson plans.
D) Training programme implementation.

1. What selection, initial training, and continuing training is arranged for simulator instructors?

   Experienced shift supervisors.
   Special didactical and methodological workshop especially for simulator training (with the vendor, General Electric).
   Including continuing training.

2. What are the arrangements for instructor monitoring of, and feedback to, trainees during simulator sessions?

   Standardised evaluation criteria (procedure) for knowledge (systems), skills and behaviour (observation, interview).

3. a) What specific training modes such as simulator freeze, playback, running at higher speed than real time, activity recording, video recording, etc. is made use of during initial training?

   All listed possibilities except video.

   b) What specific training modes such as simulator freeze, playback, running at higher speed than real time, activity recording, video recording, etc. is made use of during continuous training?

   All listed possibilities except video.

4. What limits of simulation impede planned training sessions or examination scenarios?

   None.

E) Trainee assessment.

1. a) What methods and procedures are used for initial trainee assessment during and after simulator sessions?

   Observation (structured by procedure).

   b) What methods and procedures are used for continuous trainee assessment during and after simulator sessions?

   As above.
2. List and describe the main areas or groups of skills and knowledge of the trainee assessed in training simulators (for example: “control board awareness, event diagnosis, immediate actions / entry-level actions, subsequent actions, control board manipulations, use of procedures / technical specifications / reference data, communications, supervisory ability, team skills” (IAEA-TECDOC-525)). Identify, when applicable, the types of simulator used for addressing each one.

Knowledge (systems, plant behaviour), event diagnosis, skills (control board manipulation, application of procedures), behaviour (communication, team behaviour, leadership, etc.).

3. Describe the ranking of importance, if any, given to the main areas or groups of skills and knowledge taken into account for a trainee assessment.

Depends upon the different scenarios.

4. a) Based on your experience, describe difficulties you have had for assessing the individual skills and knowledge of a trainee while operating within a whole Control Room Shift Team during simulator sessions.

Instructors cannot observe everything. Since observer and instructor is the same person, there is no clear distinction between “coaching” and “evaluation”.

b) Describe the measures adopted to overcome these difficulties.

Use two instructors, one explicitly for evaluation.
Detailed lesson plan for the instructor.
Detailed assessment form.

5. a) Based on your experience, describe influences on trainees performance during simulator sessions resulting from the attendance of personnel such as utility managers, regulatory body inspectors, etc.

Only very few but necessary audits (plant manager, operations manager). Trainees are disturbed (depending also very much on the trainee).

b) Based on your experience, describe influences on trainees performance during simulator sessions resulting from the attendance of personnel such as utility managers, regulatory body inspectors, etc.

Initial training: strong support results in good performance.
Continuous training: coaching only, observation from the background.

6. a) Are training simulator examinations used in order to grant initial license to operators?

Explain.

No.

b) Are training simulator examinations used for requalification?

Explain.

Yes; observation during normal simulator lessons (not a separate exam/lesson).
7. How is examination integrity preserved during the examination/scenario preparation period?

The lesson plans with the scenarios are not distributed to the trainees. Verbal communication has no significant effect.

8. What performance monitoring or data acquisition features of the simulator are used during simulator examinations?

Only the recording function of the simulator. Observation and personal notes of the accompanying picket-engineer.

F) Training programme evaluation.

1. Describe the approach used for evaluating the simulator training programme and main results.

Audits by line management.
Feedback from instructors and trainees.

2. What programme is in place for validation and continuous verification of the simulator performance?

None. Comparison of simulator performance to real NPP behaviour by experienced shift personnel and instructors.

3. What types of performance discrepancies are most frequently identified by operators during training sessions?

Not applicable.

4. What types of performance discrepancies are most frequently identified by examiners or inspectors?

Not applicable.

SECTION 4: Use of operating experience for operator training with simulators.

1. How is operational experience feedback incorporated into the design of simulator training programs (experience reviewed, schedule, people involved)?

Relevant events at the plant or at other similar plants are integrated in the training programme.

2. Has your organisation developed any kind of programme by which simulator operator training is correlated with real operating events?

Explain.

No.
SECTION 5: Specific topics on Operator training with simulators.

A) Team training techniques.

1. a) Are job and task analyses used for defining the role and responsibilities of the Members of the Control Room Shift Teams and, in general, of the various levels of staff who are charged with operation of the plant? Explain your answer.

Basic job analysis is used. General requirements (criteria) have been established for the selection of operators, shift supervisors and picket-engineers. These general requirements also define the training objectives.

b) Are job and task analyses used for establishing performance standards, learning objectives and training methods for Team skills training? Explain your answer.

As above.

2. List and describe Team skills (communication, management of resources, team cooperation, team leadership, feedback, conflict resolution, team decision-making, etc.) which are trained using simulators. Identify, when applicable, the types of simulator used for training each one.

Mainly communication and team leadership.

3. Are any guides used for conducting and evaluating Team skills training simulations? Explain your answer.

Included and communicated in simulator instructor training.

4. Based on your experience, describe advantages and disadvantages of Team training with the participation of the same (usual) Members every time or with changes in the Shift Team compositions.

Changes within the team are possible. This corresponds to the real world but makes the training more difficult.

5. Are simulator sessions used for the optimisation of control Room Team Shifts taking into account the characteristics (aptitudes, attitudes, ...) of each Operator? In other words, are simulator sessions used for deciding which Members are going to constitute each Shift Team? Explain your answer.

To some extent: yes.

6. Are there any licensing examinations applied to the whole Control Room Shift Team in addition to the individual licensing examinations? Explain.

No.
B) Training for stress.

1. Is any part of the simulator training programme specifically devoted to train Control Room Operators to operate under stress? Explain your answer.
   Stress induced by training, must be compatible with scenario.

2. Are stress levels induced and measured during simulator training sessions? If yes, describe the methods and results.
   No.

3. Based on your experience describe any measures adopted during simulator training to counter stress.
   Workshops, not specifically in simulator training.

C) The theoretical basis underlying training.

1. Are any models of human behaviour being used in designing and implementing training programmes?
   If yes:
   i) refer to or describe the models,
   ii) indicate the areas in which these models are being applied (for example: signal detections, decision-making, etc.)
   iii) give the main results.
   No.

D) Habits acquired during training sessions with simulators.

1. Describe, based on your experience, undesirable habits which could be acquired by trainees during training sessions with simulators (for example: due to limited number of simulated scenarios, due to lack of physical or functional fidelity, due to the use of conservative codes for simulation instead of best estimate codes, etc.) and discuss their potential consequences on safety.
   Not yet.

2. Describe, based on your experience, any measures adopted to avoid acquisition of those undesirable habits or to prevent use of them.
   Not applicable.
E) Simulator training on normal and emergency conditions during shutdown and low power operation.

1. **What use is made of simulators for Control Room Operator training in normal, abnormal and emergency conditions during shutdown and low power operation (simulated scenarios, trained skills, training techniques, ...)?**

   No scenarios at zero power.

2. **What are the criteria (risk-based criteria, deterministic criteria, results of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?**

   Not applicable.

3. **Are job and task analysis (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on shutdown and low power operation? Explain.**

   No.

4. **What are your plans for the future in this area?**

   None.

F) Simulator training on severe accidents.

1. **What use is made of simulators for Control Room Operator training in severe accidents (simulated scenarios, trained skills, training techniques, ...)?**

   No severe accident scenarios are trained at the simulator.

2. **What are the criteria (risk-based criteria, deterministic criteria, result of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?**

   Not applicable.

3. **Are job and task analysis (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on severe accidents. Explain.**

   Not applicable.

4. **What are your plans for the future in this area?**

   None.
G) Simulator training on accidents caused by fires, floods, earthquakes, etc.

1. What use is made of simulators for Control Room Operator training in accidents caused by fires, floods, earthquakes, etc. (simulated scenarios, trained skills, training techniques,...)?

   Remote shutdown operations.

2. What are the criteria (risk-based criteria, deterministic criteria, result of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?

   Criteria are the result of need analyses.

3. Are job and task analyses (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on accidents caused by fires, floods, earthquakes, etc.?

   Explain.

   No.

4. What are your plans for the future in this area?

   None.
QUESTIONNAIRE

SECTION 0: Organisation/s replying to the questionnaire

1. Name of Organisation/s.
   Gösgen NPP

2. Contact Person/s.
   Kurt Gautschi, Training Manager

3. Address and contact information (telephone, fax).
   Kernkraftwerk Gösgen-Däniken AG
   Postfach 55
   CH-4658 Däniken
   +41-62-288 20 00

SECTION 1: General Information (related to the whole country)

1. Number of nuclear reactors (Units) in operation.
   5

2. Number of Sites with at least one Unit in operation.
   4

3. Number of full-scope (replica and no replica) simulators used for operator training.
   4

4. Number of replica simulators used for operator training.
   1 (2 - one NPP (Mühleberg) is just now (April 1995) in the phase of final testing of its (“reduced”) replica simulator. All further information on the Mühleberg simulator concerns the planned situation for training on site.)

5. Number of part-task simulators used for operator training.
   0

6. Number of basic principles simulators used for operator training.
   1 basic principles simulator (fundamental education) at the centralised Reactor School of the Paul Scherrer Institute
   1 compact simulator (plant specific training)
7. Number of concept simulators used for operator training.
   0

8. Number of special-purpose simulators used for operator training.
   1 (glass model)

9. For how many Units is the training done on replica training simulators?
   1 (2 - One NPP (Mühleberg) is just now (April 1995) in the phase of final testing of its
   ("reduced") replica simulator. All further information on the Mühleberg simulator concerns the
   planned situation for training on site.)

10. For how many Units is the training done on full-scope (replica and no replica)
     training simulators.
     5

IMPORTANT QUESTION

Are your answers to the subsequent sections (2 to 5) of the questionnaire related to a
specific Organisation or Training Centre in your Country?

Yes _X_ No__ (Mark your answer with an X)

If yes, indicate the name of the Organisation or Training Centre and describe briefly
the simulation facility referred to in answer to the question below (f.i. located on-site or
off-site, type of simulator/s, sample photograph, reference NPP/s, NPP/s which receive
training in this facility, size and composition of the simulator instructional and support
staff, etc.) and, also, describe this/these NPP/s (f.i. type (PWR, BWR, etc.), vendor, start of
operation, degree of automation, Operators which constitute the Control Room Shift
Team, sample photograph of the control room/s, etc.).

<table>
<thead>
<tr>
<th>NPP</th>
<th>1 Unit 1000 MW rated power output</th>
</tr>
</thead>
<tbody>
<tr>
<td>NSSS</td>
<td>consists of a Siemens (KWU) three loop PWR</td>
</tr>
<tr>
<td>Start of operation</td>
<td>1979</td>
</tr>
<tr>
<td>Degree of automation</td>
<td>highly automated</td>
</tr>
<tr>
<td></td>
<td>30 min criterion applied</td>
</tr>
<tr>
<td>Control room staff</td>
<td>Minimum shift coverage:</td>
</tr>
<tr>
<td></td>
<td>1 shift supervisor</td>
</tr>
<tr>
<td></td>
<td>1 deputy shift supervisor</td>
</tr>
<tr>
<td></td>
<td>1 (licensed) senior reactor operator (*)</td>
</tr>
<tr>
<td></td>
<td>1 (licensed) reactor operator (*)</td>
</tr>
<tr>
<td></td>
<td>4 plant operators</td>
</tr>
<tr>
<td></td>
<td>1 picket-engineer (*) (shift technical advisor) on call at the plant</td>
</tr>
<tr>
<td>Control room staff</td>
<td>3 shift supervisors</td>
</tr>
<tr>
<td>for simulator training</td>
<td>1 licensed operators</td>
</tr>
<tr>
<td>Instructors</td>
<td>All KKG picket-engineers act as simulator instructors.</td>
</tr>
<tr>
<td></td>
<td>GfS Essen Simulator: full-time instructor from GfS</td>
</tr>
<tr>
<td></td>
<td>1-2 instructors from Gösgen (picket-engineers)</td>
</tr>
<tr>
<td></td>
<td>Furnas Simulator: 2 KKG picket-engineers as instructors</td>
</tr>
</tbody>
</table>
Simulator | 1 full scope simulator at the Simulator Training Centre in Essen (GfS), Germany, plant specific models. 1 full scope simulator in Furnas (Brazil), models partly plant specific.
--- | ---
On site support

*Picket-Engineers* are engineers who have completed the same career as Shift Supervisors (i.e. Plant Operator --> Reactor Operator --> Shift Supervisor). Additionally to that they have done special training on emergencies, severe accidents in classroom training and self study and an extensive simulator training. After their licensing examination they act as Shift Technical Advisors. The picket-engineer on duty (24 hours shift coverage) has to be at the site.

**SECTION 2:** Current practices with simulators closely related to operator training.

1. Based on your experience, describe advantages and disadvantages of the location of the Simulation Centre with regard to the plant: on-site versus off-site. Specifically, describe those factors which have some influence on the Operators’ attitude towards the simulator training and in the quality of the simulator training.

   **Full scope simulator off site**
   **Advantages:** absence from NPP --> concentrate on training group dynamic effects.
   **Disadvantages:** low accessibility to simulator problems with scheduling due to other users.

2. a) During simulator training sessions, what factors (time, communications, etc.) influencing the interactions between Control Room Operators and other Plant Personnel (Operations Department outside of Control Room Personnel, Maintenance or Instrumentation, and Control Departments, Technical Support Centre, etc.) are simulated?

   Simulated by instructor.

   b) Do these other Plant Personnel participate in the training sessions?
   Describe the present training format pertaining to involvement of non Control Room Personnel in simulator training sessions and explain why this format is used.

   No, only control room personnel.

3. What environmental conditions (normal and emergency lighting, humidity, noise, vibrations, sounds generated by equipments, etc.) that could be experienced by the reference plants, are usually simulated in the Simulator Rooms?
Describe the use of such effects at your simulator centre and explain why they are, or are not, incorporated into simulator training sessions.

   Boron counter noise
   Control rod counter
   Diesel operation (light)
4. Do Control Room Operators receive simulator training for operations outside the Control Room, for example: operations from Remote Shutdown Panels? Describe this type of training as it exists at your Simulator Centre and explain why it is, or is not, used in training sessions.

No. The emergency control rooms are very simple and they are used during weekly testing.

5. a) How frequently are the changes taking place in plant (plant design changes, procedures changes, etc.) incorporated to the replica or full-scope simulator? Describe any process or mechanism in place at your Simulator Centre to incorporate changes to the replica or full-scope simulator.

Less than once per year. Change management involves training section and the information is communicated to the instructors at the training centre.

b) Do simulator model modifications require separate approval while the simulator is being used for training?

Three phases: Modification implementation
Test and approval
Training

6. a) Identify the members of the Control Room Shift Team (Reactor Operators, Turbine Operators, Shift Supervisors, etc.) and indicate the time (in hours) dedicated to simulator training by each member in their initial training programme. Specify, when applicable, the time spent with each type of simulator.

Reactor/turbine operators have 8 weeks initial training.
Senior operators at least 3 additional weeks.
Shift supervisors at least 3 additional weeks
Picket-engineers are preferably trained at the Furnas simulator.

b) Indicate the time (in hours) dedicated to simulator training by each member of the Control Room Shift Team in their continuous training programme. Specify, when applicable, the time spent with each type of simulator.

> 1 week per year.

c) What is the minimum time, if any, required by the Regulatory Body?

Not specified for training but for requalification of licensed personnel (once every 2 years).

7. a) Indicate the percentage of simulator training time by the different Members of the Control Room Shift Team devoted to i) normal, ii) abnormal and iii) emergency conditions in their initial training programme.

Each approximately 1/3.
b) Indicate the percentage of simulator training time by the different Members of the Control Room Shift Team devoted to i) normal ii) abnormal and iii) emergency conditions in their continuous training programme.

- Normal: 20%
- Abnormal: 40%
- Emergency: 40%

c) What are the minimum percentages, if any, required by the Regulatory Body?

None.

8. What is the role and the policy of the Regulatory Body regarding the use of simulators for Control Room Operators licensing and training?

See nº6) c.

9. a) What standards (ANSI/ANS 3.5, IAEA, etc.) are simulators built to and maintained?

ANSI/ANS 3.5 is part of the simulator specification. German rules are applied.

b) What exceptions are typically taken to the standard?

Exceptions are clearly defined in the simulator specifications. GfS has internal guidelines.

c) What types of simulators are used that are not included in industry standards?

Basic principles simulator (for fundamental education at the Reactor School of the Paul Scherrer Institute).

10. a) Describe the role of part-task simulators in your current training programs.

Not applicable.

b) Describe the role of special-purpose (analytic) simulators in your current training programs.

Thermohydraulic Glassmodel is used for visualisation of TH processes.

11. Have the current operator training programs been conditioned by the availability and capabilities of the simulator(s) or, alternatively, has(ve) the simulator(s) been specified and acquired after analysing and designing the training programs? Explain.

The possibilities of the simulators do not affect the training programme. If there is a need for additional training the simulator is modified accordingly.

12. What extensions of simulator training are envisaged for the future?

Replica simulator on site.
13. a) Based on your experience, describe the uses of the simulators for activities other than training (plant drills, procedures validation, design changes validation, testing programs, acquisition of human data, licensing activities, reference plant systems “tuning”, etc.).

Generation of data for emergency exercises. Exercises done with emergency staff in the simulator control room.

b) What is the involvement of Control Room Operators for those applications?

None.

14. What are the applications of simulator training for jobs other than Operations?

Emergency staff, engineers, physicists, i&c.

SECTION 3: Systematic Approach to Training: considerations regarding the use of simulators.

A) Training analysis.

1. Are job and task analysis (or any other type of task identification technique) used for establishing a list of task, performance standards, learning objectives and training methods?
   If yes, describe the technique used.

The training goal is to have generalists in the control room which are able to understand the whole process and at the same time the purpose and effects of individual systems and components. There is a more generic approach to the task because of the high automation level of the plant.

2. a) What are the criteria that determine the limits or scope of the job analysis for the Control Room Operators?

Task requirements and learning objectives have been established by the Swiss Group of NPP Managers (GSKL).

b) From your point of view, what should the role of risk-based criteria be for determining such limits or scope? Explain your answers.

Scenarios with high risk are trained routinely.

3. Are there any special requirements for Job and Task Analysis which are imposed by the possibility of associated simulator training?

Not applicable.
B) Training programme design.

1. What are the criteria for specifying simulator training rather than another training setting (classroom, laboratory, workshop, on-the-job, etc.)?

   Learning objectives, subject must be relevant to training.

2. What are the criteria for selecting different types of simulator (full-scope, replica, part-task, basic principles, concept, special-purpose)?

   Learning objectives, basic principles simulator for primary education, full scope simulator for initial operator training and team training.

3. a) What are the criteria for selecting a replica simulator?

   Learning objectives, basic principles simulator for primary education, full scope simulator for initial operator training and team training.

   b) What are the fidelity requirements?

   Usual standards (i.e. ANSI/ANS 3.5.), detailed specifications.

4. What are the specific pre-requisites for operators undertaking simulator training?

   Successfully completed reactor technician school, completed systems training.

5. Does the possibility of simulator training impose any constraints on the definition of learning objectives?

   No (except training in emergency control room, which is covered by weekly tests).

C) Training programme development.

1. In the case of non-replica simulators, is it necessary to take parallel training actions, and if so, what kind?

   Explain your answer.

   Training (orientation) on photographs of the real and the simulator control room, drawings, preparation of class room.

2. Do you use specific procedures for the training simulator, actual plant procedures or a combination of both?

   Explain your answer and give reasons for the choice.

   Only actual plant specific procedures.
3. **What are the criteria for selecting normal, abnormal and emergency scenarios to be trained with simulators? Are they risk-based criteria? Explain your answer.**

SGTR is standard, rarely appearing events, high risk events. 
Operating experience in own plant and from others if applicable to KKG. 
Plant modifications. 
PSA. 
Results of qualification runs on simulator.

4. **How are lesson plans and support documentation developed for simulator training?**

Training programme is designed and tested in co-ordination with the GfS instructor. Second test of the programme by training manager and picket-engineers. Final run, adaptations are still possible.

**D) Training programme implementation.**

1. **What selection, initial training, and continuing training is arranged for simulator instructors?**

According to guidelines of GfS. 
Instructors have a qualification that corresponds to licensed shift supervisors (written test, interview, simulator test, test lessons). 
Instructors have to spend 2 weeks/year at the plant.

2. **What are the arrangements for instructor monitoring of, and feedback to, trainees during simulator sessions?**

Mixture of interview/instruction (intervention during the training session if necessary). 
Playback and discussion after the training session.

3. a) **What specific training modes such as simulator freeze, playback, running at higher speed than real time, activity recording, video recording, etc. is made use of during initial training?**

All listed possibilities except video.

b) **What specific training modes such as simulator freeze, playback, running at higher speed than real time, activity recording, video recording, etc. is made use of during continuous training?**

All listed possibilities except video.

4. **What limits of simulation impede planned training sessions or examination scenarios?**

Training sessions are planned within the limits of the simulation and are verified before training. If there is an ultimate need for training which is not within the capabilities of the simulator, the simulator will be modified accordingly.
E) Trainee assessment.

1. a) What methods and procedures are used for initial trainee assessment during and after simulator sessions?

   Observation (simulator instructor, picket-engineer). Check against required skills, behaviour.

   b) What methods and procedures are used for continuous trainee assessment during and after simulator sessions?

   As above.

2. List and describe the main areas or groups of skills and knowledge of the trainee assessed in training simulators (for example: “control board awareness, event diagnosis, immediate actions / entry-level actions, subsequent actions, control board manipulations, use of procedures / technical specifications / reference data, communications, supervisory ability, team skills” (IAEA-TECDODC-525)). Identify, when applicable, the types of simulator used for addressing each one.

   All mentioned criteria.

3. Describe the ranking of importance, if any, given to the main areas or groups of skills and knowledge taken into account for a trainee assessment.

   Depends upon the different scenarios.

4. a) Based on your experience, describe difficulties you have had for assessing the individual skills and knowledge of a trainee while operating within a whole Control Room Shift Team during simulator sessions.

   Observation by one person, subjective opinion.

   b) Describe the measures adopted to overcome these difficulties.

   Discussion with the GfS instructor. Individual interviews after the session.

5. a) Based on your experience, describe influences on trainees performance during simulator sessions resulting from the attendance of personnel such as utility managers, regulatory body inspectors, etc.

   During explicit qualification sessions and with the presence of external persons the trainees do not show such a free behaviour as in normal training sessions.

   b) Based on your experience, describe influences on trainees performance during simulator sessions resulting from the attendance of personnel such as utility managers, regulatory body inspectors, etc.

   Since the GfS instructor is well known and the accompanying picket-engineer is a member of the plant there is no remarkable influence.

6. a) Are training simulator examinations used in order to grant initial license to operators?
b) Are training simulator examinations used for requalification?

Explain.

Simulator sessions are used for the KKG internal qualification. Should deficiencies of individuals be recognised which result in a withdrawal from shift duties, it would be communicated to the Regulatory Body.

7. How is examination integrity preserved during the examination/scenario preparation period?

Picket-engineers are doing the qualification. All of them have run and tested the scenario. this guarantees a common understanding in the evaluation of the operators.

8. What performance monitoring or data acquisition features of the simulator are used during simulator examinations?

Only the recording function of the simulator. Observation and personal notes of the accompanying picket-engineer.

F) Training programme evaluation.

1. Describe the approach used for evaluating the simulator training programme and main results.

See programme development. Picket-engineers run the whole programme.

2. What programme is in place for validation and continuous verification of the simulator performance?

Check against codes for accident conditions (Siemens). Critical comments from operators. Comparison of plant data during transients with accordingly simulated transient.

3. What types of performance discrepancies are most frequently identified by operators during training sessions?

None.

4. What types of performance discrepancies are most frequently identified by examiners or inspectors?

None.
SECTION 4: Use of operating experience for operator training with simulators.

1. How is operational experience feedback incorporated into the design of simulator training programs (experience reviewed, schedule, people involved)?
   
   c.f. development of the training programme.

2. Has your organisation developed any kind of programme by which simulator operator training is correlated with real operating events?
   
   Explain.

   No special procedure, but involved in the development of the training programme.

SECTION 5: Specific topics on Operator training with simulators.

A) Team training techniques.

1. a) Are job and task analyses used for defining the role and responsibilities of the Members of the Control Room Shift Teams and, in general, of the various levels of staff who are charged with operation of the plant? Explain your answer.
   
   Basic job analysis is used. General requirements (criteria) have been established for the selection of operators, shift supervisors and picket-engineers. These general requirements also define the training objectives.

   b) Are job and task analyses used for establishing performance standards, learning objectives and training methods for Team skills training?
   
   Explain your answer.

   As above.

2. List and describe Team skills (communication, management of resources, team co-operation, team leadership, feedback, conflict resolution, team decision-making, etc.) which are trained using simulators. Identify, when applicable, the types of simulator used for training each one.

   Full scope simulator for communication, team co-operation, leadership and decision-making.

3. Are any guides used for conducting and evaluating Team skills training simulations?
   
   Explain your answer.

   Checklist, no video (it was observed that behaviour changes during the use of video).

4. Based on your experience, describe advantages and disadvantages of Team training with the participation of the same (usual) Members every time or with changes in the Shift Team compositions.

   Team composition corresponds not to the actual team composition in the plant. Avoid the establishment of team internal rules. The composition of shift-teams at the plant are modified approximately once per year.
5. Are simulator sessions used for the optimisation of control Room Team Shifts taking into account the characteristics (aptitudes, attitudes, ...) of each Operator? In other words, are simulator sessions used for deciding which Members are going to constitute each Shift Team? Explain your answer.

No.

6. Are there any licensing examinations applied to the whole Control Room Shift Team in addition to the individual licensing examinations? Explain.

No.

B) Training for stress.

1. Is any part of the simulator training programme specifically devoted to train Control Room Operators to operate under stress? Explain you answer.

Not specifically. Stress may occur during special scenarios and during the evaluation session.

2. Are stress levels induced and measured during simulator training sessions? If yes, describe the methods and results.

No.

3. Based on your experience describe any measures adopted during simulator training to counter stress.

Stress reduction techniques are communicated to the individuals. They are recommended to be applied during the simulator session.

C) The theoretical basis underlying training.

1. Are any models of human behaviour being used in designing and implementing training programmes? If yes:
   i) refer to or describe the models,
   ii) indicate the areas in which these models are being applied (for example: signal detections, decision-making, etc.)
   iii) give the main results.

Not specifically.
**D) Habits acquired during training sessions with simulators.**

1. Describe, based on your experience, undesirable habits which could be acquired by trainees during training sessions with simulators (for example: due to limited number of simulated scenarios, due to lack of physical or functional fidelity, due to the use of conservative codes for simulation instead of best estimate codes, etc.) and discuss their potential consequences on safety.
   
   No.

2. Describe, based on your experience, any measures adopted to avoid acquisition of those undesirable habits or to prevent use of them.
   
   Not applicable.

**E) Simulator training on normal and emergency conditions during shutdown and low power operation.**

1. What use is made of simulators for Control Room Operator training in normal, abnormal and emergency conditions during shutdown and low power operation (simulated scenarios, trained skills, training techniques, ...)?
   
   None.

2. What are the criteria (risk-based criteria, deterministic criteria, results of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?
   
   Not applicable.

3. Are job and task analysis (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on shutdown and low power operation?
   
   Explain.

   No.

4. What are your plans for the future in this area?
   
   Models for mid loop operations.

**F) Simulator training on severe accidents.**

1. What use is made of simulators for Control Room Operator training in severe accidents (simulated scenarios, trained skills, training techniques, ...)?
   
   No severe accident training on simulators. Scenarios are communicated and discussed.
2. What are the criteria (risk-based criteria, deterministic criteria, result of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?

Not applicable.

3. Are job and task analysis (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on severe accidents.

Explain.

Not applicable.

4. What are your plans for the future in this area?

None.

G) Simulator training on accidents caused by fires, floods, earthquakes, etc.

1. What use is made of simulators for Control Room Operator training in accidents caused by fires, floods, earthquakes, etc. (simulated scenarios, trained skills, training techniques,...)?

None.

2. What are the criteria (risk-based criteria, deterministic criteria, result of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?

Not applicable.

3. Are job and task analyses (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on accidents caused by fires, floods, earthquakes, etc.?

Explain.

No.

4. What are your plans for the future in this area?

None.
QUESTIONNAIRE

SECTION 0: Organisation/s replying to the questionnaire

1. Name of Organisation/s.
   Mühleberg NPP

2. Contact Person/s.
   Ulrich Ryf, Training Manager

3. Address and contact information (telephone, fax).
   BWK Energie AG
   Kernkraftwerk Mühleberg
   CH-3203 Mühleberg
   +41-31-754 71 11

SECTION 1: General Information (related to the whole country)

1. Number of nuclear reactors (Units) in operation.
   5

2. Number of Sites with at least one Unit in operation.
   4

3. Number of full-scope (replica and no replica) simulators used for operator training.
   4

4. Number of replica simulators used for operator training.
   1 (2 - one NPP (Mühleberg) is just now (April 1995) in the phase of final testing of its (“reduced”) replica simulator. All further information on the Mühleberg simulator concerns the planned situation for training on site.)

5. Number of part-task simulators used for operator training.
   0

6. Number of basic principles simulators used for operator training.
   1 basic principles simulator (fundamental education) at the centralised Reactor School of the Paul Scherrer Institute
   1 compact simulator (plant specific training)
7. Number of concept simulators used for operator training.

0

8. Number of special-purpose simulators used for operator training.

1 (glass model)

9. For how many Units is the training done on replica training simulators?

1 (2 - One NPP (Mühleberg) is just now (April 1995) in the phase of final testing of its (“reduced”) replica simulator. All further information on the Mühleberg simulator concerns the planned situation for training on site.)

10. For how many Units is the training done on full-scope (replica and no replica) training simulators.

5

IMPORTANT QUESTION

Are your answers to the subsequent sections (2 to 5) of the questionnaire related to a specific Organisation or Training Centre in you Country?

Yes X    No__  (Mark your answer with an X)

If yes, indicate the name of the Organisation or Training Centre and describe briefly the simulation facility referred to in answer to the question below ( f.i. located on-site or off-site, type of simulator/s, sample photograph, reference NPP/s, NPP/s which receive training in this facility, size and composition of the simulator instructional and support staff, etc.) and, also, describe this/these NPP/s (f.i. type (PWR, BWR, etc.), vendor, start of operation, degree of automation, Operators which constitute the Control Room Shift Team, sample photograph of the control room/s, etc.).

<table>
<thead>
<tr>
<th>NPP</th>
<th>GE-BWR4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start of operation</td>
<td>1972</td>
</tr>
<tr>
<td>Degree of automation</td>
<td>Originally low automation, many backfittings on safety systems 30 min criterion applicable on many systems according analysis.</td>
</tr>
<tr>
<td>Control room staff</td>
<td>1 shift supervisor 1 deputy shift supervisor 2-3 reactor operators (6 shifts) 1 picket-engineer (*) (shift technical advisor) on call at the plant</td>
</tr>
<tr>
<td>Control room staff for simulator training</td>
<td>3 instructors 1 s/w engineer 3-4 licensed operators / shift supervisors</td>
</tr>
<tr>
<td>Instructors</td>
<td>3 instructors (KKM picket-engineers)</td>
</tr>
</tbody>
</table>
Simulator | Reduced replica (i.e. reduction in redundant systems: indications yes, control only by instructors station). Full scope simulator in Vermont Yankee, partly KKM specific.
---|---
On site support

*Picket-Engineers* are engineers who have completed the same career as Shift Supervisors (i.e. Plant Operator --> Reactor Operator --> Shift Supervisor). Additionally to that they have done special training on emergencies, severe accidents in classroom training and self study and an extensive simulator training. After their licensing examination they act as Shift Technical Advisors. The picket-engineer on duty (24 hours shift coverage) has to be at the site.

**SECTION 2:** Current practices with simulators closely related to operator training.

1. **Based on your experience, describe advantages and disadvantages of the location of the Simulation Centre with regard to the plant: on-site versus off-site. Specifically, describe those factors which have some influence on the Operators' attitude towards the simulator training and in the quality of the simulator training.**

   *On site advantages:* personnel planning, preparation of certain actual operations, immediate training on occurred events (time, administration).
   *Off site advantages:* increased flexibility of operators demanded and achieved, “difference training”, no disturbance by daily work.

2. a) **During simulator training sessions, what factors (time, communications, etc.) influencing the interactions between Control Room Operators and other Plant Personnel (Operations Department outside of Control Room Personnel, Maintenance or Instrumentation, and Control Departments, Technical Support Centre, etc.) are simulated?**

   Remote functions done on instructor station by instructor.

   b) **Do these other Plant Personnel participate in the training sessions?**

   **Describe the present training format pertaining to involvement of non Control Room Personnel in simulator training sessions and explain why this format is used.**

   No, only control room personnel.

3. **What environmental conditions (normal and emergency lighting, humidity, noise, vibrations, sounds generated by equipments, etc.) that could be experienced by the reference plants, are usually simulated in the Simulator Rooms?**

   **Describe the use of such effects at your simulator centre and explain why they are, or are not, incorporated into simulator training sessions.**

   Only light off during “loss of power”.

4. **Do Control Room Operators receive simulator training for operations outside the Control Room, for example: operations from Remote Shutdown Panels?**

   **Describe this type of training as it exists at your Simulator Centre and explain why it is, or is not, used in training sessions.**

   RSD control room.
5. a) How frequently are the changes taking place in plant (plant design changes, procedures changes, etc.) incorporated to the replica or full-scope simulator? Describe any process or mechanism in place at your Simulator Centre to incorporate changes to the replica or full-scope simulator.

Annually updates if training relevant.

b) Do simulator model modifications require separate approval while the simulator is being used for training?

Only approved models are used for training.

6. a) Identify the members of the Control Room Shift Team (Reactor Operators, Turbine Operators, Shift Supervisors, etc.) and indicate the time (in hours) dedicated to simulator training by each member in their initial training programme. Specify, when applicable, the time spent with each type of simulator.

Control room operators: initial training 80 hours.
Shift supervisors: 200 hours (including initial training as Rx operator, including retraining).

b) Indicate the time (in hours) dedicated to simulator training by each member of the Control Room Shift Team in their continuous training programme. Specify, when applicable, the time spent with each type of simulator.

50 hours (planned) per shift member per year.

c) What is the minimum time, if any, required by the Regulatory Body?

Not specified for training but for requalification of licensed personnel (once every 2 years).

7. a) Indicate the percentage of simulator training time by the different Members of the Control Room Shift Team devoted to i) normal, ii) abnormal and iii) emergency conditions in their initial training programme.

Normal: 75%
Abnormal: 20%
Emergency: 5%

b) Indicate the percentage of simulator training time by the different Members of the Control Room Shift Team devoted to i) normal ii) abnormal and iii) emergency conditions in their continuous training programme.

Normal: 20%
Abnormal: 50%
Emergency: 30%

c) What are the minimum percentages, if any, required by the Regulatory Body?

None.
8. What is the role and the policy of the Regulatory Body regarding the use of simulators for Control Room Operators licensing and training?

See nº6) c.

9. a) What standards (ANSI/ANS 3.5, IAEA, etc.) are simulators built to and maintained?

ANSI/ANS 3.5.

b) What exceptions are typically taken to the standard?

Partly simulated systems and not simulated systems (redundancies), according training needs analysis.

c) What types of simulators are used that are not included in industry standards?

Basic principles simulator (for fundamental education at the Reactor School of the Paul Scherrer Institute).

10. a) Describe the role of part-task simulators in your current training programs.

Not applicable.

b) Describe the role of special-purpose (analytic) simulators in your current training programs.

Not applicable.

11. Have the current operator training programs been conditioned by the availability and capabilities of the simulator(s) or, alternatively, has(ve) the simulator(s) been specified and acquired after analysing and designing the training programs? Explain.

On site simulator has been designed according to a deep analysis of training needs..

12. What extensions of simulator training are envisaged for the future?

Simulator is newly installed; will be defined upon the gained experience.

13. a) Based on your experience, describe the uses of the simulators for activities other than training (plant drills, procedures validation, design changes validation, testing programs, acquisition of human data, licensing activities, reference plant systems “tuning”, etc.).

Verification, modification and evaluation of emergency procedures.
Test of plant modifications on simulator.

b) What is the involvement of Control Room Operators for those applications?

Training of picket-engineers and emergency staff members.
14. What are the applications of simulator training for jobs other than Operations?

Planned for emergency staff members.

**SECTION 3: Systematic Approach to Training: considerations regarding the use of simulators.**

**A) Training analysis.**

1. Are job and task analysis (or any other type of task identification technique) used for establishing a list of task, performance standards, learning objectives and training methods?
   If yes, describe the technique used.

   Operational experience in own and other plants is used for programme design.

2. a) What are the criteria that determine the limits or scope of the job analysis for the Control Room Operators?

   Task requirements and learning objectives have been established by the Swiss Group of NPP Managers (GSKL).

   b) From your point of view, what should the role of risk-based criteria be for determining such limits or scope? Explain your answers.

   Scenarios with high risk are trained routinely.

3. Are there any special requirements for Job and Task Analysis which are imposed by the possibility of associated simulator training?

   Not applicable.

**B) Training programme design.**

1. What are the criteria for specifying simulator training rather than another training setting (classroom, laboratory, workshop, on-the-job, etc.)?

   Defined training objectives according to training analysis (skills, practical experience).

2. What are the criteria for selecting different types of simulator (full-scope, replica, part-task, basic principles, concept, special-purpose)?

   Not applicable.

3. a) What are the criteria for selecting a replica simulator?

   Real world. Skill based behaviour. Eliminate bad habits.
b) What are the fidelity requirements?

ANSI/ANS 3.5.

4. What are the specific pre-requisites for operators undertaking simulator training?

Completed fundamental training at the Reactor School, systems training at the plant.

5. Does the possibility of simulator training impose any constraints on the definition of learning objectives?

No.

C) Training programme development.

1. In the case of non-replica simulators, is it necessary to take parallel training actions, and if so, what kind?
   Explain your answer.

   Not applicable.

2. Do you use specific procedures for the training simulator, actual plant procedures or a combination of both?
   Explain your answer and give reasons for the choice.

   Only actual plant specific procedures.

3. What are the criteria for selecting normal, abnormal and emergency scenarios to be trained with simulators? Are they risk-based criteria?
   Explain your answer.

   High probability of occurrence, operational experience (int., external), PSA-results, plant modifications.

4. How are lesson plans and support documentation developed for simulator training?

   Based on experience in training department. Lesson plans are designed and tested in advance in the training section in co-operation with the Operations Department.

D) Training programme implementation.

1. What selection, initial training, and continuing training is arranged for simulator instructors?

   Instructors are picket-engineers, didactical pedagogical skills. Normal picket-engineer training.

2. What are the arrangements for instructor monitoring of, and feedback to, trainees during simulator sessions?

   One instructor designated for direct observation according to a predefined programme. Recording of operator actions by the simulator. No video.
3. a) What specific training modes such as simulator freeze, playback, running at higher speed than real time, activity recording, video recording, etc. is made use of during initial training?

All listed possibilities except video.

b) What specific training modes such as simulator freeze, playback, running at higher speed than real time, activity recording, video recording, etc. is made use of during continuous training?

All listed possibilities except video.

4. What limits of simulation impede planned training sessions or examination scenarios?

No major impediments.

E) Trainee assessment.

1. a) What methods and procedures are used for initial trainee assessment during and after simulator sessions?

Observation, open discussion after simulator session.

b) What methods and procedures are used for continuous trainee assessment during and after simulator sessions?

As above.

2. List and describe the main areas or groups of skills and knowledge of the trainee assessed in training simulators (for example: “control board awareness, event diagnosis, immediate actions / entry-level actions, subsequent actions, control board manipulations, use of procedures / technical specifications / reference data, communications, supervisory ability, team skills” (IAEA-TECDOC-525)). Identify, when applicable, the types of simulator used for addressing each one.

All mentioned criteria.

3. Describe the ranking of importance, if any, given to the main areas or groups of skills and knowledge taken into account for a trainee assessment.

Integral evaluation according to a special qualification sheet.

4. a) Based on your experience, describe difficulties you have had for assessing the individual skills and knowledge of a trainee while operating within a whole Control Room Shift Team during simulator sessions.

None. One person acts as instructor, one as observer.

b) Describe the measures adopted to overcome these difficulties.

Not applicable.
5. a) Based on your experience, describe influences on trainees performance during simulator sessions resulting from the attendance of personnel such as utility managers, regulatory body inspectors, etc.

Trainees are disturbed, do not act “normally”.

b) Based on your experience, describe influences on trainees performance during simulator sessions resulting from the attendance of personnel such as utility managers, regulatory body inspectors, etc.

Support is important:
During preparation of simulator session
During simulator session (correction, support)
After simulator session (discussion, explanation, review)

Instructor is usually member of a shift team.

6. a) Are training simulator examinations used in order to grant initial license to operators? Explain.

No.

b) Are training simulator examinations used for requalification? Explain.

Assessment during simulator training is part of the requalification process.

7. How is examination integrity preserved during the examination/scenario preparation period?

The lesson plans with scenarios are not distributed to the trainees. Verbal communication has no significant effect.

8. What performance monitoring or data acquisition features of the simulator are used during simulator examinations?

Only the recording function of the simulator. Observation and personal notes of the accompanying picket-engineer.

F) Training programme evaluation.

1. Describe the approach used for evaluating the simulator training programme and main results.

Feedback by instructors.

2. What programme is in place for validation and continuous verification of the simulator performance?

Plant modifications are formally communicated to the training section and introduced into the simulator if necessary.
3. What types of performance discrepancies are most frequently identified by operators during training sessions?

Not applicable.

4. What types of performance discrepancies are most frequently identified by examiners or inspectors?

Not applicable.

SECTION 4: Use of operating experience for operator training with simulators.

1. How is operational experience feedback incorporated into the design of simulator training programs (experience reviewed, schedule, people involved)?

Training section is part of the Operations Department. Instructors are picket-engineers with a close relationship to operations. Events inside and outside the plant are communicated directly to the training section; special procedure.

2. Has your organisation developed any kind of programme by which simulator operator training is correlated with real operating events? Explain.

Special procedure.

SECTION 5: Specific topics on Operator training with simulators.

A) Team training techniques.

1. a) Are job and task analyses used for defining the role and responsibilities of the Members of the Control Room Shift Teams and, in general, of the various levels of staff who are charged with operation of the plant? Explain your answer.

Basic job analysis is used. General requirements (criteria) have been established for the selection of operators, shift supervisors and picket-engineers. These general requirements define also the training objectives.

b) Are job and task analyses used for establishing performance standards, learning objectives and training methods for Team skills training? Explain your answer.

As above.

2. List and describe Team skills (communication, management of resources, team cooperation, team leadership, feedback, conflict resolution, team decision-making, etc.) which are trained using simulators. Identify, when applicable, the types of simulator used for training each one.

All mentioned team skills are trained.
3. Are any guides used for conducting and evaluating Team skills training simulations? Explain your answer.

Checklist for evaluation.

4. Based on your experience, describe advantages and disadvantages of Team training with the participation of the same (usual) Members every time or with changes in the Shift Team compositions.

*Advantage:* stable roles, no proliferation effects
*Disadvantage:* decreased communication

5. Are simulator sessions used for the optimisation of control Room Team Shifts taking into account the characteristics (aptitudes, attitudes, ...) of each Operator? In other words, are simulator sessions used for deciding which Members are going to constitute each Shift Team? Explain your answer.

No.

6. Are there any licensing examinations applied to the whole Control Room Shift Team in addition to the individual licensing examinations? Explain.

No.

**B) Training for stress.**

1. Is any part of the simulator training programme specifically devoted to train Control Room Operators to operate under stress? Explain you answer.

Stress induced by scenario. Reaction to stress is a qualification criterion.

2. Are stress levels induced and measured during simulator training sessions? If yes, describe the methods and results.

No.

3. Based on your experience describe any measures adopted during simulator training to counter stress.

Not applicable.
C) The theoretical basis underlying training.

1. Are any models of human behaviour being used in designing and implementing training programmes?
   If yes:
   i) refer to or describe the models,
   ii) indicate the areas in which these models are being applied (for example: signal detections, decision-making, etc.)
   iii) give the main results.

   No.

D) Habits acquired during training sessions with simulators.

1. Describe, based on your experience, undesirable habits which could be acquired by trainees during training sessions with simulators (for example: due to limited number of simulated scenarios, due to lack of physical or functional fidelity, due to the use of conservative codes for simulation instead of best estimate codes, etc.) and discuss their potential consequences on safety.

   Not applicable (due to simulator situation).

2. Describe, based on your experience, any measures adopted to avoid acquisition of those undesirable habits or to prevent use of them.

   Use of replica simulator.

E) Simulator training on normal and emergency conditions during shutdown and low power operation.

1. What use is made of simulators for Control Room Operator training in normal, abnormal and emergency conditions during shutdown and low power operation (simulated scenarios, trained skills, training techniques, ...)?

   Scenarios with basic system tests are possible. Low power scenarios during start-up and shutdown for normal operations. One decision to install an on site replica simulator was the fact that new people do not have the original start-up experience during the commissioning of the plant and the need for training on rare operation modes (start-up, shutdown, etc.)

2. What are the criteria (risk-based criteria, deterministic criteria, results of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?

   Results of need analysis.

3. Are job and task analysis (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on shutdown and low power operation?

   Explain.

   No.
4. **What are your plans for the future in this area?**

   No plans yet, gain experience.

**F)** Simulator training on severe accidents.

1. **What use is made of simulators for Control Room Operator training in severe accidents (simulated scenarios, trained skills, training techniques, ...)?**

   No severe accident training on simulators (simulation does cover degraded core).

2. **What are the criteria (risk-based criteria, deterministic criteria, result of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?**

   Not applicable.

3. **Are job and task analysis (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on severe accidents?**

   Not applicable.

4. **What are your plans for the future in this area?**

   None.

**G)** Simulator training on accidents caused by fires, floods, earthquakes, etc.

1. **What use is made of simulators for Control Room Operator training in accidents caused by fires, floods, earthquakes, etc. (simulated scenarios, trained skills, training techniques,...)?**

   Remote shutdown operations.

2. **What are the criteria (risk-based criteria, deterministic criteria, result of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?**

   Result of need analysis and operational experience.

3. **Are job and task analyses (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on accidents caused by fires, floods, earthquakes, etc.?**

   Explain.

   No.
4. **What are your plans for the future in this area?**

Use of simulator for emergency exercises including emergency staff.
QUESTIONNAIRE

SECTION 0: Organisation/s replying to the questionnaire

1. Name of Organisation/s.
   Beznau NPP

2. Contact Person/s.
   Ernst Grimm, Mgr. Operation Technology

3. Address and contact information (telephone, fax).
   Nordostschweizerisch Kraftwerke AG NOK
   Kernkraftwerk Beznau
   CH-5312 Döttingen
   +41-56-266 71 11

SECTION 1: General Information (related to the whole country)

1. Number of nuclear reactors (Units) in operation.
   5

2. Number of Sites with at least one Unit in operation.
   4

3. Number of full-scope (replica and no replica) simulators used for operator training.
   4

4. Number of replica simulators used for operator training.
   1 (2 - one NPP (Mühleberg) is just now (April 1995) in the phase of final testing of its (“reduced”) replica simulator. All further information on the Mühleberg simulator concerns the planned situation for training on site.)

5. Number of part-task simulators used for operator training.
   0

6. Number of basic principles simulators used for operator training.
   1 basic principles simulator (fundamental education) at the centralised Reactor School of the Paul Scherrer Institute
   1 compact simulator (plant specific training)
7. Number of concept simulators used for operator training.

0

8. Number of special-purpose simulators used for operator training.

1 (glass model)

9. For how many Units is the training done on replica training simulators?

1 (2 - One NPP (Mühleberg) is just now (April 1995) in the phase of final testing of its (“reduced”) replica simulator. All further information on the Mühleberg simulator concerns the planned situation for training on site.)

10. For how many Units is the training done on full-scope (replica and no replica) training simulators.

5

IMPORTANT QUESTION

Are your answers to the subsequent sections (2 to 5) of the questionnaire related to a specific Organisation or Training Centre in you Country?

Yes _X_  No____ (Mark your answer with an X)

If yes, indicate the name of the Organisation or Training Centre and describe briefly the simulation facility referred to in answer to the question below (f.i. located on-site or off-site, type of simulator/s, sample photograph, reference NPP/s, NPP/s which receive training in this facility, size and composition of the simulator instructional and support staff, etc.) and, also, describe this/these NPP/s (f.i. type (PWR, BWR, etc.), vendor, start of operation, degree of automation, Operators which constitute the Control Room Shift Team, sample photograph of the control room/s, etc.).

<table>
<thead>
<tr>
<th>NPP</th>
<th>Two units, 364 MW each rated power output, nuclear steam supply system consists of a Westinghouse PWR, two loop plant.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start of operation</td>
<td>1969</td>
</tr>
<tr>
<td>Degree of automation</td>
<td>Originally low automation, many backfittings on safety systems 30 min criterion applicable on many systems according analysis.</td>
</tr>
<tr>
<td>Control room staff</td>
<td>1 sc 1 sc stv 1 a-OP 1 B-Op 4 field 1 picket-engineer (*) (shift technical advisor) on call at the plant</td>
</tr>
<tr>
<td>Control room staff for simulator training</td>
<td>Compact Simulator:</td>
</tr>
<tr>
<td>-----------------------------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td></td>
<td>Detail training, 1 or 2 trainees, depending on topic</td>
</tr>
<tr>
<td></td>
<td>Full scope:</td>
</tr>
<tr>
<td></td>
<td>1 shift supervisor</td>
</tr>
<tr>
<td></td>
<td>3 licensed operators</td>
</tr>
<tr>
<td>Instructors</td>
<td>3 instructors (KKB picket-engineers)</td>
</tr>
<tr>
<td></td>
<td>At the full scope simulator additionally one Westinghouse Instructor</td>
</tr>
<tr>
<td>Simulator</td>
<td>Compact simulator on site, plant specific models. Full scope simulator at Pittsburgh, SNUPPS control room design, plant specific models.</td>
</tr>
</tbody>
</table>

*Picket-Engineers* are engineers who have completed the same career as Shift Supervisors (i.e. Plant Operator --> Reactor Operator --> Shift Supervisor). Additionally to that they have done special training on emergencies, severe accidents in classroom training and self study and an extensive simulator training. After their licensing examination they act as Shift Technical Advisors. The picket-engineer on duty (24 hours shift coverage) has to be at the site.

**SECTION 2:** Current practices with simulators closely related to operator training.

1. Based on your experience, describe advantages and disadvantages of the location of the Simulation Centre with regard to the plant: on-site versus off-site. Specifically, describe those factors which have some influence on the Operators' attitude towards the simulator training and in the quality of the simulator training.

   **Compact simulator on site:**
   **Advantages:**
   Close interrelation with classroom sessions.
   **Disadvantages:**
   Limited number of instructors, which also have classroom duties.

   **Full scope simulator off site:**
   **Advantages:**
   Strong concentration on training for one week, group dynamic effects, exchange of experience on operations/training external of plant.

2. a) During simulator training sessions, what factors (time, communications, etc.) influencing the interactions between Control Room Operators and other Plant Personnel (Operations Department outside of Control Room Personnel, Maintenance or Instrumentation, and Control Departments, Technical Support Centre, etc.) are simulated?

   Communication to plant personnel, maintenance is simulated on full scope simulator by phone to the instructor.

   b) Do these other Plant Personnel participate in the training sessions?
   Describe the present training format pertaining to involvement of non Control Room Personnel in simulator training sessions and explain why this format is used.

   No. Only the control room personnel decisions are subject to training on the simulator.
3. What environmental conditions (normal and emergency lighting, humidity, noise, vibrations, sounds generated by equipments, etc.) that could be experienced by the reference plants, are usually simulated in the Simulator Rooms? Describe the use of such effects at your simulator centre and explain why they are, or are not, incorporated into simulator training sessions.

No environmental conditions are simulated. Not been considered as very relevant.

4. Do Control Room Operators receive simulator training for operations outside the Control Room, for example: operations from Remote Shutdown Panels? Describe this type of training as it exists at your Simulator Centre and explain why it is, or is not, used in training sessions.

Training on remote shutdown operations is done on both, the full scope simulator and the compact simulator, on a CRT-based panel (soft panel). There are definitely training objectives in this area and the reason for soft-panels is a cost/advantage analysis.

5. a) How frequently are the changes taking place in plant (plant design changes, procedures changes, etc.) incorporated to the replica or full-scope simulator? Describe any process or mechanism in place at your Simulator Centre to incorporate changes to the replica or full-scope simulator.

Plant design changes/procedure changes take place on the simulators according to the project schedules. Operations department participation as user in the project management, allows to define the training needs early in the project schedule.

b) Do simulator model modifications require separate approval while the simulator is being used for training?

Model modifications are subject to factory acceptance tests, predefined and supervised by the operations department.

6. a) Identify the members of the Control Room Shift Team (Reactor Operators, Turbine Operators, Shift Supervisors, etc.) and indicate the time (in hours) dedicated to simulator training by each member in their initial training programme. Specify, when applicable, the time spent with each type of simulator.

Reactor and turbine operators do have 30 hours on the compact simulator and 60 hours on the full scope simulator as initial training.
Shift supervisors do receive 30 hours on the full scope simulator prior to license examination.

b) Indicate the time (in hours) dedicated to simulator training by each member of the Control Room Shift Team in their continuous training programme. Specify, when applicable, the time spent with each type of simulator.

Control room shift team receive 30 hours on the full scope simulator every two years and 30 hours every year on the compact simulator.
c) What is the minimum time, if any, required by the Regulatory Body?

Not specified for training but for requalification of licensed personnel (once every 2 years).

7. a) Indicate the percentage of simulator training time by the different Members of the Control Room Shift Team devoted to i) normal, ii) abnormal and iii) emergency conditions in their initial training programme.

Control room shift, initial training, compact simulator:
50% normal operations
50% emergency operations

Control room shift, initial training, full scope simulator:
20% normal operations
30% abnormal
50% emergency conditions

b) Indicate the percentage of simulator training time by the different Members of the Control Room Shift Team devoted to i) normal, ii) abnormal and iii) emergency conditions in their continuous training programme.

Control room shift, continuous training, compact simulator:
50% normal operations
50% emergency operations

Control room shift, continuous training, full scope simulator:
70% normal and abnormal operations
30% emergency conditions

c) What are the minimum percentages, if any, required by the Regulatory Body?

None.

8. What is the role and the policy of the Regulatory Body regarding the use of simulators for Control Room Operators licensing and training?

See nº6) c.

9. a) What standards (ANSI/ANS 3.5, IAEA, etc.) are simulators built to and maintained?

ANSI/ANS 3.5 is part of the simulator specification.

b) What exceptions are typically taken to the standard?

Not applicable.

c) What types of simulators are used that are not included in industry standards?

Basic principles simulator (for fundamental education at the Reactor School of the Paul Scherrer Institute).

10. a) Describe the role of part-task simulators in your current training programs.

Not applicable.
b) Describe the role of special-purpose (analytic) simulators in your current training programs.

Not applicable.

11. Have the current operator training programs been conditioned by the availability and capabilities of the simulator(s) or, alternatively, has(ve) the simulator(s) been specified and acquired after analysing and designing the training programs? Explain.

The compact simulator supports the knowledge based behaviour and the full scope simulator supports the team and the rule based behaviour of the control room shift personnel.

12. What extensions of simulator training are envisaged for the future?

More frequent full scope simulator training.

13. a) Based on your experience, describe the uses of the simulators for activities other than training (plant drills, procedures validation, design changes validation, testing programs, acquisition of human data, licensing activities, reference plant systems “tuning”, etc.).

For emergency exercises very useful as a generator for real time dates. For procedures validation very useful, especially the wording.

b) What is the involvement of Control Room Operators for those applications?

Procedures validation was done with the control room shift groups, during regular training programmes. The recommendations of the groups for changing the wording has been carefully observed and was subject to later revisions of the procedures.

14. What are the applications of simulator training for jobs other than Operations?

Training programmes for emergency staff members, supporting the knowledge of background information of emergency procedures.

SECTION 3: Systematic Approach to Training: considerations regarding the use of simulators.

A) Training analysis.

1. Are job and task analysis (or any other type of task identification technique) used for establishing a list of task, performance standards, learning objectives and training methods?
   If yes, describe the technique used.

Learning objectives have been designed based on events in other plants (Steam Generator Tube Rupture Events, SGTR) or experience at their own plant. For the future, a list of critical tasks within the emergency procedures will be used for training lessons.
2. a) **What are the criteria that determine the limits or scope of the job analysis for the Control Room Operators?**

Task requirements and learning objectives have been established by the Swiss Group of NPP Managers (GSKL).

Critical Tasks in Procedures.

b) **From your point of view, what should the role of risk-based criteria be for determining such limits or scope? Explain your answers.**

Risk-based criteria are important, for example the training on SGTR at PWRs is a typical risk-based criteria. Risk analysis can generate important training criterion.

3. **Are there any special requirements for Job and Task Analysis which are imposed by the possibility of associated simulator training?**

Not applicable.

**B) Training programme design.**

1. **What are the criteria for specifying simulator training rather than another training setting (classroom, laboratory, workshop, on-the-job, etc.)?**

Operation experience, access to WANO Reports, access to Risk Analysis Reports, exchange of experiences of simulator users.

2. **What are the criteria for selecting different types of simulator (full-scope, replica, part-task, basic principles, concept, special-purpose)?**

The learning objectives are the dominant criterion for selecting the tool to reach the goal.

3. a) **What are the criteria for selecting a replica simulator?**

Criterion for a replica simulator are learning objectives in the area of skill based behaviour of control room personnel.

b) **What are the fidelity requirements?**

Fidelity requirements are based on ANSI/ANS 3.5.

4. **What are the specific pre-requisites for operators undertaking simulator training?**

Completed fundamental training and at least 50% of the systems training, for normal operations and abnormal operations, 100% of systems training of emergency procedures.

5. **Does the possibility of simulator training impose any constraints on the definition of learning objectives?**

No, learning objectives are based on job tasks.
C) Training programme development.

1. **In the case of non-replica simulators, is it necessary to take parallel training actions, and if so, what kind? Explain your answer.**

   Yes, skill based behaviour can be supported by other means (drills in the real control room, locating controls) or plant specific compact simulators, to support rule based behaviour (procedure using).

2. **Do you use specific procedures for the training simulator, actual plant procedures or a combination of both? Explain your answer and give reasons for the choice.**

   Only actual plant procedures, to support actual rule based behaviour of the control room personnel.

3. **What are the criteria for selecting normal, abnormal and emergency scenarios to be trained with simulators? Are they risk-based criteria? Explain your answer.**

   Operation experience, access to WANO Reports, Risk Analysis Reports, exchange of experiences of simulator users. Risk-based criterion are important, for example the training on SGTR at PWRs is a typical risk-based criteria. Risk analysis can generate important training criterion.

4. **How are lesson plans and support documentation developed for simulator training?**

   Lesson plans are carefully designed and tested in advance from the training group in co-operation with the operations department. Support documentation has less priority, because simulator training is learning by doing.

D) Training programme implementation.

1. **What selection, initial training, and continuing training is arranged for simulator instructors?**

   Simulator instructors are licensed shift supervisors, with the same training scope as the control room shift groups.

2. **What are the arrangements for instructor monitoring of, and feedback to, trainees during simulator sessions?**

   Full scope simulator: simulator control cabinet, with one direction windows, microphones distributed in the control room and moveable video camera on the ceiling. Feedback to trainees in the direct mode, via phone, via loudspeaker or with a briefing after the scenario.
3. a) **What specific training modes such as simulator freeze, playback, running at higher speed than real time, activity recording, video recording, etc. is made use of during initial training?**

   Initial training, compact simulator: freeze is used very often to explain and to gather all the information.
   Initial training, full scope: video is used to support team work and communication.

b) **What specific training modes such as simulator freeze, playback, running at higher speed than real time, activity recording, video recording, etc. is made use of during continuous training?**

   Continuous training, compact simulator: freeze is used very often to gather information and explain background information to the procedures.
   Continuous training, full scope: video is used to support team work and communication.

4. **What limits of simulation impede planned training sessions or examination scenarios?**

   Training sessions are planned within the limits of the simulation and are verified before training.

E) **Trainee assessment.**

1. a) **What methods and procedures are used for initial trainee assessment during and after simulator sessions?**

   Full scope simulator, initial training: observation by the simulator instructor, supported by the training manager.

b) **What methods and procedures are used for continuous trainee assessment during and after simulator sessions?**

   Full scope simulator, continuous training: observation by the simulator instructor supported by a member of the plant staff (picket-engineer).

2. **List and describe the main areas or groups of skills and knowledge of the trainee assessed in training simulators (for example: “control board awareness, event diagnosis, immediate actions / entry-level actions, subsequent actions, control board manipulations, use of procedures / technical specifications / reference data, communications, supervisory ability, team skills” (IAEA-TECDOC-525)). Identify, when applicable, the types of simulator used for addressing each one.**

   Three groups: knowledge, operating capabilities and attitude.
   Knowledge: understanding integrated plant response, general operating procedures, emergency procedures, station emergency plant and technical specifications.
Operating capabilities: normal operations, emergency operations, ability to prioritise operations during emergencies, ability to work as a team member, leadership abilities, ability to diagnose abnormal plant conditions, practice good engineering techniques, awareness of plant and equipment parameters, ability to communicate effectively.
Attitude: towards safe plant operations, co-workers, training.

Enforced by a verbal description of the overall observations. Only applied on the full scope simulator.

3. Describe the ranking of importance, if any, given to the main areas or groups of skills and knowledge taken into account for a trainee assessment.

Not applicable.

4. a) Based on your experience, describe difficulties you have had for assessing the individual skills and knowledge of a trainee while operating within a whole Control Room Shift Team during simulator sessions.

The team can override individual lacks and they remain undiscovered.

b) Describe the measures adopted to overcome these difficulties.

Individual training on the compact simulator identifies lacks more systematically.

5. a) Based on your experience, describe influences on trainees performance during simulator sessions resulting from the attendance of personnel such as utility managers, regulatory body inspectors, etc.

Influences on trainees' performance exists and is strongly related to the attending individuals behaviour during the session.

b) Based on your experience, describe influences on trainees performance during simulator sessions resulting from the attendance of personnel such as utility managers, regulatory body inspectors, etc.

At the full scope simulator the instructors normally stay in the instructors cabinet. This minimises the influence on trainees' performances. It has the disadvantage of not identifying details of operation, because of the distance. Sometimes they use a field-glass.

6. a) Are training simulator examinations used in order to grant initial license to operators?

Explain.

No.

b) Are training simulator examinations used for requalification?

Explain.

The assessment (see n°2 of this section) is used for requalification. It goes to the supervisor and has influence on the according aspect in the yearly internal requalification process.
7. **How is examination integrity preserved during the examination/scenario preparation period?**

The lesson plans with scenarios are not distributed to the trainees. Verbal communication has no significant effect.

8. **What performance monitoring or data acquisition features of the simulator are used during simulator examinations?**

Only the recording function of the simulator. Observation and personal notes of the accompanying picket-engineer.

**F) Training programme evaluation.**

1. **Describe the approach used for evaluating the simulator training programme and main results.**

   Staff of the Operating Department are regularly involved in the training programmes as observers.

2. **What programme is in place for validation and continuous verification of the simulator performance?**

   Simulator performance verification will be done against a code (Westinghouse-TREAT) for accident operations.

3. **What types of performance discrepancies are most frequently identified by operators during training sessions?**

   Steam generator level response during dryout.

4. **What types of performance discrepancies are most frequently identified by examiners or inspectors?**

   Containment response during accident conditions.

**SECTION 4: Use of operating experience for operator training with simulators.**

1. **How is operational experience feedback incorporated into the design of simulator training programs (experience reviewed, schedule, people involved)?**

   Training group is incorporated into the Operations Department. Event reports with root cause analyses identifies training related causes and initialises training needs.

2. **Has your organisation developed any kind of programme by which simulator operator training is correlated with real operating events? Explain.**

   No.
SECTION 5: Specific topics on Operator training with simulators.

A) Team training techniques.

1. a) Are job and task analyses used for defining the role and responsibilities of the Members of the Control Room Shift Teams and, in general, of the various levels of staff who are charged with operation of the plant? Explain your answer.

   Basic job analysis is used. General requirements (criteria) have been established for the selection of operators, shift supervisors and picket-engineers. These general requirements define also the training objectives.

   b) Are job and task analyses used for establishing performance standards, learning objectives and training methods for Team skills training? Explain your answer.

   As above.

2. List and describe Team skills (communication, management of resources, team co-operation, team leadership, feedback, conflict resolution, team decision-making, etc.) which are trained using simulators. Identify, when applicable, the types of simulator used for training each one.

   Non-replica full scope simulator, team skills: communication, team co-operation, leadership, and decision-making.

3. Are any guides used for conducting and evaluating Team skills training simulations? Explain your answer.

   Evaluating yes (see training assessment 2).

4. Based on your experience, describe advantages and disadvantages of Team training with the participation of the same (usual) Members every time or with changes in the Shift Team compositions.

   Advantage: stable roles, no proliferation effects
   Disadvantage: decreased communication

5. Are simulator sessions used for the optimisation of control Room Team Shifts taking into account the characteristics (aptitudes, attitudes, ...) of each Operator? In other words, are simulator sessions used for deciding which Members are going to constitute each Shift Team? Explain your answer.

   Based on the yearly requalification process, which is influenced by the simulator training assessment, shift team constitution can be affected indirectly.

6. Are there any licensing examinations applied to the whole Control Room Shift Team in addition to the individual licensing examinations? Explain.

   No.
B) Training for stress.

1. Is any part of the simulator training programme specifically devoted to train Control Room Operators to operate under stress?
   Explain you answer.

   No.

2. Are stress levels induced and measured during simulator training sessions?
   If yes, describe the methods and results.

   No.

3. Based on your experience describe any measures adopted during simulator training to counter stress.

   Not applicable.

C) The theoretical basis underlying training.

1. Are any models of human behaviour being used in designing and implementing training programmes?
   If yes:
   i) refer to or describe the models,
   ii) indicate the areas in which these models are being applied (for example: signal detections, decision-making, etc.)
   iii) give the main results.

   No.

D) Habits acquired during training sessions with simulators.

1. Describe, based on your experience, undesirable habits which could be acquired by trainees during training sessions with simulators (for example: due to limited number of simulated scenarios, due to lack of physical or functional fidelity, due to the use of conservative codes for simulation instead of best estimate codes, etc.) and discuss their potential consequences on safety.

   Response of containment model and absence of containment isolation malfunctions could decrease attention to potential radioactivity release paths.

2. Describe, based on your experience, any measures adopted to avoid acquisition of those undesirable habits or to prevent use of them.

   Backfit of both compact and full scope simulator with containment model upgrade.
E) Simulator training on normal and emergency conditions during shutdown and low power operation.

1. What use is made of simulators for Control Room Operator training in normal, abnormal and emergency conditions during shutdown and low power operation (simulated scenarios, trained skills, training techniques, ...)?

Scenarios in low power operation do have the same distribution as full power operations. Scenarios in shutdown conditions (except mid loop operations) are more related to normal operations.

2. What are the criteria (risk-based criteria, deterministic criteria, results of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?

Risk based criterion are the basis for the above-mentioned use of the simulators.

3. Are job and task analysis (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on shutdown and low power operation?

No.

4. What are your plans for the future in this area?

Upgrade the simulator models to allow mid loop operations. Based on risk criterion include emergency operations into the training programmes.

F) Simulator training on severe accidents.

1. What use is made of simulators for Control Room Operator training in severe accidents (simulated scenarios, trained skills, training techniques, ...)?

No severe accident training on simulators.

2. What are the criteria (risk-based criteria, deterministic criteria, result of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?

Risk based criterion are the basis for not using such scenarios. Availability of procedures for severe accident scenarios is not given and simulation is not available.

3. Are job and task analysis (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on severe accidents?

Explain.

Not applicable.
4. **What are your plans for the future in this area?**

   None.

G) **Simulator training on accidents caused by fires, floods, earthquakes, etc.**

1. **What use is made of simulators for Control Room Operator training in accidents caused by fires, floods, earthquakes, etc. (simulated scenarios, trained skills, training techniques,...)?**

   See section 2, question 4: Training on remote shutdown operations is done on both the full scope simulator and the compact simulator, on a CRT based panel (soft panel). This remote shutdown operation covers the external events of fire, flood, etc.

2. **What are the criteria (risk-based criteria, deterministic criteria, result of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?**

   Criteria are the result of need analyses.

3. **Are job and task analyses (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on accidents caused by fires, floods, earthquakes, etc.? Explain.**

   No.

4. **What are your plans for the future in this area?**

   Not applicable.
QUESTIONNAIRE

SECTION 0: Organisation/s replying to the questionnaire

1. Name of Organisation/s.
   Tennessee Valley Authority (TVA)

2. Contact Person/s.
   See below.

3. Address and contact information (telephone, fax).
   
   **TVA Simulator Services Managers**
   
   Tommy Albright
   Browns Ferry Nuclear Plant
   P.O. Box 2000
   Decatur, AL 35611
   Phone: (205) 729-3434
   Fax: (205) 729-3419

   Steve Michael
   Sequoyah Nuclear Plant
   P.O. Box 2000
   Soddy-Daisy, TN 37379
   Phone: (423) 843-4131
   Fax: (423) 843-4010

   Katie Lovell
   Watts Bar Nuclear Plant
   P.O. Box 2000
   Spring City, TN 37381
   Phone: (423) 365-3774
   Fax: (423) 365-3797

SECTION 1: General Information (related to the whole country)

1. Number of nuclear reactors (Units) in operation.
   Five (5).

2. Number of Sites with at least one Unit in operation.
   Browns Ferry, Sequoyah, and Watts Bar Nuclear Plants.
3. Number of full-scope (replica and no replica) simulators used for operator training.

   Three replica simulators for sites listed in nº 2.

4. Number of replica simulators used for operator training.

   Three (3).

5. Number of part-task simulators used for operator training.

   See below.

6. Number of basic principles simulators used for operator training.

   See below.

7. Number of concept simulators used for operator training.

   None.

8. Number of special-purpose simulators used for operator training.

   None.

9. For how many Units is the training done on replica training simulators?

   Five (5).

10. For how many Units is the training done on full-scope (replica and no replica)
     training simulators.

    Five (5).

Response to nº 5 and 6.
TVA has a number of workstation-driven simulator loads that are running off-line that are used for
maintenance, testing and instructor development. They are beginning to be used for some classroom
training at the Sequoyah and Watts Bar sites. These stand-alone workstation simulations can be
used as part-task or basic principles simulators.

IMPORTANT QUESTION

Are your answers to the subsequent sections (2 to 5) of the questionnaire related to a
specific Organisation or Training Centre in you Country?

Yes _X_ No__ (Mark your answer with an X)

If yes, indicate the name of the Organisation or Training Centre and describe briefly
the simulation facility referred to in answer to the question below ( f.i. located on-site or
off-site, type of simulator/s, sample photograph, reference NPP/s, NPP/s which receive
training in this facility, size and composition of the simulator instructional and support
staff, etc.) and, also, describe this/these NPP/s (f.i. type (PWR, BWR, etc.), vendor, start of
operation, degree of automation, Operators which constitute the Control Room Shift
Team, sample photograph of the control room/s, etc.).
SECTON 2: Current practices with simulators closely related to operator training.

1. Based on your experience, describe advantages and disadvantages of the location of the Simulation Centre with regard to the plant: on-site versus off-site. Specifically, describe those factors which have some influence on the Operators’ attitude towards the simulator training and in the quality of the simulator training.

On-site is definitely better in that training has little or no impact on operator’s personal lives (i.e. still have full range of family/personal activities).

2. a) During simulator training sessions, what factors (time, communications, etc.) influencing the interactions between Control Room Operators and other Plant Personnel (Operations Department outside of Control Room Personnel, Maintenance or Instrumentation, and Control Departments, Technical Support Centre, etc.) are simulated?

Simulate all communications (time factors),

b) Do these other Plant Personnel participate in the training sessions?
Describe the present training format pertaining to involvement of non Control Room Personnel in simulator training sessions and explain why this format is used.

To a limited extent (usually 1 day of 5) non-licensed operators participate.

3. What environmental conditions (normal and emergency lighting, humidity, noise, vibrations, sounds generated by equipments, etc.) that could be experienced by the reference plants, are usually simulated in the Simulator Rooms? Describe the use of such effects at your simulator centre and explain why they are, or are not, incorporated into simulator training sessions.

Normal lighting only. None of these conditions are modelled on the TVA simulators with the exception of the normal lighting which approximates the plant lighting. The other effects (sounds, vibrations, etc.) are not presently considered to be cost-effective to add to the simulation facilities.

4. Do Control Room Operators receive simulator training for operations outside the Control Room, for example: operations from Remote Shutdown Panels? Describe this type of training as it exists at your Simulator Centre and explain why it is, or is not, used in training sessions.

Yes. We have remote shutdown panel off the main simulator - used about once a year.
5. a) How frequently are the changes taking place in plant (plant design changes, procedures changes, etc.) incorporated to the replica or full-scope simulator? Describe any process or mechanism in place at your Simulator Centre to incorporate changes to the replica or full-scope simulator.

ANS 3.5-1993 allows 24 months for completing modifications.

b) Do simulator model modifications require separate approval while the simulator is being used for training?

NRC requirements (10 CFR 55.45 and Reg. Guide 1.149) that endorse ANS 3.5.

6. a) Identify the members of the Control Room Shift Team (Reactor Operators, Turbine Operators, Shift Supervisors, etc.) and indicate the time (in hours) dedicated to simulator training by each member in their initial training programme. Specify, when applicable, the time spent with each type of simulator.

Licensed personnel spend approximately 320 hours in initial training on a control room simulator.

b) Indicate the time (in hours) dedicated to simulator training by each member of the Control Room Shift Team in their continuous training programme. Specify, when applicable, the time spent with each type of simulator.

120 hours/year on a control room simulator.

c) What is the minimum time, if any, required by the Regulatory Body?

None.

7. a) Indicate the percentage of simulator training time by the different Members of the Control Room Shift Team devoted to i) normal, ii) abnormal and iii) emergency conditions in their initial training programme.

Normal - 25%
Abnormal - 25%
Emergency - 50%

b) Indicate the percentage of simulator training time by the different Members of the Control Room Shift Team devoted to i) normal ii) abnormal and iii) emergency conditions in their continuous training programme.

Normal - 20%
Abnormal - 20%
Emergency - 60%

c) What are the minimum percentages, if any, required by the Regulatory Body?

N/A

8. What is the role and the policy of the Regulatory Body regarding the use of simulators for Control Room Operators licensing and training?
NRC requires plant simulator.

9. a) **What standards (ANSI/ANS 3.5, IAEA, etc.) are simulators built to and maintained?**

   ANS 3.5 and regulatory documents (10 CFR 55.45 and Reg. Guide 1.149).

   b) **What exceptions are typically taken to the standard?**

   Very few - mainly cosmetic type exceptions.

   c) **What types of simulators are used that are not included in industry standards?**

   None.

10. a) **Describe the role of part-task simulators in your current training programs.**

    See below.

    b) **Describe the role of special-purpose (analytic) simulators in your current training programs.**

    See Section 1, n° 5 and 6.

11. **Have the current operator training programs been conditioned by the availability and capabilities of the simulator(s) or, alternatively, has(ve) the simulator(s) been specified and acquired after analysing and designing the training programs? Explain.**

    Neither. At this time, neither availability/capability affects training programmes. The second part is also not applicable.

12. **What extensions of simulator training are envisaged for the future?**

    None.

13. a) **Based on your experience, describe the uses of the simulators for activities other than training (plant drills, procedures validation, design changes validation, testing programs, acquisition of human data, licensing activities, reference plant systems “tuning”, etc.).**

    Procedure validation, emergency drills, some systems “tuning”.

b) **What is the involvement of Control Room Operators for those applications?**

   Selected available operators/instructors assist.
14. What are the applications of simulator training for jobs other than Operations?

Technical training uses the simulator in management training.

SECTION 3: Systematic Approach to Training: considerations regarding the use of simulators.

A) Training analysis.

1. Are job and task analysis (or any other type of task identification technique) used for establishing a list of task, performance standards, learning objectives and training methods? If yes, describe the technique used.

Train tasks and requalification train tasks are used in scenario development to ensure learning objectives cover the tasks and performance standards address “critical tasks”.

2. a) What are the criteria that determine the limits or scope of the job analysis for the Control Room Operators?

b) From your point of view, what should the role of risk-based criteria be for determining such limits or scope? Explain your answers.

3. Are there any special requirements for Job and Task Analysis which are imposed by the possibility of associated simulator training?

No.

B) Training programme design.

1. What are the criteria for specifying simulator training rather than another training setting (classroom, laboratory, workshop, on-the-job, etc.)?

Those tasks that can be simulator trained are incorporated. Other settings may also address or reinforce simulator train tasks.

2. What are the criteria for selecting different types of simulator (full-scope, replica, part-task, basic principles, concept, special-purpose)?

Only use replica.

3. a) What are the criteria for selecting a replica simulator?

NRC requirements.
b) What are the fidelity requirements?

As stated in ANS-3.5.

4. What are the specific pre-requisites for operators undertaking simulator training?

Enrolled in initial license training or license requalification training.

5. Does the possibility of simulator training impose any constraints on the definition of learning objectives?

No.

C) Training programme development.

1. In the case of non-replica simulators, is it necessary to take parallel training actions, and if so, what kind? Explain your answer.

N/A

2. Do you use specific procedures for the training simulator, actual plant procedures or a combination of both? Explain your answer and give reasons for the choice.

Actual plant procedures sued because our standard is to only use approved procedures (unless specifically approved to use “draft” procedures).

3. What are the criteria for selecting normal, abnormal and emergency scenarios to be trained with simulators? Are they risk-based criteria? Explain your answer.

Primarily driven by task list for both initial and requalification training.

4. How are lesson plans and support documentation developed for simulator training?

Developed by instructors using task list for what; use simulator reference guide and hands on for how; use procedures to develop lesson plan body for student actions.

D) Training programme implementation.

1. What selection, initial training, and continuing training is arranged for simulator instructors?

Selection - SRO licensed or certified individual with good people and oral presentation skills. Initial training is same as other instructors, except train or how to run simulator. Continuing training same as other instructors.

2. What are the arrangements for instructor monitoring of, and feedback to, trainees during simulator sessions?

Observe, make on-the-spot corrections, critique after scenario, weekly written evaluations.
3. **a)** What specific training modes such as simulator freeze, playback, running at higher speed than real time, activity recording, video recording, etc. is made use of during initial training?

Freeze, backtrack, video, some slowtime are all used in initial training.

**b)** What specific training modes such as simulator freeze, playback, running at higher speed than real time, activity recording, video recording, etc. is made use of during continuous training?

Same as above.

4. **What limits of simulation impede planned training sessions or examination scenarios?**

Very few limits other than any scenario which approaches/challenges a simulator out of bounds area must be developed very carefully.

E) **Trainee assessment.**

1. **a)** What methods and procedures are used for initial trainee assessment during and after simulator sessions?

On-the-spot correction; critique; written evaluation weekly.

**b)** What methods and procedures are used for continuous trainee assessment during and after simulator sessions?

Same as above.

2. List and describe the main areas or groups of skills and knowledge of the trainee assessed in training simulators (for example: “control board awareness, event diagnosis, immediate actions / entry-level actions, subsequent actions, control board manipulations, use of procedures / technical specifications / reference data, communications, supervisory ability, team skills” (IAEA-TECDOC-525)). Identify, when applicable, the types of simulator used for addressing each one.

All of the above; only one type of simulator is used (see previous).

3. **Describe the ranking of importance, if any, given to the main areas or groups of skills and knowledge taken into account for a trainee assessment.**

Most important (not in order): communications, manipulations, team work, procedure use.

4. **a)** Based on your experience, describe difficulties you have had for assessing the individual skills and knowledge of a trainee while operating within a whole Control Room Shift Team during simulator sessions.

Assessing individuals on technical and soft skills when watching 3-6 people at the same time.
b) **Describe the measures adopted to overcome these difficulties.**

Looking at using crew “extras” to help assess.

5. a) **Based on your experience, describe influences on trainees performance during simulator sessions resulting from the attendance of personnel such as utility managers, regulatory body inspectors, etc.**

It makes them extremely nervous and uptight.

b) **Based on your experience, describe influences on trainees performance during simulator sessions resulting from the attendance of personnel such as utility managers, regulatory body inspectors, etc.**

I believe they are so used to instructors being there that it has little influence.

6. a) **Are training simulator examinations used in order to grant initial license to operators? Explain.**

Yes. Our utility certifies before the NRC examines.

b) **Are training simulator examinations used for requalification? Explain.**

Yes. We examine about every other cycle (each cycle is 6 weeks long) and annually.

7. **How is examination integrity preserved during the examination/scenario preparation period?**

Scenarios locked up, individuals who worked on them are under security agreement.

8. **What performance monitoring or data acquisition features of the simulator are used during simulator examinations?**

None other than simulator operator monitoring plant parameters.

F) **Training programme evaluation.**

1. **Describe the approach used for evaluating the simulator training programme and main results.**

Management observations of simulator training. Outside organisations also observe simulator training.

2. **What programme is in place for validation and continuous verification of the simulator performance?**

Simulator Certification Requirements in ANS-3.5.

3. **What types of performance discrepancies are most frequently identified by operators during training sessions?**
4. What types of performance discrepancies are most frequently identified by examiners or inspectors?

SECTION 4: Use of operating experience for operator training with simulators.

1. How is operational experience feedback incorporated into the design of simulator training programs (experience reviewed, schedule, people involved)?

   Review both plant and industry events (via Nuclear Network) for consideration of incorporation of events. Other than those mandated, one instructor reviews events and pulls important ones for incorporation.

2. Has your organisation developed any kind of programme by which simulator operator training is correlated with real operating events? Explain.

   See above.

SECTION 5: Specific topics on Operator training with simulators.

A) Team training techniques.

1. a) Are job and task analyses used for defining the role and responsibilities of the Members of the Control Room Shift Teams and, in general, of the various levels of staff who are charged with operation of the plant? Explain your answer.

   Roles and responsibilities are determined by plant management and articulated in plant procedures.

   b) Are job and task analyses used for establishing performance standards, learning objectives and training methods for Team skills training? Explain your answer.

   Roles/responsibilities/standards of performance developed by plant management are used as standard objectives and performance standards for all scenarios.

2. List and describe Team skills (communication, management of resources, team cooperation, team leadership, feedback, conflict resolution, team decision-making, etc.) which are trained using simulators. Identify, when applicable, the types of simulator used for training each one.

   Communications, command and control, team work.

3. Are any guides used for conducting and evaluating Team skills training simulations? Explain your answer.

   Standard “form” used for all scenarios for addressing soft skills and technical skills.
4. Based on your experience, describe advantages and disadvantages of Team training with the participation of the same (usual) Members every time or with changes in the Shift Team compositions.

We generally use the same members. 
Advantages: crew begins to know each other. 
Disadvantages: crew compensates for individual weaknesses.

5. Are simulator sessions used for the optimisation of control Room Team Shifts taking into account the characteristics (aptitudes, attitudes, ...) of each Operator? In other words, are simulator sessions used for deciding which Members are going to constitute each Shift Team? Explain your answer.

No. Training does feedback individual performance; this becomes an input to management for determining crew assignments.

6. Are there any licensing examinations applied to the whole Control Room Shift Team in addition to the individual licensing examinations? Explain.

Yes. Crew is evaluated as a whole, along with each individual.

B) Training for stress.

1. Is any part of the simulator training programme specifically devoted to train Control Room Operators to operate under stress? Explain you answer.

No. Some scenarios are more stressful than others, but there is no individual “stress scenario”. All the training allows them to develop/improve response to stressful situations.

2. Are stress levels induced and measured during simulator training sessions? If yes, describe the methods and results.

Obviously induced, but not measured. Description of methods and results is N/A.

3. Based on your experience describe any measures adopted during simulator training to counter stress.

Experience of instructors and people skills used to help alleviate. No programme as such.
C) The theoretical basis underlying training.

1. Are any models of human behaviour being used in designing and implementing training programmes?
   If yes:
   i) refer to or describe the models,
   ii) indicate the areas in which these models are being applied (for example: signal detections, decision-making, etc.)
   iii) give the main results.

   N/A

D) Habits acquired during training sessions with simulators.

1. Describe, based on your experience, undesirable habits which could be acquired by trainees during training sessions with simulators (for example: due to limited number of simulated scenarios, due to lack of physical or functional fidelity, due to the use of conservative codes for simulation instead of best estimate codes, etc.) and discuss their potential consequences on safety.

   None.

2. Describe, based on your experience, any measures adopted to avoid acquisition of those undesirable habits or to prevent use of them.

   N/A

E) Simulator training on normal and emergency conditions during shutdown and low power operation.

1. What use is made of simulators for Control Room Operator training in normal, abnormal and emergency conditions during shutdown and low power operation (simulated scenarios, trained skills, training techniques, ...)?

   About 10% of training is on shutdown/low power.

2. What are the criteria (risk-based criteria, deterministic criteria, results of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?

   Task list and NRC requirements.

3. Are job and task analysis (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on shutdown and low power operation?

   Explain.

   See above.
4. What are your plans for the future in this area?

Maintain about the same level.

F) Simulator training on severe accidents.

1. What use is made of simulators for Control Room Operator training in severe accidents (simulated scenarios, trained skills, training techniques, ...)?

None - not modelled. We stay within the bounds of simulator and BWROG guidelines.

2. What are the criteria (risk-based criteria, deterministic criteria, result of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?

N/A

3. Are job and task analysis (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on severe accidents.

Explain.

N/A

4. What are your plans for the future in this area?

Depends on industry direction.

G) Simulator training on accidents caused by fires, floods, earthquakes, etc.

1. What use is made of simulators for Control Room Operator training in accidents caused by fires, floods, earthquakes, etc. (simulated scenarios, trained skills, training techniques,...)?

2-3 scenarios per year.

2. What are the criteria (risk-based criteria, deterministic criteria, result of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?

Task list/NRC requirements.

3. Are job and task analyses (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on accidents caused by fires, floods, earthquakes, etc.?

Explain.

See above.
4. **What are your plans for the future in this area?**

   Same.
QUESTIONNAIRE

SECTION 0: Organisation/s replying to the questionnaire

1. Name of Organisation/s.
   Consumers Power Company
   Palisades Nuclear Plant

2. Contact Person/s.
   Paul M. Schmidt, Simulator Supervisor

3. Address and contact information (telephone, fax).

SECTION 1: General Information (related to the whole country)

1. Number of nuclear reactors (Units) in operation.

2. Number of Sites with at least one Unit in operation.

3. Number of full-scope (replica and no replica) simulators used for operator training.

4. Number of replica simulators used for operator training.

5. Number of part-task simulators used for operator training.

6. Number of basic principles simulators used for operator training.

7. Number of concept simulators used for operator training.

8. Number of special-purpose simulators used for operator training.
9. For how many Units is the training done on replica training simulators?

10. For how many Units is the training done on full-scope (replica and no replica) training simulators.

IMPORTANT QUESTION

Are your answers to the subsequent sections (2 to 5) of the questionnaire related to a specific Organisation or Training Centre in your Country?
Yes  X  No  (Mark your answer with an X)

If yes, indicate the name of the Organisation or Training Centre and describe briefly the simulation facility referred to in answer to the question below (i.e. located on-site or off-site, type of simulator/s, sample photograph, reference NPP/s, NPP/s which receive training in this facility, size and composition of the simulator instructional and support staff, etc.) and, also, describe this/these NPP/s (i.e. type (PWR, BWR, etc.), vendor, start of operation, degree of automation, Operators which constitute the Control Room Shift Team, sample photograph of the control room/s, etc.).

Consumers Power Company owns and operates two nuclear units, Big Rock Point and Palisades. This survey response is related to the Palisades plant.

The Palisades plant is a 2530 Mwt two loop Combustion Engineering PWR with a Westinghouse turbine generator. Initial criticality was achieved in 1971. Normal control room staff includes two Reactor Operators (RO) and three Senior Reactor Operators (SRO). A copy of the control room floor plan is attached.

The Palisades Training Center, located at the Palisades Nuclear Plant site, contains a replica training simulator declared ready-for-training in 1983. Operations training includes ten Simulator Instructors (SI) and three Simulator Operators (SO). The Simulator Support Group (SSG) which modifies and maintains the simulator hardware and software as necessary, consists of five software engineers, two hardware technicians and a test operator.

SECTION 2: Current practices with simulators closely related to operator training.

1. Based on your experience, describe advantages and disadvantages of the location of the Simulation Centre with regard to the plant: on-site versus off-site. Specifically, describe those factors which have some influence on the Operators' attitude towards the simulator training and in the quality of the simulator training.

The simulator was moved from off-site to onsite in 1991. Previously the operators were required to drive 180 miles to a Company central training centre three times a year of their week(s) of simulator training. With the simulator onsite, each operating shift now spends a portion of one week of every six weeks on the simulator. This allows for greater proficiency during off normal operations than previously. This also allows for just-in-time training for upcoming plant evolutions such as reactor or turbine startup. Availability of plant comparison data has improved, resulting in simulator fidelity improvements. These items have all contributed positively to operator attitude toward simulator training.
2. a) During simulator training sessions, what factors (time, communications, etc.) influencing the interactions between Control Room Operators and other Plant Personnel (Operations Department outside of Control Room Personnel, Maintenance or Instrumentation, and Control Departments, Technical Support Centre, etc.) are simulated?

Communications systems used by the operators in the plant are also available to them in the simulator. All plant support functions and organisational interactions are available through normal communications and are provided by the SI or SO.

b) Do these other Plant Personnel participate in the training sessions? Describe the present training format pertaining to involvement of non Control Room Personnel in simulator training sessions and explain why this format is used.

Each calendar quarter a plant Site Emergency drill is conducted using the simulator. All appropriate plant organisations interface with the control room crew as they would in the real plant. Additionally, at least once per training cycle the Auxiliary Operators (AO) assigned to the crew also participate in the simulator training. This enhances teamwork for the operating crew as well as providing the AOs with additional insight regarding their activities in the plant and their importance to the control room crew activities.

3. What environmental conditions (normal and emergency lighting, humidity, noise, vibrations, sounds generated by equipments, etc.) that could be experienced by the reference plants, are usually simulated in the Simulator Rooms? Describe the use of such effects at your simulator centre and explain why they are, or are not, incorporated into simulator training sessions.

Environmental factors are required to be modelled by ANSI 3.5. Presently we include sounds (steam break, safety valve lifting, emergency siren and fire alarm), normal and emergency lighting, and maintain approximately the same temperature and humidity band as the plant control room.

These factors are necessary to ensure the operators receive the same cues to changing plant conditions as they would in the real plant. Our sound system is currently being upgraded to include additional sounds.

4. Do Control Room Operators receive simulator training for operations outside the Control Room, for example: operations from Remote Shutdown Panels? Describe this type of training as it exists at your Simulator Centre and explain why it is, or is not, used in training sessions.

Remote shutdown panels are included in the scope of simulation. These include a panel with those controls necessary to maintain the plant in Hot Shutdown conditions and a panel with the controls to bring the plant to cold shutdown conditions. Training on these panels in conducted to ensure the operators can control the plant in the event control room evacuation becomes necessary.
5. a) **How frequently are the changes taking place in plant (plant design changes, procedures changes, etc.) incorporated to the replica or full-scope simulator?** Describe any process or mechanism in place at your Simulator Centre to incorporate changes to the replica or full-scope simulator.

Plant modifications are tracked and compared to the simulator database by a computerised database management system. A comparison is made on a monthly basis and necessary changes to the simulator are scheduled based on training value. The process for modification is proceduralised, as well as the testing and approval requirements. Changes are incorporated prior to the start of a six week requalification training cycle to ensure that each operating crew receives the same training.

b) **Do simulator model modifications require separate approval while the simulator is being used for training?**

Modifications to the training model require approval of the Simulator Supervisor and must be tested prior to implementation.

6. a) **Identify the members of the Control Room Shift Team (Reactor Operators, Turbine Operators, Shift Supervisors, etc.) and indicate the time (in hours) dedicated to simulator training by each member in their initial training programme.**

Specify, when applicable, the time spent with each type of simulator.

   Initial training of the two ROs normally on shift includes approximately 300 hours dedicated to simulator training.
   
   Each of the three SROs (Shift Supervisor (SS), Shift Engineer (SE) and Control Room Supervisor (CRS)) also receive approximately 300 hours of dedicated simulator training.

b) **Indicate the time (in hours) dedicated to simulator training by each member of the Control Room Shift Team in their continuous training programme.**

Specify, when applicable, the time spent with each type of simulator.

Continuing training for the shift crew provides for approximately 120 hours of dedicated simulator time each year.

c) **What is the minimum time, if any, required by the Regulatory Body?**

There is no minimum time required by the regulating body.

7. a) **Indicate the percentage of simulator training time by the different Members of the Control Room Shift Team devoted to i) normal, ii) abnormal and iii) emergency conditions in their initial training programme.**

Approximate percentages for initial training are 30% normal, 30% abnormal and 40% emergency conditions.
b) Indicate the percentage of simulator training time by the different Members of the Control Room Shift Team devoted to i) normal ii) abnormal and iii) emergency conditions in their continuous training programme.

A recent annual continuing training cycle consisted of 18% normal, 27% abnormal and 55% emergency conditions.

c) What are the minimum percentages, if any, required by the Regulatory Body?

There are no percentages required by the regulatory body.

8. What is the role and the policy of the Regulatory Body regarding the use of simulators for Control Room Operators licensing and training?

The regulatory body presently requires that operators pass an examination on a plant-referenced simulator prior to being granted a license.

9. a) What standards (ANSI/ANS 3.5, IAEA, etc.) are simulators built to and maintained?

The simulator is built and maintained to ANSI/ANS 3.5.

b) What exceptions are typically taken to the standard?

We take exceptions to the standard only when requirements are outside the bounds of plant operations (power ops with less than full flow, surveillances performed mostly outside the control room).

c) What types of simulators are used that are not included in industry standards?

We use no other type of simulator at this time.

10. a) Describe the role of part-task simulators in your current training programs.

We do not use part-task simulators in operator training.

b) Describe the role of special-purpose (analytic) simulators in your current training programs.

We do not use special purpose simulators in operator training.

11. Have the current operator training programs been conditioned by the availability and capabilities of the simulator(s) or, alternatively, has(ve) the simulator(s) been specified and acquired after analysing and designing the training programs? Explain.

Training setting for tasks is based on a systematic approach to training. In some cases, the simulator has been modified to add capabilities to support training on difficult tasks.

12. What extensions of simulator training are envisaged for the future?

I don’t understand the question.
13. a) Based on your experience, describe the uses of the simulators for activities other than training (plant drills, procedures validation, design changes validation, testing programs, acquisition of human data, licensing activities, reference plant systems “tuning”, etc.).

We currently use the simulator for procedure violation, plant process computer programme modification, control room redesign efforts and Site Emergency drills.

b) What is the involvement of Control Room Operators for those applications?

Operating crews are involved in procedure validation and Site Emergency drills.

14. What are the applications of simulator training for jobs other than Operations?

We presently provide a systems orientation course (including 12 hours of simulator time) for engineering support personnel.

SECTION 3: Systematic Approach to Training: considerations regarding the use of simulators.

A) Training analysis.

1. Are job and task analysis (or any other type of task identification technique) used for establishing a list of task, performance standards, learning objectives and training methods?
   If yes, describe the technique used.

   Job and Task Analysis are used consistent with INPO Accreditation Criteria.

2. a) What are the criteria that determine the limits or scope of the job analysis for the Control Room Operators?

   Initial criteria included INPO and NRC data and procedure review. Existing task list is reviewed against plant modifications and procedure revisions to identify additions and deletions.

   b) From your point of view, what should the role of risk-based criteria be for determining such limits or scope? Explain your answers.

   While risk based criteria may offer efficiencies in training due to further limits on the scope of the training programme, a truly systematic approach should allow the operator to optimise plant performance, which is essential in the competitive energy market.

3. Are there any special requirements for Job and Task Analysis which are imposed by the possibility of associated simulator training?

   No.
B) Training programme design.

1. **What are the criteria for specifying simulator training rather than another training setting (classroom, laboratory, workshop, on-the-job, etc.)?**

   These criteria include: 1, whether the objective is performance level or not and 2, the location of task performance (control room or in-plant).

2. **What are the criteria for selecting different types of simulator (full-scope, replica, part-task, basic principles, concept, special-purpose)?**

   We are presently limited to a replica simulator.

3. a) **What are the criteria for selecting a replica simulator?**

   Regulatory requirement.

   b) **What are the fidelity requirements?**

   As specified in ANSI/ANS 3.5 and Reg. Guide 1.149.

4. **What are the specific pre-requisites for operators undertaking simulator training?**

   Personnel undertaking initial operator simulator training must have successfully completed an initial systems course (at the AO level) and academic fundamentals courses (reactor theory, chemistry, thermo, etc.). The simulator portion of the advanced systems course is integrated into the programme on a system by system basis as is the in-plant demonstration portion.

5. **Does the possibility of simulator training impose any constraints on the definition of learning objectives?**

   Simulator training adds the possibility of performance standards for some learning objectives (for skills and abilities), while some in-plant objectives may not actually be performed due to actual plant operating conditions. I cannot recall any constraints imposed by simulator training.

C) Training programme development.

1. **In the case of non-replica simulators, is it necessary to take parallel training actions, and if so, what kind?**

   Explain your answer.

   We do not use non-replica simulator.

2. **Do you use specific procedures for the training simulator, actual plant procedures or a combination of both?**

   Explain your answer and give reasons for the choice.

   We use actual controlled plant procedures, as required by ANSI/ANS 3.5.
3. **What are the criteria for selecting normal, abnormal and emergency scenarios to be trained with simulators? Are they risk-based criteria?**

   **Explain your answer.**

   We do not use risk-based criteria. Instead we use task analysis data, specifically the task importance, difficulty and frequency to determine the need to train on the task. Once the decision to train the task is made, the appropriate training setting is determined, using criteria from section 3.b.1, above.

4. **How are lesson plans and support documentation developed for simulator training?**

   Simulator Exercise Guides (SEG) are developed based upon the learning objectives and activities required to be mastered as a logical follow-on to the classroom presentations which provide the prerequisite knowledges to support these activities. The guidance provided in ACAD 90-022, Guidelines for Simulator Training, is generally followed.

D) **Training programme implementation.**

1. **What selection, initial training, and continuing training is arranged for simulator instructors?**

   All SRO licensed or certified instructors are selected to become Simulator Instructors. The qualification programme includes classroom and OJT as well as internship under the supervision of a qualified SI. Completion of the programme is documented by an evaluation of the instructor during a simulator training segment by the instructor’s supervisor. Continuing training includes the requalification training associated with the instructor’s SRO license or certification as well as at least one SI Continuing Training segment per calendar quarter.

2. **What are the arrangements for instructor monitoring of, and feedback to, trainees during simulator sessions?**

   The type of session dictates the monitoring and feedback arrangements and timing:

   - **Evaluation mode scenarios** are typically run without instructor intervention. The instructors note actions against predetermined success paths and provide feedback during a facilitative crew critique following the session. A videotape record of the session is available to clarify observations.
   - **Practice mode scenarios** are run similarly to the evaluation mode sessions, but the students or the instructor may freeze the simulation to clarify misconceptions or reinforce a teaching point. Critiques are again facilitative.
   - **Training mode sessions** routinely result in the instructor freezing the simulation for reinforcement or discussion. Backtrack is sometimes used to allow each crew member to perform specific evolutions. Critiques typically consist of a review of the session concentrating on strengths, weaknesses and objectives.

3. a) **What specific training modes such as simulator freeze, playback, running at higher speed than real time, activity recording, video recording, etc. is made use of during initial training?**

   During initial training, freeze, backtrack and videotaping are all routinely used.

b) **What specific training modes such as simulator freeze, playback, running at higher speed than real time, activity recording, video recording, etc. is made use of during continuous training?**
During continuing training, freeze and videotaping are routinely used; backtrack is only used if necessary for repetition of a given segment.

4. What limits of simulation impede planned training sessions or examination scenarios?

The following limits of simulation have impacted planned training sessions or examinations:
- The simplified electrical distribution model does not allow for stripping each load from each electrical bus. This can adversely affect bus restoration attempts during some scenarios.
- We presently do not have a good “reduced inventory” simulation. This has decreased our flexibility in choosing success paths for certain shutdown scenarios.

E) Trainee assessment.

(I assume that the first question here is making a distinction between initial and continuing training, not between initial and continuous assessment.)

1. a) What methods and procedures are used for initial trainee assessment during and after simulator sessions?

Throughout the Advanced Systems segments of the initial training programme, trainees are evaluated using Job Performance Measures (JPM). The JPM is an evaluation tool (condition, action, standard) that involves individual operator manipulation of a system or component at the task level. During the Integrated Plant Operations and Transient segments of the programme, trainees are typically evaluated as a team using the competencies which will be discussed in section 3.e.2.

b) What methods and procedures are used for continuous trainee assessment during and after simulator sessions?

Continuing simulator training for licensed operators utilises a crew performance evaluation at the beginning of the week to address crew weaknesses for remediation throughout the week. The crews are graded as a crew and as individuals in the competencies which will be discussed in section 3.e.2. Approximately three times during the annual requalification cycle the operators are also assessed using JPMs.

2. List and describe the main areas or groups of skills and knowledge of the trainee assessed in training simulators (for example: “control board awareness, event diagnosis, immediate actions / entry-level actions, subsequent actions, control board manipulations, use of procedures / technical specifications / reference data, communications, supervisory ability, team skills” (IAEA-TECDOC-525)). Identify, when applicable, the types of simulator used for addressing each one.

We utilise the replica simulator for assessing performance using the competencies listed in PNT 7.0, Simulator Training, Attachment 5 (attached to this survey response). These competencies were based on the guidelines contained in Form ES-604-2 of the Operator Licensing Examiner Standards (NUREG 1021) used by the Nuclear Regulatory Commission (NRG) examiners.

3. Describe the ranking of importance, if any, given to the main areas or groups of skills and knowledge taken into account for a trainee assessment.

There is no additional ranking of importance given to the competencies.
4. a) Based on your experience, describe difficulties you have had for assessing the individual skills and knowledge of a trainee while operating within a whole Control Room Shift Team during simulator sessions.

We do not appear to have this difficulty due to the process described below.

b) Describe the measures adopted to overcome these difficulties.

Our trainees are evaluated at both the crew and individual level during the crew performance evaluation. The crew members are rotated through watch stations as necessary to sample for the desired competencies. If any individual weak areas are identified or suspected, individual follow-up questions and/or JPMs are used to ascertain level of skill/knowledge.

5. a) Based on your experience, describe influences on trainees performance during simulator sessions resulting from the attendance of personnel such as utility managers, regulatory body inspectors, etc.

In the past few years, increased presence of station management at simulator sessions due to our Management Observation programme as well as increased regulatory presence has caused this to become a commonplace occurrence. Thus the tension previously exhibited by the crews no longer appears to be as great a problem.

b) Based on your experience, describe influences on trainees performance during simulator sessions resulting from the attendance of personnel such as utility managers, regulatory body inspectors, etc.

Due to the different personalities of each SI and each crew, this is an area that one could write a book on. Suffice it to say that we are endeavouring to raise our standards for excellence and professionalism to ensure consistency of training.

6. a) Are training simulator examinations used in order to grant initial license to operators? Explain.

Each trainee must pass a simulator examination to be granted a license.

b) Are training simulator examinations used for requalification? Explain.

Each licensed operator must pass a crew performance evaluation on the simulator annually to retain a license.
7. How is examination integrity preserved during the examination/scenario preparation period?

The person(s) developing the examination must have no training contact with the examinees from the moment that exam development begins until the examination has been taken by the trainee(s).

8. What performance monitoring or data acquisition features of the simulator are used during simulator examinations?

Presently, none.

F) Training programme evaluation.

1. Describe the approach used for evaluating the simulator training programme and main results.

Simulator training is not evaluated separately as a programme, rather it is included as one part of the initial and continuing training programmes. Simulator training is, however, monitored through our Management Observation programme, audits by our Nuclear Performance Assessment Department (NPAD) and the regulators (INPO and NRC). Main results are that the training is generally effective but could be improved by better instructional techniques and increased realism.

2. What programme is in place for validation and continuous verification of the simulator performance?

Simulator performance is verified by a series of tests conducted on a four year schedule, with 25% of the tests performed each year (as required by ANSI/ANS 3.5).

3. What types of performance discrepancies are most frequently identified by operators during training sessions?

Most frequent discrepancies include instrument & control power supplies and a feeling that some simulated processes respond too slowly. This latter comment is usually not the case (based on real plant data) but may result from a difference in the way the operators operate the simulator vs. the plant.

4. What types of performance discrepancies are most frequently identified by examiners or inspectors?

Examiners and inspectors typically note discrepancies associated with the Instructor’s Station displays and/or controls.
**SECTION 4: Use of operating experience for operator training with simulators.**

1. **How is operational experience feedback incorporated into the design of simulator training programs (experience reviewed, schedule, people involved)?**

   The plant has an Industry Experience and Assessment (IE&A) group which is responsible for ensuring that lessons learned from events throughout the industry are forwarded to the appropriate plant groups (including training) as appropriate. Additionally, we have a weekly meeting of the Training Review Tracking Committee (TRTC) which forwards information to various training disciplines (operations, I&C, chemistry, etc.) for incorporation into their training programmes. The Operations Training Section Supervisor will then determine the scope and schedule of the appropriate training based on priority, availability of resources, etc.

2. **Has your organisation developed any kind of programme by which simulator operator training is correlated with real operating events?**

   Explain.

   No.

**SECTION 5: Specific topics on Operator training with simulators.**

A) **Team training techniques.**

1. a) **Are job and task analyses used for defining the role and responsibilities of the Members of the Control Room Shift Teams and, in general, of the various levels of staff who are charged with operation of the plant?** Explain your answer.

   The roles and responsibilities of these personnel are specified in our Administrative Procedures. Our job and task analysis was done separately and has had some impact on these.

   b) **Are job and task analyses used for establishing performance standards, learning objectives and training methods for Team skills training?** Explain your answer.

   Our Team skills training was initially based on the INPO training modules and has been modified to reflect the individual roles.

2. **List and describe Team skills (communication, management of resources, team cooperation, team leadership, feedback, conflict resolution, team decision-making, etc.) which are trained using simulators. Identify, when applicable, the types of simulator used for training each one.**

   We use the replica simulator to reinforce team training principles, however, the initial course also uses games such as “Arctic Survival” to develop some of these skills.

3. **Are any guides used for conducting and evaluating Team skills training simulations?** Explain your answer.

   Established SEGs are used, especially in the area of diagnostic skills.
4. Based on your experience, describe advantages and disadvantages of Team training with the participation of the same (usual) Members every time or with changes in the Shift Team compositions.

The major advantage is the clear establishment of individual responsibilities during off-normal and emergency conditions (which are seldom realised in the plant). The major disadvantage is that a typical shift at the plant is seldom staffed by an intact crew due to vacation, illness, etc.

5. Are simulator sessions used for the optimisation of control Room Team Shifts taking into account the characteristics (aptitudes, attitudes, ...) of each Operator? In other words, are simulator sessions used for deciding which Members are going to constitute each Shift Team?
   Explain your answer.

   No, they are not.

6. Are there any licensing examinations applied to the whole Control Room Shift Team in addition to the individual licensing examinations?
   Explain.

   Each crew must pass an annual crew evaluation for the individuals to retain their licenses.

   **B) Training for stress.**

   1. Is any part of the simulator training programme specifically devoted to train Control Room Operators to operate under stress?
      Explain you answer.

      No.

   2. Are stress levels induced and measured during simulator training sessions?
      If yes, describe the methods and results.

      Not in a controlled manner.

   3. Based on your experience describe any measures adopted during simulator training to counter stress.

      Our initial teamwork training deals with stress and its symptoms as well as means to combat it, but we go no farther in specific training.
C) The theoretical basis underlying training.

1. Are any models of human behaviour being used in designing and implementing training programmes?
   If yes:
   i) refer to or describe the models,
   ii) indicate the areas in which these models are being applied (for example: signal detections, decision-making, etc.)
   iii) give the main results.

   We use the SAT process for designing and implementing training. I am unsure of the models used to develop this process.

D) Habits acquired during training sessions with simulators.

1. Describe, based on your experience, undesirable habits which could be acquired by trainees during training sessions with simulators (for example: due to limited number of simulated scenarios, due to lack of physical or functional fidelity, due to the use of conservative codes for simulation instead of best estimate codes, etc.) and discuss their potential consequences on safety.

   I have not seen any habits with consequences to safety; on the contrary I observe a more deliberate and careful manipulation of the controls at the plant vs. the simulator.

2. Describe, based on your experience, any measures adopted to avoid acquisition of those undesirable habits or to prevent use of them.

   The use of critiques and increased participation of management (through observation) has limited this undesirable behaviour.

E) Simulator training on normal and emergency conditions during shutdown and low power operation.

1. What use is made of simulators for Control Room Operator training in normal, abnormal and emergency conditions during shutdown and low power operation (simulated scenarios, trained skills, training techniques, ...)?

   We train our operators on individual skills (such as control of plant pressure while cold and solid) as well as integrated plant operations (control of heat up rate while on shutdown cooling as well as with shutdown cooling secured) throughout the whole range of plant conditions from cold shutdown to power operation. Any abnormal or emergency event initiated with shutdown cooling in service is addressed by one procedure, which we exercise during simulator training. We exercise our EOPs with simulated conditions from the point shutdown cooling is secured through power operations.

2. What are the criteria (risk-based criteria, deterministic criteria, results of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?

   The criteria include needs analysis and management prerogative.
3. Are job and task analysis (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on shutdown and low power operation? Explain.

Yes, based upon the controlling procedure for these operations.

4. What are your plans for the future in this area?

We have no definitive plans for the future in this area.

F) Simulator training on severe accidents.

1. What use is made of simulators for Control Room Operator training in severe accidents (simulated scenarios, trained skills, training techniques,...)?

We have not yet addressed this issue.

2. What are the criteria (risk-based criteria, deterministic criteria, result of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?

Criteria still being developed.

3. Are job and task analysis (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on severe accidents. Explain.

Still being developed.

4. What are your plans for the future in this area?

I am unsure. Presently we have been looking at emergency drills with more support from the offsite groups which will provide guidance under these circumstances, but the role of the simulator in this training is undefined. Severe accidents go beyond the present scope of the models.

G) Simulator training on accidents caused by fires, floods, earthquakes, etc.

1. What use is made of simulators for Control Room Operator training in accidents caused by fires, floods, earthquakes, etc. (simulated scenarios, trained skills, training techniques,...)?

The simulator is currently used for training for fires which threaten safety-related equipment and for control room evacuation. The scenarios exercise the appropriate abnormal procedures. We presently do not perform simulator training on floods or earthquakes, except in-plant flooding caused by equipment failures. The abnormal procedure addressing such has been exercised, but not to the point of water ingress to the plant. Earthquakes are considered an improbably event in our location and are not addressed specifically by our abnormal procedures.
2. **What are the criteria (risk-based criteria, deterministic criteria, result of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?**

The criteria includes need analysis (based on the abnormal procedures) and obviously risk analysis (which is evident by the lack of procedure for earthquake).

3. **Are job and task analyses (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on accidents caused by fires, floods, earthquakes, etc.? Explain.**

   Job and task analysis are used for all our learning objectives.

4. **What are your plans for the future in this area?**

   No future plans.
QUESTIONNAIRE

SECTION 0: Organisation/s replying to the questionnaire

1. Name of Organisation/s.
   Com Ed

2. Contact Person/s.
   Ron Bell

3. Address and contact information (telephone, fax).
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   Tel: 815-458-3411
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SECTION 1: General Information (related to the whole country)

1. Number of nuclear reactors (Units) in operation.

2. Number of Sites with at least one Unit in operation.

3. Number of full-scope (replica and no replica) simulators used for operator training.

4. Number of replica simulators used for operator training.

5. Number of part-task simulators used for operator training.

6. Number of basic principles simulators used for operator training.

7. Number of concept simulators used for operator training.
8. Number of special-purpose simulators used for operator training.

9. For how many Units is the training done on replica training simulators?

10. For how many Units is the training done on full-scope (replica and no replica) training simulators.

IMPORTANT QUESTION

Are your answers to the subsequent sections (2 to 5) of the questionnaire related to a specific Organisation or Training Centre in your Country?

Yes  X  No  (Mark your answer with an X)

If yes, indicate the name of the Organisation or Training Centre and describe briefly the simulation facility referred to in answer to the question below (i.e. located on-site or off-site, type of simulator/s, sample photograph, reference NPP/s, NPP/s which receive training in this facility, size and composition of the simulator instructional and support staff, etc.) and, also, describe this/these NPP/s (i.e. type (PWR, BWR, etc.), vendor, start of operation, degree of automation, Operators which constitute the Control Room Shift Team, sample photograph of the control room/s, etc.).

Com Ed’s LaSalle Simulator is located at the Production Training Center (PTC) 35 miles from the LaSalle Station (1,2). PTC also has the Braidwood simulator which is a PWR simulator built by Westinghouse. The LaSalle simulator was built by EAI in the early 1980s, and conducted training in the fall of 1983. Currently only LaSalle station operators use the LaSalle simulator. We have 17 instructors and LaSalle maintains 98 operator licenses (2 SROs and 4 NSOs).

SECTION 2: Current practices with simulators closely related to operator training.

1. Based on your experience, describe advantages and disadvantages of the location of the Simulation Centre with regard to the plant: on-site versus off-site. Specifically, describe those factors which have some influence on the Operators’ attitude towards the simulator training and in the quality of the simulator training.

2. a) During simulator training sessions, what factors (time, communications, etc.) influencing the interactions between Control Room Operators and other Plant Personnel (Operations Department outside of Control Room Personnel, Maintenance or Instrumentation, and Control Departments, Technical Support Centre, etc.) are simulated?
b) Do these other Plant Personnel participate in the training sessions? Describe the present training format pertaining to involvement of non Control Room Personnel in simulator training sessions and explain why this format is used.

3. What environmental conditions (normal and emergency lighting, humidity, noise, vibrations, sounds generated by equipments, etc.) that could be experienced by the reference plants, are usually simulated in the Simulator Rooms? Describe the use of such effects at your simulator centre and explain why they are, or are not, incorporated into simulator training sessions.

4. Do Control Room Operators receive simulator training for operations outside the Control Room, for example: operations from Remote Shutdown Panels? Describe this type of training as it exists at your Simulator Centre and explain why it is, or is not, used in training sessions.

5. a) How frequently are the changes taking place in plant (plant design changes, procedures changes, etc.) incorporated to the replica or full-scope simulator? Describe any process or mechanism in place at your Simulator Centre to incorporate changes to the replica or full-scope simulator.

b) Do simulator model modifications require separate approval while the simulator is being used for training?

6. a) Identify the members of the Control Room Shift Team (Reactor Operators, Turbine Operators, Shift Supervisors, etc.) and indicate the time (in hours) dedicated to simulator training by each member in their initial training programme. Specify, when applicable, the time spent with each type of simulator.

b) Indicate the time (in hours) dedicated to simulator training by each member of the Control Room Shift Team in their continuous training programme. Specify, when applicable, the time spent with each type of simulator.

c) What is the minimum time, if any, required by the Regulatory Body?
7. a) Indicate the percentage of simulator training time by the different Members of the Control Room Shift Team devoted to i) normal, ii) abnormal and iii) emergency conditions in their initial training programme.

b) Indicate the percentage of simulator training time by the different Members of the Control Room Shift Team devoted to i) normal ii) abnormal and iii) emergency conditions in their continuous training programme.

c) What are the minimum percentages, if any, required by the Regulatory Body?

8. What is the role and the policy of the Regulatory Body regarding the use of simulators for Control Room Operators licensing and training?

9. a) What standards (ANSI/ANS 3.5, IAEA, etc.) are simulators built to and maintained?

b) What exceptions are typically taken to the standard?

c) What types of simulators are used that are not included in industry standards?

10. a) Describe the role of part-task simulators in your current training programs.

b) Describe the role of special-purpose (analytic) simulators in your current training programs.

11. Have the current operator training programs been conditioned by the availability and capabilities of the simulator(s) or, alternatively, has(ve) the simulator(s) been specified and acquired after analysing and designing the training programs? Explain.

12. What extensions of simulator training are envisaged for the future?
13. a) Based on your experience, describe the uses of the simulators for activities other than training (plant drills, procedures validation, design changes validation, testing programs, acquisition of human data, licensing activities, reference plant systems “tuning”, etc.).

b) What is the involvement of Control Room Operators for those applications?

14. What are the applications of simulator training for jobs other than Operations?

SECTION 3: Systematic Approach to Training: considerations regarding the use of simulators.

A) Training analysis.

1. Are job and task analysis (or any other type of task identification technique) used for establishing a list of task, performance standards, learning objectives and training methods?
   If yes, describe the technique used.

   Yes. Job incumbents and trainers determine tasks for training and derive performance standards and objectives.

2. a) What are the criteria that determine the limits or scope of the job analysis for the Control Room Operators?

   As required by plant procedures and regulations.

b) From your point of view, what should the role of risk-based criteria be for determining such limits or scope? Explain your answers.

   As required by our emergency operating procedures, technical specifications and probability risk assessment assumptions.

3. Are there any special requirements for Job and Task Analysis which are imposed by the possibility of associated simulator training?

   No special requirements.
B) Training programme design.

1. **What are the criteria for specifying simulator training rather than another training setting (classroom, laboratory, workshop, on-the-job, etc.)?**

   Simulator capability; whether the task can be performed during BTT, operations/management input, ALARA.

2. **What are the criteria for selecting different types of simulator (full-scope, replica, part-task, basic principles, concept, special-purpose)?**

   Selected full-scope to meet NRC simulator certification requirements.

3. a) **What are the criteria for selecting a replica simulator?**

   Maximise fidelity within cost constraints.

   b) **What are the fidelity requirements?**

   ANSI 3.5.

4. **What are the specific pre-requisites for operators undertaking simulator training?**

   Power Plant Fundamentals and Systems Training.

5. **Does the possibility of simulator training impose any constraints on the definition of learning objectives?**

   Time compression in some cases to maximise simulator use.

C) Training programme development.

1. **In the case of non-replica simulators, is it necessary to take parallel training actions, and if so, what kind?**

   Explain your answer.

   N/A

2. **Do you use specific procedures for the training simulator, actual plant procedures or a combination of both?**

   Explain your answer and give reasons for the choice.

   Plant procedures (during scenarios).
   Training procedures (for evaluations).

3. **What are the criteria for selecting normal, abnormal and emergency scenarios to be trained with simulators? Are they risk-based criteria?**

   Explain your answer.

   Management inputs. 10CFR55.50 requirements, PRA assumptions, technical specifications and FSAR.
4. How are lesson plans and support documentation developed for simulator training?

Prepared by licensed instructors with Operating Department input and review.

D) Training programme implementation.

1. What selection, initial training, and continuing training is arranged for simulator instructors?

   Both are required; same as licensed operators.

2. What are the arrangements for instructor monitoring of, and feedback to, trainees during simulator sessions?

   Instructors and shift supervisors provide feedback during and/or after all scenarios.

3. a) What specific training modes such as simulator freeze, playback, running at higher speed than real time, activity recording, video recording, etc. is made use of during initial training?

   Simulator freeze, playback ("back track"), video recording.

   b) What specific training modes such as simulator freeze, playback, running at higher speed than real time, activity recording, video recording, etc. is made use of during continuous training?

   Simulator freeze, playback ("back track"), video recording.

4. What limits of simulation impede planned training sessions or examination scenarios?

   Dual-unit plant; single-unit simulator.

E) Trainee assessment.

1. a) What methods and procedures are used for initial trainee assessment during and after simulator sessions?

   Similar to Nu Reg-1021.

   b) What methods and procedures are used for continuous trainee assessment during and after simulator sessions?

   Same as Nu Reg-1021.
2. List and describe the main areas or groups of skills and knowledge of the trainee assessed in training simulators (for example: “control board awareness, event diagnosis, immediate actions / entry-level actions, subsequent actions, control board manipulations, use of procedures / technical specifications / reference data, communications, supervisory ability, team skills” (IAEA-TECDOC-525)). Identify, when applicable, the types of simulator used for addressing each one.

All listed above plus management expectations; full-scope for all.

3. Describe the ranking of importance, if any, given to the main areas or groups of skills and knowledge taken into account for a trainee assessment.

Emphasis is placed on communications, supervisory ability, team skills. However, all category items are important.

4. a) Based on your experience, describe difficulties you have had for assessing the individual skills and knowledge of a trainee while operating within a whole Control Room Shift Team during simulator sessions.

Monitoring all individual crew members without crowding control room.

b) Describe the measures adopted to overcome these difficulties.

Monitor half of the crew for one scenario, monitor the second half during another drill.

5. a) Based on your experience, describe influences on trainees performance during simulator sessions resulting from the attendance of personnel such as utility managers, regulatory body inspectors, etc.

Minimal impact.

b) Based on your experience, describe influences on trainees performance during simulator sessions resulting from the attendance of personnel such as utility managers, regulatory body inspectors, etc.

Minimal impact.

6. a) Are training simulator examinations used in order to grant initial license to operators? Explain.

Yes, required by NRC.

b) Are training simulator examinations used for requalification? Explain.

Yes, required by NRC.

7. How is examination integrity preserved during the examination/scenario preparation period?

Maintained in a locked file cabinet. Scenario conditions are password-protected.
8. What performance monitoring or data acquisition features of the simulator are used during simulator examinations?

Dynamic graphs are monitored which replicate the graphs used with the EOPs.

F) Training programme evaluation.

1. Describe the approach used for evaluating the simulator training programme and main results.

Annual internal assessments. External assessment by the NRC and INPO.

2. What programme is in place for validation and continuous verification of the simulator performance?

Quarterly fidelity surveillances are performed.

3. What types of performance discrepancies are most frequently identified by operators during training sessions?

Speed of simulator response when some controls are manipulated.

4. What types of performance discrepancies are most frequently identified by examiners or inspectors?

Amount of after-shutdown decay heat.

SECTION 4: Use of operating experience for operator training with simulators.

1. How is operational experience feedback incorporated into the design of simulator training programs (experience reviewed, schedule, people involved)?

2. Has your organisation developed any kind of programme by which simulator operator training is correlated with real operating events? Explain.

SECTION 5: Specific topics on Operator training with simulators.

A) Team training techniques.

1. a) Are job and task analyses used for defining the role and responsibilities of the Members of the Control Room Shift Teams and, in general, of the various levels of staff who are charged with operation of the plant? Explain your answer.
b) Are job and task analyses used for establishing performance standards, learning objectives and training methods for Team skills training? Explain your answer.

2. List and describe Team skills (communication, management of resources, team cooperation, team leadership, feedback, conflict resolution, team decision-making, etc.) which are trained using simulators. Identify, when applicable, the types of simulator used for training each one.

3. Are any guides used for conducting and evaluating Team skills training simulations? Explain your answer.

4. Based on your experience, describe advantages and disadvantages of Team training with the participation of the same (usual) Members every time or with changes in the Shift Team compositions.

5. Are simulator sessions used for the optimisation of control Room Team Shifts taking into account the characteristics (aptitudes, attitudes, ...) of each Operator? In other words, are simulator sessions used for deciding which Members are going to constitute each Shift Team? Explain your answer.

6. Are there any licensing examinations applied to the whole Control Room Shift Team in addition to the individual licensing examinations? Explain.

B) Training for stress.

1. Is any part of the simulator training programme specifically devoted to train Control Room Operators to operate under stress? Explain your answer.

2. Are stress levels induced and measured during simulator training sessions? If yes, describe the methods and results.

3. Based on your experience describe any measures adopted during simulator training to counter stress.
C) The theoretical basis underlying training.

1. Are any models of human behaviour being used in designing and implementing training programmes?
   If yes:
   i) refer to or describe the models,
   ii) indicate the areas in which these models are being applied (for example: signal detections, decision-making, etc.)
   iii) give the main results.

D) Habits acquired during training sessions with simulators.

1. Describe, based on your experience, undesirable habits which could be acquired by trainees during training sessions with simulators (for example: due to limited number of simulated scenarios, due to lack of physical or functional fidelity, due to the use of conservative codes for simulation instead of best estimate codes, etc.) and discuss their potential consequences on safety.

2. Describe, based on your experience, any measures adopted to avoid acquisition of those undesirable habits or to prevent use of them.

E) Simulator training on normal and emergency conditions during shutdown and low power operation.

1. What use is made of simulators for Control Room Operator training in normal, abnormal and emergency conditions during shutdown and low power operation (simulated scenarios, trained skills, training techniques, ...)?

2. What are the criteria (risk-based criteria, deterministic criteria, results of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?

3. Are job and task analysis (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on shutdown and low power operation? Explain.

4. What are your plans for the future in this area?
F) Simulator training on severe accidents.

1. What use is made of simulators for Control Room Operator training in severe accidents (simulated scenarios, trained skills, training techniques, ...)?

2. What are the criteria (risk-based criteria, deterministic criteria, result of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?

3. Are job and task analysis (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on severe accidents. Explain.

4. What are your plans for the future in this area?

G) Simulator training on accidents caused by fires, floods, earthquakes, etc.

1. What use is made of simulators for Control Room Operator training in accidents caused by fires, floods, earthquakes, etc. (simulated scenarios, trained skills, training techniques,...)?

2. What are the criteria (risk-based criteria, deterministic criteria, result of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?

3. Are job and task analyses (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on accidents caused by fires, floods, earthquakes, etc.? Explain.

4. What are your plans for the future in this area?
QUESTIONNAIRE

SECTION 0: Organisation/s replying to the questionnaire

1. Name of Organisation/s.
   
   Fermi 2
   Detroit Edison

2. Contact Person/s.

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   Supervisor, Nuclear Training Simulator & Training Support

   Bryan D. Crone
   Senior Science & Engineering Technician

3. Address and contact information (telephone, fax).

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   (313) 586-4000

SECTION 1: General Information (related to the whole country)

1. Number of nuclear reactors (Units) in operation.

2. Number of Sites with at least one Unit in operation.

3. Number of full-scope (replica and no replica) simulators used for operator training.

4. Number of replica simulators used for operator training.

5. Number of part-task simulators used for operator training.

6. Number of basic principles simulators used for operator training.
7. Number of concept simulators used for operator training.

8. Number of special-purpose simulators used for operator training.

9. For how many Units is the training done on replica training simulators?

10. For how many Units is the training done on full-scope (replica and no replica) training simulators.

IMPORTANT QUESTION

Are your answers to the subsequent sections (2 to 5) of the questionnaire related to a specific Organisation or Training Centre in your Country?

Yes X No ___ (Mark your answer with an X)

If yes, indicate the name of the Organisation or Training Centre and describe briefly the simulation facility referred to in answer to the question below (e.g. located on-site or off-site, type of simulator/s, sample photograph, reference NPP/s, NPP/s which receive training in this facility, size and composition of the simulator instructional and support staff, etc.) and, also, describe this/these NPP/s (e.g. type (PWR, BWR, etc.), vendor, start of operation, degree of automation, Operators which constitute the Control Room Shift Team, sample photograph of the control room/s, etc.).

Fermi 2

SECTION 2: Current practices with simulators closely related to operator training.

1. Based on your experience, describe advantages and disadvantages of the location of the Simulation Centre with regard to the plant: on-site versus off-site. Specifically, describe those factors which have some influence on the Operators’ attitude towards the simulator training and in the quality of the simulator training.

2. a) During simulator training sessions, what factors (time, communications, etc.) influencing the interactions between Control Room Operators and other Plant Personnel (Operations Department outside of Control Room Personnel, Maintenance or Instrumentation, and Control Departments, Technical Support Centre, etc.) are simulated?
b) Do these other Plant Personnel participate in the training sessions?
Describe the present training format pertaining to involvement of non Control Room Personnel in simulator training sessions and explain why this format is used.

3. What environmental conditions (normal and emergency lighting, humidity, noise, vibrations, sounds generated by equipments, etc.) that could be experienced by the reference plants, are usually simulated in the Simulator Rooms?
Describe the use of such effects at your simulator centre and explain why they are, or are not, incorporated into simulator training sessions.

The Fermi 2 Control Room simulator is in compliance with criteria as contained in the American National Standard ANSI/ANS - 3.5 - 1985, Nuclear Power Plant Simulators for Use in Operator Training. See the answer to question 9 below for additional “general” data in compliance with this document. Section 3.2.3 of ANSI 3.5 specifically addresses “Control Room Environment”, and states the following:
“Consideration shall be given to simulating as much of the control room environment as is reasonable and practical, for example, turbine noise, control rod step counter noise, flooring, obstructions and lighting. Communication systems that a control room operator would use to communicate with an auxiliary operator or other support activities shall be operational to the extent that the simulator instructor, when performing these remote activities, shall be able to communicate over the appropriate communication system.”

The Fermi 2 simulator currently mimics the Fermi 2 Plant Control Room to a very high degree. Some minor differences have been noted, such as computer floor tiles to facilitate simulator modifications and repairs, lack of turbine noise, and a number of other minor differences. These types of differences are input and tracked via the Fermi 2 Simulator Configuration Management System (SCMS) database. Additionally, future enhancements to correct these deficiencies are being considered, based on evaluation of cost versus training value.

4. Do Control Room Operators receive simulator training for operations outside the Control Room, for example: operations from Remote Shutdown Panels?
Describe this type of training as it exists at your Simulator Centre and explain why it is, or is not, used in training sessions.

The Fermi 2 simulator is modelled to replicate some activities or functions performed from outside the Control Room. One of the panels located in the power plant for use in controlling a reactor shutdown and cool down from outside of the control room is replicated in the simulator proper. Additionally, some panels that are located in the plant Relay Room (equipment room beneath the control room) are also provided in the simulator. Remote functions are also available to the simulator instructor for completing actions that would normally be performed in the plant, causing parameter changes in the simulator much like what would occur in the plant.
This is useful during performance of procedures where a power plant operator is implementing steps in the power plant while in communication with control room operators.

However, there are multiple panels in the actual plant used for controlling plant parameters that are not replicated in the simulator, and there are procedures performed in the plant that are not included in simulator training due to insufficient remote functions (normally training benefit is so low that remote functions are not warranted). The decision for including or excluding the ability to perform operations outside the Control Room in the simulator was evaluated based on a number of factors, including the training value of a particular evolution. Additionally, guidance on this particular subject is provided in ANSI 3.5 in section 3.3.2, titled “Systems Operation or Functions Controlled Outside of the Control Room”, and states:
“The systems that are operated outside the control room or that provide some inputs to the simulation models and are necessary to perform reference plant evolutions described in 3.1.1 (Normal Plant Evolutions) and malfunctions described in 3.1.2 (Plant Malfunctions) shall be simulated. The simulator trainee shall be able to interface with the remote activity in a similar manner as in the reference plant.”

Additional guidance is provided in NUREG 1262, Answers to Questions at Public Meetings Regarding Implementation of Title 10, Code of Federal Regulations, Part 55 on Operators’ Licences. The answer to question 195 states:

“Any surveillance that cannot be performed from the control room need not be modelled. For example, if you’re doing a diesel startup from the local panel for the diesel and that’s the way you conduct the surveillance, you need not model anything that’s done on a routine basis from outside the control room.”

5. a) How frequently are the changes taking place in plant (plant design changes, procedures changes, etc.) incorporated to the replica or full-scope simulator? Describe any process or mechanism in place at your Simulator Centre to incorporate changes to the replica or full-scope simulator.

ANSI 3.5 section 5.2 provides direction on incorporating plant changes into the simulator. Information provided in section 5.2 states:

“The simulator update design data forms the basis for future simulator design changes. This data base shall include all available plant data within 18 months after the reference plant is in commercial operation or within 18 months of the simulator operational date, whichever is later. Reference plant modifications shall be reviewed at least once per year and the simulator update design data shall be revised as appropriate based on engineering and training value assessment. Student feedback should be evaluated as part of the review process.”

Section 5.3 of ANSI 3.5, titled “Simulator Modifications”, provides additional direction on incorporating plant changes into the simulator:

“The simulator shall be modified as required within 12 months following the annual establishment of the simulator update design data referenced in 5.2 (Simulator Update Design Data). Simulator Modifications may precede reference plant modifications based on training value.”

Fermi 2 specific procedures require that plant modifications be reviewed at least once per year, and the simulator update design data be revised a appropriate based on engineer and training value assessment. This ensures compliance with the ANSI 3.5 requirement. Actual practice at Fermi 2 includes review of plant modifications on a continuous basis. As potential plant modifications are identified and developed, simulator personnel evaluate the affect the modification may have on simulator operation. Determinations are made as to whether the modification will be incorporated into the simulator, based on the deviation that could be created between the simulator and the plant. If the deviation is significant enough (based on a training value versus cost assessment), upgrade of the simulator to include the modification is performed.

b) Do simulator model modifications require separate approval while the simulator is being used for training?

The simulator at Fermi 2 utilises a separate Training Model, and a Development Model. Changes to the simulator are developed and tested on the Development Model prior to being used for training. Periodically (approximately every 6-8 weeks), changes made to the Development Model are permanently incorporated into the Training Model.
6.  a) Identify the members of the Control Room Shift Team (Reactor Operators, Turbine Operators, Shift Supervisors, etc.) and indicate the time (in hours) dedicated to simulator training by each member in their initial training programme. Specify, when applicable, the time spent with each type of simulator.

b) Indicate the time (in hours) dedicated to simulator training by each member of the Control Room Shift Team in their continuous training programme. Specify, when applicable, the time spent with each type of simulator.

c) What is the minimum time, if any, required by the Regulatory Body?

7.  a) Indicate the percentage of simulator training time by the different Members of the Control Room Shift Team devoted to i) normal, ii) abnormal and iii) emergency conditions in their initial training programme.

b) Indicate the percentage of simulator training time by the different Members of the Control Room Shift Team devoted to i) normal ii) abnormal and iii) emergency conditions in their continuous training programme.

c) What are the minimum percentages, if any, required by the Regulatory Body?

8. What is the role and the policy of the Regulatory Body regarding the use of simulators for Control Room Operators licensing and training?

9.  a) What standards (ANSI/ANS 3.5, IAEA, etc.) are simulators built to and maintained?

The capabilities, use, design, and updating of the Fermi 2 simulator meet requirements as specified in ANSI/ANS 3.5 - 1985, Nuclear Power Plant Simulators for Use in Operator Training.

b) What exceptions are typically taken to the standard?

Fermi 2 submitted documentation for initial certification of the current control room simulator in 1992. At that time, no exceptions to the ANSI requirement were noted. Currently, no exceptions are anticipated during recertification in 1996.
c) **What types of simulators are used that are not included in industry standards?**

Various simulation models are in use at Fermi 2. Maintenance and Training personnel constructed and utilise a “live loop” simulation to assist in the understanding of plant process streams and associated components. This is the only other simulation maintained by the Training Organisation (besides the Control Room Simulator). Other simulators are in use by plant groups, including those that predict accident probabilities, as well as those that predict plant response for a given scenario. These simulators, however, may be governed by some type of industry standard.

10. a) **Describe the role of part-task simulators in your current training programs.**

b) **Describe the role of special-purpose (analytic) simulators in your current training programs.**

11. **Have the current operator training programs been conditioned by the availability and capabilities of the simulator(s) or, alternatively, has(ve) the simulator(s) been specified and acquired after analysing and designing the training programs? Explain.**

   The current control room simulation model in use at Fermi 2 is actually an upgrade to the original simulator installed in 1984. Input from the plant operations group was obtained during the upgrade design phase, as was input from the operations training group. As a result, much more dynamic scenarios are available, and simulator training has evolved to include more challenging scenarios.

12. **What extensions of simulator training are envisaged for the future?**

13. a) **Based on your experience, describe the uses of the simulators for activities other than training (plant drills, procedures validation, design changes validation, testing programs, acquisition of human data, licensing activities, reference plant systems “tuning”, etc.).**

   The Fermi 2 Control Room simulator is utilised by almost every group at the plant site for various testing, training, and troubleshooting activities. The Fermi 2 Control Room simulator is routinely used to conduct Radiological Emergency Response Preparedness (RERP) drills and exercises, where use of the upgraded simulator has allowed for more realistic and dynamic drill scenarios.

   The simulator is also routinely used to perform training for Engineering Support Personnel (ESP) during implementation of the Plant Operations Course (ES 859). Through familiarisation and actual usage of the Control Room simulator by ESP trainees, a more thorough insight into the integrated operation of the plant is achieved. This benefits not only the ability of trainees to better understand the operation of the plant, it gives them a richer understanding of the duties and responsibilities of plant operating personnel.

   The simulator is also used, on occasion, for validation of plant design changes. For example, changes to the Reactor Feedwater System were implemented and evaluated in the simulator, where various negative effects that would only surface during transient
conditions were identified and made known to plant personnel.

The simulator has also been utilised for training personnel on special or infrequently performed evolutions that are to be conducted within the power plant. Because the Fermi 2 simulator can be made available 24 hours a day, unanticipated requests for such evolutions can be supported.

The Fermi 2 Control Room simulator is made available to all persons at the Fermi site with a desire to perform related activities. All requests for use of the simulator are reviewed and scheduled based on a priority system.

b) **What is the involvement of Control Room Operators for those applications?**

Generally, Control Room operators are in the simulator during assigned activities such as continuing training and RERP drills and exercise. The other uses of the simulator identified above are supported by Nuclear Training instructors.

14. **What are the applications of simulator training for jobs other than Operations?**

See answer to question 13. a) above.

**SECTION 3:** Systematic Approach to Training: considerations regarding the use of simulators.

A) Training analysis.

1. Are job and task analysis (or any other type of task identification technique) used for establishing a list of task, performance standards, learning objectives and training methods?
   If yes, describe the technique used.

2. a) **What are the criteria that determine the limits or scope of the job analysis for the Control Room Operators?**

b) From your point of view, what should the role of risk-based criteria be for determining such limits or scope? Explain your answers.

3. Are there any special requirements for Job and Task Analysis which are imposed by the possibility of associated simulator training?

B) Training programme design.

1. **What are the criteria for specifying simulator training rather than another training setting (classroom, laboratory, workshop, on-the-job, etc.)?**
2. **What are the criteria for selecting different types of simulator (full-scope, replica, part-task, basic principles, concept, special-purpose)?**

As related to training of operators licensed by the Nuclear Regulatory Commission (NRC), Title 10, Code of Federal Regulations, Part 55, “Operators' Licenses” (b) Implementation-(1) Administration states the following:

*The operating test will be administered in a plant walkthrough or in either -
(i) A simulation facility which the Commission has approved for use after application has been made by the facility licensee, or
(ii) A simulation facility consisting solely of a plant-reference simulator which has been certified to the Commission by the facility licensee.*

A plant-referenced simulator is the preferred method for implementation of this requirement.

3. a) **What are the criteria for selecting a replica simulator?**

   ANSI 3.5 provides the minimum of criteria that must be met for Control Room simulation facilities. Section 1.1 of ANSI 3.5 states:

   “It is intended that in meeting the criteria of this standard, the simulator possess a sufficient degree of completeness and accuracy to meet the needs of the industry and the requirements of NRC as described in Title 10, Code of Federal Regulations, Part 55, “Operators' Licenses” and ANSI/ANS - 3.1 - 1981.”

b) **What are the fidelity requirements?**

   ANSI 3.5 also provides the criteria for simulator fidelity. Various sections of the document provide specifics on fidelity requirements, including section 3, General Requirements, and Section 4, Performance Criteria.

4. **What are the specific pre-requisites for operators undertaking simulator training?**

5. **Does the possibility of simulator training impose any constraints on the definition of learning objectives?**

C) **Training programme development.**

1. **In the case of non-replica simulators, is it necessary to take parallel training actions, and if so, what kind?**
   Explain your answer.

2. **Do you use specific procedures for the training simulator, actual plant procedures or a combination of both?**
   Explain your answer and give reasons for the choice.
3. What are the criteria for selecting normal, abnormal and emergency scenarios to be trained with simulators? Are they risk-based criteria? Explain your answer.

4. How are lesson plans and support documentation developed for simulator training?

D) Training programme implementation.

1. What selection, initial training, and continuing training is arranged for simulator instructors?

2. What are the arrangements for instructor monitoring of, and feedback to, trainees during simulator sessions?

3. a) What specific training modes such as simulator freeze, playback, running at higher speed than real time, activity recording, video recording, etc. is made use of during initial training?

   b) What specific training modes such as simulator freeze, playback, running at higher speed than real time, activity recording, video recording, etc. is made use of during continuous training?

4. What limits of simulation impede planned training sessions or examination scenarios?

E) Trainee assessment.

1. a) What methods and procedures are used for initial trainee assessment during and after simulator sessions?

   b) What methods and procedures are used for continuous trainee assessment during and after simulator sessions?
2. List and describe the main areas or groups of skills and knowledge of the trainee assessed in training simulators (for example: “control board awareness, event diagnosis, immediate actions / entry-level actions, subsequent actions, control board manipulations, use of procedures / technical specifications / reference data, communications, supervisory ability, team skills” (IAEA-TECDOC-525)). Identify, when applicable, the types of simulator used for addressing each one.

3. Describe the ranking of importance, if any, given to the main areas or groups of skills and knowledge taken into account for a trainee assessment.

4. a) Based on your experience, describe difficulties you have had for assessing the individual skills and knowledge of a trainee while operating within a whole Control Room Shift Team during simulator sessions.

b) Describe the measures adopted to overcome these difficulties.

5. a) Based on your experience, describe influences on trainees performance during simulator sessions resulting from the attendance of personnel such as utility managers, regulatory body inspectors, etc.

b) Based on your experience, describe influences on trainees performance during simulator sessions resulting from the attendance of personnel such as utility managers, regulatory body inspectors, etc.

6. a) Are training simulator examinations used in order to grant initial license to operators? Explain.

b) Are training simulator examinations used for requalification? Explain.

7. How is examination integrity preserved during the examination/scenario preparation period?
8. What performance monitoring or data acquisition features of the simulator are used during simulator examinations?

F) Training programme evaluation.

1. Describe the approach used for evaluating the simulator training programme and main results.

2. What programme is in place for validation and continuous verification of the simulator performance?

3. What types of performance discrepancies are most frequently identified by operators during training sessions?

4. What types of performance discrepancies are most frequently identified by examiners or inspectors?

SECTION 4: Use of operating experience for operator training with simulators.

1. How is operational experience feedback incorporated into the design of simulator training programs (experience reviewed, schedule, people involved)?

2. Has your organisation developed any kind of programme by which simulator operator training is correlated with real operating events? Explain.

SECTION 5: Specific topics on Operator training with simulators.

A) Team training techniques.

1. a) Are job and task analyses used for defining the role and responsibilities of the Members of the Control Room Shift Teams and, in general, of the various levels of staff who are charged with operation of the plant? Explain your answer.
b) Are job and task analyses used for establishing performance standards, learning objectives and training methods for Team skills training? Explain your answer.

2. List and describe Team skills (communication, management of resources, team cooperation, team leadership, feedback, conflict resolution, team decision-making, etc.) which are trained using simulators. Identify, when applicable, the types of simulator used for training each one.

3. Are any guides used for conducting and evaluating Team skills training simulations? Explain your answer.

4. Based on your experience, describe advantages and disadvantages of Team training with the participation of the same (usual) Members every time or with changes in the Shift Team compositions.

5. Are simulator sessions used for the optimisation of control Room Team Shifts taking into account the characteristics (aptitudes, attitudes, ...) of each Operator? In other words, are simulator sessions used for deciding which Members are going to constitute each Shift Team? Explain your answer.

6. Are there any licensing examinations applied to the whole Control Room Shift Team in addition to the individual licensing examinations? Explain.

B) Training for stress.

1. Is any part of the simulator training programme specifically devoted to train Control Room Operators to operate under stress? Explain your answer.

2. Are stress levels induced and measured during simulator training sessions? If yes, describe the methods and results.
3. Based on your experience describe any measures adopted during simulator training to counter stress.

C) The theoretical basis underlying training.

1. Are any models of human behaviour being used in designing and implementing training programmes?
   If yes:
   i) refer to or describe the models,
   ii) indicate the areas in which these models are being applied (for example: signal detections, decision-making, etc.)
   iii) give the main results.

D) Habits acquired during training sessions with simulators.

1. Describe, based on your experience, undesirable habits which could be acquired by trainees during training sessions with simulators (for example: due to limited number of simulated scenarios, due to lack of physical or functional fidelity, due to the use of conservative codes for simulation instead of best estimate codes, etc.) and discuss their potential consequences on safety.

2. Describe, based on your experience, any measures adopted to avoid acquisition of those undesirable habits or to prevent use of them.

E) Simulator training on normal and emergency conditions during shutdown and low power operation.

1. What use is made of simulators for Control Room Operator training in normal, abnormal and emergency conditions during shutdown and low power operation (simulated scenarios, trained skills, training techniques, ...)?

2. What are the criteria (risk-based criteria, deterministic criteria, results of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?

3. Are job and task analysis (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on shutdown and low power operation? Explain.
4. What are your plans for the future in this area?

F) Simulator training on severe accidents.

1. What use is made of simulators for Control Room Operator training in severe accidents (simulated scenarios, trained skills, training techniques, ...)?

2. What are the criteria (risk-based criteria, deterministic criteria, result of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?

3. Are job and task analysis (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on severe accidents. Explain.

4. What are your plans for the future in this area?

G) Simulator training on accidents caused by fires, floods, earthquakes, etc.

1. What use is made of simulators for Control Room Operator training in accidents caused by fires, floods, earthquakes, etc. (simulated scenarios, trained skills, training techniques,...)?

2. What are the criteria (risk-based criteria, deterministic criteria, result of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?

3. Are job and task analyses (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on accidents caused by fires, floods, earthquakes, etc.? Explain.

4. What are your plans for the future in this area?
QUESTIONNAIRE

SECTION 0: Organisation/s replying to the questionnaire

1. Name of Organisation/s.

Union Electric Company
Callaway Plant Simulator

2. Contact Person/s.

Scott M. Halverson

3. Address and contact information (telephone, fax).

Union Electric Company
Callaway Plant Simulator
P.O. Box 620
Jct. Hwy. CC & Hwy. O
Fulton, Missouri 65251

Tel: 573-676-8257
Fax: 573-676-4481
E-mail: usuecsmh@ibmmail.com

SECTION 1: General Information (related to the whole country)

1. Number of nuclear reactors (Units) in operation.

N/A

2. Number of Sites with at least one Unit in operation.

N/A

3. Number of full-scope (replica and no replica) simulators used for operator training.

N/A

4. Number of replica simulators used for operator training.

N/A

5. Number of part-task simulators used for operator training.

N/A
6. Number of basic principles simulators used for operator training.
   
   N/A

7. Number of concept simulators used for operator training.
   
   N/A

8. Number of special-purpose simulators used for operator training.
   
   N/A

9. For how many Units is the training done on replica training simulators?
   
   N/A

10. For how many Units is the training done on full-scope (replica and no replica) training simulators.
   
   N/A.

   Union Electric Company has one nuclear power plant and one reference plant nuclear simulator located on-site.

   IMPORTANT QUESTION

   Are your answers to the subsequent sections (2 to 5) of the questionnaire related to a specific Organisation or Training Centre in your Country?

   Yes _X_  No _  (Mark your answer with an X)

   If yes, indicate the name of the Organisation or Training Centre and describe briefly the simulation facility referred to in answer to the question below (f.i. located on-site or off-site, type of simulator/s, sample photograph, reference NPP/s, NPP/s which receive training in this facility, size and composition of the simulator instructional and support staff, etc.) and, also, describe this/these NPP/s (f.i. type (PWR, BWR, etc.), vendor, start of operation, degree of automation, Operators which constitute the Control Room Shift Team, sample photograph of the control room/s, etc.).

   Westinghouse, PWR simulator, 4 loop ~1150 MW, SNUPPS plant.
   Simulator delivered in November 1981.
   3802 modifications made to the simulator since delivery.
   Refer to Union Electric Company home page on the internet.
SECTION 2: Current practices with simulators closely related to operator training.

1. Based on your experience, describe advantages and disadvantages of the location of the Simulation Centre with regard to the plant: on-site versus off-site. Specifically, describe those factors which have some influence on the Operators’ attitude towards the simulator training and in the quality of the simulator training.

The Callaway Plant Simulator is located in the on-site training centre, which is located outside of the security fence at the plant site.

Outside of the security fence allows easy access for plant tours.

Outside of the security fence allows for easy access by operators during training weeks.

Local simulator availability has allowed the review and modification of simulated panels prior to control room modifications and control room procedure revisions.

Local simulator availability, under the control of the licensee, has allowed focus on software modification and hardware modifications that the operations department has felt are needed. This includes changes well beyond verification requirements.

2. a) During simulator training sessions, what factors (time, communications, etc.) influencing the interactions between Control Room Operators and other Plant Personnel (Operations Department outside of Control Room Personnel, Maintenance or Instrumentation, and Control Departments, Technical Support Centre, etc.) are simulated?

- Plant radio system is simulated.
- Plant computer system is “stimulated”.
- Plant gai-tronics are simulated. They can also be connected directly into the plant systems to support site-wide drills.
- The telephone system is installed to match all control room phones.
- A maintenance line Gai-Tronics system allows headsets to be worn to simulate tripping of bistables with I&C Technicians.

b) Do these other Plant Personnel participate in the training sessions? Describe the present training format pertaining to involvement of non Control Room Personnel in simulator training sessions and explain why this format is used.

- Normally only plant operations personnel participate in simulator scenarios.
- Occasionally equipment operators also interface with the control room personnel.
- A couple of times a year we hold/conduct site-wide drills from the simulator facility that all plant personnel participate in. Non-control personnel are used as communicators in the simulator. Other non-control room personnel are located in the emergency facilities at both the on-site and off-site locations and communicate with the simulator via the plant computer monitoring process or the telephone system. This includes dedicated telephone lines and the normal telephone system. The radio system is used to contact the field teams, fire brigade and damage control teams.
3. What environmental conditions (normal and emergency lighting, humidity, noise, vibrations, sounds generated by equipments, etc.) that could be experienced by the reference plants, are usually simulated in the Simulator Rooms? Describe the use of such effects at your simulator centre and explain why they are, or are not, incorporated into simulator training sessions.

The lighting in the simulator is not exactly the same as the control room, but is similar to the control room lighting in that banks of lights cycle on and off when certain plant buses lose power. No noises are simulated other than noises that come from control room equipment. The carpeting, room configuration and furnishing match the actual control room...this includes the control room colour scheme.

The floor plan was modified to match the control room to provide proper orientation when approaching the main control boards and prevent utilisation of space that was not available in the actual control room.

External noises were not readily heard in the actual control room so they were not included in the simulator.

4. Do Control Room Operators receive simulator training for operations outside the Control Room, for example: operations from Remote Shutdown Panels? Describe this type of training as it exists at your Simulator Centre and explain why it is, or is not, used in training sessions.

We have three sets of panels that are simulated in addition to the normal control board panels:
1. Nuclear Instrumentation (behind the main control boards)
2. Ventilation control panel (behind the main control boards)
3. The auxiliary shutdown panels (located in the auxiliary building)

The nuclear instrumentation panel is used to trip bistables and switches installed on it are used to disconnect individual control rods (this panel came with the original installation of the simulator).

The ventilation control panel is used to start and stop fans that we have no other access to on the main control board (operations suggested the installation of this panel).

The auxiliary shutdown panel is used to conduct drills that require evacuation of the main control room such as a fire or bomb threat (operations suggested the installation of this panel).

5. a) How frequently are the changes taking place in plant (plant design changes, procedures changes, etc.) incorporated to the replica or full-scope simulator? Describe any process or mechanism in place at your Simulator Centre to incorporate changes to the replica or full-scope simulator.

All plant changes are completed (installed) on the simulator within 24 months after completion in the plant as required by regulation. Some changes installed on the simulator actually lead the plant installation as part of the design process.

Modification process:
1. Changes made to the plant (planned) are identified as RFR (request for resolution). This is an on-line computer system. These proposed changes are reviewed by the simulator staff to see if the simulator is impacted by the change.
2. Plant modifications are CMPs or EMPs and are also reviewed by the simulator group, a second review for simulator impact.
3. A SIFT (simulator information formal tracking) package is generated once an item is found to have impact on the simulator.
4. The item is worked under the SIFT process and closed.
5. A simulator certification review group reviews all modifications made to be sure that the intent of the modification was met. This group meets monthly unless no items need review.

b) **Do simulator model modifications require separate approval while the simulator is being used for training?**

Simulator model changes are normally made only to the TEST system. We have a TEST system and a TRNG system. The TRNG system is used for daily training activities. The TEST system is used for development or testing of software modifications. Changes can be made directly to the TRNG system if approved by the simulator supervisor and training has requested the change. Changes made directly to the TRNG system are tested prior to conducting training on the new modified system. No changes to the TRNG system are made while the system is being used for training. Changes are made to the TEST system while the system is being used for training.

6. a) **Identify the members of the Control Room Shift Team (Reactor Operators, Turbine Operators, Shift Supervisors, etc.) and indicate the time (in hours) dedicated to simulator training by each member in their initial training programme.**

Specify, when applicable, the time spent with each type of simulator.

The control room team has a normally scheduled T Week or Training Week where they have simulator training as part of the normal weekly training process. Typically the crew consists of a balance of plant operator (reactor operator), reactor operator (reactor operator), operating supervisor (senior reactor operator), shift supervisor (senior reactor operator) and a shift technical supervisor (engineer). Equipment operators may also join the crew from time to time. The crews have a six week cycle except during plant outages. Typically no training is conducted during plant outages other than hot license training and plant startup training. If possible, hot license training is also postponed until after the plant outage. All plant personnel are used to support the plant outage, if possible.

b) **Indicate the time (in hours) dedicated to simulator training by each member of the Control Room Shift Team in their continuous training programme.**

Specify, when applicable, the time spent with each type of simulator.

We use a PWR simulator. A typical simulator session lasts 4 hours out of the day. The other four hours is spent in the classroom or in the plant. Our experience is that simulator time over the 4 hour time period is not utilised to the best extent. The crew is broken into two five-man teams (normally a day shift team and an actual operating crew team). One team is on the simulator and the other team is in the classroom or in the plant.

We only have one type of simulator.

c) **What is the minimum time, if any, required by the Regulatory Body?**

The approved licensed training programme determines the simulator time required. There is not a set minimum number of hours that is specified, but by design of the systematic approach to training there is a practical minimum number of simulator hours in the licensed operator training requalification programme. A normal day consists of four hours in the simulator during the requalification work.
7. a) **Indicate the percentage of simulator training time by the different Members of the Control Room Shift Team devoted to i) normal, ii) abnormal and iii) emergency conditions in their initial training programme.**

   The simulator training is not broken down into normal, abnormal and emergency simulator time. All simulator time is considered integrated options. Malfunctions are used to demonstrate normal, abnormal and emergency operations as per the lesson plan objectives.

b) **Indicate the percentage of simulator training time by the different Members of the Control Room Shift Team devoted to i) normal ii) abnormal and iii) emergency conditions in their continuous training programme.**

   All members of the control room team receive equal hours on the simulator. They train as a team in the hot license process. There are several weeks that the emphasis is on abnormal and emergency procedures, but again simulator training is considered integrated training including monitoring for proper safety concerns and communications. The emphasis is on the team approach to problem solving.

c) **What are the minimum percentages, if any, required by the Regulatory Body?**

   There are no minimum percentages as long as the required off-normal and emergency procedures are covered in the training process. The simulator objectives that are part of the approved hot license programme lead to a practical minimum of simulator hours to cover each of the different types of plant procedures.

8. **What is the role and the policy of the Regulatory Body regarding the use of simulators for Control Room Operators licensing and training?**

   The regulatory body basically mandates that a plant specific certified simulator be used as part of the licensed operator training programme or it is up to the utility to prove that a “substitute” meets all of the legal intent of the certified simulator facility to be sure that we are meeting all of the regulatory requirements.

9. a) **What standards (ANSI/ANS 3.5, IAEA, etc.) are simulators built to and maintained?**

   ANSI 3.5-1985 is the standard that was used to certify the Callaway Plant Simulator. NRC Form 474 also related this standard to Reg. Guide 1.149 and 10CFR55.45.

b) **What exceptions are typically taken to the standard?**

   No exceptions are typically taken to this standard.

c) **What types of simulators are used that are not included in industry standards?**

   No other simulators are used at the Callaway Plant. We do have classroom training aids such as a refuelling process and core model. We do not take credit for these programmes as “simulators”.

10. a) **Describe the role of part-task simulators in your current training programs.**

Part task simulators have no role in the present training programmes. We do use models of plant equipment and mockups of systems to train on. We do not call these part-task simulators (lab equipment is the term we use to discuss any item other than the full-scope reference plant simulator).

b) **Describe the role of special-purpose (analytic) simulators in your current training programs.**

We use no special purpose simulators in the training programme.

11. **Have the current operator training programs been conditioned by the availability and capabilities of the simulator(s) or, alternatively, has(ve) the simulator(s) been specified and acquired after analysing and designing the training programs? Explain.**

The simulator was contracted and purchased to match the at-the-controls area of the main control room where the control room operators are required to be located as part of the license requirements issued by the NRC. Models have been steadily improved over the years as operators have provided feedback on improvement opportunities in excess of the Standard requirements. Changes to control room procedures have been reviewed and analysed that have also led to simulator model changes. The operator training programmes based on use of plant procedures and industry events have also led to simulator modifications. In short, the simulator is continuously improving based on feedback from the operators. Much of the feedback far exceeds the requirements of the ANSI Standard.

12. **What extensions of simulator training are envisaged for the future?**

Future extensions of simulator training include more uses of personal computers and plant computer system is diagnosing plant problems and isolating the cause of the plant problems. Simulators of the future will most probably be converted to the Pentium (Intel line of products) platform and away from the proprietary platforms and will interlink or connect to the plant computer system as a seamless integrated package. This will probably result in simulation brought directly into the classroom on a personal computer system.

13. a) **Based on your experience, describe the uses of the simulators for activities other than training (plant drills, procedures validation, design changes validation, testing programs, acquisition of human data, licensing activities, reference plant systems “tuning”, etc.).**

We have used the simulator to develop new procedures, changes to existing procedures, plant equipment response, startup training, shutdown training, revisiting of plant events, modification design, RERP drills, university support (University of Missouri - Columbia) and plant simulator tours. Training is also available for engineers that do not plant to license at the plant. New switch designs, new recorder installations, plant CRT installations, control room printers, control room furniture, etc. have all been implemented in the simulator prior to installation in the plant to pass a feasibility test.
b) What is the involvement of Control Room Operators for those applications?

Operators have been surveyed on how they like the installation on the simulator prior to making the change to the plant. In some cases the operators have selected between choices A, B or C based on the simulator temporary installations.

14. What are the applications of simulator training for jobs other than Operations?

Very little use of the simulator has been made to support other than the operator training programmes. Some examples include:
1. Communicator training
2. Radio system training
3. RERP drills
4. Engineer training
5. Nuclear Power Plant Fundamentals training for the University of Missouri - Columbia
6. Plant systems training (control room components)

SECTION 3: Systematic Approach to Training: considerations regarding the use of simulators.

A) Training analysis.

1. Are job and task analysis (or any other type of task identification technique) used for establishing a list of task, performance standards, learning objectives and training methods?

If yes, describe the technique used.

Job and task analysis. Job performance measures are actually performed on the simulator using plant procedures as part of the licensed operator training programme.

2. a) What are the criteria that determine the limits or scope of the job analysis for the Control Room Operators?

The criteria are part of the JTA process. Frequency, Criticality and Difficulty are reviewed and then 1 or more of the 10 training settings are selected to provide the needed training.

b) From your point of view, what should the role of risk-based criteria be for determining such limits or scope? Explain your answers.

The training based solely on risk would be a poor criteria to use for retraining. If the task is simple, easy to complete and happens only rarely...but is a high risk item this could be included in the normal training process without developing a special “bullet” to cover only this item. Training should be approached from an “integrated approach” and “trouble identification and isolation” approach. A “cook book” step by step process that leads to low thought process by the operator should be avoided. Crews should talk about abnormal conditions, have procedures that help to guide them through the plant recovery process, and have procedures that provide feedback that the plant conditions are improving by what the operators are doing to recover the plant. The present emergency procedures are designed to provide this type of informational feedback to the operators.
3. Are there any special requirements for Job and Task Analysis which are imposed by the possibility of associated simulator training?

Simulator training allows the operators an opportunity to “break” simulated plant equipment and take the “simulated” unit off-line. If the real plant were used this training would not be economical. The simulator serves a useful role in providing this service to the operating staff.

B) Training programme design.

1. What are the criteria for specifying simulator training rather than another training setting (classroom, laboratory, workshop, on-the-job, etc.)?

This goes back to the JTA. Is the item performed from the control room? Is the activity performed by a licensed operator? Frequency, Criticality, Difficulty are used to determine if the simulator is to be used to support the evolution. Typically a combination of classroom and simulator are used. The procedure or process is reviewed in the classroom, then applied in the simulator.

2. What are the criteria for selecting different types of simulator (full-scope, replica, part-task, basic principles, concept, special-purpose)?

We have one choice right now, full scope simulation.

3. a) What are the criteria for selecting a replica simulator?

A replica simulator is the easiest way to show that we meet the intent of the regulations that developed following the Three Mile Island accident.

b) What are the fidelity requirements?

Fidelity requirements include:
1. The static simulator conditions meet expected or anticipated actual plant conditions.
2. Normal operations can be performed on the simulator following plant procedures.
3. Trend and direction are the same for changing simulator parameters.
4. The ten transients can be run on the simulator.
5. Alarms received or not received match plant data.
6. Pass all of the safety related surveillance procedures.

And one big internal requirement:
Keep the licensed operators satisfied regardless of what the regulations allow; the operators are normally much more difficult to please.

4. What are the specific pre-requisites for operators undertaking simulator training?

The operators need a strong foundation in theory and systems prior to the start of the simulator training so that they can concentrate on the whole BIG PICTURE of what is happening during simulator operations vs. the specific details. Too much time would be lost on the simulator if you had to teach systems and theory in a “simulator” classroom. There is simply not enough simulator time to allow this to happen.
5. **Does the possibility of simulator training impose any constraints on the definition of learning objectives?**

If anything the simulator allows a broader more full-scope learning objective through the use of the simulator. Impact on many systems can be visually and verbally reinforced on the simulator.

C) Training programme development.

1. **In the case of non-replica simulators, is it necessary to take parallel training actions, and if so, what kind?**
   
   *Explain your answer.*

   N/A.

2. **Do you use specific procedures for the training simulator, actual plant procedures or a combination of both?**

   *Explain your answer and give reasons for the choice.*

   We use plant specific procedures with the exception of procedures dealing with BOL, MOL and EOL plant conditions. We must use simulator developed curves since the controlled copy plant procedures are only available for one time in core life (wherever the plant is at that moment). You can't be at BOL, MOL and EOL conditions all at the same time in the plant.

3. **What are the criteria for selecting normal, abnormal and emergency scenarios to be trained with simulators? Are they risk-based criteria?**

   *Explain your answer.*

   The criteria used is that the procedures must change something that is visible by operators in the control room. The integrated operations then dictate which procedures can be combined for any particular simulator scenario.

4. **How are lesson plans and support documentation developed for simulator training?**

   The requalification programme is developed as a joint effort between operations and training based on feedback from operators, the semi-annual training conference and regulatory requirements. The simulator scenario is then developed prior to the actual training date and approved by the licensed training group.

D) Training programme implementation.

1. **What selection, initial training, and continuing training is arranged for simulator instructors?**

   Simulator Instructors are normally selected from the senior licensed operator staff and are provided with specific training on how to run the simulator equipment and how to develop simulator scenarios. The instructors are selected by the Supervisor, Licensed Training.

   Feedback from the licensed operators will immediately identify any “poor” instructor selections and usually leads to immediate reassignment of the instructor if deemed necessary by the operators. The customers are the “licensed operators”.
2. **What are the arrangements for instructor monitoring of, and feedback to, trainees during simulator sessions?**

Instructors are evaluated as part of the weekly simulator sessions. Students are provided feedback forms at the end of any training session (feedback or classroom). Feedback is provided to the originator if simulator modifications are made.

3. **a) What specific training modes such as simulator freeze, playback, running at higher speed than real time, activity recording, video recording, etc. is made use of during initial training?**

Normal simulator speed, video taping, fast time may be used during heatup or cooldown cycles once a stable condition is achieved, freeze, writing snapshots.

**b) What specific training modes such as simulator freeze, playback, running at higher speed than real time, activity recording, video recording, etc. is made use of during continuous training?**

Same as nº 3. a).

4. **What limits of simulation impede planned training sessions or examination scenarios?**

None. The simulator scenarios are reviewed in advance and any simulator problems are “avoided” until they are corrected. Normally the students will never be aware that a problem exists in an attempt to make the simulator like the control room vs. the simulator. If a problem is encountered the instructor identifies simulator vs. plant problems (this happens only rarely).

**E) Trainee assessment.**

1. **a) What methods and procedures are used for initial trainee assessment during and after simulator sessions?**

   Self critique by the crew members. Guided crew critique by the simulator instructor. VCR playback in the classroom; includes video and sound.

**b) What methods and procedures are used for continuous trainee assessment during and after simulator sessions?**

Discuss procedures to be used, but not specific scenario prior to the simulator class. Can include JPMs Job Performance Measures during routine evaluations. Trainee evaluation forms. Instructor evaluation forms. Discussions in the classroom.
2. List and describe the main areas or groups of skills and knowledge of the trainee assessed in training simulators (for example: “control board awareness, event diagnosis, immediate actions / entry-level actions, subsequent actions, control board manipulations, use of procedures / technical specifications / reference data, communications, supervisory ability, team skills” (IAEA-TECDOC-525)). Identify, when applicable, the types of simulator used for addressing each one.

   All skills not tested on the full scope simulator.
   Items not covered on the full scope simulator or conducted in the plant as actual evaluations or as part of the on-the-job training process, or as plant walkthrough.
   Skills range from component level, to train level, to system level, to cross system level, to fully plant integrated operations.
   Procedures cover general operations, normal operations, off-normal operations, alarm response, surveillance procedures, special procedures, emergency procedures and emergency implementing procedures.
   Controlled copies of procedures are used in the simulator.

3. Describe the ranking of importance, if any, given to the main areas or groups of skills and knowledge taken into account for a trainee assessment.

   Ranking of skills is unique for each task and is covered in detail the Job and Task Analysis (i.e. no easy answer).

4. a) Based on your experience, describe difficulties you have had for assessing the individual skills and knowledge of a trainee while operating within a whole Control Room Shift Team during simulator sessions.

   The greatest difficulty in assessing an individual knowledge or skill comes when another crew member covers more than his panel or station, overlapping the other crew members' area. Individual questioning following the scenario is sometimes required to assess knowledge levels.

   b) Describe the measures adopted to overcome these difficulties.

      The on-the-floor evaluator can sometimes guide the operator not being evaluated at the task to a different part of the control board.
      The in-the-booth instructor can place multiple malfunctions in the system so that both operators are occupied at the same time.
      Follow-up questions can be used after the scenario is completed to clarify “fuzzy” areas.

5. a) Based on your experience, describe influences on trainees performance during simulator sessions resulting from the attendance of personnel such as utility managers, regulatory body inspectors, etc.

   The full range of impact has been observed.
   No change, little change, canned performance to reflect perceived expectations, total nervousness...this question is too broad!
   The internal manager present in the room often has the most noticeable impact, if a change is seen.
   The other time is the final NRC examination, which is always stressful; a career may depend on passing the exam.
b) Based on your experience, describe influences on trainee performance during simulator sessions resulting from the attendance of personnel such as utility managers, regulatory body inspectors, etc.

Some instructors tend to provide coaching and guidance vs. allowing the student to learn and experience on their own. This is normally acceptable at the early stages of training and avoided in the later stages of training. During evaluation sessions it is not allowed.

6. a) Are training simulator examinations used in order to grant initial license to operators? Explain.

Yes. If you don’t pass the simulator examination you do not obtain an NRC license. You must also pass a written exam and walkthrough exam.

b) Are training simulator examinations used for requalification? Explain.

Yes. Requalification exams are now developed by the plant staff and proved to the NRC. The NRC always has the option to modify the exam or provide feedback and have the plant staff modify the exam.

7. How is examination integrity preserved during the examination/scenario preparation period?

Protected religiously! You shall not release exam information. The person writing the exam has no contact with the people that will take the exam. The scenarios are locked up when not in use during development. Crews are not allowed in the same building when exams are in progress. New (different) exams are given each day. In short, everything possible is done to prevent release of exam information. A list is signed prior to the exam and following the exam by anyone who has seen the exam material.

8. What performance monitoring or data acquisition features of the simulator are used during simulator examinations?

As few as possible. In order to protect exam security as little information as possible is recorded that would allow anyone to rebuild the scenario at a latter time.

F) Training programme evaluation.

1. Describe the approach used for evaluating the simulator training programme and main results.

Review and approval of the objectives by the department head that is to have personnel trained to be sure that it meets the department objectives and direction. Plant data is reviewed and lesson plans are updated to match the latest plant information. Exams are reviewed prior to administration. Student feedback forms.
2. **What programme is in place for validation and continuous verification of the simulator performance?**

   Instructor evaluation forms.
   Semi-annual training conferences are held to address any training concerns or new upcoming needs.

3. **What types of performance discrepancies are most frequently identified by operators during training sessions?**

   Operator observed responses that are not captured in procedures, setpoint documents, etc. I consider these “tuning items” i.e. too fast, too slow, responsiveness, occasional logic questions/concerns.

4. **What types of performance discrepancies are most frequently identified by examiners or inspectors?**

   Obvious items, meters sticking, missing procedure page, questions on response that may be correct at this plant but different at another plant.
   Operator opinion items similar to question n° 1, Section 3 F).

**SECTION 4: Use of operating experience for operator training with simulators.**

1. **How is operational experience feedback incorporated into the design of simulator training programs (experience reviewed, schedule, people involved)?**

   Most operational experience items have no impact on the simulator models, they are simply added to the future simulator requalification scenarios. The models usually support them. If the model does not support the event the model is changed to allow the training on the simulator if it applies to our plant.

2. **Has your organisation developed any kind of programme by which simulator operator training is correlated with real operating events? Explain.**

   Yes. Plant events are reviewed for training impact or the possibility to train on items:
   Loss of annunciator power supplies.
   Loss of plant instrument bus.
   Installation of new switches on the control board (train on the new switch on the simulator prior to the switch installation in the plant).
   Control rod failure to insert.
   Plant events and industry events are reviewed and included as appropriate.
SECTION 5: Specific topics on Operator training with simulators.

A) Team training techniques.

1. a) Are job and task analyses used for defining the role and responsibilities of the Members of the Control Room Shift Teams and, in general, of the various levels of staff who are charged with operation of the plant? Explain your answer.

   Yes, JTAs are used for all INPO accredited programmes. Procedure revisions are trained on in the simulator as part of the development process.

b) Are job and task analyses used for establishing performance standards, learning objectives and training methods for Team skills training? Explain your answer.

   Yes. Job and Task Analysis links the job, duty and task to an objective in the simulator scenario lesson plan. Special team skills training is given to all crews.

2. List and describe Team skills (communication, management of resources, team cooperation, team leadership, feedback, conflict resolution, team decision-making, etc.) which are trained using simulators. Identify, when applicable, the types of simulator used for training each one.

   All training on the full scope simulator. Crews discussions and feedback during the event.

3. Are any guides used for conducting and evaluating Team skills training simulations? Explain your answer.

   Yes. Simulator scenarios used to guide all simulator training that is conducted.

4. Based on your experience, describe advantages and disadvantages of Team training with the participation of the same (usual) Members every time or with changes in the Shift Team compositions.

   Team of crews that work together on a daily basis often do well on the simulator even during times of poor communications. If a day shift has team problems and communications problems it will simply not pass the scenario.

5. Are simulator sessions used for the optimisation of control Room Team Shifts taking into account the characteristics (aptitudes, attitudes, ...) of each Operator? In other words, are simulator sessions used for deciding which Members are going to constitute each Shift Team? Explain your answer.

   No. The on-shift crews are trained as a crew whenever possible. The crew makeup is determined by Union seniority for the Balance of Plant Operator and the Reactor Operator.
6. Are there any licensing examinations applied to the whole Control Room Shift Team in addition to the individual licensing examinations? Explain.

Yes. The whole crew can fail anytime a simulator scenario is run or an individual person can fail on a particular scenario.

B) Training for stress.

1. Is any part of the simulator training programme specifically devoted to train Control Room Operators to operate under stress? Explain your answer.

Yes. The last portion of the course dealing with multiple malfunctions requires the operator to prioritise the sequence in which he will handle the events that are provided. Also use of events with no procedures are experienced late in the simulator training sessions, forcing decisions not guided by procedures.

2. Are stress levels induced and measured during simulator training sessions? If yes, describe the methods and results.

No. No method of measurement is used. They are simply recorded as events that were performed and passed.

3. Based on your experience describe any measures adopted during simulator training to counter stress.

Less interruptions from radio and gai-tronics traffic.

C) The theoretical basis underlying training.

1. Are any models of human behaviour being used in designing and implementing training programmes? If yes:

   i) refer to or describe the models,
   ii) indicate the areas in which these models are being applied (for example: signal detections, decision-making, etc.)
   iii) give the main results.

No, not directly. The only area in which the models are being applied would be general implementation of the decision making process. Results include that all candidates are required to make decisions throughout the simulator scenarios. Some bad decisions are made, some good decisions are made. Past simulator reviews and critiques help to clarify where improvements could be made.
D) Habits acquired during training sessions with simulators.

1. Describe, based on your experience, undesirable habits which could be acquired by trainees during training sessions with simulators (for example: due to limited number of simulated scenarios, due to lack of physical or functional fidelity, due to the use of conservative codes for simulation instead of best estimate codes, etc.) and discuss their potential consequences on safety.

   Poor attitude of an individual student. Treating the simulator as a “simulator” vs. the “plant”. Example: just turn the switch it doesn’t really matter here. Example: Oh that is probably a simulator problem, just ignore it.

2. Describe, based on your experience, any measures adopted to avoid acquisition of those undesirable habits or to prevent use of them.

   Instructors and operations staff reinforce that the operators should respond as if this were real plant equipment and react to the observed response unless directed by the simulator instructor that the session is terminated or frozen.

E) Simulator training on normal and emergency conditions during shutdown and low power operation.

1. What use is made of simulators for Control Room Operator training in normal, abnormal and emergency conditions during shutdown and low power operation (simulated scenarios, trained skills, training techniques, ...)?

   During initial license training we use the full scope simulator to conduct training beginning in cold shutdown and continuing through full power operations and then shutdown again. Emergency conditions are covered in a section on accidents.

   License requalifications simulator training sessions vary with industry events and plant events. A special shutdown training session is conducted just prior to the plant shutdown for a refuelling outage. A special startup session is conducted just prior to startup from a refuelling outage.

   Controlled copies of procedures are used throughout the training sessions.

2. What are the criteria (risk-based criteria, deterministic criteria, results of need analyses, simulation availability, etc....) supporting the above mentioned use of simulators?

   The simulator scenarios simply use the controlled copy emergency procedures. No additional analysis is conducted to determine risk, frequency, probabilities, etc. It is assumed that these studies are done in the development of the emergency procedures.

3. Are job and task analysis (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on shutdown and low power operation?

   Yes. A job and task analysis is used for all INPO accredited programmes. The basis for the JTA comes from the approved controlled copy plant procedures for low power and cold operations, as well as full power operations. A single JTA applies to (includes) all areas. Objectives are then derived from the JTA.
4. **What are your plans for the future in this area?**

Future simulator scenarios will continue to be developed based on known industry events, plant events, changes to the emergency procedures, emergency implementing procedures, general operating procedures, normal procedures, off-normal procedures, etc. Other scenarios will be used to challenge and develop better team skills training and communications techniques.

**F) Simulator training on severe accidents.**

1. **What use is made of simulators for Control Room Operator training in severe accidents (simulated scenarios, trained skills, training techniques, ...)?**

Any severe accident that can be observed or controlled from the control room is a possible candidate for addition to a simulator scenario. The operating crews also experience major accidents over long periods of time during the annual RERP drills which include the simulator. Prioritisation is also emphasised during major malfunction training.

2. **What are the criteria (risk-based criteria, deterministic criteria, result of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?**

Again only the fullscope simulator is used during accident training. Pass/fail criteria are based on proper response to the emergency procedures and classification of the accident using the emergency implementing procedures.

3. **Are job and task analysis (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on severe accidents. Explain.**

Yes, same as before. The severe accidents are treated no differently than any other task in the JTA.

4. **What are your plans for the future in this area?**

No significant changes, over what we do now, are planned for the future.

**G) Simulator training on accidents caused by fires, floods, earthquakes, etc.**

1. **What use is made of simulators for Control Room Operator training in accidents caused by fires, floods, earthquakes, etc. (simulated scenarios, trained skills, training techniques, ...)?**

Limited training on fires, floods, earthquakes, etc.
- Control room fire.
- Fires in safety related equipment.
- Loss of plant buses due to fires.
- Earthquake alarms.
- Loss of off-site transmission line due to fire.
- Floods during RERP to redirect traffic.
- Not typical training items in a requalification programme.
2. What are the criteria (risk-based criteria, deterministic criteria, result of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?

Same as before.

3. Are job and task analyses (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on accidents caused by fires, floods, earthquakes, etc.? Explain.

Same as before.

4. What are your plans for the future in this area?

Same as before.

Why even own and use a simulator?

The “bottom line” or purpose of the full-scope simulator is to allow initial training and examination of operators to be licensed in the plant and to retrain licensed operators at the plant. The simulator allows the training of operators with no negative impact on the daily operation of the “real” plant. Training can challenge simulated equipment to beyond the “normal operations” point to a non-recoverable condition, i.e. “broken”. Training on accidents, using the simulator, can go beyond what would be possible or desirable using the actual plant equipment. If the simulator crew response is not as desired in the simulator scenario then it can easily run a second or third time. This provides the crews with the opportunity to practice again, when needed.

We have only a limited number of hours in the simulator and must constantly balance this simulator time between normal operations, plant evolutions, equipment malfunctions and major accidents. The goal is to experience the potential problem in the simulator the first time to prevent the same problem in the plant. If the problem can not be prevented in the plant then at least the response can be simulated first to make the recovery in the plant go a little smoother.
QUESTIONNAIRE

SECTION 0: Organisation/s replying to the questionnaire

1. Name of Organisation/s.
   Entergy Operations

2. Contact Person/s.
   Mr. Michael Wright, Chairman
   ANSI/ANS 3.5 Writing Group

3. Address and contact information (telephone, fax).
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SECTION 1: General Information (related to the whole country)

1. Number of nuclear reactors (Units) in operation.

2. Number of Sites with at least one Unit in operation.

3. Number of full-scope (replica and no replica) simulators used for operator training.

4. Number of replica simulators used for operator training.

5. Number of part-task simulators used for operator training.

6. Number of basic principles simulators used for operator training.

7. Number of concept simulators used for operator training.
8. Number of special-purpose simulators used for operator training.

9. For how many Units is the training done on replica training simulators?

10. For how many Units is the training done on full-scope (replica and no replica) training simulators.

IMPORTANT QUESTION

Are your answers to the subsequent sections (2 to 5) of the questionnaire related to a specific Organisation or Training Centre in your Country?

Yes ___ No ___ (Mark your answer with an X)

If yes, indicate the name of the Organisation or Training Centre and describe briefly the simulation facility referred to in answer to the question below (i.e., located on-site or off-site, type of simulator/s, sample photograph, reference NPP/s, NPP/s which receive training in this facility, size and composition of the simulator instructional and support staff, etc.) and, also, describe this/these NPP/s (i.e., type (PWR, BWR, etc.), vendor, start of operation, degree of automation, Operators which constitute the Control Room Shift Team, sample photograph of the control room/s, etc.).

The answers to this questionnaire apply to all five Entergy Operations units and are reflective of general practices in use in the US nuclear industry.

Entergy Operations has five units in operation: ANO 1&2, Grand Gulf, River Bend, and Waterford-3. The units are located at four sites. Each unit has its own full-scope replica simulator located at the plant site. The primary use of all simulators is for operator training. Only one part task simulator is used in operator training at the four sites. Basic principles, concept, and special purpose simulators are not used. Training for licensed operators is performed on full-scope replica simulators and one part task simulator.

SECTION 2: Current practices with simulators closely related to operator training.

1. Based on your experience, describe advantages and disadvantages of the location of the Simulation Centre with regard to the plant: on-site versus off-site. Specifically, describe those factors which have some influence on the Operators' attitude towards the simulator training and in the quality of the simulator training.

In my opinion simulators are best located at the particular reference plant to allow ease of use and timely training in response to specific plant events, system modifications, and industry issues. The ability to use the simulator without excessive travel, and the responsiveness in using the simulator to train or refresh operators for upcoming events, such as unit restart or specialised testing, are the issues that positively affect operators' attitudes towards simulators.
2. a) During simulator training sessions, what factors (time, communications, etc.) influencing the interactions between Control Room Operators and other Plant Personnel (Operations Department outside of Control Room Personnel, Maintenance or Instrumentation, and Control Departments, Technical Support Centre, etc.) are simulated?

Key interactions with other groups supporting emergency response are simulated and used following a realistic time scale. All major communications links including plant PA, plant telephone, communications with site emergency response facilities and state and federal agencies, etc. are simulated. Time response for plant support functions is built into simulator scenarios to provide realism in completion of support activities such as chemistry sampling, jumpering of relays as directed by EOP, etc.

b) Do these other Plant Personnel participate in the training sessions? Describe the present training format pertaining to involvement of non Control Room Personnel in simulator training sessions and explain why this format is used.

Plant personnel who provide emergency response capabilities periodically participate in simulator exercises both during EP drills and normal training. This method is used to familiarise both operators and the support personnel with realistic support training for emergency conditions.

3. What environmental conditions (normal and emergency lighting, humidity, noise, vibrations, sounds generated by equipments, etc.) that could be experienced by the reference plants, are usually simulated in the Simulator Rooms? Describe the use of such effects at your simulator centre and explain why they are, or are not, incorporated into simulator training sessions.

Simulator lighting both normal and emergency and ambient noise levels have been demonstrated to meet actual conditions in the reference plant. Equipment noise and vibration levels are usually not simulated and are not necessary to provide comprehensive training. The Waterford-3 plant does simulate plant noise levels and the sounds associated with certain equipment running or trips of major plant equipment, such as a turbine trip and the running noise of a diesel when the PA for the diesel station is in use.

4. Do Control Room Operators receive simulator training for operations outside the Control Room, for example: operations from Remote Shutdown Panels? Describe this type of training as it exists at your Simulator Centre and explain why it is, or is not, used in training sessions.

Yes, some of the plants which have remote shutdown panels at one location have them included in the simulator and they are used to periodically retrain operators. Since the remote shutdown functions are duplicates of some of the control room instrumentation, simulator training is not mandatory for the remote shutdown panel functions. For plants where there are several local control stations, rather than one or two more comprehensive panels, the training is usually done through plant walkthroughs.
5. a) **How frequently are the changes taking place in plant (plant design changes, procedures changes, etc.) incorporated to the replica or full-scope simulator?**

Describe any process or mechanism in place at your Simulator Centre to incorporate changes to the replica or full-scope simulator.

Plant procedure changes almost never result in simulator changes, due to the ability of the simulators to accurately replicate plant response. The actual procedures located in the simulator are controlled copies and are updated just like the control room copies. Plant design changes are reviewed for simulator configuration changes during the final design phase. If simulator changes will result they are scheduled to occur as soon as possible based on the scope of the change. In many cases design changes have been incorporated into the simulator in parallel with modifications to the plant to allow operator training prior to unit restart from refuelling.

b) **Do simulator model modifications require separate approval while the simulator is being used for training?**

Simulator model changes require extensive fidelity testing and approval before they are implemented to avoid any negative training impact.

6. a) **Identify the members of the Control Room Shift Team (Reactor Operators, Turbine Operators, Shift Supervisors, etc.) and indicate the time (in hours) dedicated to simulator training by each member in their initial training programme.**

Specify, when applicable, the time spent with each type of simulator.

Approximately 320 hours are spent in full scope replica simulator training for initial license classes which includes students for RO and SRO licenses.

b) **Indicate the time (in hours) dedicated to simulator training by each member of the Control Room Shift Team in their continuous training programme.**

Specify, when applicable, the time spent with each type of simulator.

Approximately 96 hours per year are spent using the full scope replica simulator for requalification training of each control room crew.

c) **What is the minimum time, if any, required by the Regulatory Body?**

The NRC imposes no minimum number of hours of simulator training.

7. a) **Indicate the percentage of simulator training time by the different Members of the Control Room Shift Team devoted to i) normal, ii) abnormal and iii) emergency conditions in their initial training programme.**

In initial training the % of simulator time is about evenly divided between these three categories. 33.3% to each. It is important to recognise though that scenarios usually start with a normal evolution, or abnormal condition prior to entering an emergency condition for those scenarios which will test an emergency response learning objective.
b) Indicate the percentage of simulator training time by the different Members of the Control Room Shift Team devoted to i) normal ii) abnormal and iii) emergency conditions in their continuous training programme.

In requalification training the normal operations take about 20% of the time, with abnormal and emergency scenarios accounting for 20% and 60% respectively. The not in 7a above also applies to requalification scenarios.

c) What are the minimum percentages, if any, required by the Regulatory Body?

No minimum percentages are required by the NRC.

8. What is the role and the policy of the Regulatory Body regarding the use of simulators for Control Room Operators licensing and training?

Simulators used in operator training and examination are required to be certified in accordance with ANS 3.5.

9. a) What standards (ANSI/ANS 3.5, IAEA, etc.) are simulators built to and maintained?

ANS 3.5.

b) What exceptions are typically taken to the standard?

Typical exceptions might include duplication of all divisional cabinets and duplication of all control room backpanel, where it can be shown that simulation is not required to effectively teach the desired objective.

c) What types of simulators are used that are not included in industry standards?

Part task and limited scope simulators are used by some US utilities. The latest versions of the industry standards do not address requirements for these types of simulators.

10. a) Describe the role of part-task simulators in your current training programs.

Only one part task simulator is in use in Entergy Operations. This is a Rod Position and Information System simulator which is not interfaced with the full scope simulator, but is based on the control room panels from Grand Gulf Unit 2 which was never completed.

b) Describe the role of special-purpose (analytic) simulators in your current training programs.

11. Have the current operator training programs been conditioned by the availability and capabilities of the simulator(s) or, alternatively, has the simulator(s) been specified and acquired after analysing and designing the training programs? Explain.

The current operator training programme has been conditioned by the availability and capabilities of simulators, but those capabilities are driven by assessments of needs from the
Systematic Approach to Training which leads to the addition of simulator functions needed to support the training programme.

12. What extensions of simulator training are envisaged for the future?

Simulator training will probably evolve through the addition of more crew based team training, which will include shift support activities such as chemistry, maintenance and technical support functions.

13. a) Based on your experience, describe the uses of the simulators for activities other than training (plant drills, procedures validation, design changes validation, testing programs, acquisition of human data, licensing activities, reference plant systems “tuning”, etc.).

Simulators are generally used for each of the activities listed as long as it doesn't interfere with availability for license training.

b) What is the involvement of Control Room Operators for those applications?

Control room operators usually are not involved in the activities listed in 13) a. above, with the exception of emergency drills and procedure validation. Training personnel usually run the simulator for the other activities which prevents a negative training impact on the licensed operators.

14. What are the applications of simulator training for jobs other than Operations?

Simulators are used to conduct basic familiarisation classes for engineering personnel and to familiarise maintenance personnel on communications with the control room and a basic understanding of both control room responsibilities and plant operations.

SECTION 3: Systematic Approach to Training: considerations regarding the use of simulators.

A) Training analysis.

1. Are job and task analysis (or any other type of task identification technique) used for establishing a list of task, performance standards, learning objectives and training methods?
   If yes, describe the technique used.

   The standard job and task analysis is applied as suggested in INPO guidelines to develop task lists, objectives, measures and training methods.

2. a) What are the criteria that determine the limits or scope of the job analysis for the Control Room Operators?

   The limits and scope are determined through a review of job responsibilities and tasks required by procedures.
b) From your point of view, what should the role of risk-based criteria be for determining such limits or scope? Explain your answers.

I’m not sure how risk based criteria would be applied other than in selecting lists of evolutions that the simulator should model as referenced in ANS 3.5.

3. Are there any special requirements for Job and Task Analysis which are imposed by the possibility of associated simulator training?

No special requirements are imposed because the simulator is just one of several means to accomplish the training. In a number of cases the simulator is the most effective means available, but other methods would be adequate.

B) Training programme design.

1. What are the criteria for specifying simulator training rather than another training setting (classroom, laboratory, workshop, on-the-job, etc.)?

The learning objective (skill or knowledge) dictates the use of performance training such as the simulator, lab or JPM or knowledge transfer such as the classroom.

2. What are the criteria for selecting different types of simulator (full-scope, replica, part-task, basic principles, concept, special-purpose)?

This is a question of economics and what is the most training and cost effective method to accomplish hands on training. Modifying the full scope simulator to add concept training may be cheaper than buying a concept trainer.

3. a) What are the criteria for selecting a replica simulator?

Selection criteria would include a value assessment of the degree of simulation required as defined in ANS 3.5.

b) What are the fidelity requirements?

ANS 3.5 defines fidelity requirements.

4. What are the specific pre-requisites for operators undertaking simulator training?

The prerequisites are that the simulator models and scenarios have been verified to accurately represent the reference plant response.

5. Does the possibility of simulator training impose any constraints on the definition of learning objectives?

No, not that I am aware. The simulator capabilities may dictate that a more cost effective training method be developed to accomplish the learning objective.
C) Training programme development.

1. In the case of non-replica simulators, is it necessary to take parallel training actions, and if so, what kind? Explain your answer.

   Entergy Operations does not use non-replica simulators for operator training. If they were used however, additional training might be required because of physical fidelity differences, etc.

2. Do you use specific procedures for the training simulator, actual plant procedures or a combination of both? Explain your answer and give reasons for the choice.

   Actual plant procedures are always used because we only employ full scope plant replica simulators.

3. What are the criteria for selecting normal, abnormal and emergency scenarios to be trained with simulators? Are they risk-based criteria? Explain your answer.

   Some of the criteria used are:
   - included two year training plant
   - included in 10 CFR 55 required evolutions
   - recent industry event item
   - recent plant specific event
   - operations identified crew enhancement training

   Some scenarios are developed and used in training in response to the identification of plant specific high risk events and primary risk contributors, such as station blackout, ATWS.

4. How are lesson plans and support documentation developed for simulator training?

   Lesson plans are supporting documentation which consist mainly of simulator exercise guides and scenarios are based on the learning objectives and knowledge, skills, and abilities identified from task lists or task analysis. The scenarios and exercise guides identify specific actions that operators should take or be exposed to through the training experience to meet the knowledge or skill performance measures. Once the skill, knowledge, or ability sets needed are identified, a knowledgeable training person writes one or more scenarios or exercises to fall within reasonable time limits and sets to normal, abnormal, and emergency events.

D) Training programme implementation.

1. What selection, initial training, and continuing training is arranged for simulator instructors?

   Simulator instructors complete basic instructor training and then complete a simulator instructors’ training programme developed by INPO. An advanced simulator instructors’ training course is completed at some time following initial instruction in the simulator.
2. What are the arrangements for instructor monitoring of, and feedback to, trainees during simulator sessions?

Response applicable to 2, 3) a., and 3) b.

Simulator instructors monitor trainee performance and frequently use all of the methods listed to reinforce proper operator response, point out errors and explain the causes for significant pant responses. All methods are available for both initial and requalification training. For requalification training, however, the students take a more participative approach in evaluating performance, and there is more emphasis on crew performance in requalification than in initial training.

3. a) What specific training modes such as simulator freeze, playback, running at higher speed than real time, activity recording, video recording, etc. is made use of during initial training?

b) What specific training modes such as simulator freeze, playback, running at higher speed than real time, activity recording, video recording, etc. is made use of during continuous training?

4. What limits of simulation impede planned training sessions or examination scenarios?

Following upgrade of the simulator's modelling, the limits of simulation are pretty consistent with the limits of the analytical data for the response f the reference unit. Limits of simulation are very seldom reached for events that are credible as defined in license basis documents such as the UFSAR.

E) Trainee assessment.

1. a) What methods and procedures are used for initial trainee assessment during and after simulator sessions?

Simulator exercise guides list the desired responses to specific simulated events. The plant procedures detail the appropriate ways to respond and actions that should be taken. These procedures establish performance measures which are used to judge student actions and event response.

b) What methods and procedures are used for continuous trainee assessment during and after simulator sessions?

The methods and procedures are the same for requalification training except that there is greater use of scenarios than exercise guides, although they contain the same types of information about expected trainee actions as the guides do.
2. List and describe the main areas or groups of skills and knowledge of the trainee assessed in training simulators (for example: “control board awareness, event diagnosis, immediate actions / entry-level actions, subsequent actions, control board manipulations, use of procedures / technical specifications / reference data, communications, supervisory ability, team skills” (IAEA-TECDOC-525)).

Identify, when applicable, the types of simulator used for addressing each one.

All of the listed areas and groups of skills and knowledge are assessed. The full scope replica simulator is used for all evaluations except for the performance of RC&IC JPMs on the limited scope simulator at Grand Gulf.

3. Describe the ranking of importance, if any, given to the main areas or groups of skills and knowledge taken into account for a trainee assessment.

The ranking of skills and knowledge is as given in the NUREGs for PWR and BWR operator training.

4. a) Based on your experience, describe difficulties you have had for assessing the individual skills and knowledge of a trainee while operating within a whole Control Room Shift Team during simulator sessions.

Response applicable to both 4) a. and 4) b.

No large difficulty has been experienced, although the assessment imposed requires closer observation to determine individual knowledge and skill weaknesses if several operators become involved in solving one problem or responding to one event. Instructors need to be especially cognisant of each trainees' involvement in the overall scenario. The simulator instructor and advanced simulator instructor training emphasise accurate observation skills and non-intrusive monitoring of individual and group actions.

b) Describe the measures adopted to overcome these difficulties.

5. a) Based on your experience, describe influences on trainees performance during simulator sessions resulting from the attendance of personnel such as utility managers, regulatory body inspectors, etc.

The introduction of any extra personnel over and above the instructors they are used to being evaluated by introduces some strain and stress which the trainees are open to point out. Extra observation personnel must be aware enough not to get directly involved in the exercise or its evaluation.

b) Based on your experience, describe influences on trainees performance during simulator sessions resulting from the attendance of personnel such as utility managers, regulatory body inspectors, etc.

Instructors need to stay out of the trainees' way, and not become involved in active participation with the students until the event is terminated and trainee evaluation begins.
6. a) Are training simulator examinations used in order to grant initial license to operators? Explain.

Simulators are used in granting initial licenses, and in evaluating requalification performance as required to meet the operating test requirements of 10 CFR 55.

b) Are training simulator examinations used for requalification? Explain.

7. How is examination integrity preserved during the examination/scenario preparation period?

The exam is only available to authorised training personnel. The exam set usually contains several scenarios which can be used to meet each objective. The specific scenario to be used is often not picked until just before the exam. Crews are kept segregated during initial exams until all exams are complete. NRC practices are followed internally to enforce exam security.

8. What performance monitoring or data acquisition features of the simulator are used during simulator examinations?

Video/audio recording and instructor monitoring of the instructors panel are the two main acquisition means used other than direct observation of students by simulator instructors.

F) Training programme evaluation.

1. Describe the approach used for evaluating the simulator training programme and main results.

Simulator training is evaluated about once a year through training assessments consisting of training professionals from across the Entergy Operations plants with assistance from members of other utilities. In addition simulator performance is evaluated by NRC for requalification and initial examinations. INPO evaluates simulator performance as part of the Evaluation and Assistance visits every 12 to 18 months, and when Operations training programme accreditation is re-evaluated every 4 years.

2. What programme is in place for validation and continuous verification of the simulator performance?

Simulator performance is evaluated through a yearly test programme meeting the requirements of ANS 3.5.

3. What types of performance discrepancies are most frequently identified by operators during training sessions?

Most of the discrepancies identified by operators, since the core and containment model upgrades, have been due to failures of the physical equipment comprising the simulator.
4. **What types of performance discrepancies are most frequently identified by examiners or inspectors?**

Examiners and inspectors most often identify areas where it appears that the simulator does not match the expected plant response. Since the core and containment model upgrades these identifications appear to have been of lower significance than previously when the limits of simulation were sometimes reached.

**SECTION 4: Use of operating experience for operator training with simulators.**

1. **How is operational experience feedback incorporated into the design of simulator training programs (experience reviewed, schedule, people involved)?**

Operational feedback from industry and plant events is reviewed on a continuous cycle as the information is received. When training is needed as part of the review of plant specific actions, the Systematic Approach to Training is used to identify the proper training setting which could be the simulator.

2. **Has your organisation developed any kind of programme by which simulator operator training is correlated with real operating events? Explain.**

Part of the input for the content of the requalification programme is based on the perceived need for enhancement training identified by Operations management. The review of plant operating events sometimes identifies needed training which is conducted on the simulator.

**SECTION 5: Specific topics on Operator training with simulators.**

**A) Team training techniques.**

1. a) **Are job and task analyses used for defining the role and responsibilities of the Members of the Control Room Shift Teams and, in general, of the various levels of staff who are charged with operation of the plant? Explain your answer.**

Response applicable to both 1. a) and 1. b).

Yes, job and task analysis is used to determine training requirements. The analysis used follows the INPO TSD process. Performance standards, learning objectives, and training methods are all identified as part of the TSD process.

b) **Are job and task analyses used for establishing performance standards, learning objectives and training methods for Team skills training? Explain your answer.**
2. List and describe Team skills (communication, management of resources, team cooperation, team leadership, feedback, conflict resolution, team decision-making, etc.) which are trained using simulators. Identify, when applicable, the types of simulator used for training each one.

Full scope simulators are used to conduct Control Room Teamwork Development training which covers all of the skills that were noted. The Control Room Teamwork Development training programme was developed by INPO and handed over to the industry after an initial pilot programme taught by INPO.

3. Are any guides used for conducting and evaluating Team skills training simulations? Explain your answer.

Yes, exercise guides are used which include specific learning objectives.

4. Based on your experience, describe advantages and disadvantages of Team training with the participation of the same (usual) Members every time or with changes in the Shift Team compositions.

The advantages are that the team members have detailed knowledge of the capabilities of the other team members and have an understanding of what they can expect. The disadvantage is that the crew develops its own paradigms over time and it is easier to develop tunnel vision than when crew members are periodically changed.

5. Are simulator sessions used for the optimisation of control Room Team Shifts taking into account the characteristics (aptitudes, attitudes, ...) of each Operator? In other words, are simulator sessions used for deciding which Members are going to constitute each Shift Team? Explain your answer.

Certainly, the input on individual performance gained by Operations management observation of simulator training is very critical in assessing the strengths of individual members. The management observations allow an appropriate matching of skills and strengths when crew changes are made.

6. Are there any licensing examinations applied to the whole Control Room Shift Team in addition to the individual licensing examinations? Explain.

Generally, the initial license exam is a test of individual performance, whereas the requalification exams assess both individual and team/crew performance.

B) Training for stress.

1. Is any part of the simulator training programme specifically devoted to train Control Room Operators to operate under stress? Explain you answer.

No specific part is devoted to stress training.
2. Are stress levels induced and measured during simulator training sessions?  
   If yes, describe the methods and results.

   Stress levels are definitely induced, but not formally measured.

3. Based on your experience describe any measures adopted during simulator training to counter stress.

   The Instructor crew briefing at the beginning of the scenario tends to reduce stress by pointing out that the purpose of simulator evaluations is not to fail people, but to enhance their ability to cope with plant events. The Instructor establishes a non-adversarial relationship right from the very beginning. Also scenarios are structured with a minor operational evolution or abnormal condition to let the operators get familiar with the board and plant status before initiating a major emergency event. This warming up for the critical event helps build confidence, and adds realism.

C) The theoretical basis underlying training.

1. Are any models of human behaviour being used in designing and implementing training programmes?
   If yes:
   i) refer to or describe the models,
   ii) indicate the areas in which these models are being applied (for example: signal detections, decision-making, etc.)
   iii) give the main results.

   Models of human behaviour are generally not used in designing the training programme.

D) Habits acquired during training sessions with simulators.

1. Describe, based on your experience, undesirable habits which could be acquired by trainees during training sessions with simulators (for example: due to limited number of simulated scenarios, due to lack of physical or functional fidelity, due to the use of conservative codes for simulation instead of best estimate codes, etc.) and discuss their potential consequences on safety.

   Response applicable to both 1. and 2.

   The biggest habit is probably caused by a small number of scenarios which can condition the operator to always expect a certain type of transient. The recent trend has been to prevent guessing about the scenario by varying the initial conditions and minor normal or abnormal events that are used at the beginning of a scenario. Utility actions to increase the number of scenarios and varying the initial conditions have pretty much eliminated this as an issue. Another problem which used to be apparent, before simulator models were upgraded involved the use of a very small number of core and containment model nodes which would cause drastic changes in the response to significant events such as the ATWS for a BWR. This response had the effect of amplifying the simulator response to operator input and in some cases made the simulator much more responsive than best estimate models would predict. The effect on operator training was that any given operator response could produce widely varying plant effects due to timing differences. The advent of multi point models had lead to much more realistic simulator response and has allowed a better review of the operator response and comparison of the expected effects.
2. Describe, based on your experience, any measures adopted to avoid acquisition of those undesirable habits or to prevent use of them.

E) Simulator training on normal and emergency conditions during shutdown and low power operation.

1. What use is made of simulators for Control Room Operator training in normal, abnormal and emergency conditions during shutdown and low power operation (simulated scenarios, trained skills, training techniques, ...)?

Response applicable to 1., 2., and 3.

Operators are trained in the simulator on shutdown and low power operation based on the plant specific risk assessment. For instance, most PWR simulators have the mid loop capability included in their simulators and train on these events. The mid loop operation condition has been added based on a review of significant industry events and task analysis has been used to determine objectives, performance standards and training methods. In the BWR area a similar approach has focused training on high xenon startups as one area of increased risk.

2. What are the criteria (risk-based criteria, deterministic criteria, results of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?

3. Are job and task analysis (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on shutdown and low power operation? Explain.

4. What are your plans for the future in this area?

Most plants will continue to add shutdown and low power event capability to their simulators as review of industry event data and plant specific risk analysis show risks of a significant nature, for which the most reasonable training setting is the simulator.

F) Simulator training on severe accidents.

1. What use is made of simulators for Control Room Operator training in severe accidents (simulated scenarios, trained skills, training techniques, ...)?

Response applicable to 1., 2., and 3.

Operators are not trained on severe accidents by the strict definition of the term. A severe accident is considered to be one beyond analysis such as loss of a coolable core geometry. Since there is no analytically derived plant response for these beyond design events, simulators cannot be realistically expected to model them. Operators do receive extensive training on Emergency Operating Procedures which in many cases are symptom based. The symptom basis allows the
operators to respond to a wide range of conditions that could be due to severe accidents in addition to many other causes. Much of the response to severe accidents is in the area of technical support to operations. Simulator training is probably not the appropriate method for training for this technical support role. Job and task analysis are not yet appropriate until the industry defines the general responsibilities of each group which would be called upon to deal with the results of a severe accident.

2. What are the criteria (risk-based criteria, deterministic criteria, result of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?

3. Are job and task analysis (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on severe accidents. Explain.

4. What are your plans for the future in this area?

Future plans are dependent on industry initiatives to develop a position on severe accident training and general responsibilities.

G) Simulator training on accidents caused by fires, floods, earthquakes, etc.

1. What use is made of simulators for Control Room Operator training in accidents caused by fires, floods, earthquakes, etc. (simulated scenarios, trained skills, training techniques, ...)?

Response applicable to 1., 2., 3. and 4.

Simulators are used to train operators on the response to each of these natural events. These events form the cause for the simulated loss of plant functions. The natural events were originally analysed as were all emergency response procedures. The natural events are the initiators for equipment casualties etc., which are modelled on the simulator. The use of specific procedures for response to the natural events, and activation of the emergency plan based on the event are the only issues that set apart an equipment failure caused by one of these natural events from other causes, thus many of the learning objectives and performance measures are the same for natural and non natural causes. No special changes are planned for the future in this area.

2. What are the criteria (risk-based criteria, deterministic criteria, result of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?
3. Are job and task analyses (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on accidents caused by fires, floods, earthquakes, etc.? Explain.

4. What are your plans for the future in this area?
QUESTIONNAIRE

SECTION 0: Organisation/s replying to the questionnaire

1. Name of Organisation/s.
   U.S. Nuclear Regulatory Commission

2. Contact Person/s.
   Mr. Frank Collins, Operator Licensing Branch

3. Address and contact information (telephone, fax).
   OWFN MS 10 D 22
   Washington, DC, USA 20555
   Tel: (301) 414-3173

SECTION 1: General Information (related to the whole country)

1. Number of nuclear reactors (Units) in operation.
   111

2. Number of Sites with at least one Unit in operation.
   73

3. Number of full-scope (replica and no replica) simulators used for operator training.
   73

4. Number of replica simulators used for operator training.
   73

5. Number of part-task simulators used for operator training.
   Indeterminate with data available - facility programme specific.

6. Number of basic principles simulators used for operator training.
   Indeterminate with data available - facility programme specific.

7. Number of concept simulators used for operator training.
   Indeterminate with data available - facility programme specific.
8. Number of special-purpose simulators used for operator training.

Indeterminate with data available - facility programme specific.

9. For how many Units is the training done on replica training simulators?

111

10. For how many Units is the training done on full-scope (replica and no replica) training simulators.

111

IMPORTANT QUESTION

Are your answers to the subsequent sections (2 to 5) of the questionnaire related to a specific Organisation or Training Centre in your Country?

Yes ___ No ___ (Mark your answer with an X)

If yes, indicate the name of the Organisation or Training Centre and describe briefly the simulation facility referred to in answer to the question below (f.i. located on-site or off-site, type of simulator/s, sample photograph, reference NPP/s, NPP/s which receive training in this facility, size and composition of the simulator instructional and support staff, etc.) and, also, describe this/these NPP/s (f.i. type (PWR, BWR, etc.), vendor, start of operation, degree of automation, Operators which constitute the Control Room Shift Team, sample photograph of the control room/s, etc.).

SECTION 2: Current practices with simulators closely related to operator training.

1. Based on your experience, describe advantages and disadvantages of the location of the Simulation Centre with regard to the plant: on-site versus off-site. Specifically, describe those factors which have some influence on the Operators’ attitude towards the simulator training and in the quality of the simulator training.

Facility programme specific.

2. a) During simulator training sessions, what factors (time, communications, etc.) influencing the interactions between Control Room Operators and other Plant Personnel (Operations Department outside of Control Room Personnel, Maintenance or Instrumentation, and Control Departments, Technical Support Centre, etc.) are simulated?

Facility programme specific.
b) Do these other Plant Personnel participate in the training sessions? Describe the present training format pertaining to involvement of non Control Room Personnel in simulator training sessions and explain why this format is used.

Facility programme specific.

3. What environmental conditions (normal and emergency lighting, humidity, noise, vibrations, sounds generated by equipments, etc.) that could be experienced by the reference plants, are usually simulated in the Simulator Rooms? Describe the use of such effects at your simulator centre and explain why they are, or are not, incorporated into simulator training sessions.

- Almost all simulators integrate normal and emergency control room lighting with the model.
- Many simulators have incorporated turbine, steam, and safety relief valve sounds.
- Some simulators include sounds for specific equipment that is located near or is particularly audible in the control room.

4. Do Control Room Operators receive simulator training for operations outside the Control Room, for example: operations from Remote Shutdown Panels? Describe this type of training as it exists at your Simulator Centre and explain why it is, or is not, used in training sessions.

- Many simulators include remote shutdown panels that are located in a separate nearby room for operator training.
- Auxiliary operator tasks outside of the control room are modelled as instructor controls.

5. a) How frequently are the changes taking place in plant (plant design changes, procedures changes, etc.) incorporated to the replica or full-scope simulator? Describe any process or mechanism in place at your Simulator Centre to incorporate changes to the replica or full-scope simulator.

- Changes in reference plant design are required by ANSI/ANS 3.5 (Standard) to be incorporated in the simulator within 18 months.
- All simulator users have implemented a configuration management programme as required by Standard. Most programmes include the simulation support staff in distribution for plant modifications. Each modification is then evaluated for simulator applicability and a management decision to incorporate the modification in the simulator or not is made based on a separate cost-benefit training value assessment.

b) Do simulator model modifications require separate approval while the simulator is being used for training?

Regulatory approval is not required for simulator model modifications. Administrative control of the simulation software is accomplished on a facility programme specific basis.

6. a) Identify the members of the Control Room Shift Team (Reactor Operators, Turbine Operators, Shift Supervisors, etc.) and indicate the time (in hours) dedicated to simulator training by each member in their initial training programme. Specify, when applicable, the time spent with each type of simulator.

Facility programme specific.
b) Indicate the time (in hours) dedicated to simulator training by each member of the Control Room Shift Team in their continuous training programme. Specify, when applicable, the time spent with each type of simulator.

Facility programme specific.

c) What is the minimum time, if any, required by the Regulatory Body?

There is no regulatory minimum time requirement for simulator training time. The distribution of training time within the initial training and the biennial requalification training is facility programme specific.

7. a) Indicate the percentage of simulator training time by the different Members of the Control Room Shift Team devoted to i) normal, ii) abnormal and iii) emergency conditions in their initial training programme.

Facility programme specific.

b) Indicate the percentage of simulator training time by the different Members of the Control Room Shift Team devoted to i) normal ii) abnormal and iii) emergency conditions in their continuous training programme.

Facility programme specific.

c) What are the minimum percentages, if any, required by the Regulatory Body?

There is no regulatory minimum percentage requirement for simulator training time by job position. The distribution of training time within the initial training and the biennial requalification training is facility programme specific.

8. What is the role and the policy of the Regulatory Body regarding the use of simulators for Control Room Operators licensing and training?

- Simulators are used for all license examinations, including biennial requalification.
- Simulators are also required to be used in the requalification training programme.

9. a) What standards (ANSI/ANS 3.5, IAEA, etc.) are simulators built to and maintained?

Except by specific approval, all full scope simulators are built and maintained to ANSI/ANS 3.5 as endorsed and clarified by Regulatory Guide 1.149.

b) What exceptions are typically taken to the standard?

Exceptions to the Standard typically include simplifications of testing requirements and deletion of capability requirements that are not compatible with the reference plant reactor type.

c) What types of simulators are used that are not included in industry standards?

Indeterminate with data available - facility programme specific.
10. a) Describe the role of part-task simulators in your current training programs.

   Facility programme specific.

b) Describe the role of special-purpose (analytic) simulators in your current training programs.

   Facility programme specific.

11. Have the current operator training programs been conditioned by the availability and capabilities of the simulator(s) or, alternatively, has(ve) the simulator(s) been specified and acquired after analysing and designing the training programs? Explain.

   The Standard defines a specific set of simulator capabilities that are independent of the unique training programme. In terms of the range of operations to be simulated, the Standard is inclusive. In terms of malfunction capability, the Standard specifies approximately one-third of a typical simulator scope. Unique training programme requirements define the remaining capability.

12. What extensions of simulator training are envisaged for the future?

   In the future, simulators will be increasingly used for emergency preparedness training and engineering/procedural analysis.

13. a) Based on your experience, describe the uses of the simulators for activities other than training (plant drills, procedures validation, design changes validation, testing programs, acquisition of human data, licensing activities, reference plant systems “tuning”, etc.).

   Facility programme specific.

b) What is the involvement of Control Room Operators for those applications?

   Facility programme specific.

14. What are the applications of simulator training for jobs other than Operations?

   Facility programme specific.

SECTION 3: Systematic Approach to Training: considerations regarding the use of simulators.

A) Training analysis.

1. Are job and task analysis (or any other type of task identification technique) used for establishing a list of task, performance standards, learning objectives and training methods? If yes, describe the technique used.

   Facility programme specific.
2. a) What are the criteria that determine the limits or scope of the job analysis for the Control Room Operators?

   Facility programme specific.

b) From your point of view, what should the role of risk-based criteria be for determining such limits or scope? Explain your answers.

   Facility programme specific.

3. Are there any special requirements for Job and Task Analysis which are imposed by the possibility of associated simulator training?

   Facility programme specific.

B) Training programme design.

1. What are the criteria for specifying simulator training rather than another training setting (classroom, laboratory, workshop, on-the-job, etc.)?

   Facility programme specific.

2. What are the criteria for selecting different types of simulator (full-scope, replica, part-task, basic principles, concept, special-purpose)?

   Facility programme specific.

3. a) What are the criteria for selecting a replica simulator?

   The criteria for selecting a replica simulator are the requirements of Section 6 of the Waste Policy Act of 1982 as codified in 10 CFR 55.45, Operating Tests, and 10 CFR 55, Requalification.

b) What are the fidelity requirements?

   Simulator fidelity requirements are contained in the Standard.

4. What are the specific pre-requisites for operators undertaking simulator training?

   Facility programme specific.

5. Does the possibility of simulator training impose any constraints on the definition of learning objectives?

   Facility programme specific.
C) Training programme development.

1. In the case of non-replica simulators, is it necessary to take parallel training actions, and if so, what kind? Explain your answer.
   Facility programme specific.

2. Do you use specific procedures for the training simulator, actual plant procedures or a combination of both? Explain your answer and give reasons for the choice.
   A combination of simulator specific procedures and actual plant procedures are used. The Standard requires the simulator to be capable of using actual plant procedures. However, some simulators are used for multiple units; necessitating modification of certain procedures.

3. What are the criteria for selecting normal, abnormal and emergency scenarios to be trained with simulators? Are they risk-based criteria? Explain your answer.
   Facility programme specific.

4. How are lesson plans and support documentation developed for simulator training?
   Facility programme specific.

D) Training programme implementation.

1. What selection, initial training, and continuing training is arranged for simulator instructors?
   Facility programme specific.

2. What are the arrangements for instructor monitoring of, and feedback to, trainees during simulator sessions?
   Facility programme specific.

3. a) What specific training modes such as simulator freeze, playback, running at higher speed than real time, activity recording, video recording, etc. is made use of during initial training?
   Facility programme specific.

   b) What specific training modes such as simulator freeze, playback, running at higher speed than real time, activity recording, video recording, etc. is made use of during continuous training?
   Facility programme specific.
4. **What limits of simulation impede planned training sessions or examination scenarios?**

Examination scenarios are usually not impeded by limits of simulation. The typical limits include fuel temperature >2000 F, bulk boiling of containment pressure suppression systems, loss of coolable geometry, and physical damage to structures or components.

E) **Trainee assessment.**

1. a) **What methods and procedures are used for initial trainee assessment during and after simulator sessions?**

   Facility programme specific.

   b) **What methods and procedures are used for continuous trainee assessment during and after simulator sessions?**

   Facility programme specific.

2. **List and describe the main areas or groups of skills and knowledge of the trainee assessed in training simulators (for example: “control board awareness, event diagnosis, immediate actions / entry-level actions, subsequent actions, control board manipulations, use of procedures / technical specifications / reference data, communications, supervisory ability, team skills” (IAEA-TECDOC-525)). Identify, when applicable, the types of simulator used for addressing each one.**

   Eight main areas or groups of Senior Reactor Operator skills and knowledge are assessed in the simulator during examinations, namely:
   - the ability to prioritise, interpret, and verify alarms and annuciators.
   - diagnostic capabilities, including co-ordination of crew diagnostic activities.
   - the ability to interpret systems response and to predict the effects on plant operations.
   - the ability to properly select and correctly use plant procedures, both individually and as a member of the operating crew.
   - control board operations, including the ability to locate and manipulate controls, verify proper response, and to take manual control of automatic systems when required.
   - the ability to clearly give and receive information and to keep the crew informed.
   - the ability to supervise and direct the operation of other licensed operators (SRO only).
   - the ability to recognise and to ensure compliance with Technical Specifications safety limits and limiting conditions for operation.

3. **Describe the ranking of importance, if any, given to the main areas or groups of skills and knowledge taken into account for a trainee assessment.**

   Facility programme specific.
4. a) Based on your experience, describe difficulties you have had for assessing the individual skills and knowledge of a trainee while operating within a whole Control Room Shift Team during simulator sessions.

Difficulties encountered in assessing operator performance in the simulator include:
- difficulty in keeping track of the simultaneous individual actions of multiple operators.
- co-ordination of instructor activities with the planned scenario.
- too many people in the simulator control room during examinations (operators/evaluators/observers)

b) Describe the measures adopted to overcome these difficulties.

Enhanced use of instructor station features such as video, audio, and digital parameter recording facilitate assessing operator performance.

5. a) Based on your experience, describe influences on trainees performance during simulator sessions resulting from the attendance of personnel such as utility managers, regulatory body inspectors, etc.

Facility programme specific.

b) Based on your experience, describe influences on trainees performance during simulator sessions resulting from the attendance of personnel such as utility managers, regulatory body inspectors, etc.

Facility programme specific.

6. a) Are training simulator examinations used in order to grant initial license to operators? Explain.

All initial license examinations involve the use of simulators in accordance with 10 CFR 55.59.

b) Are training simulator examinations used for requalification? Explain.

All requalification license examinations involve the use of simulators in accordance with 10 CFR 55.59.

7. How is examination integrity preserved during the examination/scenario preparation period?

In order to preserve examination integrity during the examination/scenario preparation facility:
- instructors and the staff sign a security agreement and are removed from the training schedule until the examination is administered.
- the Examiner Standards provide guidance to examiners as to the monitoring and recording features of the simulator that might affect examination integrity.
8. **What performance monitoring or data acquisition features of the simulator are used during simulator examinations?**

The performance monitoring or data acquisition features the simulator that are used during simulator examinations include:

**INSTRUCTOR STATION FEATURES**

- **TREND RECORDING** - Most simulators have the ability to monitor and graph several parameters that are selected by the instructor. Many simulators allow any global variable to be assigned to the trending feature. Often, the trend data can be spooled to a file for later printing.
- **SNAPSHOTS** - All simulators have snapshot capability. Initial conditions (ICs) are recorded for future recall.
- **BACKTRACK** - Backtrack files are snapshots that are automatically recorded at predetermined intervals, usually up to 1 hour of operation at intervals as frequent as 1 minute. Backtrack files are usually only accessible through the BACKTRACK feature. The files typically cannot be erased, only over-written by real-time operation.
- **REPLAY/PLAYBACK** - The replay/playback feature steps through a series of snapshots and displays the I/O status (lights, meters, etc.) for each sequentially. Often, the replay feature uses the backtrack files, although separate relay file storage may be provided.
- **SCRIPTS/COMPUTER ASSISTED EXERCISES** - Many simulators have a feature that allows pre-programmed implementation of malfunctions and remote functions based on time and/or logical conditions. Scripts may be used by the simulator staff to facilitate scenario administration. Scripts can typically be stored for future use. Stored scripts can also be selected for review and editing from the instructor station.
- **INITIAL CONDITIONS SUMMARY** - Snapshots are usually labeled on the instructor station IC menu with date/time recorded, pertinent plant parameter status, and instructor comments. Even in the comment field has been changed to indicate that a snapshot is available for re-use, the data (scenario initialisation) may still be representative of test conditions until the snapshot is actually over-written or updated.
- **MALFUNCTION SUMMARY** - Malfunction summary menus display the status of selected malfunctions, both active and inactive. The malfunction summary is usually IC dependent and therefore depicts the malfunctions that were active or staged when an IC, such as a scenario validation, was stored.
- **MONITORED PARAMETERS** - Instructors are afforded the capability to define individual or groups of parameters for display or printout. The monitored parameter group assignments can be recalled for review and editing. If used to facilitate scenario validation or examination administration, the monitored parameters can provide insight into the focus of the examination.
- **TREND RECORDING** - Groups of parameters can be defined and assigned to trend recorders. The recorders may be, but is not necessarily, located at the instructor station. The recording may also be in file format for presentation on instructor station screens. Recording sessions are typically activated or de-activated at the instructor station.
- **STUDENT PERFORMANCE MONITORING** - Special groups of parameters and simulated plant operating conditions can often be assigned to a tracking and recording function that plots an individual student’s performance during training exercises. Recording sessions are typically activated or de-activated at the instructor station.
- **VIDEO & AUDIO RECORDING** - Many simulators are equipped with video and audio recording capability in the control room. Video and audio controls are typically located at the instructor station.

**PROGRAMMERS’ TOOLS**
SOFTWARE TERMINALS - Simulator engineers have access to real-time monitoring and control for simulator and model conditions through software support terminals. These terminals may be located in the computer facility or at the engineer’s desk.

INDEPENDENT EXECUTIVES - The conditions for scenarios can sometimes be replicated off-line using independent executive programmes. These programmes should not be in communication with the I/O. Independent executives and their associated initialisation files may provide an indication of planned exercises in they have been used to resolve problems during scenario validation.

GRAPHICAL USER INTERFACES - Instructor station graphical user interfaces often display simulated plant conditions and performance in real-time. At remote locations, such as a programmer’s desk, the GUI could display the full scenario.

EXTERNAL INTERCONNECTIONS

ESF FEEDS - Many simulators have data links to the ESF and the operations management offices for emergency planning drills. These links can display simulated plant condition to observers outside the simulated control room during scenario validation and examinations.

REMOTE PLANT PROCESS COMPUTER & INSTRUCTOR STATION SCREENS - Repeater screens in the training area can display scenario validation and examinations in real time to observers outside the simulated control room.

MODEMS & REMOTE SIMULATOR SUPPORT SYSTEMS - Many simulators are equipped with modems from the instructor station or simulation computers for outside monitoring and control of simulator status and activities by parties off site.

F) Training programme evaluation.

1. Describe the approach used for evaluating the simulator training programme and main results.

Facility programme specific.

2. What programme is in place for validation and continuous verification of the simulator performance?

- ANSI/ANS 3.5 provides specific requirements for both initial validation of simulator performance and annually recurrent verification of simulator operability. Verification testing is used to assure the user that the validated integrity of the software has not been inadvertently degraded by routine maintenance or modifications.
- Except by specific approval, all full scope simulators are tested and maintained to ANSI/ANS 3.5 as endorsed and clarified by Regulatory Guide 1.149. Regulatory clarification imposes an additional verification test requirement that the malfunctions be verified on a quadrennial basis at a rate of approximately 25%/year.

3. What types of performance discrepancies are most frequently identified by operators during training sessions?

Indeterminate with data available - facility programme specific.
4. What types of performance discrepancies are most frequently identified by examiners or inspectors?

Over the five year period of 1989-1994, NRC examiners identified the following types of simulator performance discrepancies:

<table>
<thead>
<tr>
<th>Type of Observation</th>
<th>Number of Comments</th>
<th>Percentage of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>NSSS Dynamic Response Discrepancies In EOPs</td>
<td>98</td>
<td>8.8</td>
</tr>
<tr>
<td>NSSS Dynamic Response in Normal Operations</td>
<td>91</td>
<td>8.1</td>
</tr>
<tr>
<td>NSSS Logic Response Discrepancies</td>
<td>96</td>
<td>8.6</td>
</tr>
<tr>
<td>BOP Dynamic Response Discrepancies</td>
<td>78</td>
<td>6.9</td>
</tr>
<tr>
<td>BOP Logic Response Discrepancies</td>
<td>69</td>
<td>6.2</td>
</tr>
<tr>
<td>Display Systems (Plant Process Computer, etc.) Discrepancies</td>
<td>44</td>
<td>3.9</td>
</tr>
<tr>
<td>Radiation Monitor Program Discrepancies</td>
<td>52</td>
<td>4.6</td>
</tr>
<tr>
<td>Instructor Station Errors</td>
<td>42</td>
<td>3.7</td>
</tr>
<tr>
<td>Hardware/Computer Problems</td>
<td>13</td>
<td>1.2</td>
</tr>
<tr>
<td>Software/Executive Program Problems</td>
<td>58</td>
<td>5.2</td>
</tr>
<tr>
<td>Hardware/Panel Components Problems</td>
<td>54</td>
<td>4.8</td>
</tr>
<tr>
<td>Physical Fidelity Discrepancies</td>
<td>95</td>
<td>8.5</td>
</tr>
<tr>
<td>Unknown Problems</td>
<td>73</td>
<td>6.4</td>
</tr>
<tr>
<td>Documentation Discrepancies</td>
<td>15</td>
<td>1.3</td>
</tr>
<tr>
<td>Lack of Repeatability</td>
<td>27</td>
<td>2.4</td>
</tr>
<tr>
<td>None</td>
<td>93</td>
<td>8.5</td>
</tr>
<tr>
<td>Lack of Capability - ANS 3.5 Required</td>
<td>24</td>
<td>2.1</td>
</tr>
<tr>
<td>Lack of Capability - Examiner Preferred</td>
<td>75</td>
<td>6.7</td>
</tr>
<tr>
<td>Other</td>
<td>23</td>
<td>2.1</td>
</tr>
</tbody>
</table>

SECTION 4: Use of operating experience for operator training with simulators.

1. How is operational experience feedback incorporated into the design of simulator training programs (experience reviewed, schedule, people involved)?

Facility programme specific.

2. Has your organisation developed any kind of programme by which simulator operator training is correlated with real operating events? Explain.

Facility programme specific.
SECTION 5: Specific topics on Operator training with simulators.

A) Team training techniques.

*General response for all of Section 5:* Facility programme specific.

1. a) Are job and task analyses used for defining the role and responsibilities of the Members of the Control Room Shift Teams and, in general, of the various levels of staff who are charged with operation of the plant? Explain your answer.

   b) Are job and task analyses used for establishing performance standards, learning objectives and training methods for Team skills training? Explain your answer.

2. List and describe Team skills (communication, management of resources, team cooperation, team leadership, feedback, conflict resolution, team decision-making, etc.) which are trained using simulators. Identify, when applicable, the types of simulator used for training each one.

3. Are any guides used for conducting and evaluating Team skills training simulations? Explain your answer.

4. Based on your experience, describe advantages and disadvantages of Team training with the participation of the same (usual) Members every time or with changes in the Shift Team compositions.

5. Are simulator sessions used for the optimisation of control Room Team Shifts taking into account the characteristics (aptitudes, attitudes, ...) of each Operator? In other words, are simulator sessions used for deciding which Members are going to constitute each Shift Team? Explain your answer.

6. Are there any licensing examinations applied to the whole Control Room Shift Team in addition to the individual licensing examinations? Explain.
B) Training for stress.

1. Is any part of the simulator training programme specifically devoted to train Control Room Operators to operate under stress? Explain you answer.

2. Are stress levels induced and measured during simulator training sessions? If yes, describe the methods and results.

3. Based on your experience describe any measures adopted during simulator training to counter stress.

C) The theoretical basis underlying training.

1. Are any models of human behaviour being used in designing and implementing training programmes? If yes:
   i) refer to or describe the models,
   ii) indicate the areas in which these models are being applied (for example: signal detections, decision-making, etc.)
   iii) give the main results.

D) Habits acquired during training sessions with simulators.

1. Describe, based on your experience, undesirable habits which could be acquired by trainees during training sessions with simulators (for example: due to limited number of simulated scenarios, due to lack of physical or functional fidelity, due to the use of conservative codes for simulation instead of best estimate codes, etc.) and discuss their potential consequences on safety.

2. Describe, based on your experience, any measures adopted to avoid acquisition of those undesirable habits or to prevent use of them.
**E) Simulator training on normal and emergency conditions during shutdown and low power operation.**

1. **What use is made of simulators for Control Room Operator training in normal, abnormal and emergency conditions during shutdown and low power operation (simulated scenarios, trained skills, training techniques, ...)?**

2. **What are the criteria (risk-based criteria, deterministic criteria, results of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?**

3. **Are job and task analysis (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on shutdown and low power operation?**
   Explain.

4. **What are your plans for the future in this area?**

**F) Simulator training on severe accidents.**

1. **What use is made of simulators for Control Room Operator training in severe accidents (simulated scenarios, trained skills, training techniques, ...)?**

2. **What are the criteria (risk-based criteria, deterministic criteria, result of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?**

3. **Are job and task analysis (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on severe accidents.**
   Explain.

4. **What are your plans for the future in this area?**
G) Simulator training on accidents caused by fires, floods, earthquakes, etc.

1. What use is made of simulators for Control Room Operator training in accidents caused by fires, floods, earthquakes, etc. (simulated scenarios, trained skills, training techniques,...)?

2. What are the criteria (risk-based criteria, deterministic criteria, result of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?

3. Are job and task analyses (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on accidents caused by fires, floods, earthquakes, etc.? Explain.

4. What are your plans for the future in this area?
QUESTIONNAIRE

SECTION 0: Organisation/s replying to the questionnaire

1. **Name of Organisation/s.**
   
   Carolina Power & Light Company  
   Harris Training Section

2. **Contact Person/s.**
   
   J.T. Bryan

3. **Address and contact information (telephone, fax).**
   
   3932 New Hill - Holleman Road  
   New Hill, NC 27562
   
   Phone: (919) 362-3322  
   Fax: (919) 362-3446  
   E-mail: jonius.bryan@cplc.com

SECTION 1: General Information (Harris Nuclear Plant only)

1. **Number of nuclear reactors (Units) in operation.**
   
   1

2. **Number of Sites with at least one Unit in operation.**
   
   1

3. **Number of full-scope (replica and no replica) simulators used for operator training.**
   
   1

4. **Number of replica simulators used for operator training.**
   
   1

5. **Number of part-task simulators used for operator training.**
   
   0

6. **Number of basic principles simulators used for operator training.**
   
   1
7. Number of concept simulators used for operator training.
0

8. Number of special-purpose simulators used for operator training.
0

9. For how many Units is the training done on replica training simulators?
1

10. For how many Units is the training done on full-scope (replica and no replica) training simulators.
1

IMPORTANT QUESTION

Are your answers to the subsequent sections (2 to 5) of the questionnaire related to a specific Organisation or Training Centre in your Country?

Yes _X_ No ___ (Mark your answer with an X)

If yes, indicate the name of the Organisation or Training Centre and describe briefly the simulation facility referred to in answer to the question below (f.i. located on-site or off-site, type of simulator/s, sample photograph, reference NPP/s, NPP/s which receive training in this facility, size and composition of the simulator instructional and support staff, etc.) and, also, describe this/these NPP/s (f.i. type (PWR, BWR, etc.), vendor, start of operation, degree of automation, Operators which constitute the Control Room Shift Team, sample photograph of the control room/s, etc.).

Response is for the Harris Plant and the Harris Simulation facility only. Questionnaires were provided to other CP&L training organisations for their own responses (Robinson and Brunswick).

Carolina Power & Light Company
Harris Nuclear Plant (3-loop PWR Westinghouse)
Harris Training Section
Harris Simulator (original RFT - Nov. 1977)

Harris Simulator is located approximately 2 miles from the plant site at the Harris Energy & Environmental Center (aka Harris Visitor’s Center).
SECTION 2: Current practices with simulators closely related to operator training.

1. Based on your experience, describe advantages and disadvantages of the location of the Simulation Centre with regard to the plant: on-site versus off-site. Specifically, describe those factors which have some influence on the Operators’ attitude towards the simulator training and in the quality of the simulator training.

   It’s far enough away to prevent routine trainee interruption to handle plant activities but close enough to be convenient. It’s a very good training environment.

2. a) During simulator training sessions, what factors (time, communications, etc.) influencing the interactions between Control Room Operators and other Plant Personnel (Operations Department outside of Control Room Personnel, Maintenance or Instrumentation, and Control Departments, Technical Support Centre, etc.) are simulated?

   Communications with plant personnel/functions and response times, such as the time it would take for someone to get to a pump or valve.

   b) Do these other Plant Personnel participate in the training sessions? Describe the present training format pertaining to involvement of non Control Room Personnel in simulator training sessions and explain why this format is used.

   Occasionally, based on training activities.

3. What environmental conditions (normal and emergency lighting, humidity, noise, vibrations, sounds generated by equipments, etc.) that could be experienced by the reference plants, are usually simulated in the Simulator Rooms? Describe the use of such effects at your simulator centre and explain why they are, or are not, incorporated into simulator training sessions.

   Lighting and equipment noise. Lighting failures (caused by bus failures) are provided for added realism and as indicators of specific plant problems.

4. Do Control Room Operators receive simulator training for operations outside the Control Room, for example: operations from Remote Shutdown Panels? Describe this type of training as it exists at your Simulator Centre and explain why it is, or is not, used in training sessions.

   No.

5. a) How frequently are the changes taking place in plant (plant design changes, procedures changes, etc.) incorporated to the replica or full-scope simulator? Describe any process or mechanism in place at your Simulator Centre to incorporate changes to the replica or full-scope simulator.

   At least within 1 year of plant change operability. Sometimes the simulator is changed first.
b) Do simulator model modifications require separate approval while the simulator is being used for training?

No.

6. a) Identify the members of the Control Room Shift Team (Reactor Operators, Turbine Operators, Shift Supervisors, etc.) and indicate the time (in hours) dedicated to simulator training by each member in their initial training programme. Specify, when applicable, the time spent with each type of simulator.

RO - 9 weeks (72 hours), SRO - 5 weeks, Managers - 4 weeks. All on plant specific replica simulator.

b) Indicate the time (in hours) dedicated to simulator training by each member of the Control Room Shift Team in their continuous training programme. Specify, when applicable, the time spent with each type of simulator.

80 hours/year.

c) What is the minimum time, if any, required by the Regulatory Body?

Not delineated.

7. a) Indicate the percentage of simulator training time by the different Members of the Control Room Shift Team devoted to i) normal, ii) abnormal and iii) emergency conditions in their initial training programme.

Normal - 20%
Abnormal - 40%
Emergency - 40%

b) Indicate the percentage of simulator training time by the different Members of the Control Room Shift Team devoted to i) normal ii) abnormal and iii) emergency conditions in their continuous training programme.

Same.

c) What are the minimum percentages, if any, required by the Regulatory Body?

Not specified.

8. What is the role and the policy of the Regulatory Body regarding the use of simulators for Control Room Operators licensing and training?

Required for initial and annual retraining using a certified simulator.

9. a) What standards (ANSI/ANS 3.5, IAEA, etc.) are simulators built to and maintained?

b) **What exceptions are typically taken to the standard?**

Plant design variations (BWR standards/requirements don’t apply to PWR).

c) **What types of simulators are used that are not included in industry standards?**

Classroom Trainer (aka Basic Principles Simulator).

10. a) **Describe the role of part-task simulators in your current training programs.**

   N/A

b) **Describe the role of special-purpose (analytic) simulators in your current training programs.**

   N/A

11. **Have the current operator training programs been conditioned by the availability and capabilities of the simulator(s) or, alternatively, has the simulator(s) been specified and acquired after analysing and designing the training programs? Explain.**

   Yes to both. Simulator was procured based on training needs. As training has evolved/improved, some simulator limitations have been reached which must be circumvented. The simulator is enhanced when possible to meet new training needs.

12. **What extensions of simulator training are envisaged for the future?**

   Beginning to use the simulator during Emergency Preparedness drills beginning 2/29/96.

13. a) **Based on your experience, describe the uses of the simulators for activities other than training (plant drills, procedures validation, design changes validation, testing programs, acquisition of human data, licensing activities, reference plant systems “tuning”, etc.).**

   To some extent for all of the following items: plant drills, procedures validation, design changes validation, testing programs, reference plant systems “tuning”.

b) **What is the involvement of Control Room Operators for those applications?**

   They function in their normal roles with oversight by EP, engineers and so forth, as required.

14. **What are the applications of simulator training for jobs other than Operations?**

   To assist craft personnel in understanding how their activities impact the plant operator (what the operator sees). Also, used for management training to a limited extent, normally associated with SRO certification classes.
SECTION 3: Systematic Approach to Training: considerations regarding the use of simulators.

A) Training analysis.

1. Are job and task analysis (or any other type of task identification technique) used for establishing a list of task, performance standards, learning objectives and training methods? If yes, describe the technique used.
   Yes. Use info developed by INPO. Use a tool called “Task Master” to develop task lists.

2. a) What are the criteria that determine the limits or scope of the job analysis for the Control Room Operators?
   INPO lists, industry events.

   b) From your point of view, what should the role of risk-based criteria be for determining such limits or scope? Explain your answers.

3. Are there any special requirements for Job and Task Analysis which are imposed by the possibility of associated simulator training?
   No.

B) Training programme design.

1. What are the criteria for specifying simulator training rather than another training setting (classroom, laboratory, workshop, on-the-job, etc.)?
   Practicality and best retention technique. Hands-on visual is always better than listening. Also, failures are best handled through simulation.

2. What are the criteria for selecting different types of simulator (full-scope, replica, part-task, basic principles, concept, special-purpose)?
   10 CFR 55 requirements and best available training aide.

3. a) What are the criteria for selecting a replica simulator?
   10 CFR 55.456.

   b) What are the fidelity requirements?
   Defined by ANSI/ANS-3.5.

4. What are the specific pre-requisites for operators undertaking simulator training?
   The need for acquisition or maintenance of operator license or certification.
5. Does the possibility of simulator training impose any constraints on the definition of learning objectives?

No.

C) Training programme development.

1. In the case of non-replica simulators, is it necessary to take parallel training actions, and if so, what kind?
   Explain your answer.

   N/A

2. Do you use specific procedures for the training simulator, actual plant procedures or a combination of both?
   Explain your answer and give reasons for the choice.

   Actual plant procedures. Maintains operator familiarity with procedures to be used in the plant in case of emergency or plant transient (planned or unplanned).

3. What are the criteria for selecting normal, abnormal and emergency scenarios to be trained with simulators? Are they risk-based criteria?
   Explain your answer.

   Regulator requirements and industry events. Training on specific plant manoeuvres and events are required on a specified periodicity. Regulator expectation is training on events occurring at your plant or like plants to reduce probability of recurrence.

4. How are lesson plans and support documentation developed for simulator training?

   Same as for classroom training using recognised accredited standards. All simulator scenarios are pre-run to ensure that the simulator can support training as desired. Simulator specifics (malfunction numbers, overrides, local operator actions, data collection and so forth) are included in lesson plans.

D) Training programme implementation.

1. What selection, initial training, and continuing training is arranged for simulator instructors?

   Operator qualified personnel are selected for instructor duties. They are put through an instructor certification training programme before assuming duties. Continuing training is conducted annually.

2. What are the arrangements for instructor monitoring of, and feedback to, trainees during simulator sessions?

   Pre- and post-scenario briefings are held. Post-scenario discussions are student-led critiques of the session with instructor feedback/interaction as required.
3. a) What specific training modes such as simulator freeze, playback, running at higher speed than real time, activity recording, video recording, etc. is made use of during initial training?

All items listed are used.

b) What specific training modes such as simulator freeze, playback, running at higher speed than real time, activity recording, video recording, etc. is made use of during continuous training?

All items listed are used.

4. What limits of simulation impede planned training sessions or examination scenarios?

None.

E) Trainee assessment.

1. a) What methods and procedures are used for initial trainee assessment during and after simulator sessions?

Weekly exams and remediation as required.

b) What methods and procedures are used for continuous trainee assessment during and after simulator sessions?

Same.

2. List and describe the main areas or groups of skills and knowledge of the trainee assessed in training simulators (for example: “control board awareness, event diagnosis, immediate actions / entry-level actions, subsequent actions, control board manipulations, use of procedures / technical specifications / reference data, communications, supervisory ability, team skills” (IAEA-TECDOC-525)). Identify, when applicable, the types of simulator used for addressing each one.

All listed are incorporated in training; all use plant specific replica simulator.

3. Describe the ranking of importance, if any, given to the main areas or groups of skills and knowledge taken into account for a trainee assessment.

All listed are about equal (except team skills would follow the block and supervisory skills would be last, if any break-out was considered).

4. a) Based on your experience, describe difficulties you have had for assessing the individual skills and knowledge of a trainee while operating within a whole Control Room Shift Team during simulator sessions.

The short-comings of one may be masked by the effectiveness of the team.
b) **Describe the measures adopted to overcome these difficulties.**

Multiple assessors when possible, changing roles within the control room, and individual examinations.

5. a) **Based on your experience, describe influences on trainees performance during simulator sessions resulting from the attendance of personnel such as utility managers, regulatory body inspectors, etc.**

None. They do equally well (regulatory inspectors raise anxiety level).

b) **Based on your experience, describe influences on trainees performance during simulator sessions resulting from the attendance of personnel such as utility managers, regulatory body inspectors, etc.**

None. This is a normal practice.

6. a) **Are training simulator examinations used in order to grant initial license to operators?**

Explain.

Yes. We give both a written (includes static simulator exam) and a dynamic simulator exam.

b) **Are training simulator examinations used for requalification?**

Explain.

Yes. Same as for initial but with higher performance expectations.

7. **How is examination integrity preserved during the examination/scenario preparation period?**

Exams are lock-up, observation of simulator activities are limited to a “need to know” basis, and scenario information on the simulator is saved on tape and deleted from simulator.

8. **What performance monitoring or data acquisition features of the simulator are used during simulator examinations?**

Operator action logs and data collection are used to acquire data for future reference if the performance of an operator is questioned.

F) **Training programme evaluation.**

1. **Describe the approach used for evaluating the simulator training programme and main results.**

Primarily the operators’ performance is indicative of the programme. INPO & NRC and assessment groups observe programme in action.

2. **What programme is in place for validation and continuous verification of the simulator performance?**

Simulator certification testing programme as required under 10 CFR 55.456.
3. **What types of performance discrepancies are most frequently identified by operators during training sessions?**

   Differences between plant and simulator.

4. **What types of performance discrepancies are most frequently identified by examiners or inspectors?**

   Discrepancies which cause inappropriate operator action or tend to mislead or distract operator.

**SECTION 4: Use of operating experience for operator training with simulators.**

1. **How is operational experience feedback incorporated into the design of simulator training programs (experience reviewed, schedule, people involved)?**

   Various administrative processes are used. Nothing specifically oriented to ensure that OE is incorporated in simulator training.

2. **Has your organisation developed any kind of programme by which simulator operator training is correlated with real operating events?**
   **Explain.**

   No.

**SECTION 5: Specific topics on Operator training with simulators.**

A) **Team training techniques.**

1. a) **Are job and task analyses used for defining the role and responsibilities of the Members of the Control Room Shift Teams and, in general, of the various levels of staff who are charged with operation of the plant? Explain your answer.**

   Yes.

   b) **Are job and task analyses used for establishing performance standards, learning objectives and training methods for Team skills training? Explain your answer.**

   Yes.

2. **List and describe Team skills (communication, management of resources, team cooperation, team leadership, feedback, conflict resolution, team decision-making, etc.) which are trained using simulators. Identify, when applicable, the types of simulator used for training each one.**

   Communications, particularly repeat-backs, are a primary focus.
3. Are any guides used for conducting and evaluating Team skills training simulations? Explain your answer.

I don’t know.

4. Based on your experience, describe advantages and disadvantages of Team training with the participation of the same (usual) Members every time or with changes in the Shift Team compositions.

Advantage: becoming comfortable makes communications easier.
Disadvantage: assumes a response to communications rather than verification.

5. Are simulator sessions used for the optimisation of control Room Team Shifts taking into account the characteristics (aptitudes, attitudes, ...) of each Operator? In other words, are simulator sessions used for deciding which Members are going to constitute each Shift Team? Explain your answer.

Generally not.

6. Are there any licensing examinations applied to the whole Control Room Shift Team in addition to the individual licensing examinations? Explain.

Yes. Individuals may pass an exam but the team fails. Conversely, the team could pass but individuals on the team could fail.

B) Training for stress.

1. Is any part of the simulator training programme specifically devoted to train Control Room Operators to operate under stress? Explain you answer.

No.

2. Are stress levels induced and measured during simulator training sessions? If yes, describe the methods and results.

No.

3. Based on your experience describe any measures adopted during simulator training to counter stress.

None.
C) The theoretical basis underlying training.

1. Are any models of human behaviour being used in designing and implementing training programmes?
   If yes:
   i) refer to or describe the models,
   ii) indicate the areas in which these models are being applied (for example: signal detections, decision-making, etc.)
   iii) give the main results.

   No.

D) Habits acquired during training sessions with simulators.

1. Describe, based on your experience, undesirable habits which could be acquired by trainees during training sessions with simulators (for example: due to limited number of simulated scenarios, due to lack of physical or functional fidelity, due to the use of conservative codes for simulation instead of best estimate codes, etc.) and discuss their potential consequences on safety.

   A temporary simulator deficiency may cause the operator to become complacent and ignore a warning indication when, in the plant, ignoring the same thing would be bad.

2. Describe, based on your experience, any measures adopted to avoid acquisition of those undesirable habits or to prevent use of them.

   Pre-scenario briefing to warn of simulator deficiency and post-scenario discussions. Instructors may remind student to expect different plant response.

E) Simulator training on normal and emergency conditions during shutdown and low power operation.

1. What use is made of simulators for Control Room Operator training in normal, abnormal and emergency conditions during shutdown and low power operation (simulated scenarios, trained skills, training techniques, ...)?

   The capability for such training has been added to the simulator. However, demos are generally used rather than dynamic training sessions.

2. What are the criteria (risk-based criteria, deterministic criteria, results of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?

   No significant drivers except just prior to refuelling outages.

3. Are job and task analysis (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on shutdown and low power operation?

   Explain.

   No.
4. **What are your plans for the future in this area?**

   Not determined at this time.

F) **Simulator training on severe accidents.**

1. **What use is made of simulators for Control Room Operator training in severe accidents (simulated scenarios, trained skills, training techniques, ...)?**

   None.

2. **What are the criteria (risk-based criteria, deterministic criteria, result of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?**

   N/A

3. **Are job and task analysis (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on severe accidents.**

   Explain.

   New area.

4. **What are your plans for the future in this area?**

   Just beginning to formulate plans; too early to say at this time.

G) **Simulator training on accidents caused by fires, floods, earthquakes, etc.**

1. **What use is made of simulators for Control Room Operator training in accidents caused by fires, floods, earthquakes, etc. (simulated scenarios, trained skills, training techniques,...)?**

   Scenarios with a fire in the plant is a routine event covered at least once every 2 years.

2. **What are the criteria (risk-based criteria, deterministic criteria, result of need analyses, simulation availability, etc...) supporting the above mentioned use of simulators?**

   Fire detection/alarm is a part of the simulation. There is no criteria different from normal casualty/transient training.

3. **Are job and task analyses (or any other type of task identification technique) used for establishing a list of tasks, performance standards, learning objectives and training methods on accidents caused by fires, floods, earthquakes, etc.?**

   Explain.

   None specific.
4. **What are your plans for the future in this area?**

   Continue as in the past. No specific changes are anticipated.