INPO Engagement in Operator Training

Steve Johnson
Director, Accreditation

INPO Engagement with Operator Training

Four cornerstones:

- Evaluation
- Training and Accreditation
- Analysis
- Assistance

INPO Engagement with Operator Training

Evaluation:

- Every 2 years
- Crew performance evaluation
- Focus on operator fundamentals

INPO Engagement with Operator Training

Accreditation:

- Every 4 years
- Comprehensive self assessment conducted by member
- Accreditation team visit
- Accrediting Board

INPO Engagement with Operator Training

Accreditation:

- NRC observations of visits
- NRC nominated member of Accrediting Board
- NRC observations of Accrediting Boards
- Annual INPO / NRC meeting

INPO Engagement with Operator Training

Initial Licensed Operator Training:

- Reviewed as part of every evaluation and accreditation visit
- Ongoing monitoring of industry performance
- Challenges in RO/SRO throughput

INPO Engagement with Operator Training

Initial Licensed Operator Training:

- Revised Academy Guideline for Initial Operator License Training
- Assist industry in improving candidate selection and training
- Support industry efforts to improve operator licensing examination development

Operator Initial and Requalification Training and Evaluation - an Operator's Perspective

November 27, 2012

Brian Snyder
Vice President, PROS

PROS Introduction

- ***PROS (Professional Reactor Operator Society)***
- ***Our mission is to serve individuals involved with safe nuclear operations. The society will work to communicate and promote the knowledge and professional values of our members, and to offer constructive input to the regulatory process on issues related to Operators.***

NRC/INPO Reactive Impacts on Training

- Fukushima Recommendations
- INPO SOER 10-2 Response
- INPO LER/SOER Response
- Regulatory Violations OE Response

Historical Operator Through put

- Varies across the 4 NRC regions
- Historically, NRC region 2 has lower through put as compared to other regions
- Through put can improve by facility training management and PROS working with INPO and the NRC on clear and concise testing requirements

Through put compared to Pass rate

- 2010: SRO Through put = 73%
  SRO Pass rate = 91%
- 2010: RO Through put = 68%
  RO Pass rate = 95%
- 2011: SRO Through put = 80%
  SRO Pass rate = 97%
- 2011: RO Through put = 66%
  RO Pass rate = 98%

Through put compared to Pass rate

- 2012: SRO Through put = 80%
  SRO Pass rate = 94%
- 2012: RO Through put = 84%
  RO Pass rate = 94%

(Through 3rd quarter of 2012)

Increase NUREG & ACAD experience requirements

- ***Six months on site experience for direct SRO candidates is not adequate.***
- ***One year reactor operator experience for upgrade SRO is not adequate.***
- ***Education cannot replace operating experience***

Increase NUREG & ACAD experience requirements

- ***Allows an inexperienced candidate to progress from SRO to OSM in short period without invaluable operating experience.***
- ***Process should require a candidate to have more experience in the non-licensed operator and reactor operator positions***

INPO ACAD documents & NUREG 1021 differs on Exams

- ***ACAD 10 - 001: Recommends using essay, drawings and short answer questions during ILT training***
- ***ACAD 07-001: A variety of question types (essay, drawings, and so forth) are considered to evaluate the knowledge required for operating the plant.***

INPO ACAD documents & NUREG 1021 differs on Exams

Questions with no single correct answer or for which the credit given can vary, depending on who graded it or when it was graded, have no place on an NRC examination.

Initial License Exam issues

- ***ILT exam questions - two part questions to meet K/A requirements***
- ***Focus on system/interrelation knowledge questions***
- ***All answers to questions must be plausible***

License Requalification exam issues

- Increased closed reference questions (50% to 80%)
- Open reference is not direct lookup
- Knowledge tested and not memorization of trivial items
- K/A should be direct link to exam questions
- PWR Exam Example Questions

Fukushima Recommendation impacts

Increased staff required to perform walk-downs and Engineering support for plant modifications.

Increased operator staffing to meet additional mitigation requirements

Fukushima Recommendation impacts

Increased staffing for procedure upgrades:

- ***External Flood Mitigation***
- ***Spent Fuel Pool operations***
- ***SAMG/Beyond Design Basis***

Facility/Corporate development of Fukushima Response Organizations

Fukushima Recommendation impacts

Operator Training

- Increased emphasis on multiple unit event scenarios
- Increased emphasis on Time Critical Actions in classroom and simulator training

Conclusion

INPO/NRC Impacts on Training

- Policy and Regulation changes have large impact on Training

K/A catalog and ILT Exam improvements

- Increases operator through put and NRC exam pass rates

Conclusion

K/A catalog and LOR Exam improvements

- Allows for a fair and practical evaluation of licensed operator knowledge

Plant operating experience

- Should be earned with time and not replaced with previous education or experience

Conclusion

Fukushima Impact

- Staffing requirements increased to ensure plant equipment and procedures are adequate to protect against similar occurrence at U.S. facilities
- U.S. facilities performing further analysis of Design Basis Events

Conclusion

Fukushima Impact

- Operator training has been expanded to ensure operators are prepared for mitigating multiple unit or beyond design basis events.

PROS Presentation talking points

Slide 1: Introduction

Slide 2: PROS Introduction

Slide 3: INPO/NRC Reactive Impacts on Training

Increased simulator and class room training. Increased Certified Instructor staffing demands.

- **Fukushima Recommendations**
- **INPO SOER 10-2 Response**
- **INPO CPE/Operator Fundamentals**
- **INPO LER/SOER Response**
- **Regulatory Violations OE Response**

Slides 4, 5 and 6: Operator through put (2009 – 2012)

Slight variations but trends are improving. Goal should be have through put to be maintained between 80-90 % to ensure industry licensed staffing demands met and plant safety operating margins maintained.

Slides 7 & 8: **ISRO/Upgrade SRO experience requirements**

The current requirements allows a candidate with a technical degree (i.e. Engineering) or Equivalent Industry/Military experience with only 6 months site specific experience to be selected as ISRO (Direct Instant Senior Reactor Operator)candidate. The candidate could spend 6 months in the operations department to complete abbreviated qualification process for non-licensed operator position. This could be the only in plant experience if the candidate is hired directly into the operations department.

This would allow a recent college graduate to be selected as an ISRO with very little operations experience. The average length of initial licensing training is 18 to 24 months. ILT primarily teaches GFES, EOP, AP and fundamental systems training. ILT tasks do not encompass the entire range of operations. Upon graduation from ILT, the ISRO may spend six months to one year as a RO. The candidate may not spend any time as an RO due SRO staffing demeans.

The candidate should have both on-line and outage experience. This is difficult to achieve due to most facilities are single. The typical core cycle is 18 to 24 months. One core operating cycle is defined as the period of time that encompasses a refueling outage and the operating period between the refueling.

The candidate would have little to no outage experience before taking the responsibilities of supervising an operating crew.

The additional time spent in the roles as NEO, RO and SRO would allow for mentoring and to gain experience vital for operator development.

The current process allows RO with a minimum amount of experience to be selected as an Upgrade SRO. The same reasoning applies to this as well.

Slides 9&10: **NUREG 1021 and ACAD document differs on Exam development**

ACAD 10-001 (ILT) recommends using drawings, short answers and essays questions (subjective) for ILT. INPO ILT recommendation to use as an evaluation tool for program. The NRC exam is objective multiple choice question and candidates should be evaluated by that measure.

ACAD 07-001(LOR) recommends using variety of question types (essay, drawings, and so forth) to evaluate the knowledge required for operating the plant for continuing training exams.

NUREG 1021 requires objective and not subjective questions such as drawings, essays and short answer for LOR and ILT exams. The questions should not have partial credit or more than one correct answer.

Appendix B, which is referred to as guidance in ES-401and ES-602 of NUREG 1021 simply states "Questions with no single correct answer or for which the credit given can vary, depending on who graded it or when it was graded, have *no* place on an NRC examination."

Slide 11: **ILT Exam issues**

The perception by the examinees is that the ILT exam questions are two part concept questions. One part to meet the K/A requirement and one part administrative (plant procedures).

Exam questions should focus on plant systems and their interrelation for the knowledge questions. Mitigation strategies and basis for time critical actions should be emphasized.

Knowing the next procedural step in abnormal or emergency operating procedure from memory for a closed reference exam make the questions memorization or guessing the correct answer.

Operators need to use their APs, EOPs and OPs in hand and not from memory. They should be examined in that manner that follows the normal processes.

PROS members understand that is difficult to write questions where all answers to questions must be plausible to meet all the requirements of the ACAD and NUREG guidance.

See Example questions submitted by PROS members.

<u>Slide 12:</u> LOR Exam issues

An open reference exam does not mean the questions are "direct" or "immediate look up" questions. The LOR exams should be similar in concept as the ILT exams.

The perception by PROS members is that the closed reference question portion of an LOR exam make up has been increasing since 2003. The percentages are ranging from 50% to almost 80% in some instances. Is this way the NRC and INPO wants LOR exams to become?

LOR training is impacted more by INPO SOER/LER events and the perception is that the SOER/LER additional training is never completed. The training will replace topics or just increases the training curriculum load.

Slides 13, 14 & 15: Fukushima Impact

Increases are been seen in staffing for procedure upgrades, additional training, plant walk-downs, plant modifications and design basis event analysis.

Simulator and class room training for operators has been changed to allow for multiple unit event and beyond design basis events. Increased emphasis on time critical action completion times and operator staffing levels for the most challenging design basis events.

Mitigation strategies for external plant flood and abnormal spent fuel operations.

The licensed operator staffing is also being analyzed to ensure all design basis events can be effectively mitigated.

Slides 16, 17, 18 and 19 Conclusion

Examples of Sequoyah NRC tests questions

A large break LOCA occurred on Unit 1 and the crew is currently implementing ES-1.3, "Transfer to Containment Sump."

The following conditions currently exist:

- Both RHR Pumps are running aligned to the Containment Sump.
- The charging pump suction from the RWST has been manually isolated.
- The crew is ready to close 1-FCV-63-5, SI Pump Suction from RWST.

RHR Pump 1 A-A subsequently trips.

Which ONE of the following identifies the CCPIT Inlet Flow rate on 1-FI-63-170 and the required actions for the following step in accordance with ES-1.3?

"14. Monitor Both RHR Pumps Running"

A. Greater than zero;
Ensure 18-8 CCP and 18-8 SI Pumps are running and then place the 1A-A CCP and 1 A-A SI Pumps control switches to the pull-to-lock (P-T-L) position.

8. Greater than zero;
Close 1-FCV-63-72, Train A Containment Sump Valve

C. Zero;
Ensure 18-8 CCP and 18-8 SI Pumps are running and then place the 1 A-A CCP and 1 A-A SI Pumps control switches to the pull-to-lock (P-T-L) position

D. Zero;
Close 1-FCV-63-72, Train A Containment Sump Valve

Answer: A

The issue here is that (this not really a hard question), but the concept of the question is in two part due to the all distracters have to be plausible with the KA requirements. Also, the question is asking about a specific step in ES-1.3 so the operator has to know what the previous steps are by memory without a procedure or reference. The NRC would not want us to operator the plant going by memory on procedures. For this question the procedure is one we practice often, but it is the concept of getting a step number and having to memorize the stuff that happens before that step.

During a prejob brief, an operator discovers a procedure step meets the critical step criteria listed in SPP-2.2, "Administration of Site Technical Procedures"; however, it is not identified as a critical step.
Which ONE of the choices completes the following statements?
The procedure step (1)
Critical steps performed outside the control room require (2) ,in accordance with OPDP-1, "Conduct of Operations."
A. (1) can be marked or highlighted to identify the step as a Critical Step and the procedure performed prior to revision.
(2) a Peer Check

B. (1) can be marked or highlighted to identify the step as a Critical Step and the procedure performed prior to revision.
(2) Independent Verification

C. (1) will require a revision prior to performance. (cannot be performed as is)
(2) a Peer Check

D. (1) will require a revision prior to performance. (cannot be performed as is)
(2) Independent Verification

Answer:A

This question is a prime example of what is wrong with the ILT test process. First it is a two part question required to answer one KA. Secondly, it is based on Admin. procedure that could and would be in this instance looked up and not required to be memorized.

Given the following plant conditions:
- A reactor trip has occurred.
RCS pressure is 1810 psig and lowering.
- Containment Pressure is 1.55 psig and rising.
Which ONE of the following identifies the status of the RCP's #1 sealleakoff flowpath?

A. routed to the PRT
B. routed directly to the VCT
C. routed to the RCDT
D. routed to the CCP suction

Answer: A

This is an example of a good question which test Operator Fundamental System Knowledge.

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Licensed Operator Training Program Challenges for Existing and New Build Plants

November 27, 2012

Andy Barbee, Director Nuclear Training, VC Summer

Existing Plant Challenges

- **Collaborative Solutions**
  - RIS solicitation of Industry Exam Plans
  - Regional Exam Writer Workshops
- **Issues with Clear Path Forward**
  - Revision of outdated KA Catalogs
- **Issues Requiring more Discussion**
  - Regional NUREG 1021 Inconsistencies
  - Disposition of IRT Recommendations

New Build Challenges

- **Collaborative Solutions**
  - Cold Licensing Process
  - KA Catalog Development
  - Initial Accreditation
- **Issues with Clear Path Forward**
  - NRC Approval of Plant Referenced Simulator
  - Exam Administration
  - Conditional Operator Licenses
- **Issues Requiring more Discussion**
  - Same as Existing Plant Challenges

Future Uncertainties

- Fukushima Influence on Program
  - Management of Content
    - Potential 10CFR55 Rule Change
    - Systematic Approach to Training
  - Changes to Training Content
    - New Build Training Schedule Uncertainties
    - Redesign of Existing Programs

Future Uncertainties (cont)

- ***Unintended Consequences***
  - ***Excessively long training programs***
  - ***Displacement of important training content***

Industry Recommendations to Improve the Initial Licensed Operator Licensing Process

Chuck Sizemore

Chair, NEI Licensed Operator Focus Group (LOFG) and Manager Fleet Operations Training, NextEra Energy

Actions in Progress

- ***Implementation of the INPO Call to Action***
  - ***Training of Exam Developers***
  - ***Supporting INPO Assist Visits***
  - ***Training Program Improvements***

Actions in Progress (cont.)

- **Revision of the Current Knowledge & Abilities Catalogs**
  - **Funding established and Bids Requested for Project Manager**
  - **Revision to address multiple items:**
    - **better alignment with testing in proper setting and more aligned with the Systematic Approach to Training**

Actions in Progress (cont.)

- ***Reinforcement of Current Standard for use of Bank Questions***
- ***Bi-Annual Meetings between the NRC and NEI LOFG***

Actions in Progress (cont.)

- **Establishment of a National Examiners WorkShop**
  - **Supported by both the NRC and Industry to provide Operating Experience and Changes to the Licensing Process for Industry Examination Developers**

Additional Recommendations/Actions

Revision of NUREG 1021 Operator Licensing Standard

- For Implementation of Revised Knowledge & Abilities Catalogs
- Enhancements to the Integrated NRC Examination Plan
- Add detail to subjective areas

Additional Recommendations/Actions

Establishment of a Process for NRC approved Examination Questions. Which will allow Future Use on Exams as written. (unless identified as incorrect/Unsat) Similar to Generic Fundamentals Examination Bank

Additional Recommendations/Actions

Improve the Current Process to Approve and Communicate Changes in Interpretation of Existing Licensing Examination Requirements. To Ensure Communication at a National Level vs. a Regional Level. (LOFG/NEI/NRC)

Comments on SECY-12-0151

Agree with the staff's view that average written examination scores are a better indicator of examination difficulty. That is if all things remain constant. The fact is that the programs have changed considerably over the last 10 to 15 Years.

Comments on SECY-12-0151

For example:

- Better Selection Tools and Pre-Program Preparation in Place
- GFE lengthen from Approximately 6 Weeks to 9 to 12 Weeks
- Overall Program Length increased from 12 to 16 Months to 18 to 24 months.
- Program Examination Methodology Expanded Significantly
- Simulator Fidelity, Realism, and Functionalities Greatly Improved

Independent Review Team Observations & Comparisons

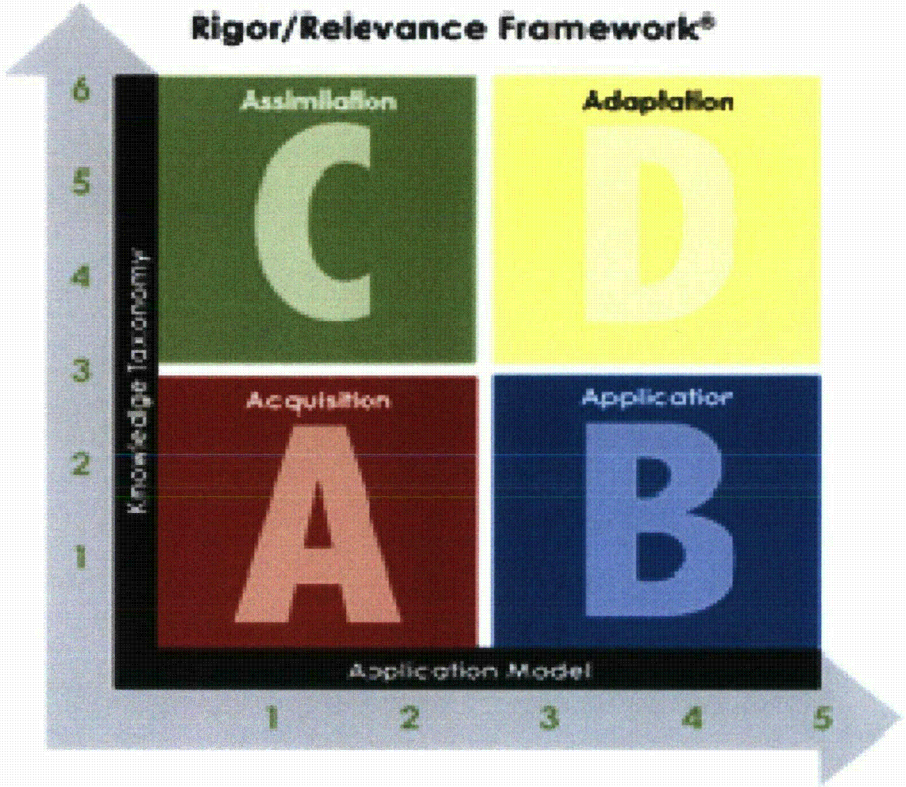
November 27, 2012

Audeen Fentiman
Nuclear Engineering Professor

Charge to IRT

- ***Review NRC initial license examination process***
- ***Consider current educational theory***
- ***Consider advances in simulator technology and training programs***
- ***Recommend ways to improve effectiveness and efficiency of initial license examination process***

Rigor/Relevance Framework



Y-axis -- Bloom's Taxonomy

6 Evaluation

5 Synthesis

4 Analysis

3 Application

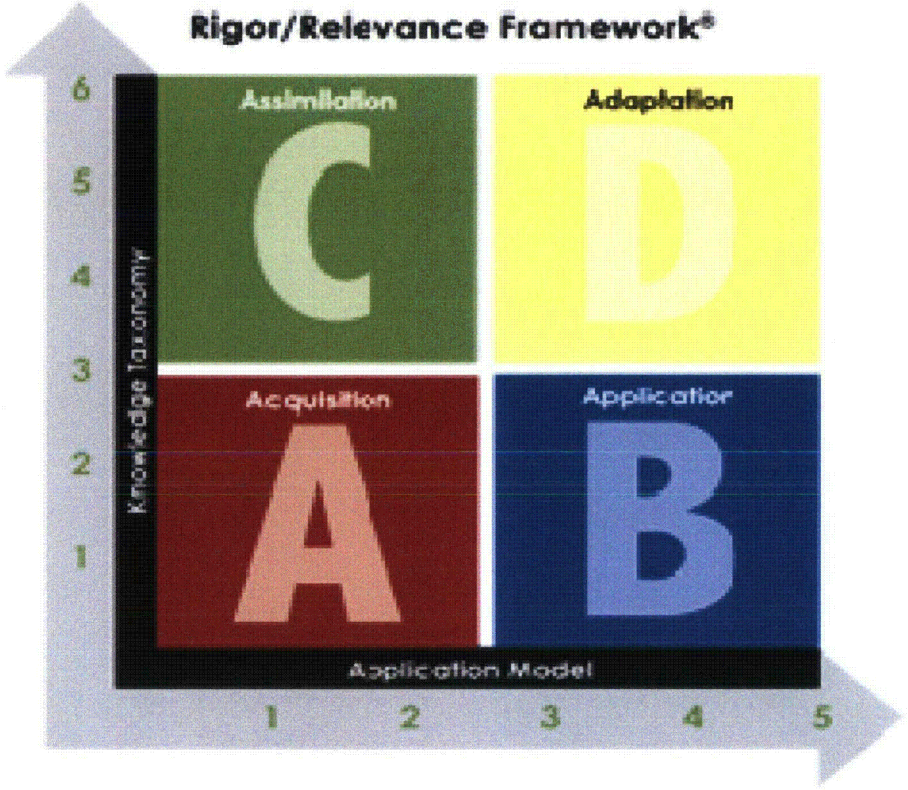
2 Comprehension

1 Knowledge

X-axis -- Application Model

1 Knowledge in one discipline
2 Apply knowledge in discipline
3 Apply knowledge across disciplines
4 Apply to real world predictable situations
5 Apply to real world unpredictable situations

Rigor/Relevance Framework



Rigor/Relevance Framework

A (Acquisition) Gather, store, remember, understand knowledge

B (Application) Use knowledge to solve problems

C (Assimilation) Use knowledge automatically to analyze and solve problems

D (Adaptation) Solve complex problems; learn more as needed

IRT Recommendations Summary Integrated Exam Plan

- ***Knowledge and Abilities (K/A) catalogs should be aligned with current RO and SRO job requirements***
- ***K/A should be tested in the proper setting***
- ***Exam questions should be valid and consistent across regions***

Training and Examination in Other Fields

- **Nurse**
  - **Training**
    - **Formal degree or diploma**
    - **Practical experience**
  - **Examination – depends on the level**
    - **Registered Nurse – national, computer adaptive exam (75 – 265 questions)**
    - **Includes performance questions – e.g. show where you would put the stethoscope**

Training and Examination in Other Fields

- **Airline Pilot**
  - **Training**
    - **College degree, military**
    - **Flight experience**
  - **Examination**
    - **Written test**
    - **Oral test**
    - **Flight test**

U.S.NRC

United States Nuclear Regulatory Commission

Protecting People and the Environment

Operator Licensing Program Briefing

Bill Borchardt,

Executive Director for Operations

November 27, 2012

Agenda

- Overview (Ho Nieh, NRR)
- Operating Reactors (Jack McHale, NRR)
- New Reactors (Mike Junge, NRO)
- Regional Perspectives (Mark Haire, R-IV)

Operator Licensing Program Goals and Objectives

- Only safe, competent operators are licensed
- Reliable, valid exams support making confident licensing decisions
- Respond to operating experience

Initial Licensing Examinations

- **Written examination**
  - **multiple choice format: 75 RO questions, 25 "SRO only" questions**
  - **Random and systematic sampling of Knowledge and Abilities (NUREG)**
  - **Content, operational & discrimination validity; examination reliability**
  - **Facility prepared, NRC approved and administered**

Initial Licensing Exam Structure (cont.)

- **Job Performance Measures (JPM)**

Initial Licensing Exam Structure (cont.)

- **Simulator operating test**

Requalification Program

- Industry accredited programs
- Administered by licensees and inspected by NRC
- Recent changes to NRC inspection procedure emphasize operator in-plant performance

Post-Fukushima Impacts

- NTTF Recommendations
- Key elements: new equipment, procedures, command & control, training/qualification/exercises
- Considerations:
  - Leverage current training and expertise
  - Cumulative effect on operators
  - Initial and requalification training
  - Exercises and performance monitoring

Key New Reactor Staff Activities

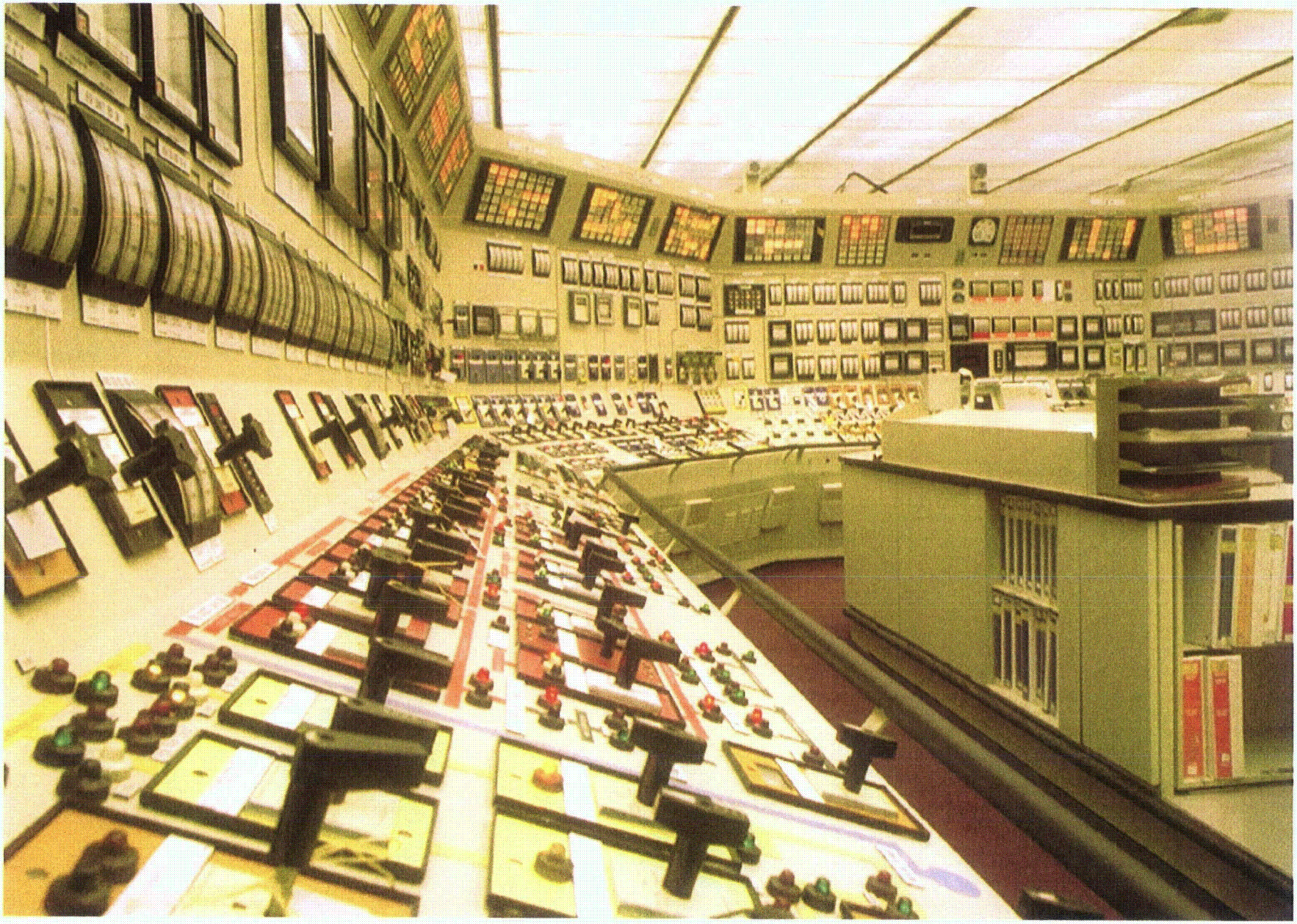
- Technical Training
  - Classroom
  - Simulator
- Qualified Operator Licensing Examiners
  - Regions
  - Technical Training Center
  - NRR
  - NRO

Approach to Initial Licensing for New Reactors

- **Same Process as Operating Reactors**
  - **Minor changes to accommodate highly integrated control rooms**
- **Design Specific Knowledge and Abilities Catalogs**
- **Operator Examinations**

Plans to Address Key Challenges

- **Job Performance Measures**
- **Plant Reference Simulators**
  - **Reactivity Manipulations**
  - **Examination**



Regional Perspective – Value of Examiners: Exam Quality

- Our Goal: Ensure Exam Distinguishes Between Applicants Well-Prepared for Safe Operation and Those that Are Not

- One Way Examiners Add Significant Value is Through Science of Knowledge Measurement

- An Example:

Value of Examiners: Exam Quality

Given, [technical plant conditions]... What should you do?

A. Exit EOP-20 immediately and enter AOP-17.

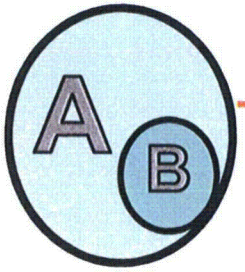
B. Exit EOP-20 immediately and enter AOP-17. Reenter EOP-20 when you reach the AOP-17 exit conditions.

C. Complete the actions in EOP-20, and then enter AOP-17 when you reach the EOP-20 exit conditions.

D. Perform AOP-17 actions in parallel with EOP-20.

Value of Examiners: Exam Quality

Given, [technical plant conditions]...
What should you do?



A. Exit EOP-20 immediately and enter AOP-17.

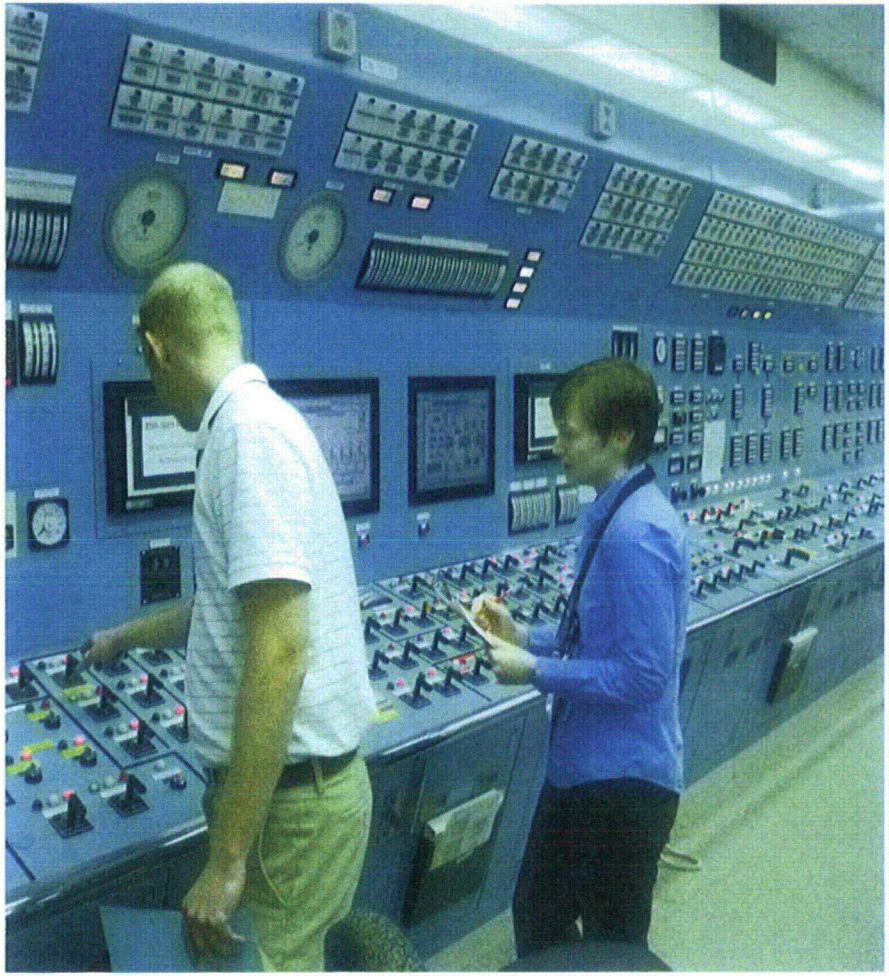
B. Exit EOP-20 immediately and enter AOP-17. Reenter EOP-20 when you reach the AOP-17 exit conditions.

C. Complete the actions in EOP-20, and then enter AOP-17 when you reach the EOP-20 exit conditions.

D. Perform AOP-17 actions in parallel with EOP-20.

'B' is a subset of 'A' and therefore 'B' is not credible as written.

Value of Examiners: Plant Procedures



- Exam Reviews = procedure quality review
- Recent 2012 exam in RIV yielded 16 NCVs

Example: Starting a Main Feed Pump requires starting an Aux Lube-Oil Pump, but procedure didn't direct the Lube-Oil Pump to be started; affected 8/10 applicants

Value of Examiners: Operator Performance

- Effective Operator Licensing results in competent operators

- Example: 2009 Electrical Fire at CGS = licensed operators performed as trained.

Conclusion

- NRC is licensing safe, competent operators
- Operator licensing staff making broad contributions to NRC safety mission
- Programs are responsive to emerging issues, such as new reactors and Fukushima lessons-learned

List of Acronyms

- AOP – Abnormal Operating Procedure
- CGS – Columbia Generating Station
- DCIP – Division of Construction Inspection and Operational Programs
- DIRS – Division of Inspection and Regional Support
- DRS – Division of Reactor Safety
- EOP – Emergency Operating Procedure
- FY – Fiscal Year
- JPM – Job Performance Measure

List of Acronyms (cont.)

- NCV – Non-Cited Violation
- NRC – Nuclear Regulatory Commission
- NRR – Office of Nuclear Reactor Regulation
- NRO – Office of New Reactors
- NUREG – NRC technical report designation
- NTTF – Near Term Task Force
- RIV – NRC Region 4
- RO – Reactor Operator
- SRO – Senior Reactor Operator