

NEI Operator Licensing Task Force Cold Licensing Plan Submittal to NRC

Background

Cold licensing of licensed operators at a new plant is a temporary, evolving process utilized during the preoperational phase of a new nuclear plant. It provides the method for operations personnel to acquire the knowledge and experience required for licensed operator duties during the unique conditions of new plant construction.

Since the late 1980s, NRC regulation and guidelines and industry guidelines have undergone revisions that removed guidance related to the “cold licensing process” for operators during new nuclear plant construction. This guidance provided the method for operations personnel to obtain an operator license. Currently the only regulatory guidance addressing the issue of granting operator licenses prior to a plant becoming operational is contained in NUREG 1021, ES-202.

During the 1980s, the Systematic Approach to Training (SAT) and Training Program Accreditation processes were implemented. These processes provided methods for determining job performance needs, implementing required training and evaluating performance and training results. Today, the accreditation renewal process continues to evaluate training program effectiveness and provide feedback for the continued improvement of nuclear training programs.

Plants in the past were constructed with “one of a kind” designs. This resulted in long construction phases which integrated on-site training (i.e. classroom instruction, simulator training, etc) with construction and startup testing late in project life. New nuclear plant deployment schedules have significantly shorter construction phases requiring training implementation early in the construction phase. This results in the inability to use the constructed plant to support the early phases of the training program.

For new nuclear plants, the early hiring, training and qualification of licensed operator candidates will be critical. Optimized construction schedules for the new advanced plants indicate that operator training will be needed early in the construction phase to support preoperational testing and fuel load activities. With the potential for multiple units scheduling fuel loading activities in a narrow time frame, the need for a highly efficient and effective licensed operator training and licensing process will be required. A nominal schedule utilizing two simulators for the cold license process is shown below:

<u>Milestone Relative to Fuel Load</u>	<u>Months</u>
Licensed operator training begins	- 48
Plant construction begins	- 48
Plant Reference Simulator Available	- 24
NRC examinations begin	- 18
Pre-operational Testing begins	- 12
Fuel Load	+ 0
Startup Testing begins	+ 0
Plant Operational	+ 6

Since December 2006, an industry task force facilitated by NEI, has reviewed the needs of licensing operators for the new nuclear plants in comparison to the current operator licensing regulations and processes denoted in Reg. Guide 1.8, ANSI 3.1, 10CFR 50.120, 10CFR55, RG 1.149 and NUREG-1021. This review determined that some elements of the regulatory guidance related to licensed operators will be difficult if not impossible to meet for new nuclear power plants. The commitment (NEI 06-13) to the selection and training regulatory guidance contained in FSAR Section 13.2 must be updated to address the unique situation facing new nuclear power plant builders in regards to the selection, training and licensing of operations personnel during the construction and testing phases.

Problem Statement:

Existing regulatory guidance addresses only the training and qualification needs of a licensed candidate for an operating nuclear power plant. The current regulatory guidance doesn't address the situation where the plant is not operational (i.e. under construction). Regulatory guidance related to the cold licensing process needs to be developed so that clear, appropriate, and achievable training commitments can be documented in each facility's FSAR and COL application.

Recommendations:

The "cold licensing" process for the selection, training and licensing of Operations personnel for the new nuclear plants should follow current industry guidance for operating plants with exemptions and additional guidance in the following areas:

- A. Experience Requirements for License Candidates
- B. Crew Experience Requirements During First Year of Operation
- C. Training Program Accreditation and Implementation
- D. In-Plant JPMs and On-Shift OJT During Construction Phase
- E. Simulator Training Using a Part Task/Limited Scope Simulator
- F. Continuing Training for License Candidates Prior to NRC License Exams
- G. Scheduling of NRC License Examinations
- H. Initiation of Licensed Operator Continuing Training

Since the initial licensed operator training classes will not have the opportunity to gain operating experience for the new design prior to fuel load, alternative solutions will be necessary to support the training and licensing processes.

As the plant evolves during the construction phase, the SAT process will be utilized to implement the best applicable training strategy.

Plants will meet current regulatory requirements without utilizing these cold license provisions as capabilities become available and are practical. An example of this would be that if a plant reference simulator is available prior to the start of licensed operator training classes, then the allowances in Items E, need not be followed but standard practices take their place.

A. Experience Requirements for License Candidates

Build on previous guidance used during nuclear plant construction but update the guidance to reflect advances in training effectiveness due to the use of the systematic approach to training, advances in simulation technology, the use of advanced technology control rooms, and the use of virtual technology. Systematically developed training provides a high degree of assurance that the integrated requisite knowledge and ability has been attained.

Persons eligible for the cold license process shall meet the following requirements:

- Candidates for a Reactor Operator license shall have a High School Diploma or equivalent as required by R.G. 1.8 Revision 3.
- Candidates for a Senior Reactor Operator license shall have at least one of the following qualifications:
 - Previously held a Senior Reactor Operator license for an operating nuclear power plant
 - Previously held a Reactor Operator license for an operating nuclear power plant.
 - Have a Bachelor's Degree in engineering or science as defined by R.G. 1.8 Revision 3.
 - Experience as a licensed operator training instructor with an SRO certification.
 - Two years military experience in a position equivalent to a reactor operator.

Exempt cold license applicants from the referenced license specific and total power plant experience requirements of Rev. 3 of Reg. Guide 1.8. This is consistent with the precedent established in Rev 2 of Reg. Guide 1.8. In addition, update the regulatory guidance to include the following provisions:

1. License candidates who do not meet Reg. Guide 1.8 Rev. 3 experience requirements shall have at least six months experience performing one or more of the below activities including participation in preoperational testing. Activity performance completed to satisfy required experience shall be documented. The scope of each of the following activities has been bounded to ensure meaningful experience is attained:
 - a. Preoperational testing of safety significant, defense in depth or other major operating components or plant systems. This includes the manipulation and monitoring of components, systems or controls or the field supervision of such activities related to the testing of plant operating systems.
 - b. Plant operating procedure development and verification of EOP, AOP, NOP or other safety significant or defense in depth procedures. Verification activities include tabletop, walkdown or simulator verification or validation of these procedures.
 - c. Human Factors Engineering activities and task analysis verification. Verification activities include tabletop, walkdown or simulator verification or validation of such tasks.
 - d. Conducting operations classroom training on plant systems, EOP, AOP, NOP, other safety significant and defense in depth or major system procedures.

- e. Conducting operations OJT training or evaluation on EOP, AOP, NOP, other safety significant and defense in depth or major system tasks.
 - f. Conducting operations simulator training on integrated plant operations, EOP, AOP, NOP, other safety significant, defense in depth or major system evolutions or procedures.
2. Experience requirements established in item 1 above do not have to be met prior to enrolling in a licensed operator training program.
 3. Experience requirements established in item 1 above that have not been fully met at the time of the licensed operator application submittal shall be met prior to issuing the individual's NRC operator license. Following satisfactory completion of a NRC license examination, the Licensee will notify the NRC when the candidate's experience requirements have been met.
 4. Time spent in an on-the-job training phase may be counted as on-site and total nuclear power plant experience.
 5. Completion of a site familiarization course based on a SAT analysis of site design features and operator site familiarization needs is an acceptable alternative to the six month on-site requirement for both reactor operator and senior operator candidates. The course objectives should include: gaining familiarity with overall site layout, location of functional groups, functional group responsibilities and interfaces, applicable programs and processes (such as configuration control, maintenance, safety and emergency response), key building configurations and major equipment locations. Course activities should include plant walkdowns and/or virtual tours. The duration of the course will vary depending on candidate's previous experience but should not be less than two weeks.
 6. Six months experience performing activities described in Item 1 above is an acceptable alternative to the requirements for a degreed direct SRO to have a minimum of 12 months responsible power plant experience performing duties as a member of Technical Staff and at least six months on-site. Technical Staff includes any individual in a technical support position who is responsible for the management, coordination, implementation, or engineering support of activities including but not limited to the following: plant equipment control, integrated operation procedures, operations, maintenance, and radiological support, or review of modification and maintenance plans for plant systems.
 7. Completion of a site-specific non-licensed operator training program for critical non-licensed operator tasks by a reactor operator candidate is an acceptable alternative to the requirement to have one year on-site experience and six months as a non-licensed operator at the facility for which the license is sought. The program should include tasks identified as important to plant operation with respect to nuclear safety, defense in depth or risk impact.
 8. Completion of a combined reactor operator and senior reactor operator course by a senior operator candidate is an acceptable alternative to the requirement for one year experience as an RO.
 9. Completion of Plant Operational Excellence Course based on a SAT analysis of the supervisory skill, knowledge, and ability required of a SRO, is an acceptable alternative

to the special experience requirements related to at-power and startup/shutdown operations for senior operator candidates.

10. Completion of an observation program, based on a SAT analysis of the supervisory skill, knowledge, and ability required of a SRO, at an operating reactor by a senior operator candidate is an acceptable alternative to the special experience requirements related to at power and startup/shutdown operations.

Table 1 summarizes the RO or SRO current licensing exemption need and the alternative method requirements.

Table 2 illustrates the overall cold licensing plan for each candidate type based on experience at time of hiring.

B. Crew Experience Requirements During First Year of Operation

Based upon the above alternatives to the regulatory individual experience requirements for operator licensing eligibility, the industry concurs with the NRC that minimum operating shift crew experience requirements should be established. These requirements will be in place for the first year of operation or until minimum crew experience requirements are achieved whichever occurs earliest.

Each operating crew's cumulative experience shall not be less than 6 years nuclear power plant experience and not less than 13 years total power plant experience.

Table 3 provides the weighting factors and maximum credit limitations for determining individual and crew experience to meet this requirement.

An example of target experience for each licensed crew member is in **Table 4**.

Each operating crew has either 1) a senior reactor operator who has hot plant experience at an operating nuclear power plant or alternative experience, or 2) a shift advisor with hot plant experience and appropriate training. A shift advisor for a crew is only maintained until Hot Plant Experience requirements or cumulative experience requirements are met for the crew.

Hot plant experience requirements, alternatives and shift advisor training requirements are listed in **Table 5**.

C. Training Program Accreditation and Implementation

Use the Systematic Approach to Training (SAT) to develop and implement the new plant licensed operator training programs. Initial accreditation will be obtained in the licensed operator training phase to ensure that the analysis, design and development of the programs meet industry standards. Training program accreditation renewal will be achieved prior to fuel load.

D. In-plant JPMs and On-shift OJT During Construction Phase

Until equipment installation is sufficiently complete, use viable alternatives for performance of In-plant JPMs including but not limited to discussion, mockups, virtual presentations and part task simulation.

Until the plant becomes operational, use viable alternatives for the Main Control Room OJT (three months on-shift as an extra person) including, but not limited to preoperational testing activities, simulator time focused on crew operations or dedicated observation time in the MCR of an operating nuclear plant (See A, experience requirements for license candidates discussion above, for further information).

E. Simulator Training Using a Part Task/Limited Scope Simulator

Use part task or limited scope Simulator(s) as the starting point for initial Licensed Operator simulator training. The part task or limited scope simulator would evolve into the “plant referenced, ANSI 3.5” simulator prior to the operator candidates taking a NRC license operating examination.

The part task/limited scope Simulator will meet option (3) of Reg. Guide 1.149 requirements. This simulator will be a high fidelity/quality training device that will be maintained in accordance with ANSI-3.5, 1998, section 5 and Appendix D.

The Plant-Referenced Simulator will meet 10CFR 55.4 requirements as a simulator modeling the systems of the reference plant with which the operator interfaces in the control room, including operating consoles, and which permits use of the reference plant's procedures.

The simulator models will be updated as information concerning plant design and performance is obtained. These updates will ensure the simulator is current with plant design and can be used as a realistic training tool.

The following generic training sequence shows use of part task/limited scope simulator and plant referenced simulator for licensed operator training. The actual sequence may vary depending on reactor design.

- Phase 1 (approximately 40 months prior to fuel load) - The part task/limited scope simulator is used to provide licensed operator training based on standardized design simulator modeling and operating procedures
- Phase 2 (approximately 24 months prior to fuel load) – An ANSI/ANS 3.5 (1998) plant referenced simulator is used in final segment of licensed operator initial training to perform reactivity manipulations and complete required NRC license candidate training
- Phase 3 (approximately 18 months prior to fuel load) - An ANSI/ANS 3.5 (1998) plant referenced simulator is used for performance of NRC Operator Initial License Examinations

Current Regulatory guidance (Reg. Guide 1.149 and ANSI 3.5 Appendix D) references the use and criteria that Part Task/Limited Scope simulators must meet. Therefore no change to current regulatory documents would be needed to allow the use of this type of simulator.

The NRC Form 398 Box 12.b question "Is a plant-referenced simulator (as defined in 10CFR 55.4) used in the operator training program?" may be answered affirmatively since a standardized design part task/limited scope simulator per Reg. Guide 1.149 is utilized during early segments of training and a plant referenced simulator per 10CFR 55.4 is utilized during the last segment of operator training.

F. Continuing Training for License Candidates Prior to NRC License Examinations

Use the SAT process to determine continuing training needs for license candidates following completion of the initial phases of their licensed operator training. Provide structured continuing training to maintain the license candidates' knowledge and ability.

G. Scheduling of NRC License Examinations

Schedule NRC examinations to start approximately 18 months prior to fuel load and generally complete these initial examinations early in the preoperational testing phase. Plant construction should be sufficiently completed to support the performance of initial operator examinations. Adequate time should remain for the issuance of operator licenses to support fuel load activities with licensed operators.

H. Initiation of Licensed Operator Continuing Training

Implement an accredited licensed operator requalification program within 90 days following the issuance of the first NRC operator licenses. This will facilitate maintaining the licensed operators' knowledge and ability and meet the guidance provided in Reg. Guide 1.206 for training program and operational program implementation.

Applicability

The Cold Licensing process for a new nuclear plant will terminate when the last licensing class initiated during the construction / preoperational test phases has taken a scheduled NRC License examination or the plant becomes operational, whichever is later.

Summary

The description and milestones described above provide a success path for the selection, training and licensing of operations personnel to support the safe fuel load and startup testing at each unit.

Table 1 Current NRC License Exemption Need and Alternative

Applicable Position	Requirement	Alternative Experience Activity
All	Pre-requisite experience requirements to enter training program	Experience requirements must be met prior to NRC license issuance
All	OJT time credited as training time	OJT time may be counted as on-site and nuclear power plant experience
All	Six months on-site at reactor for which license is sought	Completion of a site familiarization course designed on a systematic evaluation of site design features and operator site familiarization needs.
RO	One year on-site at the reactor for which the license is sought with six months as a NLO	<p>Completion of a site familiarization course designed on a systematic evaluation of site design features and operator site familiarization needs.</p> <p style="text-align: center;">and</p> <p>Completion of a site-specific non-licensed operator training program for critical non-licensed operator tasks.</p>
SRO (Non-degreed)	RO license actively involved in the performance of licensed duties for at least one year	<p>Completion of a site familiarization course designed on a systematic evaluation of site design features and operator site familiarization needs.</p> <p style="text-align: center;">and</p> <p>Completion of a combined RO and SRO course at the reactor for which the license is sought.</p>
SRO (Degreed)	At least twelve months performing responsible power plant engineering functions and at least six months on-site	Six Months Experience per A.1.

Table 1 cont'd

Applicable Position	Requirement	Alternative Experience Activity
<p>SRO (Degreed and Non-degreed)</p>	<ul style="list-style-type: none"> • At least 6 weeks of operation above 20% power, and • Startup from subcritical to 20% power, and • Shutdown from above 20% power to cold (less than 212°F) and subcritical, and • Startup preparations following a fueling or refueling outage. 	<p>Completion of a plant referenced Plant Operational Excellence course, based on a SAT analysis of the supervisory skill, knowledge, and ability required of a SRO.</p> <p style="text-align: center;">or</p> <p>Completion of an observation program, based on a SAT analysis of the supervisory skill, knowledge, and ability required of a SRO.</p>

Table 2 Cold Licensing Plan by Candidate Type

License Candidate	Education	Site Familiarization	NLO Critical Task Training	RO Training	Combined RO & SRO Training	Plant Operational Excellence Course Or Hot Plant Observation	Six Months Experience per A.1.	Preoperational Testing
RO	HS	Y	Y	Y			Y	Y
SRO – Degreed Manager or Degreed Non-licensed Operator or Technical Staff	BS Eng or Science	Y	Y		Y	Y	Y	Y
SRO-previous license, Military Equivalent,	HS	Y	Y		Y	Y-Note 1	Y	Y
SRO – Certified Instructor	HS	Y	Y		Y	Y	Y	Y

Note 1: No if previously licensed on hot plant and active for minimum of six months

Table 3 Nuclear Power Plant Experience Equivalencies* for Cold Licensing Candidates

Type of Experience	Weighting Factor	Max Credit	Justification
1. Commercial Nuclear Plant RO/SRO on same type plant (PWR/BWR)	1.00	No Limit	Task Analysis for same type plant are essentially the same
2. Commercial Nuclear Plant RO/SRO from different type plant (PWR/BWR)	0.75	No Limit	Task Analysis demonstrates that 75% of PWR/BWR tasks are similar
3. Military Nuclear Propulsion Plant Experience (RO, EWS, EOW)	0.5	36 months	For these military nuclear propulsion plant watch qualifications, approximately 50% of the job tasks are similar
4. Military Nuclear Propulsion Plant Experience (Other than watch qualifications in 3 above)	0.25	36 months	For these (other) watch qualifications, a range of similarities between job tasks (25-75%) exists, so a conservative value of 25% is credited
5. Commercial Power Plant Experience (Non-Nuclear) with Digital I&C platform	0.75	36 Months	Fossil Plants in the U.S. have undergone significant modernization of control platforms that are similar to the new nuclear plant control platforms
6. Commercial Power Plant Experience (Non-Nuclear) with analog control platform	0.5	18 months	Approximately 50% of fossil plant tasks are similar to a nuclear environment
7. Other Industrial Facility experience (chemical, petro-chemical, other heavy industry)	0.5	12 months	Approximately 50% of industrial plant tasks are similar to a nuclear environment
8. Reference Plant Simulator	5.00	12 months	Industry analysis demonstrated that activities completed in a simulator, compare to an operating Control Room, occur in a ratio of approx. 400/1

* Weighting factors and max credit values based on those identified in the “Industry Evaluation of Operating Shift Experience Requirements” By: J.H. Miller Jr. 2/24/1984, except where noted (areas with gray background are either a new category or a departure from credit values delineated in the referenced document)

Table 3 cont'd

Type of Experience	Weighting Factor	Max Credit	Justification
9. Limited Scope Simulator	3.00	9 months	Similar to Reference Plant Simulator justification. NRC weighting factor
10. Actual Nuclear plant experience during construction	0.25	12 months	Approximately 25% of the tasks during construction testing in preparation for system turnover to Ops is similar to an operating facility
11. Actual Nuclear plant experience during pre-operational testing	0.75	12 months	75% of tasks during pre-op are similar to an operating facility
12. Actual Nuclear plant experience during fuel load and startup testing	1.00	12 months	Tasks during initial startup are similar to operating facility
13. License Classroom training	0.25	9 months	Theory of ops and specific plant design knowledge is critical to an operator's success
14. Participation in Ops duties at another commercial nuclear facility	0.75	12 months	Task similarities
15. Other Nuclear Plant experience	0.25	12 months	Procedure writing, facility operation (water plant and other support facilities, etc)
16. License Class Instructor	0.5	12 months	Instructors will have participated in a training program that includes simulator, classroom (systems, theory)
17. Bachelors Degree in an Engineering, Science or Technical field	N/A	24 months	College work (in these fields) gives student an understanding of the fundamentals of plant operations
18. Bachelors Degree (non-technical)	N/A	6 Months	Verification (transcript review) would be require to grant equivalency
19. Associates Degree (technical)	N/A	6 Months	Student gains knowledge of fundamentals
<p>* Weighting factors and max credit values based on those identified in the "Industry Evaluation of Operating Shift Experience Requirements" By: J.H. Miller Jr. 2/24/1984, except where noted (areas with gray background are either a new category or a departure from credit values delineated in the referenced document)</p>			

Table 4 Shift Crew Cumulative Experience Requirements to Support Core Load

Crew Position	NRC License	Nuclear Plant Experience (Years) ⁽¹⁾	Power Plant Experience (Years) ⁽¹⁾
1. Shift Manager	SRO	2	4
2. Control Room Supervisor	SRO	2	3
3. RO	RO	1	3
4. BOP	RO	1	3
Cumulative Crew Experience Requirement		6	13

Notes:

1. Defined years of experience (by position) are recommended targets. The strict requirement is that the cumulative crew experience shall not be less than 6 years (Nuclear Plant) and 13 years (Power Plant). The Nuclear Plant experience includes the acceptable alternatives previously defined in the individual experience section. Table 4 shows an of example distribution of crew experience.

Table 5 Hot Plant Experience Alternatives

Crew Position	H1 Experience at Similar Design ⁽¹⁾ at > 20% Power	H2 Perform Startup & Shutdown at Similar Design ⁽¹⁾	H3 Experience as RO/SRO/STA ⁽³⁾ at Similar Design ⁽¹⁾	or	Plant Operational Excellence Course ⁽⁴⁾
Shift Manager	6 weeks ⁽²⁾	Yes ⁽²⁾	6 months ⁽²⁾		4 weeks
Control Room Supervisor	6 weeks ⁽²⁾	Yes ⁽²⁾	6 months ⁽²⁾		4 weeks
Shift Advisor ⁽⁵⁾			1 Year		4 weeks ⁽⁶⁾

Notes:

1. “Similar Design” is defined as commercial PWR or BWR (operator’s experience is at the same type plant)
2. The Startup/Shutdown and 6 month Hot Plant Experience requirements can be met by either crew SRO. Completion of the Plant Operational Excellence Course is an acceptable alternative to the Hot Plant Experience requirements
3. SRO Licensed STA
4. The Plant Operational Excellence Course is a (minimum) 4 week course that is required only for those candidates that do not have the required hot plant experience in columns H1, H2, and H3. The course includes:
 - Performance on a simulator of a complete plant startup and shutdown (from cold-plant to 100%, and returning to cold-plant), including performance of all supporting procedures for system and component startup/shutdown, surveillances to support mode changes, etc.
 - Routine operations including the processing of administrative documents such as safety tagging, work packages, surveillance documents, Technical Specification LCO entry and exit, Operability Determinations, etc.
5. The Shift Advisor position shall be staffed on each shift where crew SRO Hot Plant Experience (H1, H2, and H3) requirements are not met during initial core load and for the subsequent 6 months of plant operation, until crew experience requirements are met.
6. Training requirements for the Shift Advisor will be determined by an evaluation of the specific experiences of the candidate. This requirement may be waived if the candidate has completed other relevant training covering plant procedures, tech specs, plant systems, and simulator training at the facility.