NuScale Power, LLC

Inspections, Tests, Analyses, and Acceptance Criteria

Nonproprietary

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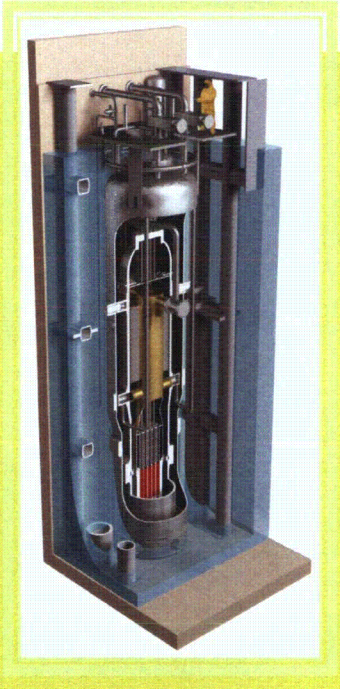

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July 18, 2012

NuScale Power™

Agenda

- Purpose
- Background and drivers
- ITAAC optimization strategy
- ITAAC categories
- ITAAC consolidation
- Aggregate benefit
- Related issues
- Next steps

Purpose

- Inform U.S. Nuclear Regulatory Commission (NRC) of ITAAC aspects unique to NuScale Power, LLC design
- Outline proposed strategy to manage ITAAC
- Obtain NRC agreement on NuScale strategy and structure
  - Identify potential regulatory challenges
  - Identify potential differences in Tier 1 structure

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Construction Sequence

- Site and shared systems and site programs completed with first reactor (Rx) unit
- Subsequent unit installation timeline will vary based on client needs
  - As frequently as one per month
  - Optionally, one per quarter
  - May be installed in groups (e.g., two every six months)

Regulatory Requirements

- 10 CFR 52.47 – Design Certification Application ITAAC
  - NUREG-0800, Section 14.3.
- 10 CFR 52.80 – Combined License Applications ITAAC
  - RG 1.206, "Combined License Applications for Nuclear Power Plants."
- 10 CFR 52.99 – ITAAC Closure and Maintenance
  - NEI 08-01, "Industry Guidance for the Closure of ITAAC Under 10 CFR 52."
  - RG 1.215, "Guidance for ITAAC Closure Under 10 CFR Part 52."

NuScale ITAAC Approach

- Engaged with NEI Construction Inspection Program Task Force
- Initial ITAAC design assessment completed
  - Essentially same scope as advanced light-water reactor (ALWR) ITAAC
  - ITAAC for passive features mimic AP1000 and Economic Simplified Boiling-Water Reactor (ESBWR)
  - Lessons learned from previous design certification applications considered
- AP1000 progress monitored

NuScale ITAAC Driver 1

- Driver 1 – ITAAC quantities
  - Application of current industry approach combined with 12 licensed units results in large ITAAC quantities
    - ~400 ITAAC for site and shared systems
    - ~500 ITAAC for individual unit structures, systems, and components (SSCs)
  - Estimates based on similar ITAAC for similar ALWR systems
  - Closing every ITAAC for every unit nets ~900 for each unit

NuScale ITAAC Driver 2

- Driver 2 – pronounced ITAAC surge
  - ITAAC closure rates driven by construction sequence

Unit Installation	Peak Monthly ITAAC Closure Rate
1 every month	460
1 every 2 months	370
1 every 3 months	280

  - Compares to typical ALWR peak of 85 ITAAC per month

NuScale ITAAC Driver 3

- Driver 3 – extended ITAAC maintenance periods
  - Unit installation could spread out over several years
  - ITAAC for site and shared systems (site ITAAC) completed and closed for Unit 1
  - Current practice would require ITAAC closure for each unit with the potential for extended ITAAC maintenance period
- Normal operational maintenance on site systems could trigger ITAAC maintenance issues
  - Could necessitate repetitive inspections, tests, or analyses
  - Single issues could trigger supplemental ICNs for multiple units
  - Enormous administrative burden

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ITAAC Optimization Strategy

- Goals
  - Develop ITAAC scope in accordance with regulations
  - Mitigate ITAAC surge
  - Close each ITAAC once
  - Reduce ITAAC count
  - Reduce ITAAC maintenance burden
- Strategies
  - Leverage Rx module and other factory equipment packages
  - When appropriate, credit operational programs for maintaining operability on shared SSCs after ITAAC closure

ITAAC Optimization Strategy

- ITAAC grouped into five categories:
  - Site ITAAC
  - Programmatic ITAAC
  - Factory ITAAC (i.e., at the factory)
  - Receipt ITAAC
  - Unit ITAAC (i.e., onsite)
- Consolidation – identical ITAAC across multiple systems consolidated into one or more ITAAC, when appropriate

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Site ITAAC — Scope

- Scope
  - Site and shared systems
  - Site programs (e.g., emergency planning and security)
- Completed under Unit 1 license
  - Site ITAAC completed and closed once for Unit 1 fuel load
  - Uniquely identified in Tier 1
- After first 10 CFR 52.103(g) finding, continued compliance assured by
  - Technical Specifications, Maintenance Rule, and preventive maintenance programs
  - Normal NRC reactor oversight process
- To be discussed in design control document (DCD)

Site ITAAC — Examples

- Control room habitability
  - ITAAC completed and closed for first unit
  - Continued operability ensured by Technical Specifications, Maintenance Rule, and control room habitability program
- Emergency response
  - Facilities and capability initially confirmed by ITAAC
  - ITAAC completed and closed for first unit
  - Continued compliance ensured by emergency response program, preventive maintenance programs, and periodic drills

Site ITAAC — Benefits

- No reduction in ITAAC scope
- Reduction in ITAAC quantity
  - Shared SSCs ITAAC – avoids multiple closure of 340 ITAAC
  - Site program ITAAC – avoids multiple closure of 60 ITAAC
- Corresponding reduction in overall administrative burden
- Reduction in ITAAC maintenance burden

Programmatic ITAAC — Scope

- Scope
  - Common engineering activities for each unit
  - Qualification activities and engineering analyses
  - Excludes unit-specific reconciliation analyses and as-built activities
- Closed under first unit
  - Completed and closed for Unit 1 fuel load
  - Uniquely identified in Tier 1
- ITAAC maintenance assures ITAAC continue to be met
  - ITAAC maintenance applies through Unit 12
  - Additional confirmation by reconciliation and as-built ITAAC

Programmatic ITAAC — Examples

- Environmental qualification-type testing
  - Identical components for each unit
  - Performed once for each component
  - Vendor configuration changes will trigger ITAAC maintenance
  - As-built ITAAC provide further confirmation
- Unit stress analysis
  - Identical piping design for each unit
  - Single analysis applicable to all units
  - As-built reconciliation ITAAC performed for each unit

Programmatic ITAAC — Benefits

- No reduction in ITAAC scope
- Reduction in ITAAC quantity
  - Avoids repetitive closure of ~90 ITAAC
- Surge mitigation
  - Programmatic activities completed early in construction sequence (or prior to combined operating license)
  - Closed once prior to Unit 1 fuel load
- Simplifies ITAAC maintenance
  - Supplemental ICNs submitted under single ITAAC
  - Avoids supplemental ICNs for every unit

Factory ITAAC — Scope

- Concept applies to integrated factory equipment packages
- Reactor module consists of Rx vessel, containment vessel, and internal components
- ~60 ITAAC currently identified
  - American Society of Mechanical Engineers (ASME) inspections and tests
  - Physical attributes and passive features (e.g., dimensions and volumes)
  - As-built confirmations for environmental, seismic, and functional qualification
  - Functional tests, where appropriate
- Other modularization opportunities under evaluation

Factory ITAAC — Scope

- Performance at factory consistent with NEI 08-01 and RG 1.215
  - Consistent with standard definition of "as-built"
  - DCD will clearly identify factory ITAAC (08-01 Rev 4., Sect. 8.5.1).
  - Scope of factory ITAAC generally conforms with "standard industry practice" (08-01 Rev.4, Section 8.5.2).
- ICNs submitted coincident with equipment package shipment
  - Continued validity assured by receipt ITAAC
  - Subsequent ITAAC at site confirm interfacing design features and integrated performance.

Factory ITAAC — Scope

- Concept applies only to integrated structures and components
  - Individual stand-alone components delivered to site (e.g., valves) handled in accordance with existing 08-01 guidance
    - ITAAC closure after final installation
    - Technical justification for remote performance provided in ICN

Receipt ITAAC — Scope

- Factory assembly integrity during shipment assured by dedicated receipt ITAAC
- Incorporates typical preservation and shipping considerations (corrosion, handling, foreign material exclusion)
- Receipt ITAAC remains open until assembly in final location
- No ITAAC maintenance anticipated for receipt ITAAC
  - ITAAC would not be completed until all discrepancies are resolved
  - Identified discrepancies handled under ITAAC maintenance for original factory ITAAC
  - Discrepancies discussed in ICN for receipt ITAAC

Factory and Receipt ITAAC — Benefits

- No reduction in scope
- Surge mitigation
  - ICNs submitted up to 12 to18 months prior to fuel load versus 2 to 3 months
  - Minimal increase of a few receipt ITAAC
- Increased efficiency and quality
- Execution in consistent and tightly controlled conditions
  - Dedicated personnel assuring efficient and accurate execution
- Efficient NRC oversight
  - Consistent schedule, location, conditions, and expectations

Standard Unit ITAAC

- Unit-specific SSCs ITAAC performed onsite
- Some performed during initial construction or prior to Rx module installation, for example,
  - ASME inspections and design reconciliations
  - As-built verifications and functional checks on site-installed components
  - Divisional separation

Standard Unit ITAAC

- Remainder performed after Rx module installation, for example,
  - Divisional power
  - Main control room control and indication
  - Testing of actuation logic
  - Functional arrangement

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ITAAC Consolidation — Scope

- Individual NuScale ITAAC are small in scope when compared to ALWRs
  - AP1000 charging and volume control system has 19 active safety-related valves compared to five for NuScale design
  - Welds on NuScale decay heat removal system constitute a small percentage of a typical ALWR

ITAAC Consolidation — Scope

- Identical ITAAC for multiple systems can be combined into a single ITAAC
  - For example, one unit ITAAC for ASME welds on unit SSCs
  - Net scope of individual NuScale consolidated ITAAC consistent with or smaller than large ALWRs
- Applies to site, programmatic, factory, and unit ITAAC

ITAAC Consolidation — Examples

- Electrical separation
  - Consolidated under buildings versus ITAAC for each electrical and I&C system
  - Similar to AP1000 approach
- ASME compliance
  - Specified in generic Tier 1 section on piping
  - Consolidated ITAAC for welding, hydrostatic tests, and inspections
    - System listing provided
  - Maintain separate ITAAC for factory and unit scope
  - Similar to, but more extensive than, advanced pressurized-water reactor approach
  - Design and stress reports handled under programmatic ITAAC

ITAAC Consolidation — Benefits

- No reduction in overall ITAAC scope
- ITAAC count reduced by up to 100 per unit
- Applied judiciously to minimize impact on ITAAC surge
- Separation maintained between factory and onsite unit ITAAC
  - For example, separate ASME weld ITAAC for factory and unit scope

Optimization Summary

ITAAC Category	Applies	Closure	Qty.	ITAAC Maint.	Location
Site	site SSCs and programs	once	400	no	onsite
Programmatic	all units	once	95	yes	remote
Factory	each assembly	each assembly	60	yes	remote
Receipt	each assembly	each assembly	1 min.	no	onsite
Unit	each unit	each unit	260	yes	onsite

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Aggregate Benefit

- No reduction in ITAAC scope
- First unit
  - 500 site and programmatic ITAAC completed and closed for first unit
  - 300 factory and unit ITAAC completed and closed for first unit
- Subsequent units
  - 300 factory and unit ITAAC completed and closed for each subsequent unit
- Reduced administrative burden for licensee and NRC
- Eliminates redundant NRC review and processing of closed issues (i.e., one issue, one review)

Aggregate Benefit

- Reduces ITAAC surge
  - Benefit varies depending on installation schedule

Module Installation	Peak Monthly Closure Rate	
	Before	After
1 every month	460	230
1 every 2 months	370	160
1 every 3 months	280	110

  - Compares to large ALWR peak of ~85 ITAAC per month

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Related Issues

- 225-day notification
  - ~220 ITAAC fall within 225-day window for each unit
  - Essentially the same list for each unit
  - Some site ITAAC will be included with first unit notice
- 10 CFR 52.103(g) finding
  - Need for Commission meetings and findings commensurate with installation schedule
  - As often as monthly

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Next Steps

- No apparent conflicts with Part 52
- NEI 08-01 provides guidance on ITAAC performed at other than final location
  - Strategy consistent with NEI 08-01 closure process
- Tier 1 structure will depart from ALWR system-based structure
  - Site and programmatic ITAAC addressed separately from unit and factory ITAAC
- Discussion of approach to revised application content and Design-Specific Review Standard (DSRS)
- Questions