Standardization of ITAAC for Part 52 Applications

Industry Perspectives

NRC Public Meeting

April 1, 2015

Agenda Topics

- Review of standardization process
- Feedback on NRC proposed draft ITAAC
- Proposed path forward

Purpose of ITAAC Standardization Effort

- Ensure appropriate ITAAC scope
  - Top level features, consistent with first principles rooted in NRC policy papers (e.g. SECY 90-241)
  - Enhance integration with other required programs/ processes (e.g., QAP, Preoperational Test Program, Operational Programs)
- Improve manageability of ITAAC process
  - Predictability during application review process
  - Mitigate bow-wave in ITAAC completion
  - Ensure ITAAC can be implemented and inspected
- Enhance consistency (~90% standardization for LWRs)
- Apply lessons learned from first generation ITAAC

ITAAC First Principles (1/2)

1. Tier 1 Design Descriptions and ITAAC consist of the top-level design features and performance characteristics.
   - Safety-related structures, systems and components
   - Nonsafety-related SSC that protect safety-related SSC
   - Other (e.g., Radiation Protection, Control Room habitability, Security)
   - Non-safety risk-significant SSC as determined by PRA (Design Specific)
2. Tier 1 Design Descriptions are derived solely from the Tier 2 design information, and ITAAC are derived solely from Tier 1.
3. The amount of detail in Tier 1 Design Descriptions is proportional to the safety significance of the design information contained in Tier 2 (i.e., a graded approach).

Application of ITAAC First Principles (2/2)

4. Tier 1 Design Descriptions only include fixed design features of SSC that will be completed during construction and installed prior to fuel loading, and are expected to be in place for the lifetime of the plant.
5. Tier 1 Design Descriptions and ITAAC are only established when necessary to provide reasonable assurance of compliance with applicable NRC regulations.
6. Tier 1 Design Descriptions reflect the Commission's intent to provide flexibility for DC holders and licensees to make certain changes without prior NRC approval.
7. Multiple provisions in the Tier 1 Design Descriptions may be verified by a single ITAAC.
8. ITAAC is a focused subset of the construction verification activities.

Assessment of Standardization Process

- Productive series of public meetings over the last 16 months
  - 11/19/2013 kick-off
  - 9 meetings in total; including today
  - 5 meetings to discuss proposed ITAAC from May 2014 to January 2015
- Significant alignment on ITAAC scope coming out of September 2014 NRC meeting
  - January 2015 meeting to further discuss ASME, Structural and Containment
- Has provided insights to near-term applicants

NRC-Proposed ITAAC

- NRC-proposed ITAAC reflect substantial progress
- Alignment on ~80% of ITAAC
- Inconsistent results; disciplines with significant interactions resulted in close alignment
- Many new ITAAC
  - Not previously discussed over several public meetings
  - Not found in other design certifications
- A few ITAAC changes are significant and adverse to clarity and/or intent

Significant Number of NRC Additions

Standard ITAAC Type	Symbol	# NEI Proposed ITAAC Types	# NRC Proposed ITAAC Types	# New NRC ITAAC Types
ASME	A	8	9	1
Backfill	B	0	3	3
Containment	C	4	6	2
DRAP**	D	1	1	0
Electrical	E	16	30	14
Fire Protection and Hazard Barriers	F/HB	8	12	4
HFE	H	2	2	0
I&C	I	19	28	9
Mechanical	M	26	36	10
Equipment Qualification	Q	9	10	1
Radiation Protection	R	6	19	13
Structural	S	8	9	1
Total		107	165	58

**Even though industry provided an ITAAC for DRAP, industry believes that no DRAP ITAAC is necessary

Red Text = Disciplines where significant differences have not benefited from public discussion

Functional Arrangement (FA) ITAAC

- FA ITAAC do not add value and are not necessary given:
  - Other ITAAC on specific SSCs and functions
  - QA Program implementation and oversight
  - Preoperational and startup testing
- NRC proposed seven (7) FA ITAAC
  - Mechanical, Radiation Protection, and Electrical
  - Scope is not consistent with first principles
    - Similar staff proposal reversed in 2011

Example of NRC-Proposed FA ITAAC

No.	ITAAC Category/Type	Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
M34	System Functional Arrangement	The functional arrangement of [XXX system] is	An inspection will be performed of the as-built [XXX system] to	The as-built [XXX system] functional
	Verification of functional arrangement of Components, Piping, and Supports in [XXX system]	consistent with design specifications.	verify that [components, piping, and supports] are functionally arranged consistent with design specifications.	arrangement is consistent with design specifications.

Mechanical ITAAC

No.	ITAAC Type	Industry Concern
M12	Safety-Related HVAC Design Temperature Control	Simulation of DBA conditions
M18	Control Room Envelope Pressurization Test	Duplicates other ITAAC (R06)
M19	Charcoal Absorber Efficiency Laboratory Testing	Test of a consumable
M22	[XXX filtration units] In-Place Leak Test	Test of a consumable
M34	Verification of functional arrangement of Components, Piping, and Supports in [XXX system]	Functional Arrangement
M35	Physical separation of divisions	Verified by other ITAAC

Example of NRC-Proposed Mech. ITAAC

No.	ITAAC Category/Type	Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
M19	**Vendor Test** Charcoal Absorber Efficiency Laboratory Testing	The [XXX filtration units] meet the laboratory test standards described in ASME Code AG-1 and RG 1.52 for carbon absorber efficiency.	A laboratory test will be performed of each charcoal absorber in accordance with the standards described in ASME Code AG-1 Section FE.	Charcoal absorber efficiency meets the acceptance criteria for laboratory testing per RG 1.52, Regulatory Position 7, when tested in accordance with the standards described in ASME Code AG-1, Section FE.

Radiation Protection ITAAC (1/2)

No.	ITAAC Type	Industry Concern
R04	[XXX system] Equipment	Seismic Qual. of non-safety
R07	[XXX system] High Radioactivity Automatic System Isolation/Alignment Test	Test Rad Monitor with source instead of safety function
R10	Radiation Shielding Integrity Assurance	Material of construction
R11	Radiation Barriers - Radiation Attenuating Doors	Locks on doors
R17	Engineered Safety Features (ESF) Heating, Ventilation, and Air Conditioning (HVAC) Duct Leakage Test	Not top-level, not associated with off-site dose
R18	Tank Failure Leakage Prevention	Material of construction
R19	Minimizing Contamination	Design philosophy

Radiation Protection ITAAC (2/2)

No.	ITAAC Type	Industry Concern
R12	Verification of Functional Arrangement of Components in the Liquid Waste Management System	Functional Arrangement
R13	Verification of Functional Arrangement of Components in the Gaseous Waste Management System	Functional Arrangement
R14	Verification of Functional arrangement of Components in the Solid Waste Management System	Functional Arrangement
R15	Verification of Functional arrangement of Components in the Effluent Monitoring System	Functional Arrangement
R16	Verification of Functional arrangement of Radiation Monitoring Equipment System	Functional Arrangement

Example of NRC-Proposed RP ITAAC

No.	ITAAC Category/Type	Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
R11	**As-built Inspection** Radiation Barriers - Radiation Attenuating Doors	The [YYY structure] radiation attenuating door(s) for very high radiation areas include locking features to prevent unauthorized access and allow unfettered egress.	An inspection will be performed of the as-built [YYY structure] radiation attenuating door(s) for very high radiation areas.	The [YYY structure] radiation attenuating door(s) for very high radiation areas include locking features to prevent unauthorized access and allow unfettered egress.

Electrical ITAAC

No.	ITAAC Type	Industry Concern
E05	Class 1E AC Electrical Equipment Capacity	Agree except for cables (level of detail)
E17	Division Separation and Functional Arrangement	Functional Arrangement
E19	Class 1E AC and DC Circuit Interrupting Device Verification	Level of detail
E21	Harmonic Distortion Waveforms	Cannot be performed before operations
E29	Class 1E electric power distribution cables and raceways	Level of detail

Example of NRC-Proposed Elec. ITAAC

No.	ITAAC Category/Type	Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
E19	**Preoperational Test** Class 1E AC and DC Circuit Interrupting Device Verification	The [XXX system] Class 1E feeder and load circuit breakers for the switchgear, load centers, and MCCs provide instantaneous and thermal overload fault protection.	A test will be performed of the [XXX system] as-built Class 1E feeder and load circuit breakers.	For each [XXX system] Class 1E circuit breaker listed in [Table x.x.x-x], the instantaneous and thermal overload trip points conform to the circuit breaker's design requirements and the breaker coordination analysis.

I&C ITAAC

No.	ITAAC Type	Industry Concern
I02	Software Lifecycle Implementation for Protection System	Verification of QA Program
I05	Class 1E [XXX system] power sources	Design specific
I06	Qualification and Inspection of electrical isolation devices	Level of detail
I15	Protection System Reactor Trip Breakers Arrangement	Functional Arrangement
I24	Main Control Room and [Remote Shutdown Station] Displays and Alarms	Expanded beyond HFE displays and alarms
I25	[XXX system] controls located on the [YYY] operator workstations in the MCR and [RSS]	Expanded beyond HFE controls
I27	Self-testing features	No ITAAC for test capability
I28	Protection system setpoint determination	No ITAAC for methodologies

Example of NRC-Proposed I&C ITAAC

No.	ITAAC Category/Type	Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
I02	**Design Analysis** Software Lifecycle Implementation for Protection System	Protection System design and software are implemented using a quality process.	An analysis will be performed on the Protection System implementation of the quality process.	The Protection System design and software were implemented in accordance with the Protection System quality process.

Fire Protection and Barriers ITAAC

No.	ITAAC Type	Industry Concern
F05	Post-Safe Shutdown Earthquake Fire Protection System Function	Seismic Qual. of non-safety system
F06	Enhanced Fire Protection Safe-Shutdown Capability	Scope includes inspection
F07	Fire Hazards Analysis	Scope includes inspection

ITAAC for RTNSS[1] SSC

- Some RTNSS SSC will have associated ITAAC
- The scope of RTNSS SSC is design specific
  - Based on PRA insights
  - Scope of associated ITAAC will reflect a graded approach
- Industry guidance will propose approach for design-specific determination of RTNSS ITAAC
- Scope of EQ ITAAC should not include non-safety-related SSCs

[1] Regulatory Treatment of Non Safety Systems (RTNSS), see RG 1.206

Design Reliability Assurance Program (DRAP)

- Industry continues to recommend deletion of the DRAP ITAAC
  - Revisit NRC policy on DRAP ITAAC
  - DRAP ITAAC does not add value and is not necessary
  - Programs should not be ITAAC (per first principles)
  - QA Program will ensure design control

SAFETY-RELATED VALVE ITAAC

(EXAMPLE: SAFETY-RELATED, REMOTELY-OPERATED, CONTAINMENT ISOLATION AOV)

29 Total ITAAC

Containment

***Containment* ITAAC**

As-built Inspections

- Containment Leak Rate Tests (10 CFR Part 50, Appendix J) (C04)
- Containment Isolation Valve Closure Time (C05)
- Containment Isolation Valve Position (C06)

Containment ITAAC

DC Power to Operate Valve

***Electrical* ITAAC (DC Power Source)**

Design Analysis

- Class 1E AC and DC Circuit Interruption Devices Coordination Analysis (E04)

As-built Inspections

- Physical Separation of Class 1E Electrical Circuits (E02)
- Electrical Isolation of Class 1E Power Circuits (E03

Preoperational Tests

- Class 1E Electrical Divisional Power Verification (E01)

DC Power Supply

Valve Qualification

***Equipment Qualification* ITAAC**

- Safety-Related Mechanical, Electrical, and Instrumentation & Control Equipment Seismic Category I Qualification/ Installation (Q01)*
- Class 1E Electrical Equipment Harsh Environment Qualification/ Installation (10 CFR Part 50.49) (Q02)*
- Safety-Related Mechanical Equipment Harsh Environment Qualification (Q03)
- Safety-Related [Digital or Analogue] Equipment Mild Environment Qualification/ Installation (Q04)*
- Instrumentation & Control Class 1E Digital Equipment EMI, RFI, ESD and SWC Qualification (Q05)
- Safety-Related Valve Functional Qualification (Q06)

*ITAAC Q01 Q02 and Q04 have two parts: (i) verification of qualification testing and (2) as-built inspection at design location

Equipment Qualification

I&C Systems Necessary to Provide Engineered Safeguards Equipment Actuation

***I&C* ITAAC**

As-built Inspections

- Physical Independence Between Redundant Class 1E I&C Circuits (I02)
- Physical Independence Between Class 1E I&C Circuits and non-Class 1E Circuits (I03)
- Electrical Isolation Between Redundant Class 1E I&C Circuits (I04)
- Electrical Isolation Between Class 1E I&C Circuits and non-Class 1E Circuits (I05)

Preoperational Tests

- Protection System Automatic Control – ESF Equipment Actuation (I12)
- Protection System Manual Control – ESF Equipment Actuation (I14)
- Protection System Completion of Protective Actions (I15)
- Response Time Testing of ESF Equipment Actuation (I16)
- Minimum Inventory of Main Control Room and Remote Shutdown Workstation Displays and Alarms (I20)
- Minimum Inventory of Main Control Room and Remote Shutdown Workstation Manual Controls (I21)

I&C Controls and Indication

Mechanical

Reactor Coolant Pressure Boundary (RCBP) (Fission Product Barrier)

***Mechanical* ITAAC**

As-built Inspection

- ASME Section III Piping System Design Report - As-built Design Reconciliation (A02)
- ASME Section III Code Class 1, 2 and 3 Component Data Report (A03)
- Pipe Break Hazards Protective Features Verification and Design Reconciliation (A06)
- Outboard Containment Isolation Valve Location (C06)

Preoperational Tests

- Safety-Related Remotely Operated Valve Functional Test During Preoperational Test Conditions (M06)
- Safety-Related Air- Operated Valve Fail Position on Loss of Motive Power (M08)

Containment Isolation Valve Safety-Related Component Functions

- Maintains Containment Pressure Boundary under design basis accident conditions
- Achieves its safe position (close) by receipt of control signal from the Protection System.
- Fails close on loss of air.

Summary

- Application of first principles has improved the focus of ITAAC scope
- Standardized ITAAC enhance clarity and consistency
- Alignment on a large portion of ITAAC scope

Proposed Path Forward

- NEI will submit guidance, NEI 15-02, by April 30th
  - Incorporates NRC feedback to maximize alignment on standardized ITAAC
  - Will include underlying Tier 1/ITAAC guidance (e.g., first principles and lessons learned)
  - Will include guidance to design certification applicants
- NRC review of industry guidance
  - Provides process to formally document alignment on ITAAC
  - Provides timely and efficient feedback to near-term applicants
  - Endorsement through a regulatory guide