

NRC INSPECTION MANUAL

IRAB

INSPECTION MANUAL CHAPTER 1245, APPENDIX C15

CONSTRUCTION INSPECTOR TECHNICAL PROFICIENCY
TRAINING AND QUALIFICATION JOURNAL

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Introduction

The qualification in this appendix, Construction Inspector, contains the technical proficiency requirements for inspectors who perform inspections at all NRC regulated facilities under construction. The intent is to qualify the inspector to perform construction-related inspections at NRC regulated facilities, up to and including pre-operational testing. It is not intended to qualify inspectors to perform operational inspections, such as start-up testing. Additional NRC inspector qualification or equivalent inspector experience should be considered prior to inspectors performing operational inspections, such as start-up testing.

General Guidance

- Complete all parts of each activity.
- Do not begin the activities or complete the courses in this qualification journal until you have completed the Basic Inspector Certification Journal contained in Appendix A.
- You may complete the General Proficiency requirements contained in Appendix B concurrently with the Technical Proficiency requirements outlined in this journal.
- Your supervisor will act as a resource as you complete each activity. Discuss any questions you may have about how a task must be done or how the guidance is applied. Your supervisor may also designate other fully qualified inspectors to work with you as you complete the various activities.
- You are responsible for keeping track of what tasks you have completed. Ensure you have completed all aspects of the rotation (qualification task ROT-1), if available, before you meet with your supervisor for evaluation.

Required Construction Inspector Training Courses

These courses can be taken in any order:

- Power Plant Engineering (E-110) (course or self-study)
- Reactor Technology overview (104 P or B)
- Advance Technology Differences Course (R107 P or B)
- **G-113: Construction Reactor Oversight Process (cROP)**
- F-201 or F-201S: Fuel Cycle Processes
- Quality Assurance Course, as designated by Supervisor (e.g., external training such as the Electric Power Research Institute (EPRI) Nuclear Utility Procurement Training Course, or another course similar to previous NRC course E-301 "Quality Assurance Program Training.")

Construction Inspector Individual Study Activities

Construction Inspector Individual Study Activity

TOPIC: (ISA-1) Title 10, "Energy," of the Code of Federal Regulations

PURPOSE: The purpose of this activity is to familiarize you with the contents of Chapter 1 of Title 10 of the *Code of Federal Regulations* (CFR). This activity will provide you with a working knowledge of the contents of Title 10, Parts 1 through 199, and an understanding of the broad spectrum of requirements associated with your inspection activities.

The CFR is a codification of the rules published in the *Federal Register* by the executive departments and agencies of the Federal Government. Title 10 represents the broad area of energy, and Chapter 1, Parts 1 through 199, pertain to the U.S. Nuclear Regulatory Commission (NRC), an independent agency established by the Congress of the United States under the Energy Reorganization Act of 1974. NRC rules and regulations are established to ensure adequate protection of public health and safety, the common defense and security, and the environment in the use of nuclear materials in the United States.

COMPETENCY
AREAS:

INSPECTION
REGULATORY FRAMEWORK

LEVEL OF
EFFORT:

40 hours

REFERENCES:

Chapter 1, Parts 1 through 199, of the *Code of Federal Regulations*
Energy Reorganization Act of 1974

EVALUATION
CRITERIA:

At the completion of this activity, you should be able to do the following:

1. Discuss the broad requirements and significance of the following parts of Title 10 of the *Code of Federal Regulations*. You should develop a general sense of what the requirements are and where the following requirements are located:
 - a. 10 CFR Part 25, "Access Authorization for Licensee Personnel"
 - b. 10 CFR Part 26, "Fitness for Duty Programs" with emphasis on the difference between construction and operating reactors
 - c. 10 CFR Part 40, "Domestic Licensing of Source Material"
 - d. 10 CFR Part 70, "Domestic Licensing of Special Nuclear Material"
 - e. 10 CFR Part 73, "Physical Protection of Plants and Materials" with emphasis on the difference between construction and operating reactors
 - f. 10 CFR Part 100, "Reactor Site Criteria"

2. Discuss the broad requirements and significance of 10 CFR Part 52, “Licenses, Certifications, and Approvals for Nuclear Power Plants,” especially the following appendices:
 - a. Appendix C, “Combined Licenses”
 - b. Appendix D, “Design Certification Rule for the AP1000 Design”
 - c. Appendix E, “Design Certification Rule for the ESBWR Design”
 - d. Appendix H, “Enforcement”

TASKS:

1. Perform a detailed review of the 10 CFR parts listed above and perform a broad overview of 10 CFR Parts 1-199. Understand key items, including any differences between construction and operating facilities.
2. Review several enforcement actions issued to licensees with respect to the various Title 10 Parts. These can be found by using the [Office of Nuclear Reactor Regulation \(NRR\) Dynamic Web Page](#), [NRR Reactor OpE Information Gateway](#), the [ConE database](#), or by searching inspection reports on the [NRC public web page](#). Discuss compliance issues with various Parts of Title 10 with senior inspectors, senior project engineers, or senior residents.
3. Meet with your supervisor, or a qualified operations inspector, to demonstrate your understanding of the evaluation criteria.

DOCUMENTATION: Construction Inspector Technical Proficiency-Level Qualification Signature Card Item ISA-1.

Construction Inspector Individual Study Activity

TOPIC:	(ISA-2) Overview of 10 CFR Part 21, "Reporting of Defects and Noncompliance"
PURPOSE:	The purpose of this activity is to familiarize you with 10 CFR Part 21 "Reporting of Defects and Noncompliance." These regulations require notification to the NRC of defects by suppliers of basic components. This individual study activity will help you understand the purpose of 10 CFR Part 21 and provide you with some basic knowledge that NRC inspectors will use when conducting construction inspections.
COMPETENCY AREA:	REGULATORY FRAMEWORK
LEVEL OF EFFORT:	20 hours
REFERENCES:	<p>10 CFR Part 21, "Reporting of Defects and Noncompliance"</p> <p>Issued Part 21 Reports (can be found on the NRC Public Website: Home > NRC Library > Document Collections > Events, Reports > Part 21 Reports)</p> <p>Generic Letter 89-02, "Actions to Improve the Detection of Counterfeit and Fraudulently Marketed Products"</p> <p>Generic Letter 91-05, "Licensee Commercial-Grade Procurement and Dedication Programs"</p> <p>Inspection Procedure (IP) 43004, "Inspection of Commercial-Grade Dedication Programs"</p> <p>Regulatory Guide 1.164, "Dedication of Commercial-Grade Items for Use in Nuclear Power Plants"</p> <p>Vendor Workshop on Commercial-Grade Dedication (can be found on the NRC Public Website: Home > Nuclear Reactors > New Reactors > Oversight > Reactor Quality Assurance > Workshops on Vendor Oversight for New Reactor Construction > 2008)</p>
EVALUATION CRITERIA:	<p>Upon completion of this activity, you will be asked to demonstrate your general understanding of 10 CFR Part 21 and why these regulations are important by successfully addressing the following:</p> <ol style="list-style-type: none">1. Describe the general purpose of 10 CFR Part 21.2. Discuss the basis for the applicability of 10 CFR Part 21 to applicants, licensees, vendors and suppliers.

3. Define a defect in the context of 10 CFR Part 21.
4. Identify what 10 CFR Part 21 requires to be reported. Describe the notification requirements of 10 CFR 50.55(e) and explain the relationship of this part to 10 CFR Part 50 and Part 21.
5. Discuss the definitions of basic component, commercial grade item, critical characteristics, and dedication.
6. Describe the process of selecting critical characteristics and how 10 CFR Part 50, Appendix B relates to the process.
7. Describe the different methods for acceptance of commercial-grade items, any restrictions on use of these methods, and how 10 CFR Part 50, Appendix B relates to the acceptance methods.
8. Discuss why it is important for every NRC inspector to have a general understanding of 10 CFR Part 21.
9. Discuss Enforcement Actions to be taken for 10 CFR Part 21 issues discovered by an inspector

TASKS:

1. Review 10 CFR Part 21 for a general understanding of the following:
 - a. The purpose of 10 CFR Part 21 [21.1]
 - b. The meaning of commercial grade item dedication [21.3]
 - c. The relationship of 10 CFR Part 21 to Part 50.55(e) [21.2(b)]
 - d. Documents that are required to be posted [21.6]
 - e. Requirements for reporting defects [21.21(d)(4)]
2. Locate and review issued 10 CFR Part 21 reports. Discuss experiences with senior inspectors and residents.
3. Meet with your supervisor or the person designated to be your resource for this activity and discuss the items listed in the Evaluation Criteria section.

DOCUMENTATION:

Construction Inspector Technical Proficiency-Level Qualification
Signature Card Item ISA-2.

Construction Inspector Individual Study Activity

TOPIC: (ISA-3) Design Control Document

PURPOSE: The purpose of this activity is for you to learn about a key document related to the licensing and construction of a new plant under 10 CFR Part 52. A design control document (DCD) is a repository of information about a standard design certified under 10 CFR Part 52. Under 10 CFR Part 52, a reactor design can be submitted to the NRC for review and approval, even if there are no applicants to build the plant. The applicant submits sufficient design information such that the staff can make an overall determination of the design adequacy as it relates to safety and risk. Typically, the information needed to certify a design includes the principal plant systems and components and their corresponding inspections, tests, analysis, and acceptance criteria (ITAAC). In addition to the detailed design information, the applicant also provides information about the site parameters (e.g., the postulated physical, environmental, and demographic features of an assumed site) for a plant and the other system interfaces that will be needed to support the safe operation of the reactor. 10 CFR Part 52 also requires the applicant to provide other types of information for use in the future when an applicant for a combined license references an already certified design.

This ISA focuses on the AP1000 and advanced boiling-water reactor (ABWR) DCDs with the intent of highlighting the differences in these documents. This approach will show how these and future DCDs may vary and should sensitize the inspector to the differences that can be encountered from various certified designs.

COMPETENCY AREAS: REGULATORY FRAMEWORK

LEVEL OF EFFORT: 8 hours per design

REFERENCES: 10 CFR Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants"

Inspection Manual Chapter (IMC) 2508, "Construction Inspection Program: Design Control Documents"

NUREG-0800, "Standard Review Plan"

EVALUATION CRITERIA: At the conclusion of this activity, the inspector should be able to:

1. Define the following terms:
 - a. Design Control Document (DCD)
 - b. Tier 1 information
 - c. Tier 2 information

- d. Tier 2* information
- e. Inspections, tests, analysis, and acceptance criteria (ITAAC)
- f. Design Acceptance Criteria (DAC)

2. Explain the relationship between Tier 1 and Tier 2 information.
3. Describe the kind of information required to be provided by a combined operating license (COL) applicant as described in the DCD.
4. Compare and contrast the methods required to make changes to Tiers 1, 2, and 2* information.
5. Locate the ITAAC information and tables in the DCD.
6. Identify the kind of information available in the Tier 2 section of the DCD.
7. Discuss in detail why DAC were used as part of the design certification and demonstrate an understanding of the practical application of DAC.
8. Discuss in detail the different definitions of “as built” in each design. Describe how these differences can affect inspection planning.

TASKS:

1. Locate the DCD for the AP1000 and the ABWR on the Construction Inspection Program webpage. This site can be accessed via cROP website and the NRR websites.
2. Look at the organization of both DCDs.
3. Read the Introduction to the DCD section for each design.
4. Review Chapter 1 of Tier 1 for each design. Within the General Provisions sections take particular note of:
 - a. Treatment of individual items
 - b. Implementation of ITAAC
 - c. Verification for Basic Configuration for Systems for ABWR

Consider how the differences between these sections may affect inspection planning.

5. In both DCDs review the content, format, and presentation of the ITAAC
6. Read the definitions for the terms listed in evaluation criterion 1 a-f, in both the AP1000 and the ABWR.
7. Review the content and format of Tier 2 for AP1000 and ABWR.

8. Read the description of DAC in Chapter 14.3 of NUREG-0800, the Standard Review Plan.
9. Review the ITAAC for Human Factors Engineering for both designs as related to DAC.
10. Meet with your supervisor, mentor, or a qualified construction inspector to discuss any questions you may have as a result of this activity. Discuss the answers to the questions listed under the Evaluation Criteria section of this study guide with your supervisor.

DOCUMENTATION:

Construction Inspector Technical Proficiency-Level Qualification
Signature Card Item ISA-3.

Construction Inspector Individual Study Activity

TOPIC:	(ISA-4) Significance Determination Process for Construction Inspection Findings
PURPOSE:	The purpose of this activity is to familiarize you with the Construction Significance Determination Process (SDP). The SDP uses risk insights, where appropriate, to help NRC inspectors and staff determine the safety or security significance of inspection findings identified within the six cornerstones of safety at nuclear reactors that are under construction. The SDP is a risk-informed process and the resulting safety significance of findings is used to define a licensee's level of safety performance in constructing the facility and to define the level of NRC engagement with the licensee. The construction SDP supports the cornerstones that are associated with the strategic performance areas as defined in IMC 2506, "Construction Reactor Oversight Process General Guidance and Basis Document" and IMC 2200, "Security Program for Construction." The SDP determinations for inspection findings are used in assessing licensee performance in accordance with guidance provided in IMC 2505, "Periodic Assessment of Construction Inspection Program Results."
COMPETENCY AREAS:	INSPECTION TECHNICAL AREA EXPERTISE REGULATORY FRAMEWORK
LEVEL OF EFFORT:	16 hours
REFERENCES:	IMC 2519, "Construction Significance Determination Process" IMC 2506, "Construction Reactor Oversight Process General Guidance and Basis Document" IMC 2200, "Security Program for Construction"
EVALUATION CRITERIA:	At the completion of this activity, you should be able to do the following: <ol style="list-style-type: none">1. Explain the purpose, objectives, and applicability of the Construction SDP.2. Describe and discuss the objective of the six cornerstones and three strategic performance areas of Construction.3. Define the safety significance and give examples of Green, White, Yellow, and Red findings.

4. Explain how Construction findings are assessed using the Significance Determination Matrix in Appendix A of IMC 2519. Explain when findings would be processed using Appendix M of IMC 2519.
5. Discuss the Significance and Enforcement Review Panel (SERP) process and purpose, information contained in a SERP package, and the inspector's role during the SERP as described in IMC 2519, Exhibits 2-3 and Attachment 1.
6. Discuss the "Process for Appealing NRC Characterization of Inspection Findings (SDP appeal process)" as described in IMC-2519, Attachment 2.

TASKS:

1. Read the referenced section of IMC 2519, with a particular focus on Appendix A.
2. Go to the Construction Reactor Oversight Process (cROP) Web site under section Plant Assessment & Results. Review the individual plant performance summaries for a sample of Green, White, Yellow, and Red findings in each of the six cornerstones (if samples of each safety significance are posted).
3. Using a previous construction inspection finding, process the finding using the screening questions for the Appendix A to IMC 2519. Discuss your results with your supervisor or a qualified inspector, specifically discussing the methodology used to determine the following:
 - a. Performance deficiency
 - b. If the performance deficiency is more than minor
 - c. If the issue is Green or if a more detailed risk evaluation is required. Be able to justify your determination.
 - d. Compare your conclusion with those given in the actual findings.
4. Whenever possible, attend a SERP. If you are unable to attend a SERP, review IMC 2519, Attachment 1 and an actual SERP package to develop an understanding of the SERP purpose, process, and the contents of the SERP package. Discuss the rationale for the outcome/resolution of the panel with a qualified inspector.
5. Meet with your supervisor or a qualified inspector to discuss any questions you may have as a result of this training activity.

DOCUMENTATION: Construction Inspector Technical Proficiency-Level Qualification Signature Card Item ISA-4. Construction Inspector Individual Study Activity.

TOPIC: (ISA-5) Fuel Cycle Process Fundamentals

PURPOSE: The purpose of this activity is to provide a basic overview of the nuclear fuel cycle. This individual study activity will help you to understand the common processes of the nuclear fuel cycle.

COMPETENCY AREAS: REGULATORY FRAMEWORK

LEVEL OF EFFORT: 16 hours

REFERENCES: Fuel Cycle Process (F-201S) Self Study Course

- (F-201S) Module 1.0
- (F-201S) Module 4.0, Learning Objective 4.1.4
- (F-201S) Module 4.0, Learning Objective 4.1.5
- (F-201S) Module 4.0, Learning Objective 4.1.6
- (F-201S) Module 5.0, Learning Objective 5.1.1
- (F201S) Module 5.0, Learning Objective 5.1.10

EVALUATION CRITERIA: Upon completion of this activity, you will be asked to demonstrate your general understanding of the commercial nuclear fuel cycle applications of nuclear energy, by successfully discussing the following concepts:

1. Discuss in general the nuclear fuel cycle as described in Module 1.0.
2. What isotope of uranium is preferred for enrichment and why?
3. Describe basic steps of the gas centrifuge uranium enrichment process.
4. Refer to the reference material and discuss the hazards of UF_6 and the gas centrifuge enrichment operation.
5. Refer to the reference material and describe the basic steps of the laser-based uranium enrichment processes (AVLIS, MLIS, and SILEX).
6. Refer to the reference material and discuss the hazards of the laser based enrichment processes.
7. Discuss the meaning of Items Relied On For Safety (IROFS) as related to fuel fabrication facilities.

8. Discuss why the NRC regulates fuel fabrication facilities.
9. Describe mixed oxide (MOX) fuel and its purpose.
10. What are the intended products of the MOX Fuel Fabrication Facility (MFFF)?
11. What is the current intent of the MOX program?
12. What facility/country is the United States MFFF based upon and where is it being built?

TASKS:

- Option 1: Review the references material to gain an understanding of the principles discussed in the evaluation material; review and discuss the evaluation criteria with your supervisor, mentor, or a qualified construction inspector.
- Option 2: Complete the Fuel Cycle Process (F-201) course or self study course (F201S).

DOCUMENTATION: General Proficiency Certification Signature Card, Item ISA-5

Or

General Proficiency Certification Signature Card Item Training Course
F-201/F201S: Fuel Cycle Process/Directed Self Study

Construction Inspector Individual Study Activity

TOPIC: (ISA-6) Fuel and Non-Power Producing Facilities

PURPOSE: The purpose of this activity is to provide a basic understanding of the Construction Inspection Program (CIP) for fuel facilities and non-power production and utilization facilities (NPUFs) under 10 CFR Parts 30, 40, 50, and 70.

The fuel facility and NPUF CIPs apply to all safety related construction activities, including, design, procurement, fabrication, construction, pre-operational testing activities, and development of programs required for operation. Implementation of IMCs 2630, 2696, and 2550 will begin at NRC issuance of the Construction Permit and will continue through completion of construction. The IMCs implementing this CIP will provide reasonable assurance that the design and construction of fuel facilities and NPUFs have been completed in accordance with applicable regulations, license requirements, and commitments.

COMPETENCY AREA: INSPECTION

LEVEL OF EFFORT: 16 hours

REFERENCES: IMC 2630, "Mixed Oxide Fuel Fabrication Facility Construction Inspection Program"

IMC 2696, "Louisiana Energy Services Gas Centrifuge Facility Construction and Pre-Operational Readiness Review Inspection Programs"

IMC 2550, "Non-Power Production and Utilization Facilities (NPUFs) Licensed under 10 CFR Part 50: Construction Inspection Program (CIP)"

10 CFR Part 30, Rules of General Applicability to Domestic Licensing of Byproduct Material

10 CFR Part 40, Domestic Licensing of Source Material

10 CFR Part 50, Domestic Licensing of Production and Utilization Facilities

10 CFR Part 70, Domestic Licensing of Special Nuclear Material

Online information and discussions with cognizant branch chiefs and/or inspectors

EVALUATION

CRITERIA:

Upon completion of the tasks, you should be able to demonstrate your general understanding of the fuel facilities and NPUFs, by discussing the following topics:

1. Describe the importance and purpose of the following types of fuel facilities and NPUFs facilities:
 - a. Mixed Oxide Fuel Fabrication Facility
 - b. Gas Centrifuge Facilities (URENCO USA, formerly the National Enrichment Facility)
 - c. Molybdenum-99 Production Facilities such as Subcritical Hybrid Intense Neutron Emitter (SHINE) Medical Technologies, Northwest Medical Isotopes (NWMI), and Coqui (Coquí Radiopharmaceuticals)
2. Discuss which parts of 10 CFR the fuel facilities and NPUFs fall under during construction.
3. Describe the CIPs as specified below:
 - a. Discuss how the Fuel and Non-Power Producing Facilities, such as the Mixed Oxide Fuel Fabrication Facility (MOX), construction inspection program requirements will verify that the construction of the principal systems, structures, and components (PSSCs) and items relied on for safety (IROFS) have been completed in accordance with the construction authorization and license application to possess and use special nuclear material.
 - b. Discuss how the Fuel and Non-Power Producing Facilities, such as the URENCO USA facility, construction inspection program requirements will verify that the construction of the IROFS was completed in accordance with the documents comprising the license application (Safety Analysis Report (SAR), etc.); the Integrated Safety Analysis (ISA), the Integrated Safety Analysis Summary (ISAS), and the Safety Evaluation Report (SER).
 - c. Discuss how the Fuel and Non-Power Producing Facilities, such as the SHINE Medical Technologies facility, construction inspection program requirements will verify that the construction of the safety-related systems, structures and components (SSCs) was completed in accordance with the documents comprising the license application (Preliminary Safety Analysis Report (PSAR) and Final Safety Analysis Report (FSAR)); the Construction Permit (CP), and the Safety Evaluation Report (SER).
4. Demonstrate general understanding of the Digital Information Archive for Mixed Oxide Fuel Fabrication Facility (MFFF) and Online Normalized Database (DIAMOND).

TASKS:

1. Locate and review the listed references to understand the importance, purpose, and construction inspection programs of fuel facilities and NPUFs.
2. For the following construction fuel facilities and NPUFs the NRC currently inspects, understand which parts of 10 CFR they fall under.
 - a. Mixed Oxide Fuel Fabrication Facility (10 CFR 70.23(a)(8))
 - b. URENCO USA (10 CFR 40.41(g) and 10 CFR 70.32(k)) – possible future expansion
 - c. SHINE Technologies, Inc. (Regulatory requirements for SHINE construction permit):
 - i. 10 CFR 50.22, Commercial and industrial facility licenses
 - ii. 10 CFR 50.30, Environmental Report
 - iii. 10 CFR 50.34(a), Preliminary safety analysis report
 - iv. 10 CFR 50.35, Issuance of construction permits
3. After researching online, or talking to a cognizant branch chief or inspector, be able to describe the status of the domestic supply of Molybdenum-99, and how SHINE Medical Technologies proposes to produce Molybdenum-99.
4. Perform the following tasks related to DIAMOND:
 - a. Locate DIAMOND from the RII home web page
 - b. Navigate DIAMOND and locate the following:
 - i. Open and closed items
 - ii. PSSC Central (inspection verification plans, scoping documents)
 - iii. Inspection Reports
 - iv. Licensing documents (construction authorization request, license application, integrated safety analysis, safety evaluation report, and quality assurance plan)
5. Meet with your supervisor or a qualified operations inspector to discuss any questions that you may have as a result of these activities and demonstrate that you can meet the evaluation criteria.

DOCUMENTATION:

Construction Inspector Technical Proficiency-Level Qualification
Signature Card Item ISA-6.

Construction Inspector Individual Study Activity

TOPIC:	(ISA-7) Industry Codes & Standards
PURPOSE:	The purpose of this activity is to introduce you to some of the basic Codes, NRC Regulatory Guides (RG) and associated industry standards commonly used during construction activities. The list is not inclusive but it does contain the major documents that will be utilized during construction and fabrication.
COMPETENCY AREAS:	INSPECTION
LEVEL OF EFFORT:	40 hours
REFERENCES:	See the attached list of References for ISA-7
EVALUATION CRITERIA:	<p>At the completion of this activity, and as determined by the supervisor, inspectors should be able to:</p> <ol style="list-style-type: none">1. Identify the general codes commonly used by construction inspectors and discuss the topics included in these codes.2. Discuss the relationship between RGs (guidelines) and industry standards (accepted methodologies).3. Identify the RG and associated industry standards that address the 10 CFR Part 50, Appendix B, Quality Assurance (QA) Criteria. Discuss the topics included in the RG and industry standards associated with each.
TASKS:	<ol style="list-style-type: none">1. For the appropriate technical area, locate and review each of the documents listed in the attached list of references.2. When available, complete NRC or SF-182 equivalent training related to relevant Industry Codes and Standards. This is a post qualification requirement and not a prerequisite to completing this ISA.3. Meet with your supervisor, mentor, or a qualified construction inspector to discuss any questions you may have as a result of this activity. Discuss the answers to the questions listed under the Evaluation Criteria section of this study guide with your supervisor.
DOCUMENTATION:	Construction Inspector Technical Proficiency-Level Qualification Signature Card Item ISA-7.

References for ISA-7

General

10 CFR Part 50	Appendix A, General Design Criteria for Nuclear Power Plants
10 CFR 50.46	Acceptance Criteria for Emergency Core Cooling Systems for Light-Water Nuclear Power Reactors
10 CFR 50.49	Environmental Qualification of Electric Equipment Important to Safety for Nuclear Power Plants
10 CFR 50.55a	Codes and Standards

The American Society for Mechanical Engineers (ASME)

Boiler & Pressure Vessel Code

Section II	Materials
Section III	Nuclear
Section V	Nondestructive Examination
Section VIII	Pressure Vessels
Section IX	Welding and Brazing Qualifications
Section XI	Inservice inspection

Civil/Structural

American Concrete Institute (ACI)

ACI 117	Tolerances for Concrete Construction and Materials
ACI 214	Recommended Practice for Evaluation of Strength Test Results of Concrete
ACI 301	Specifications for Structural Concrete
ACI 304	Measuring, Mixing, Transporting and Placing Concrete
ACI 305	Hot Weather Concreting
ACI 306	Cold Weather Concreting
ACI 304	Guide for Measuring, Mixing, Transporting and Placing Concrete
ACI 308	Curing Concrete
ACI 309	Consolidation of Concrete
ACI 311	Recommended Practice for Concrete Inspection
ACI 318	Building Code Requirements for Reinforced Concrete
ACI 349-01	Code Requirements for Nuclear Safety Related Concrete Structures
ACI SP-2	Manual of Concrete Inspection

American Institute of Steel Construction (AISC)

M011	Manual of Steel Construction
S326	Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings
S329	Specification for Structural Joints Using ASTM A325 or A490 Bolts

American National Standards Institute (ANSI)

N45.2.5 Supplemental QA Requirements for Installation, Inspection, and Testing of Structural Concrete and Structural Steel

American Society for Testing and Materials (ASTM)

A 36 Specification for Structural Steel
A 325 Specification for High-Strength Bolts for Structural Steel Joints
A 490 Specification for Heat Treated, Steel Structural Bolts, 150 ksi Tensile Strength
C 29 Unit Weight and Voids in Aggregates
C 94 Specifications for Ready-Mixed Concrete
C 172 Method of Sampling Freshly Mixed Concrete
C 1077 Practice for Laboratories Testing concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
D 422 Method for Particle-Size Analysis of Soils
D 1556 Test Method for Density of Soil in Place by the Sand-Cone Method
D 2167 Test Method for Density and Unit Weight of Soil In-Place by the Rubber Balloon Method
D 2922 Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods
D 3017 Moisture Content of Soil and soil Aggregate in Place by Nuclear Methods
D 3740 Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
E 329 Evaluation of Testing and Inspection Agencies

American Welding Society (AWS)

AWS D1.1 Structural Welding Code - Steel
AWS B2.1 Specification for Welding Procedure and Performance Qualification

The International Organization for Standardization (ISO)

ISO 14731 Welding Coordination - Tasks and Responsibilities

Nuclear Regulatory Commission Regulatory Guides (RG)

RG 1.107 Qualifications for Cement Grouting for Prestressing Tendons in Containment Structures
RG 1.127 Inspection of Water-Control Structures Associated with Nuclear Power Plants
RG 1.132 Site Investigations for Foundations of Nuclear Power Plants
RG 1.136 Materials, Construction, and Testing of Concrete Containments (Articles CC-1000, -2000, and -4000 through -6000 of the Code for Concrete Reactor Vessels and Containments)
RG 1.138 Laboratory Investigations of Soils for Engineering Analysis and Design of Nuclear Power Plants
RG 1.142 Safety Related Concrete Structures for Nuclear Power Plants

Concrete Reinforcing Steel Institute (CRSI)

MSP-1 Manual of Standard Practice

Portland Cement Association (PCA)

EB001 Design and Control of Concrete Mixtures

Mechanical

American Society of Mechanical Engineers (ASME)

Boiler & Pressure Vessel Code

Section III, Division 1	Nuclear Power Plant Components
Section III, Division 2	Concrete Reactor Vessels and Containments

Nuclear Regulatory Commission Regulatory Guides (RG)

RG 1.27 Ultimate Heat Sink for Nuclear Power Plants
RG 1.31 Control of Ferrite Content in Stainless Steel Weld Metal
RG 1.43 Control of Stainless Steel Weld Cladding of Low-Alloy Steel Components
RG 1.44 Control of the Use of Sensitized Stainless Steel
RG 1.50 Control of Preheat Temperature for Welding of Low-Alloy Steel
RG 1.54 Service Level I, II, and III Protective Coatings Applied to Nuclear Power Plants
RG 1.71 Welder Qualification for Areas of Limited Accessibility
RG 1.84 ASME Code Case Applicability
RG 1.87 Guidance for Construction of Class 1 Components in Elevated-Temperature Reactors (Supplement to ASME Section III Code Cases 1592, 1593, 1594, 1595, and 1596)
RG 1.96 Design of Main Steam Isolation Valve Leakage Control Systems for Boiling Water Reactor Nuclear Power Plants
RG 1.100 Seismic Qualification of Electrical and Mechanical Equipment for Nuclear Power Plants
RG 1.116 QA Requirements for Installation, Inspection and Testing of Mechanical Equipment and Systems
RG 1.150 Ultrasonic Testing of Reactor Vessel Welds During Preservice and Inservice Examinations

Electrical

Institute of Electrical and Electronics Engineers (IEEE)

315 Graphic Symbols for Electrical and Electronics Diagrams
336 Installation, Inspection, and Testing Requirements for Power, Instrumentation, and Control Equipment at Nuclear Facilities
338 IEEE Standard Criteria for Periodic Testing of Nuclear Power Generating Station Class 1E Power and Protection Systems
603 Criteria for Safety Systems for Nuclear Power Generating Stations
7-4.3.2 Standard Criteria for Digital Computers in Safety Systems

- 828 Standard for Software Configuration Management Plans
- 829 Standard for Software Test Documentation
- 830 Standard for Software Requirements Specification
- 1012 Standard for Software Verification and Validation
- 1028 Standard for Software Reviews and Audits
- 1074 Standard for Developing Software Lifecycle Processes
- 1050 Guide for Instrument and Control Equipment Grounding in Generating Stations

Nuclear Regulatory Commission Regulatory Guides (RG)

- RG 1.6 Independence Between Redundant Standby (Onsite) Power Sources and Between Their Distribution Systems
- RG 1.11 Instrument Lines Penetrating Primary Containment
- RG 1.30 Quality Assurance Requirements for the Installation, Inspection, and Testing of Instrumentation and Electric Equipment (ANSI N45.2.4/IEEE 336)
- RG 1.32 Criteria for Safety-Related Electric Power Systems for Nuclear Power Plants (IEEE 308)
- RG 1.40 Qualification Tests of Continuous-Duty Motors Installed Inside the Containment of Water-Cooled Nuclear Power Plants (IEEE 334)
- RG 1.47 Bypassed and Inoperable Status Indication for Nuclear Power Plant Safety Systems
- RG 1.53 Application of the Single-Failure Criterion to Nuclear Power Plant Protection Systems (IEEE 279 and IEEE 379)
- RG 1.63 Electric Penetration Assemblies in Containment Structures for Nuclear Power Plants (IEEE 317)
- RG 1.73 Qualification Tests of Electric Valve Operators Installed Inside the Containment of Nuclear Power Plants
- RG 1.75 Physical Independence of Electric Systems (IEEE 384)
- RG 1.81 Shared Emergency and Shutdown Electric Systems for Multi-Unit Nuclear Power Plants
- RG 1.89 Qualification of Class 1E Equipment for Nuclear Power Plants (IEEE 323)
- RG 1.97 Criteria For accident Monitoring Instrumentation for Nuclear Power Plants
- RG 1.100 Seismic Qualification of Electrical and Mechanical Equipment for Nuclear Power Plants
- RG 1.105 Instrument Set points (ISA S67.04)
- RG 1.106 Thermal Overload Protection for Electric Motors on Motor-Operated Valves
- RG 1.118 Periodic Testing of Electrical Power and Protection Systems
- RG 1.128 Installation Design and Installation of Large Lead Storage Batteries for Nuclear Power Plants (IEEE 484)
- RG 1.129 Maintenance, Testing, and Replacement of Large Lead Storage Batteries for Nuclear Power Plants (IEEE 450)
- RG 1.131 Qualification Tests of Electric Cables, Field Splices, and Connections for Light-Water-Cooled Nuclear Power Plants (IEEE 383)
- RG 1.151 Instrument Sensing Lines (ISA S67.02)
- RG 1.152 Criteria for Programmable Digital computer System Software in Safety Systems
- RG 1.168 Verification, Reviews and Audits for Digital Computer Software used in Safety Systems
- RG 1.169 Configuration Management Plans for Digital Software Used in Safety Systems
- RG 1.170 Software Test Documentation for Digital Computer Software used in Safety Systems
- RG 1.171 Software Unit Testing for Digital Computer Systems

- RG 1.172 Software Requirements Specifications for Digital Computer Software
- RG 1.173 Developing Software Life Cycle Processes for Digital Computer Software
- RG 1.180 Guidelines for Evaluating Electromagnetic and Radio-Frequency Interference in Safety-Related Instrumentation and Control Systems

Testing

Nuclear Regulatory Commission Regulatory Guides (RG)

- RG 1.68 Initial Test Programs for Water-Cooled Nuclear Power Plants
- RG 1.79 Preoperational Testing of Emergency Core Cooling Systems for Pressurized Water Reactors

Construction Inspector Individual Study Activity

TOPIC:	(ISA-8) Construction and Preoperational Testing
PURPOSE:	The purpose of this activity is to provide a basic overview of the purpose and the inspection requirements for construction and preoperational testing. This individual study activity will help you to understand and inspect activities relating to construction and preoperational testing.
COMPETENCY AREAS:	INSPECTION
LEVEL OF EFFORT:	32 hours
REFERENCES:	10 CFR Part 50, Domestic Licensing of Production and Utilization Facilities, 10 CFR 50.34(b)(6)(iii) 10 CFR Part 52, Licenses, Certifications, and Approvals for Nuclear Power Plants; 10 CFR 52.79(a)(28) 10 CFR Part 70, Domestic Licensing of Special Nuclear Material; 10 CFR 70.64(a)(8) RG 1.68, Initial Test Programs for Water-Cooled Nuclear Power Plant Online information and discussions with cognizant branch chiefs and/or inspectors
EVALUATION CRITERIA:	Upon completion of this activity, you will be asked to demonstrate your general understanding of construction, preoperational, and startup testing by successfully discussing the following concepts: <ol style="list-style-type: none">1. What is the purpose of the NRC inspecting construction and preoperational testing (what is the basis for the testing and what is the NRC there to do)?2. Explain the difference between construction, preoperational and startup testing and when each is performed.3. Where do you find requirements for preoperational testing, including prerequisites, test methods, and acceptance criteria (for both 10 CFR Part 50 and Part 52 testing)?4. How do you prepare for a construction or preoperational testing inspection (generic items such as familiarization with the inspection procedures (IPs), licensee's test procedure(s), licensee's test conduct procedures, awareness of plant conditions, etc.)?

5. Describe what you look for when reviewing test procedure specifications and attributes prior to and during testing.
6. Explain how operating and testing experience is used during the test program. Explain the steps you would use to find operating experience for a part, component, or system you are inspecting.
7. Explain the following attributes in performing a Main Control Room (MCR) inspection
 - a. what to look for (system response AND personnel response),
 - b. how/when to ask questions, intervene, observe process, etc.
8. Explain the following attributes in performing field inspections:
 - a. what to look for (system response AND personnel response) for each type of component (valve, supports, cabinets, pumps, etc.),
 - b. how/when to ask questions, intervene
 - c. safety during observations of testing
9. Explain what an inspector would do with data/discrepancies, including:
 - a. Difference between observation of the data collection process and the acceptance criteria
 - b. corrective action process for test deficiencies
 - c. when/if to intervene
10. Explain which 10 CFR Part 50, Appendix B Criteria would specifically apply to the pre-operational testing?

TASKS:

1. Locate and read the following documents, specifically the chapters and sections related to testing during the different construction phases and the differences between licensee facilities:
 - a. 10 CFR Part 50, Appendix A, General Design Criteria (GDC)
 - b. 10 CFR Part 50, Appendix B, Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants
 - c. 10 CFR Part 50 or 52 licensee FSAR Chapter 14, Initial Test Program
 - d. NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition, Chapter 14, Initial Test Program and ITAAC-Design Certification"
 - e. NUREG-1520, "Standard Review Plan for Fuel Cycle Facilities License Applications," Sections 2.4.3, "Regulatory Acceptance Criteria; and 11.4.3.2, "Maintenance"
 - f. RG 1.68, "Initial Test Programs for Water-Cooled Nuclear Power Plant"

2. Read the sections of the following IMCs and Inspection Procedures (IPs) that describe testing. Be familiar with testing during the different phases of construction and at the different types of licensee facilities:
 - a. IMC 2514, AP 1000 Reactor Inspection Program - Startup Testing Phase
 - b. IMC 2515, Light-Water Reactor Inspection Program- Operations Phase
 - c. IMC 2550, Non-Power Production Facilities (NPUFs) Licensed Under 10 CFR Part 50: Construction Inspection Program (CIP)
 - d. IMC 2630, Mixed Oxide Fuel Fabrication Facility Construction Inspection Program
 - e. IMC 2696, Louisiana Energy Services Gas Centrifuge Facility Construction and Pre-Operational Readiness Review Inspection Programs
 - f. IP 70702, Part 52, Inspection of Preoperational Test Performance

3. Using ADAMS and NRR Digital City OpE Gateway website, search for construction- related operating experience. Determine how such information could be used in preparing and executing an inspection.

DOCUMENTATION: Construction Inspector Technical Proficiency-Level Qualification Signature Card Item ISA-8.

Constructor Inspector On-the-Job Activities and Basic-Level Rotations

Construction Inspector On-the-Job Activity

TOPIC:	(OJT-1) Construction Inspection Accompaniment
PURPOSE:	The purpose of this activity is to familiarize you with a typical construction inspection for a nuclear facility.
COMPETENCY AREA:	INSPECTION
LEVEL OF EFFORT:	40 hours
REFERENCES:	Applicable Final Safety Analysis Report Sections Applicable Inspection Procedures IMCs 2503, 2504, 2506, 0613 ITAAC (as applicable)
EVALUATION CRITERIA:	Upon completion of the tasks, you should be able to: <ol style="list-style-type: none">1. State the actions required to be taken to plan and perform a construction inspection.2. Identify licensee activities that will occur throughout the performance of a designated construction inspection.3. Discuss the results of the inspection both in technical and regulatory contexts.4. Discuss how deficiencies identified during an inspection are communicated to the licensee and dispositioned by the inspector.5. State how the goals of the construction inspection program were achieved by the activities performed during the inspection.
TASKS:	<ol style="list-style-type: none">1. Accompany a qualified inspector and conduct an inspection of construction activities in progress.2. Review the applicable site inspection schedule; select an upcoming inspection and discuss your participation in the inspection with the lead inspector.3. Begin preparations for the inspection by completing the following tasks:

- a. Review applicable licensing basis documentation (FSAR, license, ITAAC, etc.) to gain an understanding of requirements for construction to the licensing basis.
 - b. Review the applicable IPs to identify the inspection attributes that will be evaluated during the inspection.
 - c. For ITAAC inspection(s) review applicable Smart Plans (if available) for inspection sample guidance and specific insights.
 - d. Review the regulatory requirements with regard to quality assurance contained within 10 CFR Part 50, Appendix B and the licensee's Quality Assurance Program.
 - e. Review and familiarize with the applicable licensee implementing procedures and applicable requirements from referenced codes and standards. Develop an understanding of any criteria for successful implementation of the item to be inspected.
 - f. Locate and review relevant OpE/ConE and previous inspection reports for the inspection that you are conducting.
 - g. Ensure you are familiar with all personnel safety procedures and equipment requirements for the area that you will inspect.
 - h. Develop an inspection plan as necessary or as directed incorporating information from the above items. Discuss any questions with a qualified construction inspector.
4. Conduct the inspection entrance meeting.
 5. Perform an independent observation of the licensee activities selected for inspection, sufficient to reach an independent conclusion regarding compliance with all applicable requirements. Exercise caution and awareness to not interfere with the licensee's conduct of the activity. Document your observations, any issues or concerns. Ensure that you capture licensee procedure information, information for personnel performing the activities (names, titles), and other relevant information. Do not discuss your observations or conclusions during the inspection with the licensee.
 6. Discuss any observations or issues (issues of concern) with the lead inspector and provide a preliminary determination as to whether the licensee demonstrated satisfactory compliance with all applicable requirements.
 7. Determine if any issues of concern identified represent a performance deficiency (refer to IMC 0613) of minor or more-than-minor significance (i.e., a "finding").

8. Conduct the inspection exit meeting.
9. Prepare your report input describing your inspection activities and conclusions and submit to the lead inspector. If directed, input your inspection activities and results in CIPIMS.
10. Meet with your supervisor or a qualified inspector designated by your supervisor to discuss any questions that you may have as a result of this activity and demonstrate that you can meet the evaluation criteria listed above.

DOCUMENTATION: Construction Inspector Technical Proficiency-Level Qualification
Signature Card Item OJT-1.

Construction Inspector Basic-Level Rotation

TOPIC:	(ROT-1) Construction Site (if Available)
PURPOSE:	The purpose of this activity is for you to gain understanding of the licensee's construction organization, the applicable licensing documents, the licensee's quality assurance program, and the inspection process.
COMPETENCY AREAS:	INSPECTION COMMUNICATION FUNDAMENTAL PLANT DESIGN AND CONSTRUCTION
LEVEL OF EFFORT:	Minimum 2 weeks
REFERENCES:	Licensee's drawing(s) of the site building layouts.
EVALUATION CRITERIA:	<p>Upon completion of this activity, you will be asked to demonstrate your understanding of the general plant layout and inspector behavior at the site by successfully addressing the following:</p> <ol style="list-style-type: none">1. Given a drawing of the site building layout, be able to identify where the major facility areas are located or are to be located.2. Review the licensee's construction organization. Identify the functional responsibilities of each department. Identify the major construction contractors.3. Locate the applicable licensing documents such as the FSAR, SER, License, amendments, Construction Permit. Review applicable sections relevant to your engineering/inspection discipline.4. Review the licensee's and major contractor's Quality Assurance Program Document. Identify the licensee's implementing procedures. Review a selection of licensee procedures relevant to your engineering / inspection discipline.5. Review the licensee's corrective action program. Review examples of issues that have been identified and entered into the program.6. Identify the types of information discussed in the work control meeting / plan of the day (POD) meeting that are important to an inspector and discuss why the information is important.7. Given specific examples, be able to discuss if it is appropriate for an inspector to participate in the discussion at or about the POD Meeting / work control meeting.

TASKS:

1. Tour construction and quality assurance oversight activities at approximately a daily frequency.
2. Locate the licensee's document control center and obtain copies of selected engineering drawings, installation procedures, and other records.
3. Participate in the inspection planning process. Review the applicable inspection manual chapter and relevant inspection procedures. Prepare an inspection plan for an upcoming activity.
4. Participate in inspections under the guidance of the resident inspector.
5. Document inspection results.
6. Meet with your supervisor or the person designated to be your resource for this activity and discuss the items listed in the Evaluation Criteria section.

DOCUMENTATION:

Construction Inspector Technical Proficiency – Level Qualification
Signature Card Item ROT-1

Construction Inspector Technical Proficiency-Level Signature Card and Certification

<u>Inspector Name:</u>	<u>Employee Initials/Date</u>	<u>Supervisor's Signature/Date</u>
<u>A. Training Courses</u>		
E-110: Power Plant Engineering (course or self-study)		
Reactor Technology overview (104 P or B)		
Advance Technology Differences Course (R107P or B)		
G-113: Construction Reactor Oversight Process (cROP)		
F-201 or F-201S: Fuel Cycle Processes		
Quality Assurance Course, as designated by supervisor (e.g., external training such as EPRI Nuclear Utility Procurement Training Course, or similar to NRC E-301)		
<u>B. Individual Study Activities</u>		
ISA-1: Title 10, "Energy," of the <u>Code of Federal Regulations</u>		
ISA-2: Overview of 10 CFR Part 21		
ISA-3: Design Control Document		
ISA-4: Significance Determination for Process Construction Inspection Findings		
ISA-5: Fuel Cycle Process Fundamentals		
ISA-6: Fuel and Non Power-Producing Facilities		
ISA-7: Industry Codes & Standards		
ISA-8: Construction and Preoperational Testing		
<u>C. Basic-Level Rotations and On-the-Job Training Activities</u>		
OJT-1: Construction Inspection Accompaniment		
ROT-1: Construction Site (if available)		

Supervisor's signature indicates successful completion of all required courses and activities listed in this journal and readiness to appear before the Oral Board.

Supervisor's Signature: _____ Date: _____

The appropriate "Construction Inspector Technical Proficiency Level Equivalency Justification" form must accompany this signature card and certification, if applicable.

Form 1: Construction Inspector Technical Proficiency-Level Equivalency Justification	
Inspector Name: _____	Identify equivalent training and experience for which the inspector is to be given credit.
E-110: Power Plant Engineering (course or self-study)	
Reactor Technology overview (104 P or B)	
Advance Technology Differences Course (R107P or B)	
G-113: Construction Reactor Oversight Process (cROP)	
F-201 or F-201S: Fuel Cycle Processes	
Quality Assurance Course, as designated by supervisor (e.g., external training such as EPRI Nuclear Utility Procurement Training Course, or similar to NRC E-301)	
ISA-1: Title 10, "Energy," of the <u>Code of Federal Regulations</u>	
ISA-2: Overview of Part 21	
ISA-3: Design Control Document	
ISA-4: Significance Determination Process Construction Inspection Findings	
ISA-5: Fuel Cycle Process Fundamentals	
ISA-6: Non Power Utilization Facilities (Shine)	
ISA-7: Industry Codes & Standards	
ISA-8: Construction and Preoperational Testing	
OJT-1: Construction Inspection Accompaniment	
ROT-1: Construction Site (if available)	

Supervisor's Recommendation: _____
Supervisor Signature/Date

Division Director's Approval: _____
Division Director Signature/Date

Revision History Sheet for IMC 1245 Appendix C-15
Attachment 1

Commitment Tracking Number	Accession Number Issue Date Change Notice	Description of Change	Description of Training Required and Completion Date	Comment Resolution and Closed Feedback Form Accession Number (Pre-Decisional, Non-Public)
N/A	ML17072A344 08/15/17 CN 17-014	First issuance. Completed 4 year search for commitments and found none.	None	ML17089A364
N/A	ML21106A282 04/22/21 CN 21-019	Minor editorial change to reflect changed organizational responsibility due to the reunification of NRO and NRR and the replacement of TTC training course G110, "Licensing Reactors under Part 52," with G113, "Construction Reactor Oversight Process (cROP)."	None	NA