



U.S. NRC

UNITED STATES NUCLEAR REGULATORY COMMISSION

Protecting People and the Environment

**AP1000 Piping Systems
Design Acceptance Criteria
(DAC)**

Inspection Overview & Walk-through

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Objectives

- Provide an overview of the expected activities leading up to, and including, piping design and PRHA inspection
- Provide expectations for information exchange as it relates to the inspection process framework and inspection planning
- Walk through the Piping Design and PRHA inspection procedures, with correlation to WEC Piping Package samples
- Provide an overview of post-inspection activities and expected disposition of inspection results



Pre-Inspection Protocol



VEGP U3

License Condition

12. (c) Before commencing installation of individual piping segments, identified in AP1000 DCD, Rev. 19, Section 3.9.8.7, and connected components in their final locations in the facility, SNC shall complete the analysis of the as-designed individual piping segments and shall inform the Director of NRO, or the Director's designee, in writing, upon the completion of these analyses and the availability of the design reports for the selected piping packages.

VEGP U4 and VCS U2&3 similar



Staff Proposal

- Establish and maintain a proactive communications channel with the DCWG (e.g. conference call) to stay abreast of Piping Package schedule and availability
 - allows for timely and advance resource planning
 - allows Staff to assess impact of schedule changes
- RII lead inspector will coordinate with key DCWG POCs



Pre-Inspection Process

- Proactive interaction will allow for:
 - Inspection scheduling
 - Inspector assignments
 - Inspection Report opening
 - Development of the Inspection Plan
 - Assignment of technical staff to support
 - Inspection preparation



Inspection Model

- Typical inspection complement for DAC-related ITAAC inspection:
 - RII inspector(s) supported by one or more NRO technical staff (DE or DSRA experts) acting in an inspector capacity
 - RII inspectors have the lead, and provide direction (scope, insights, perspective, etc.) to tech staff as necessary



Inspection Report

- Mechanism for documenting inspection results (IMC 0613P)
- For ITAAC inspection, results are typically documented in the Vogtle/VC Summer Resident Inspector integrated report (quarterly)
- RII has the option to open a stand-alone inspection report



Inspection Plan

- RII lead inspector develops
- Provides scope, sampling guidance, logistics, schedule and expectations for the inspection
- Inspection process is conducted “through the license”; licensee POC should be established as the inspection support liaison
- Inspection Plan is approved prior to the inspection



Inspection Prep

- Inspectors and technical staff review procedures and references as necessary
- Staff proposes use of a SharePoint site to facilitate documentation availability for inspection prep (including Piping Packages); method successful during DI&C inspection
- Location of inspection is flexible; propose the first piping package inspection at WEC-Cranberry (access to WEC resources)
- Follow on inspections can be conducted at any consortium facility



Typical Pre-inspection Scenario

- Teleconference held with DCWG; Piping Packages 1 through 6 availability is ID'd
- RII lead inspector confers with DCWG; inspection date is proposed and agreed upon
- RII lead inspector identifies available resources (2 inspectors and 1 tech staff) for a three-day inspection at WEC
- Inspection Plan is developed (including sample)
- Licensee POC is established
- Inspection commences on designated date . . .



Piping Design

Inspection Procedure 65001.20



ITAAC Inspection

Verification that the design, as implemented, conforms to the licensing basis

Not a design review!



Piping Systems DAC

- Identified in site-specific ITAAC (# 843) in Table C.3.8.2
 - Design of piping complies with ASME Code Section III
- Inspection for this ITAAC is embodied in the verification of the following for safety-related piping systems:
 - the as-built piping meets ASME requirements
 - the piping is designed to meet functional capability requirements



IP 65001.20

- Inspection of Safety-Related Piping DAC/ITAAC
- Section 01 provides objectives
- Section 02 of the procedure contains inspection requirements and guidance
- Sections 02.01 and 02.02 provide background and guidance on DAC
- Section 02.03 provides inspection planning guidance
- Section 02.04 provides inspection attributes for piping systems and related guidance
- Sections 02.05 and 02.06 provide a resource estimate for inspection and references, as applicable



WEC Sample Package

- WEC provided the following for the purposes of procedure walk-through:
 - Calc Note APP-PXS-PLR-060, Rev. 4
“AP1000 CMT 02B Supply Line Pipe Stress Analysis Report”
 - Isometrics and Support drawings for PXS-PLR-060
- Calc Note contains a summary of analysis results and conclusions



Piping Package Inspection

- From Section 02.04 Design Inspection, subsection a:

“Verify aspects of the design specification for the piping segment” (six attributes listed).

The design specification is not provided; from an inspection standpoint, would want access to all reference material that supports the package. In this case, the design specification is Reference 1.



Piping Package Inspection (cont.)

- From Section 02.04, subsection b:

“Review Design Report/Stress Report to verify that the design meets the specification and was developed using the DCD and ASME methodology”

Attributes listed are derived from the Piping Design Criteria listed in Table 3.9-19 of the DCD, and were consolidated in the procedure as follows:

- Analysis and modeling inputs
- Thermal and Seismic analysis
- Dynamic analysis
- Fatigue evaluation
- Stress qualification



Piping Package Inspection (cont.)

- Inspectors may choose to use the Summary of Results in the WEC Sample Package as a starting point for the attributes identified in subsection b of the procedure
- Verification of attributes in the WEC Sample Package is accomplished on a “sampled” basis
- Note also that inspectors may review selected calculations and/or analysis details at their discretion



Piping Package Inspection (cont.)

- From Section 02.04, subsection c:

“Review pipe support design” (13 attributes)

Attributes are derived from Table 3.9-19 of the DCD and would be verified in the WEC Sample Package



“Sample of a Sample”

- Typical inspection is on a sampling basis, subject to attribute inspectability, risk significance, inspector insights, etc.
- Assuming “x” number of Piping Packages are available, “y” number of Packages would be selected (sampled) for inspection
- Of the “y” sample, another “z” sample of attributes from IP 65001.20 would be inspected; the “z” sample may vary package to package



Pipe Rupture Hazards Analysis

Inspection Procedure 65001.21



VEGP U3

License Condition

12. (b) Before commencing installation of individual piping segments and connected components in their final locations, SNC shall complete the as-designed pipe rupture hazards analysis for compartments (rooms) containing those segments in accordance with the criteria outlined in the AP1000 DCD, Rev. 19, Sections 3.6.1.3.2 and 3.6.2.5, and shall inform the Director of NRO, or the Director's designee, in writing, upon the completion of this analysis and the availability

VEGP U4 and VCS U2&3 similar



PRHA DAC

- Identified in site-specific ITAAC (# 842) in Table C.3.8.-1 - An as-designed PRHA report exists
- Inspection for this ITAAC is embodied in the verification of the following for safety-related piping systems:
 - a leak-before-break (LBB) evaluation report exists
 - an as-designed PRHA report



IP 65001.21

- Inspection of Pipe Rupture Hazards Analysis DAC/ITAAC
- Section 01 provides objectives
- Section 02 of the procedure contains inspection requirements and guidance
- Sections 02.01 provides guidance for inspection planning
- Section 02.02 provides inspection detail for PRHA
- Section 02.03 provides as-built inspection guidance
- Sections 03 and 04 provide a resource estimate for inspection and references, as applicable



WEC PRHA Sample

- WEC provided the following for the purposes of procedure walk-through:
 - Calc Note APP-GW-PLC-204, Rev. 0
 - PRHA Input Sheet for APP-CVS-PLR-100”
- Calc Note contains a summary of analysis results and conclusions



PRHA Inspection

- PRHA inspection is room/space/area-based
- Inspection should be conducted once PRHA is complete, but may be conducted in a “phased” approach as rooms/spaces/areas are completed



PRHA Inspection (cont.)

- From procedure Section 02.02, verify the following:
 - each space containing SSCs important to safety is addressed
 - for the chosen pipe segment (PLR-100), licensed methodology for determining pipe breaks and locations is followed
 - licensed methodology for evaluation of dynamic and environmental effects is followed (jet effect, mitigation features, design of surrounding SSCs, flood protection, etc.)
 - potential target SSCs will be protected by mitigation features



PRHA Inspection (cont.)

- From Section 02.02:
 - sample guidance calls for 10-15 isolation and/or protection mechanisms to be verified
 - inspectors will select from a sample of 10-15 piping packages
 - as an example, a sample of the pipe break data in the Sample PRHA would be verified
- Inspectors may use the Summary and Checklist in the PRHA Sample as a starting point
- Note that field verification of SSCs may take place as they are constructed



Post-Inspection Protocol



Inspection Exit

- Each inspector (and supporting technical staff) will develop a report “feeder” using the format in IMC 0613
- Reported results should correlate to individual ITAAC
- Reported results are uploaded to CIPIMS (to support subsequent closure verification)
- Inspection Report is issued and docketed
- Any Notices of Violation (NOVs) are written to the appropriate licensee



Example

- **Inspectors sample 8 PXS piping design packages; in 5 of the packages, a critical design specification element was not accounted for in the package**
- **Inspectors identify this as an “issue of concern” and start to screen per IMC 0613P**



Example (cont.)

- Issue of Concern is determined to be a Performance Deficiency and is screened to determine if minor or more-than-minor; performance deficiency could impact the closure of an ITAAC, so screened as more-than-minor, and now classified as a Finding
- Per IMC 2519P, the Finding is a “Technical Finding” (it is associated with an ITAAC) and is screened for significance; determined that could reasonable affect all trains of PXS (a high importance system), so is characterized as a WHITE finding
- For this example, a Notice of Violation (NOV) would be written against Appendix B Criterion III (Design Control)