PMSTPCOL PEmails

From: Tai, Tom
Sent: Tuesday, January 31, 2012 2:32 PM
To: Spicher, Terri; Huang, Jason
Cc: Colaccino, Joseph; STPCOL
Subject: FW: FMCRD
Attachments: TESTING REFERENCES013012~1.pdf; FMCRD ITAAC.pdf; Visio-STP 34 Process Flow Diagram revised.pdf

For tomorrow's discussion.

Tom Tai
DNRL/NRO
(301) 415-8484
Tom.Tai@NRC.GOV

From: Scheide, Richard [mailto:rhscheide@STPEGS.COM]
Sent: Tuesday, January 31, 2012 10:57 AM
To: Tai, Tom
Cc: Daley, Thomas J; Mookhoek, William; Thomas, Steven
Subject: FMCRD

Tom,

Relative to your question regarding functional testing of the FMCRDs, attached is a table which references the applicable sections of the SRP, DCD, FSER, and the FMCRD design Spec. Also attached for your convenience are the DCD Tier 1 ITAAC referenced in the table. Additionally, I included the revised flowchart that I sent last week showing at what point in the process the test specifications are developed and implemented. Give me a call if you have any additional questions and/or comments.

Regards,

Dick Scheide
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Mail Envelope Properties (0A64B42AAA8FD4418CE1EB5240A6FED160DDA2FF09)

Subject: FW: FMCRD
Sent Date: 1/31/2012 2:32:01 PM
Received Date: 1/31/2012 2:32:02 PM
From: Tai, Tom

Created By: Tom.Tai@nrc.gov

Recipients:
"Colaccino, Joseph" <Joseph.Colaccino@nrc.gov>
Tracking Status: None
"STPCOL" <STP.COL@nrc.gov>
Tracking Status: None
"Spicher, Terri" <Terri.Spicher@nrc.gov>
Tracking Status: None
"Huang, Jason" <Jason.Huang@nrc.gov>
Tracking Status: None

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Files	**Size**	**Date & Time**
MESSAGE	898	1/31/2012 2:32:02 PM
TESTING REFERENCES013012~1.pdf	9842	
FMCRD ITAAC.pdf	21097	
Visio-STP 34 Process Flow Diagram revised.pdf	48349	

Options
Priority: Standard
Return Notification: No
Reply Requested: No
Sensitivity: Normal
Expiration Date:
Recipients Received:

FMCRD TESTING REFERENCES

SRP	DCD	FSER	FMCRD DESIGN SPEC.
SRP **3.9.4** Section I.4 discusses the review of the life cycle test program for the CRDS, including mechanism functional tests. SRP **3.9.4** Section III.4 discusses additional tests that should be conducted for a new design or configuration. SRP **4.6** Section III.4 discusses CRDS functional testing.	DCD Tier 2 Section **4.6.3.1** discusses developmental tests that have already been completed with satisfactory results. These include European prototype designs, and a prototype that has been installed at LaSalle-2. DCD Tier 2 Sections **3.9.1.3.2** and 3D.2.1 discuss the FMCRD01 program and prototype testing which have been accomplished to establish the FMCRD design pressure. DCD Tier 2 Section **4.6.3.2** discusses factory quality control tests that will be performed on the FMCRDs and HCUs. DCD Tier 2 Section **4.6.3.3** discusses functional tests that will evaluate FMCRD performance under normal and abnormal conditions. DCD Tier 2 Section **4.6.3.4** discusses operability testing of the FMCRDs.	FSER Section **3.9.4** states that the functional design and testing of the CRDS is discussed in Section **4.6**. FSER Section **4.6** states that the design of the reactivity control system conforms to the applicable acceptance criteria of SRP Section **4.6**, and is acceptable.	Section 8 discusses the testing that is to be accomplished on the FMCRDs prior to N-stamping and shipment to the site. It refers to the Design Acceptance Test Specification and the Production Test Specification, which will be issued prior to the factory testing. Testing on-site will be governed by test procedures that will be developed in accordance with DCD/COLA Tier 2 Section **14**.

	DCD Tier 2 Section 4.6.3.5 discusses acceptance testing that will take place during pre-operational and start-up testing programs. DCD Tier 2 Section **4.6.3.6** discusses surveillance test requirements.		
SRP **3.9.4** Section I.5 discusses ITAACs.	ITAACs3,4,5,6,7,8,12 of DCD **Tier 1 Table 2.2.2** discuss tests that are to be performed to confirm FMCRD acceptability.		

Table 2.2.2 Control Rod Drive System

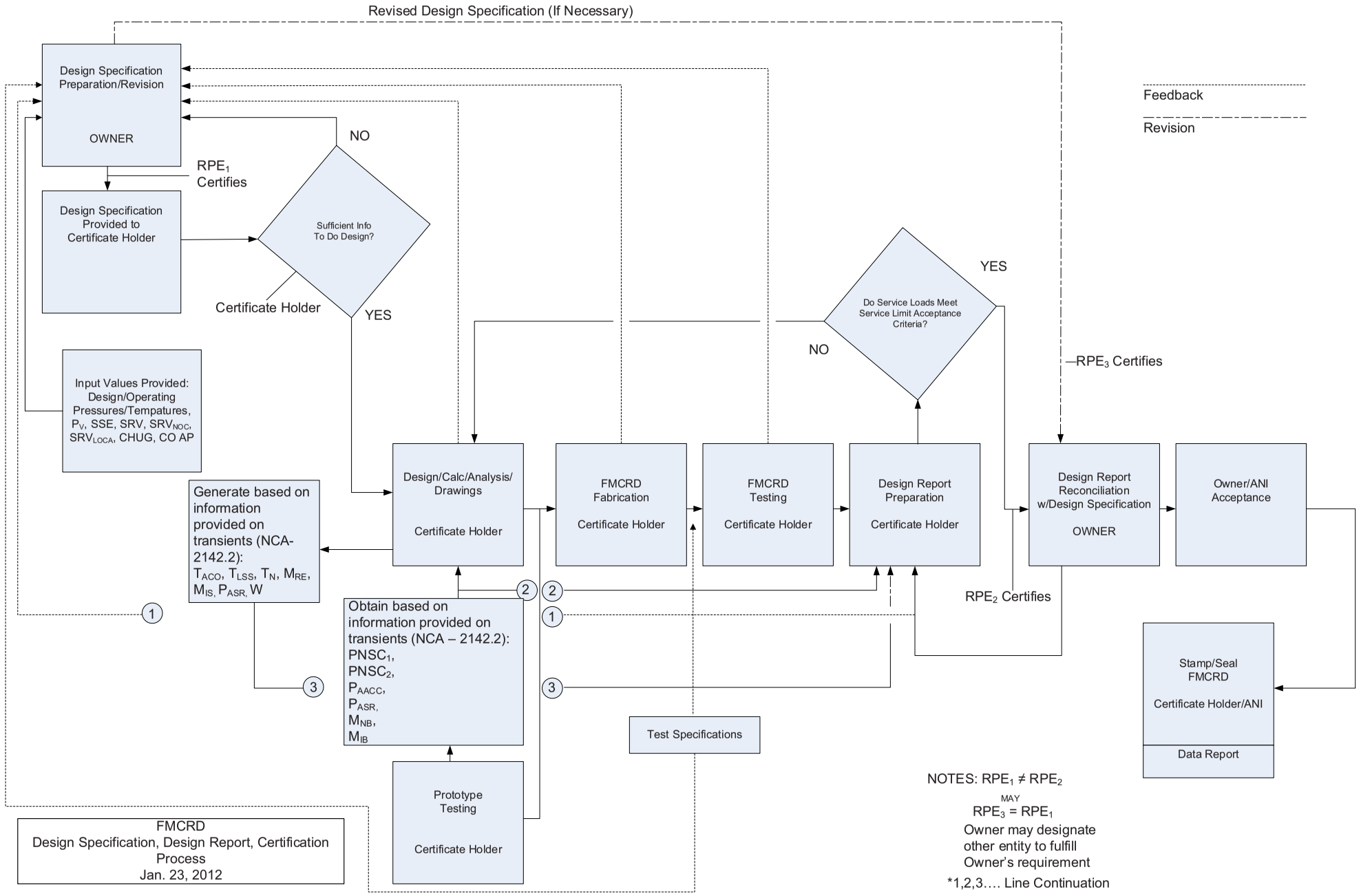
Inspections, Tests, Analyses and Acceptance Criteria		
Design Commitment	**Inspections, Tests, Analyses**	**Acceptance Criteria**
1. The basic configuration of the CRD System is as shown on Figure 2.2.2.	1. Inspections of the as-built system will be conducted.	1. The as-built CRD System conforms with the basic configuration shown on Figure 2.2.2.
2. The ASME Code components of the CRD System retain their pressure boundary integrity under internal pressures that will be experienced during service.	2. A hydrostatic test will be conducted on those code components of the CRD System required to be hydrostatically tested by the ASME Code.	2. The results of the hydrostatic test of the ASME Code components of the CRD System conform with the requirements in the ASME Code, Section III.
3. The FMCRD can move the control rod up or down over its entire range by a ball nut and ball screw driven at a speed of 30 mm/s ±10% by the electric stepper motor.	3. Tests will be conducted on each installed FMCRD.	3. Each control rod moves up and down over its entire range at a speed of 30 mm/s ±10%. The time to insert each control rod from full-out to full-in is ≤ 135 seconds when driven by the electric stepper motor.
4. The average scram times of all FMCRDs with the reactor pressure as measured at the vessel bottom below 7.48 MPaG are: Percent Insertion / Time (s) 10 / ≤ 0.42 40 / ≤ 1.00 60 / ≤ 1.44 100 / ≤ 2.80 These times are measured starting from loss of signal to the scram solenoid pilot valves in the HCU.	4. Tests will be conducted on each installed HCU and its associated FMCRD. The results of the tests performed at low reactor pressure will be extrapolated to the Design Commitment pressure (7.48 MPaG).	4. The average scram times of all FMCRDs with the reactor pressure as measured at the vessel bottom below 7.48 MPaG are: Percent Insertion / Time (s) 10 / ≤ 0.42 40 / ≤ 1.00 60 / ≤ 1.44 100 / ≤ 2.80 These times are measured starting from loss of signal to the scram solenoid pilot valves in the HCU
5. The FMCRD has an electro-mechanical brake with a minimum holding torque of 49 N·m on the motor drive shaft.	5. Tests of each FMCRD brake will be conducted in a test facility.	5. The FMCRD electro-mechanical brake has a minimum holding torque of 49 N·m on the motor drive shaft.

Table 2.2.2 Control Rod Drive System (Continued)

Inspections, Tests, Analyses and Acceptance Criteria		
Design Commitment	**Inspections, Tests, Analyses**	**Acceptance Criteria**
6. Two redundant and separate switches in the FMCRD detect separation of the hollow piston from the ball nut.	6. Tests of each as-built FMCRD will be conducted.	6. Both switches in each FMCRD detect separation of the hollow piston from the ball nut.
7. Following receipt of an ARI signal, solenoid valves on the scram air header open to reduce pressure in the header, allowing the HCU scram valves to open.	7. Tests will be conducted on the as-built ARI valves using a simulated actuation signal.	7. Following receipt of a simulated ARI signal, solenoid valves on the scram air header open to reduce pressure in the header, allowing the HCU scram valves to open.
8. Each of the four divisional HCU charging header pressure sensors are powered from their respective divisional Class 1E power supply. For the four HCU charging water header pressure sensors, independence is provided between Class 1E divisions, and between Class 1E divisions and non-Class 1E equipment.	8. a. Tests will be conducted on the as-built charging water header sensors by providing a test signal in only one Class 1E division at a time. b. Inspections of the as-installed charging water header sensor Class 1E divisions will be conducted.	8. a. The test signal exists only in the Class 1E Division under test. b. Physical separation or electrical isolation exists between Class 1E divisions. Physical separation or electrical isolation exists between these Class 1E divisions and non-Class 1E equipment.
9. For the FMCRD separation switches, independence is provided between the Class 1E divisions and also between the Class 1E divisions and non-Class 1E equipment.	9. Inspections of the as-installed Class 1E divisions in the CRD System will be performed.	9. In the CRD System, physical separation or electrical isolation exists between Class 1E divisions. Physical separation or electrical isolation exists between Class 1E divisions and non-Class 1E equipment.
10. For their preferred source of power, the FMCRDs are collectively powered from one Class 1E division; for their alternate source of power, they are collectively powered from one non-Class 1E PIP bus.	10. Inspections of the as-built CRD System will be conducted.	10. For their preferred source of power, the FMCRD motors are collectively powered from one Class 1E division; for their alternate source of power, they are collectively powered from one non-Class 1E PIP bus.

Table 2.2.2 Control Rod Drive System (Continued)

Inspections, Tests, Analyses and Acceptance Criteria		
Design Commitment	**Inspections, Tests, Analyses**	**Acceptance Criteria**
11. Main control room alarms, displays and controls provided for the CRD System are defined in Section 2.2.2.	11. Inspections will be performed on the main control room alarms, displays and controls for the CRD System.	11. Alarms, displays and controls exist or can be retrieved in the main control room as defined in Section 2.2.2.
12. CVs designated in Section 2.2.2 as having an active safety-related function close under system pressure, fluid flow, and temperature conditions.	12. Tests of installed valves for closing will be conducted under system preoperational pressure, fluid flow, and temperature conditions.	12. Each CV closes.


Revised Design Specification (If Necessary)
Design Specification Preparation/Revision
OWNER
RPE1 Certifies
Design Specification Provided to Certificate Holder
Sufficient Info To Do Design?
NO
YES
Certificate Holder
Input Values Provided: Design/Operating Pressures/Tempatures, PV, SSE, SRV, SRVNOC, SRVLOCA, CHUG, CO AP
Generate based on information provided on transients (NCA-2142.2): TACO, TLSS, TN, MRE, MIS, PASR, W
Obtain based on information provided on transients (NCA – 2142.2): PNSC1, PNSC2, PAACC, PASR, MNB, MIB
Prototype Testing
Certificate Holder
Design/Calc/Analysis/ Drawings
Certificate Holder
FMCRD Fabrication
Certificate Holder
FMCRD Testing
Certificate Holder
Design Report Preparation
Certificate Holder
Do Service Loads Meet Service Limit Acceptance Criteria?
YES
NO
RPE3 Certifies
RPE2 Certifies
Design Report Reconciliation w/Design Specification
OWNER
Owner/ANI Acceptance
Stamp/Seal FMCRD
Certificate Holder/ANI
Data Report
Test Specifications
Feedback
Revision
1
2
3
NOTES: RPE1 ≠ RPE2
MAY
RPE3 = RPE1
Owner may designate other entity to fulfill Owner's requirement
*1,2,3…. Line Continuation
FMCRD
Design Specification, Design Report, Certification Process
Jan. 23, 2012