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NUCLEAR REGULATORY COMMISSION
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November 12, 1996

MEMORANDUM TO: Charles E. Rossi, Director
Safety Programs Division
Office for Analysis and Evaluation
of Operational Data

FROM: Patrick W. Baranowsky, Chief
Reliability and Risk Assessment Branch
Safety Programs Division
Office for Analysis and Evaluation
of Operational Data

SUBJECT: INPO/NRC MEETING ON THE EQUIPMENT PERFORMANCE AND INFORMATION EXCHANGE (EPIX) SYSTEM

On October 22, 1996, Tom McHenry, Department Manager, Equipment Performance, INPO, updated NRC on INPO's plans for the Equipment Performance Information and Exchange (EPIX) System. The meeting handouts and list of the participants are attached. Changes in their plans for EPIX include the following:

- The scope of EPIX has been revised to a three-tier approach, i.e., three levels of components and information reporting:
  - Maintenance rule mission important components, on which functional failure root cause information will be provided,
  - NPRDS application coded components in the maintenance rule risk-significant systems (about 300-800 components), on which information on functional failure root cause and failure rates (number of failures per number of components per time period) will be provided, and
  - NPRDS application coded components within the SSPI systems (30 to 100 components), on which functional failure root cause, functional failure rate, and SSPI reliability information will be provided.
- In addition to the archived NPRDS records, the general EPIX database, and the focused information (special databases to support specific data needs), the system will have a fourth module, Info-link, an E-mail or BBS for exchange of information among EPIX users.
- The implementation schedule has been accelerated as follows:
  - Early 1997 - issue interim EPIX software (This would include the functional failure root cause and failure rate information for the maintenance rule components but not the SSPI WANO information, the focused information, NPRDS archive and Info-link.) Utilities begin collecting EPIX data.

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OFM-6 Meetings-Gen
96-146 x RD-25 INPO

- Mid 1997 - discontinue reporting and archive NPRDS information.

- January 1998 - final EPIX implementation (including SSPI WANO information).

The EPIX system will only provide the reliability data contained in the INPO/WANO SSPI program and one time estimated demands and run hours for maintenance rule risk-significant systems. For the remaining components in the EPIX scope, no reliability type information will be collected. The system is still in the planning stage. We will continue to actively follow the plans and development of EPIX.

Attachments: As stated

cc: T. McHenry, INPO

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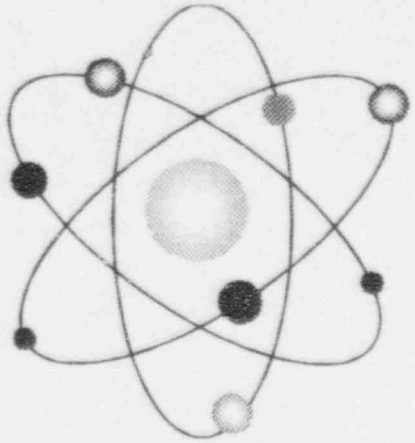
OCTOBER 22, 1996 NRC/INPO MEETING ON THE
EQUIPMENT PERFORMANCE AND INFORMATION EXCHANGE SYSTEM

NAME	ORGANIZATION
Tom McHenry	INPO
Jerry Dozier	Scientech
David Goldin	SC&A, Inc.
Ernest Lofgren	SAIC
Dennis Allison	NRC/AEOD
Pat Baranowsky	NRC/AEOD
Bennett Brady	NRC/AEOD
Ron Frahn Jr.	NRC/NRR
Neal Hunemuller	NRC/NRR
Erasmia Lois	NRC/RES
Charles E. Rossi	NRC/AEOD



EPIX

EQUIPMENT PERFORMANCE

and

INFORMATION EXCHANGE

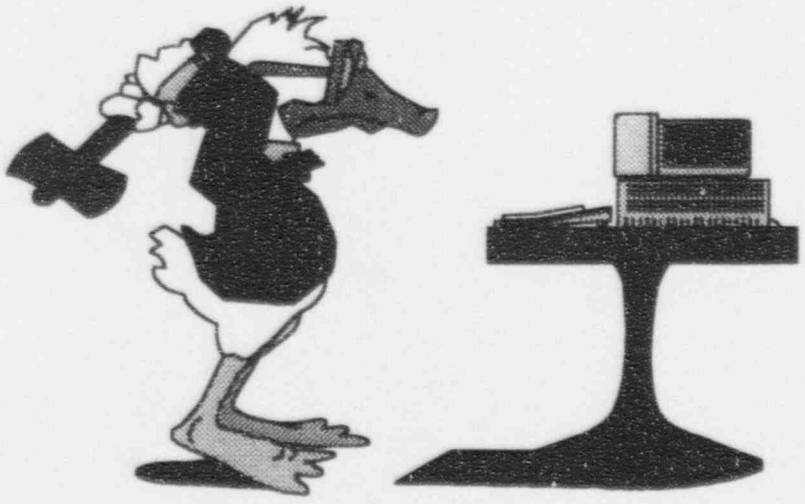
NRC Update

Tom McHenry

October 22, 1996

MANDATE

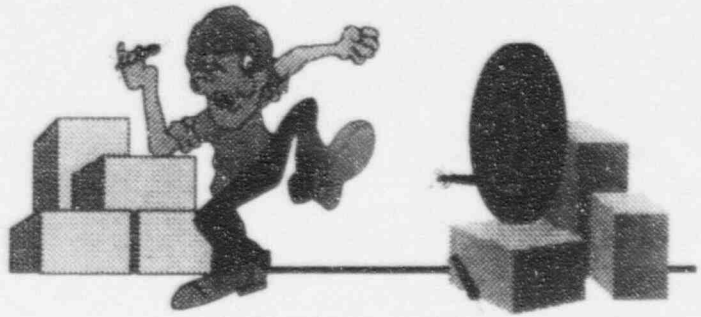
To create an effective component level information exchange system to replace NPRDS



But, it must:

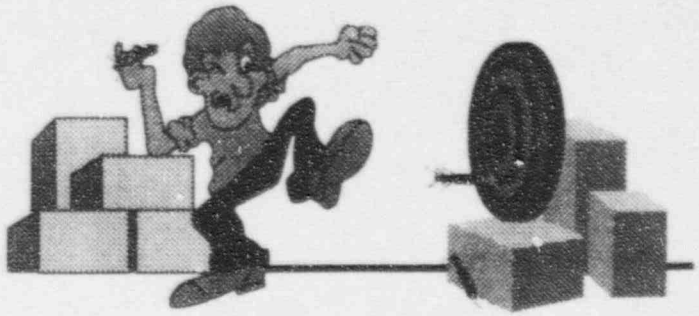
- Be simple
  - User friendly
  - Require minimal training
  - Yield repeatable results
- Be cheap
  - Use minimal human resources
  - Use common software & hardware
- Be flexible to support changing industry needs
- Have an optimized scope
  - Focused list of components
  - High overlap

General principles



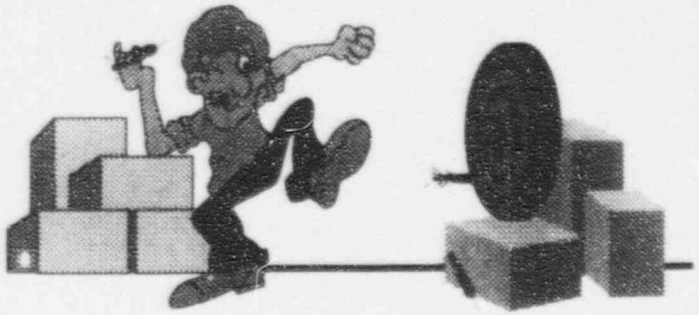
- Needs to consider plant reliability as well as safety
- Supports risk-informed management decisions
- Good compatibility between EPIX, maintenance rule, and SSPI

Minimum rule basing



- Clear definitions
- Simple rules

Reporting principles



- Ties well to plant failure screening mechanisms to ensure all failures are reported
- Should not require a specialist
- About 10 minutes for a knowledgeable person to complete a report
- Ensures repeatable input for like failures to ensure consistent and accurate analysis results

Environment for the next 20 years

- Risk informed management
- Risk based regulation
- Increased economic competition

Risk Informed Management

Outage Length

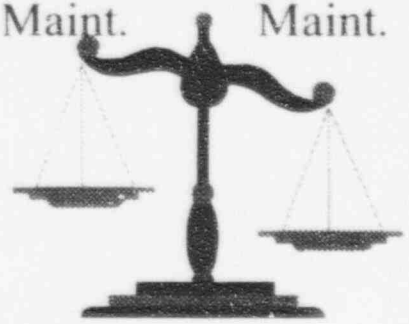
On-line Maint.

Commercial Dedication

Qualified Replacements

Condition Based Maint.

Time Based Maint.



Repairing Equipment

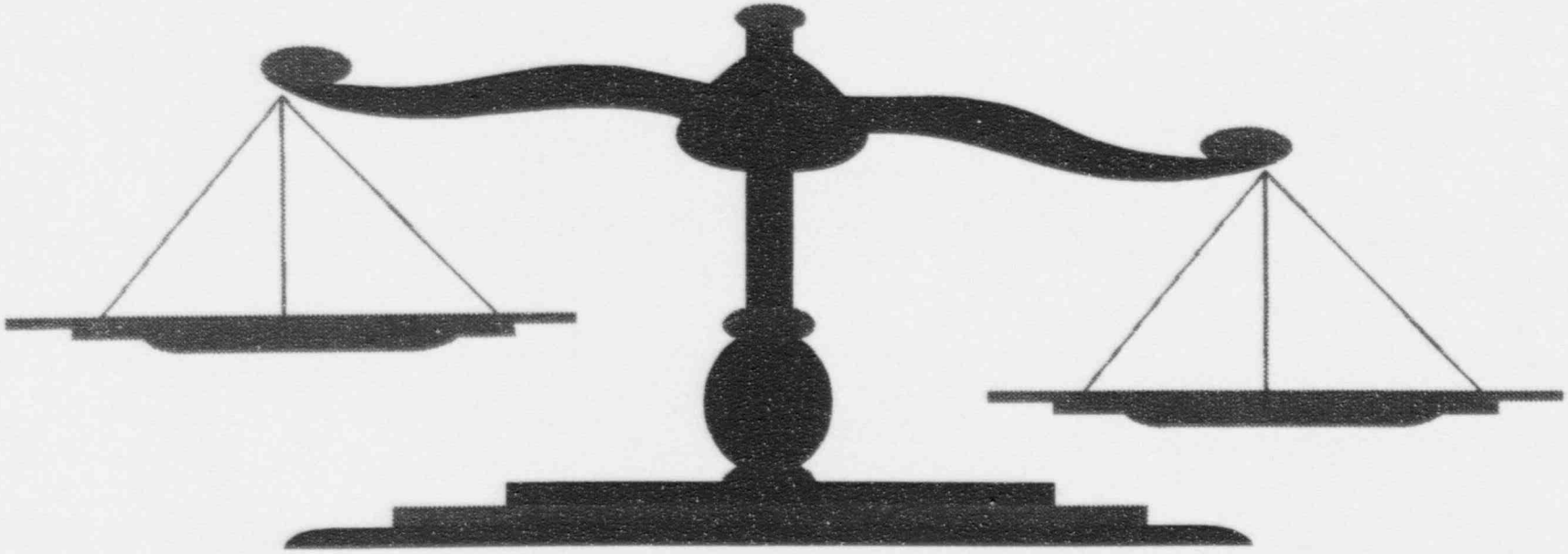
Replacing Equipment

Performance Improvement

Modification Costs

EPIX Bottom Line

Costs Benefits



Minimizing the costs!

- Capitalizes on work required by the maintenance rule, or already done for SSPI and NPRDS
- Does not require one-size-fits-all scope and reports
- Does not require a trained specialist

Maximizing the ber.efits!

- Solution - focused on issues and problem resolution
- Graduated approach to information provided based on risk importance
- Functional failure root cause information for important components
- Ouput focused on analyzed information vs. unanalyzed data
- User accessibility

EPIX Modules

- Archived NPRDS
- Maintenance Rule and Reliability Information
- Focused Information
- Info-link

Archived NPRDS

Windows interface to access more than 20 years of component performance history.

- 170,000 failure records
- 680,000 component records

Maintenance Rule and Reliability Information

The living, required reporting database to replace NPRDS, supports maintenance rule implementation and risk-informed management activities.

Focused Information

Voluntary database available as needed to support a variety of industry component activities such as a known obsolete components lists or prior commercial dedication lists.

Info-link

Engineer to engineer set of private bulletin boards used to exchange a wide variety of information.

Maintenance Rule and Reliability Information

- Results in one common set of scoping and reporting criteria for the maintenance rule and EPIX
- Focuses on component functional failures likely to get the most extensive root cause investigations
- Allows consolidation of failure screening into one activity

Maintenance Rule and Reliability Information

- Allows use of EPIX as a low-cost alternative to custom development of a database to track maintenance rule failures
- Facilitates required reviews of industry experience as outlined in NUMARC 93-01
- Estimate 3-4 EPIX reports per unit per month versus 5-8 for NPRDS

Functional Failure Root Cause

Functional Failure Rate

Risk-significant Systems

- NPRDS application-coded components
- 300-800 components

Functional Failure Root Cause

Component Reliability

SSPI Systems

- NPRDS application-coded components
- 30-100 components

Function Failure Rate

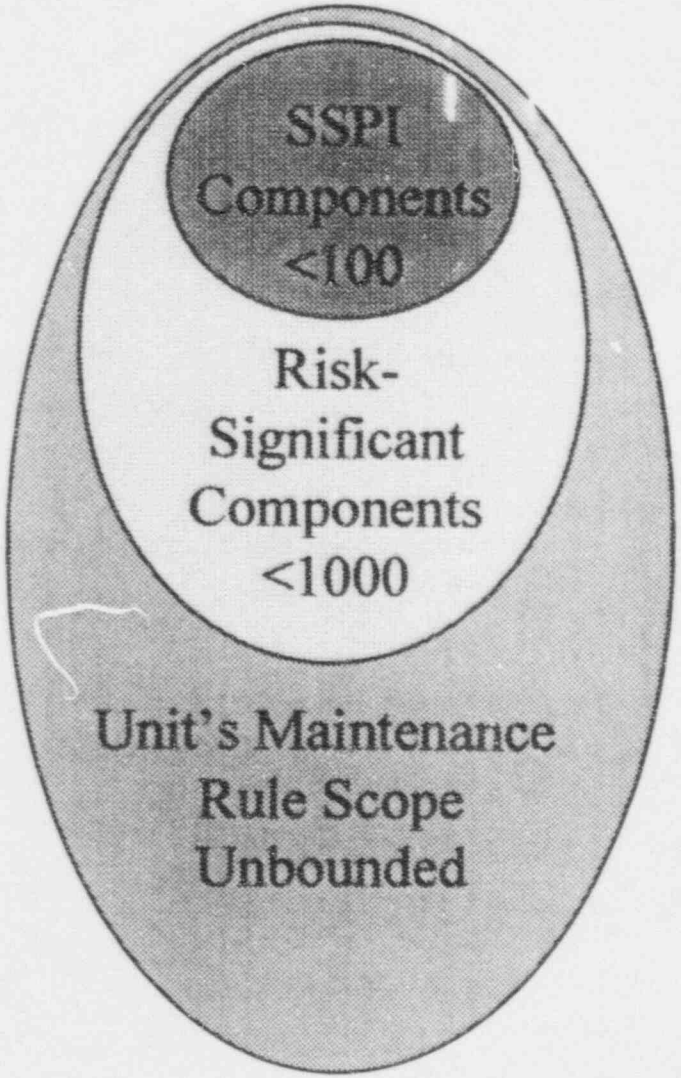
Functional Failure Root Cause

EPIX Maintenance Rule and Reliability Information Module

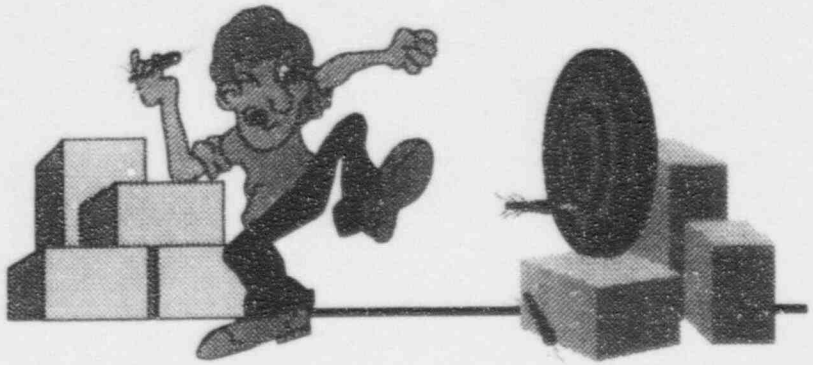
EPIX COMPONENT REPORTING CATEGORIES

- **Maintenance Rule Scope (Functional failure/root cause level)- component failures resulting in functional failures**

- **SSPI (Reliability level) - collects same level of failure information as Risk-Significant, also makes available SSPI information reported to WANO**



- **Risk-Significant (Functional failure rate level)- in addition to component failures resulting in functional failures also collects component failures resulting in the component being declared inoperable due to functional degradation for a defined scope of primary components, makes available est. annual demand & run-time information as well as risk category**

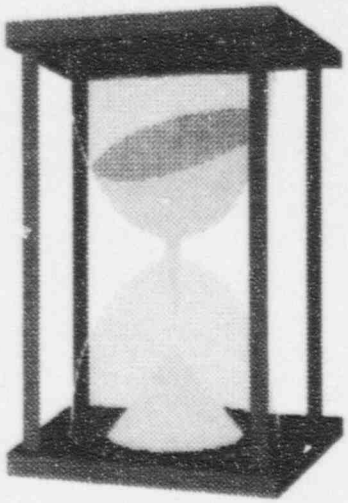


EPIX Applications

- Automated system/component health reports focused on impact to the station
- High quality input for root cause analysis
- Identifying emerging issues
- Benchmarking performance
- Risk-informed decision making

Estimated Resources (per unit)

	NPRDS	EPIX
Startup	Several person-years	**8** person-weeks
Operation	**20** person-weeks per year	**2** person-weeks per year



Proposed Schedule

- **January 1997**
  - Issue EPIX interim data collection software
  - Begin collecting EPIX maintenance rule and reliability information
- **April 1997**
  - Terminate NPRDS reporting

Summary of EPIX Reliability Data Scope for Various Plant Designs

BWR Summary:

BWR 2 (No HPI function and IC): 23 to 49 primary components per unit

BWR 2 or early BWR 3 (HPCI and IC): 28 to 60 primary components per unit

Newer BWR 3 or BWR 4 (HPCI and RCIC): 31 to 60 primary components per unit

BWR 5 or BWR 6 (HPCS and RCIC): 33 to 58 primary components per unit

PWR Summary:

B&W: 36 to 59 primary components per unit

CE: 56 to 83 primary components per unit

W, 2-Loop: 43 to 65 primary components per unit

W, 3-Loop (standard design): 51 to 70 primary components per unit

W, 3-Loop (S&W design): 51 to 86 primary components per unit

W, 4-Loop (standard design): 60 to 104* primary components per unit

W, 4-Loop (S&W design): 63 to 102 primary components per unit

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* The upper portion of this range is due to South Texas Project which has one extra train in each of the monitored systems.

Typical BWR Primary Components for EPIX Reliability Data Scope (SSPI Systems)

HPCI/HPCS/RCIC

1. Torus/Supp. Pool Suction Valve (1)
2. CST Suction Valve (1)
3. Pump and associated components[3] (1)
4. Injection Valve (1)
5. Full Flow Test Return Valve to Torus/Supp. Pool (1) (?)
6. Miniflow Test Return Valve to CST (1) (?)

Total components: 4-6 per system

IC

1. Condenser Inlet Valve (1-2)
2. Condenser (1-2)
3. Condenser Outlet Valve (1-2)

Total components: 3-6

RHR

1. Torus/Supp. Pool Suction Valve (2-4)
2. Shutdown Cooling Isolation Valve (1-2)
3. Shutdown Cooling to Pump Isolation Valve (2-4)
4. Pump (2-4)[4] and associated components[5]
5. Heat Exchanger (2-4)
6. Heat Exchanger Bypass Valve (2-4)
7. Miniflow Test Return Valve to Torus/Supp. Pool (2-4)
8. Torus/Supp. Pool Injection Valve (2)
9. Vessel Injection Valve (4)
10. Heat Exchanger Inlet Valve (2-4) (?)
11. Heat Exchanger Outlet Valve (2-4) (?)

Total components: 19-40

EAC

1. Diesel Generator and associated components[1] (2-5)
2. Output Circuit Breaker and associated components[2] (2-5)

Total components: 4-10

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[1] Associated components for EDG: governor, initiation and control subsystem, DC power system (if dedicated), starting air subsystem, lubricating oil subsystem, fuel oil subsystem, cooling water/jacket warming subsystem, intake and exhaust subsystem

[2] Associated components for output circuit breaker: actuation and control subsystem (includes sequencer)

[3] Associated components for HPCI pump: turbine, governor, governor valve, stop valve, steam admission valve, steam supply isolation valve, initiation and control subsystem, gland seal condenser subsystem, leak detection and isolation subsystem
Associated components for HPCS pump: motor, circuit breaker, initiation and control subsystem
Associated components for RCIC pump: turbine, governor, governor valve, trip-throttle valve, steam admission valve, steam supply isolation valve, initiation and control subsystem, gland seal condenser subsystem, leak detection and isolation subsystem

[4] Some units may have installed spare pumps (1 per train) that are not included in this count (i.e., a two-train system may actually have 4 pumps).

[5] Associated components for RHR pump: motor, circuit breaker, initiation and control subsystem

Typical PWR Primary Components for EPIX Reliability Data Scope (SSPI Systems)

HPI (B&W)

1. Suction from BWST Isolation Valve (2)
2. Suction from DHR Discharge Isolation Valve (2)
3. Pump and associated components[1] (2-3)[2]
4. Injection Valve (2)
5. Train Cross-Tie Valve (1-2) (?)
6. Miniflow Test Return Valve to VCT/BWST (2-3) (?)

Total Components: 8-14

HPSI (CE)

1. Suction from RWT Valve (1-2)
2. Suction from Containment Sump Isolation Valve (2)
3. Pump and associated components[1] (2-3)[2]
4. Cold-Leg Injection Valve (4-8)
5. Hot-Leg Injection Valve (2)
6. Train Cross-Tie Valve (1-2) (?)
7. Miniflow Test Return Valve to RWT (2) (?)

Total Components: 11-21

HPSI (W, 2-Loop)

1. Suction from RWST Isolation Valve (1-2)
2. Suction from RHR Discharge Isolation Valve (2)
3. SI Pump and associated components[1] (2-3)
4. BIT Inlet Valve (2)
5. BIT Outlet Valve (2)
6. Hot-Let Injection Valve (2)
7. Train Cross-Tie Valve (1-2) (?)
8. Miniflow Test Return Valve to VCT/RWST (2-3) (?)

Total Components: 11-18

HPSI (W, 3-Loop)

1. Suction from RWST Isolation Valve (2)
2. Suction from RHR Discharge Isolation Valve (2)
3. HPSI/Charging Pump and associated components[1] (2-3)
4. BIT Inlet Valve (2)
5. BIT Outlet Valve (2)
6. Hot-Leg Injection Valve (2)
7. Train Cross-Tie Valve (1-2) (?)
8. Miniflow Test Return Valve to VCT/RWST (2-3) (?)

Total Components: 12-18

HPSI (W, 4-Loop)

1. Suction from RWST Isolation Valve (3-4)
2. Suction from RHR Discharge Isolation Valve (2-3)
3. Charging/SI Suction Cross-Tie Valve (2) (?)
4. Charging Pump and associated components[1] (2) (?)[3]
5. Miniflow Test Return Valve to VCT (2) (?)[3]
6. SI Pump and associated components[1] (2-3)
7. Miniflow Test Return Valve to RWST (2) (?)
8. BIT Inlet Valve (2)
9. BIT Outlet Valve (2)
10. Cold-Leg Injection Valve (1-3) (?)
11. Hot-Leg Injection Valve (2)
12. Train Cross-Tie Valve (1-2) (?)

Total Components: 15-26

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[1] Associated components for HPI (HPSI, SI, charging) pump: motor, circuit breaker, initiation and control subsystem

[2] The number of HPI pumps can vary depending on whether an installed spare pump is claimed.

[3] Some designs do not use charging pumps for the high pressure injection function.

Typical PWR Primary Components for EPIX Reliability Data Scope (SSPI Systems) – Continued

AFW/EFW

1. Alternate Suction from Service Water Isolation Valve (2-4)
2. Pump and associated components[5]
3. Injection Flow Control Valve (2-8)
4. Injection Isolation Valve (2-8)
5. Train Cross-Tie Valve (1-2) (?)
6. Miniflow Test Return Valve to CST (2-4) (?)

Total Components: 8-30

RHR/DHR/SDC

1. Suction from Hot-Leg Isolation Valve (2-4)
2. Suction from Containment Sump Isolation Valve (2-3)
3. Pump Suction Isolation Valve (2-3)
4. Pump and associated components[7] (2-3)
5. Heat Exchanger (2-3)
6. Heat Exchanger Bypass Valve (2-3)
7. Heat Exchanger Inlet Valve (2-3) (?)
8. Heat Exchanger Outlet Valve (2-3) (?)
9. Injection Valve (2-8)
10. Hot-Leg Injection Valve (1-2) (?)
11. Train Cross-Tie Valve (1-3) (?)
12. Miniflow Valve (2-3)
13. Test Return Valve to BWST/RWT/RWST (2-3) (?)

Total Components: 16-42

EAC

1. Diesel Generator and associated components[4] (2-4)
2. Output Circuit Breaker and associated components[6] (2-4)

Total Components: 4-8

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[4] Associated components for EDG: governor, initiation and control subsystem, DC power system (if dedicated), starting air subsystem, lubricating oil subsystem, fuel oil subsystem, cooling water/jacket warming subsystem, intake and exhaust subsystem

[5] Associated components for motor-driven pump: motor, circuit breaker, initiation and control subsystem.
Associated components for turbine-driven pump: turbine, governor, governor valve, trip-throttle valve, steam admission valves, steam supply isolation valves, initiation and control subsystem
Associated components for diesel-driven pump: diesel engine, governor, DC power subsystem (if dedicated), fuel oil subsystem, lubricating oil subsystem, cooling water/jacket warming subsystem, initiation and control subsystem, speed changer coupling (?)

[6] Associated components for output circuit breaker: actuation and control subsystem (includes sequencer)

[7] Associated components for RHR pump: motor, circuit breaker, initiation and control subsystem