GE Nuclear Energy

ABWR

Date 30 JUNE 92

To GLENN KELLY
NRC

Fax No. _____

This page plus 10 page(s)

From JACK DUNCAN

Mail Code ____
175 Curtner Avenue
San Jose, CA 95125

Phone (408) 925- 6947

FAX (408) 925-1193
or (408) 925-1687

Subject PRA Input to ITAAC
= Section 19.8

Message

PRA Input to ITAAC follows. Although the "input" is complete, all the ITAAC references - the right column - which indicate "closure" are not complete. This closure will depend on the ITAAC Schedule.

CC
JNFox
AJJames

19.8 Tier 1 Treatment of Design Features Identified as Important by the PRA

As the PRA was being finalized during NRC staff development of the Final Safety Evaluation Report, the PRA was reviewed to identify the most important PRA-related ABWR features. The judgement of several engineers was used to identify those features and capabilities which are most important in maintaining a low core damage frequency and in mitigating the consequences of an accident should one occur. Achieving both of these objectives results in a balanced design in that many very diverse features provide defense in depth to avoid excessive offsite consequences.

The results of this review are summarized in Table 19.8-1 through 6. For each feature, reference is provided to the corresponding verifying ITAAC by indicating the system number followed by the entry number in the corresponding ITAAC table. In addition, key subsections of Chapter 19 are identified to allow a reviewer to appreciate the general significance of the feature beyond that identified here.

Table 19.8-1
FRA INPUT TO ITAAC: PREVENTION OF CORE DAMAGE

General Capability	Specific Feature/Capability	Chapter 19 Subsection	ITAAC Reference
Redundant Systems	• Three separated divisions of ECCS and decay heat removal, ECCS pumps able to pump saturated water.	19.1.2 19.6.5 19D.5.11.3	2.4.1(RHR) – 1, 2, 3, 8, 9, 18 2.4.2(HPCF) – 1, 2, 3, 4, 11, 10
	• RHR vessel injection valve which admits fire water to the RPV and drywell spray valve have handwheels for local manual operation without power.	19J.3	2.4.1 (RHR) – 7
	• Automatic depressurization for transients and LOCAs	19.1.2 19D.6.2.5	2.1.2 (Nuclear Boiler) – 11, 12
Diversity	• RCIC capable of operation for several hours without AC power, and ability to override switchover to makeup water source from CST to suppression pool.	19.1.2, 19E.2.2.3 19D.4.2.8 19D.4.2.9	2.4.4(RCIC) – 6 says isolation fails as is on loss of ac. Need to add switchover. 2.12.12 (Direct current power supply) – 1b, 1c
	• Combustion Turbine Generator, connectable to at least one of three safety divisions to provide ac power.	19D	2.12.11 (CTG) – 1
	• Ability to operate one HPCF pump independent of essential multiplexing system.	19D	2.2.6 (RSS) – 1

Table 19.8-1
PRA INPUT TO ITAAC: PREVENTION OF CORE DAMAGE (Continued)

General Capability	Specific Feature/Capability	Chapter 19 Subsection	ITAAC Reference
Diversity	• Seismically qualified ac independent water addition system, including dedicated diverse diesel (which need not be seismically qualified) and manually operable valves. Calculated flow rates: – for vessel injection, between 0.50 and 0.60 cubic meters/sec with RPV at ambient pressure. The shutoff head for RPV injection should be 1.7 MPa. – for drywell spray, between 0.50 and 0.60 cubic meters/sec with drywell at ambient presure.	19.1.2	2.4.1 (RHR) – 7 2.15.6 (FPWSS) – 13 (Flow rates will be added)
Support Systems	• Sufficient cooling capacity available in service water systems to provide seal and motor bearing cooling for ECCS core cooling pumps with one RCW and one RSW pump in each loop in each division and two RCW heat exchangers in each division operating.	19D.6.4.2	2.11.9 (RSW) – (to be added) Heat removal capacity will be compared with heat removal requirements by evaluation of as-built components.

Table 19.8-1
PRA INPUT TO ITAAC: PREVENTION OF CORE DAMAGE (Continued)

General Capability	Specific Feature/Capability	Chapter 19 Subsection	ITAAC Reference
Support Systems	• Sufficient cooling capacity available in service water systems supporting each RHR division to remove heat from the RHR heat exchangers during LOCA with all pumps and heat exchangers in that division operating.	19D.6.4.2	2.11.9 (RSW) – (to be added) Heat removal capacity will be compared with heat removal requirements by evaluation of as-built components.
Minimize Potential for Failure to Shutdown	• Highly reliable reactor protection and control rod drive system to insert control rods.	19.3.1.3 19D.6.5.2 19D.6.5.6	2.2.7 (RPS) – 2, 4, 5 2.2.2 (CRD) – 2, 3, 4, 9, 10
	• Alternate rod insertion system to provide backup and diversity to control rod drive system.	19D.6.5.6	No ARI ITAAC yet
	• Automatically initiated standby liquid control system to provide backup shutdown capability in event of failure to insert control rods.	19.3.1.3 19D.6.5.4	2.2.4(SLC) – 1, 2, 3, 4, 5, 6

Table 19.8-2
PRA INPUT TO ITAAC: AVOIDANCE OF SUPPRESSION POOL BYPASS

General Capability	Specific Feature/Capability	Chapter 19 Subsection	ITAAC Reference
Avoid Unisolatable RWCU Break	• Reactor water clean-up Isolation Valves must be properly qualified (including seismic) for expected duty	19.3.2.6	2.6.1(RWCU) – 3. In addition, see RWCU EQ entry in Table 3.0 of Tier 1 material.
	• Reactor water cleanup drain line includes globe valve which can be closed by remote manual means.	19.3.2.6	2.6.1 (RWCU) – not addressed yet.
Control Unisolatable RWCU Break	• Reactor water clean-up suction nozzle must be at least 5 feet above the planned elevation of the top of the active fuel.	19.3.2.6	2.6.1 (RWCU) – 4 to be added.
Control Unisolatable RWCU Break	• Reactor water cleanup drain line tie in to the suction line must be at least 18 inches above the planned elevation of the top of the active fuel.	19.3.2.6	2.6.1 (RWCU) – 5 Not addressed yet.
Avoid Unisolatable RHR Break	• Seismically qualified RHR isolation pool suction valve	19.6.3	See RHR EQ entry in Table 3.0 of Tier 1 material
Release Paths to Suppression Pool	• At least 4 SRVs operate in ADS mode.	19E.2.3.3	2.1.2 (Nuclear Boiler) – 11
	• At least ten 24" upper vent paths from the drywell.	19E.2.3.3	2.14.3 (RPV Pedestal) – Figure 2.14.3 shows ten 27" vents. Need to reflect in table.

Table 19.8-2
PRA INPUT TO ITAAC: AVOIDANCE OF SUPPRESSION POOL BYPASS (Continued)

General Capability	Specific Feature/Capability	Chapter 19 Subsection	ITAAC Reference
	• At least 20 ft Suppression pool level above the SRV discharge.	19E.2.3.3	2.14.3 (RPV Pedestal)– Figure 2.1.4.2a shows elevation of quencher. Figure 2.14.3a elevation of the bottom vent is sufficient to verify. However, need to reflect in table.
	• At least 15 ft Suppression pool level above the DW vent.	19E.2.3.3	2.14.3 (RPV Pedestal) – 3 – Figure 2.14.3a is inconsistent with item 3. The figure shows about 12 feet submergence.
Valve Reliability	• Main Steamline Drains are closed during normal operation.	19E.2.3.3	2.1.2 (Nuclear Boiler) – ? Figure 2.1.2b shows the valves as normally open. Isolation addressed in section 2.4.3 text.
	• Drywell equipment and floor drain sump discharge lines contain containment isolation valves and check valves to prevent backflow to other areas.	19E.2.3.3	No ITAAC yet to cover this.
Valve Controls	• ECCS valves have a remote m ual closure capability.	19E.2.3.3	Need ECCS ITAAC.
Minimize Leakage	• Leakage from equipment to closed cooling water systems is highly restricted.	19E.2.3.3	2.11.3 (RBCWS) – Not currently addressed.

Table 19.8-3

PRA INPUT TO ITAAC: MAINTENANCE OF CONTAINMENT INTEGRITY

General Capability	Specific Feature/Capability	Chapter 19 Subsection	ITAAC Reference
Avoid Hydrogen Related Threats	• Provisions to provide inerted containment	19.6.6 19.6.8	2.14.6 (ACS) – 1
Avoid Containment Structural Failure	• Containment over pressure protection system with rupture disk set-point established at 90 psig and nominal flow rate of 35 kg/sec when containment pressure is 90 psig.	19.2.4.3	2.14.6 (ACS) –5, –6, –8
Minimize Challenge to Containment	• Passive Flooder system: – Ten valves which open when lower drywell temperature exceeds 500°F – 10.5 liters/sec nominal flow rate per valve		No ITAAC section yet.
Maintenance of Suppression Pool Integrity	• RHR heat exchanger seismic capacity	19J.3	See RHR EQ entry in Table 3.0 of Tier 1 material

Table 19.8-3

PRA INPUT TO ITAAC: MAINTENANCE OF CONTAINMENT INTEGRITY

General Capability	Specific Feature/Capability	Chapter 19 Subsection	ITAAC Reference
Avoid Hydrogen Related Threats	• Provisions to provide inerted containment	19.6.6 19.6.8	2.14.6 (ACS) – 1
Avoid Containment Structural Failure	• Containment over pressure protection system with rupture disk set-point established at 90 psig and nominal flow rate of 35 kg/sec when containment pressure is 90 psig.	19.2.4.3	2.14.6 (ACS) –5, –6, –8
Minimize Challenge to Containment	• Passive Flooder system: – Ten valves which open when lower drywell temperature exceeds 500°F – 10.5 liters/sec nominal flow rate per valve		No ITAAC section yet.
Maintenance of Suppression Pool Integrity	• RHR heat exchanger seismic capacity	19J.3	See RHR EQ entry in Table 2.0 of Tier 1 material

Table 19.8-4
PRA INPUT TO ITAAC: MINIMIZE THREATS FROM INTERNAL FLOODS

General Capability	Specific Feature/Capability	Chapter 19 Subsection	ITAAC Reference
Defense Against Turbine Building Flooding	• Normally closed watertight door between turbine building and service building tunnel.	19R.4.3	2.15.11 (Turbine Building) – 5
Defense Against Control Building Flooding	• Control building lower floor level sensors which alarm at 0.15 meter and trip RSW pumps and close RSW isolation valves in affected division at 0.8 meter.	19R.4.4	2.15.12 (Control Building) – 2
	• RSW pipe run between control building and first RSW valve outside control building is limited to less than 2000 meters length.	19R.4.4	2.15.12 (Control Building) – 2
Defense Against Reactor Building Flooding	• ECCS rooms have water tight doors which open into corridor.	19R.4.5	2.15.10 (Reactor Building) – 2
	• Reactor building corridor and ECCS rooms (Floor B3F) can each contain largest flood source (i.e., equilibrium level with suppression pool is lower than room ceiling).	19R.4.5	2.15.10 (Reactor Building) – 2
	• Reactor building floor B1F outside secondary containment sumps have overfill lines to B3F corridor.	19R.4.5	2.15.10 (Reactor Building) – 2

Table 19.8-5
PRA INPUT TO ITAAC: MINIMIZE THREATS FROM INTERNAL FIRES

General Capability	Specific Feature/Capability	Chapter 19 Subsection	ITAAC Reference
Remote RCIC Operation	• Capability to operate RCIC from outside the control room.	19M.4.1.1 19M.3 19M.6.2	2.4.4 (RCIC) – 11 (needs to be added) Testing will verify operational capability?
Depressurization	• Capability to operate four SRVs from the remote shutdown panel.	19M.3 19M.6.2	2.2.6 (RSS) – 1. Needs to specify four.
Divisional Separation	• Three hour rated fire barriers surrounding each fire area which includes individual safety divisions. Includes barriers formed by: 1) concrete fire barrier floors, ceilings, and walls: 2) partitions; 3) rated fire doors; 4) penetration seals for process pipes and cable trays; 5) special assemblies and constructions; and 6) fire dampers	19M.2 19M.4.1.1	2.15.6 (FPS) – 15. + addition needed: verify by inspection of as built plant that safety divisions are isolated from each other by three hour rated fire barriers.

Table 19.8-6
PRA INPUT TO ITAAC: MINIMIZE THREATS WHILE SHUTDOWN

General Capability	Specific Feature/Capability	Chapter 19 Subsection	ITAAC Reference
Decay Heat Removal	• No isolation of SDC on loss of RPS logic power	19Q.11 19QC	2.4.1 (RHR) – 12
Decay Heat Removal and Inventory Control	• 3 ECCS divisions with support systems physically separated and independent	19Q.7	2.4.1 (RHR) – 2 2.4.2 (HPCF) – 1
Inventory Control	• RPV isolation on low water level	19Q.4.2	2.4.1 (RHR) – 12
	• RHR mode switch automatically realigns system	19Q.4.1 19Q.4.2	2.4.1 (RHR) – 13
	• AC independent water addition system	19Q.4.2	2.4.1 (RHR) – 7
	• SDC piping connects to nozzle in RPV above top of active fuel	19Q.4.2	2.1.1 (Reactor Pressure Vessel System) – 1
Electric Power Availability	• 2 offsite power and 4 onsite power sources available, physically separated and independent	19Q.4.4	2.12.1 (Electrical Power Distribution System) – 1 2.12.11 (Combustion Turbine Generator) – 1 2.12.13 (Emergency Diesel Generator System) – 1, 3
Flood Control	• Watertight doors and floor drains	19Q.6, 19R	2.15.10 (Reactor Building) – 2 2.15.12 (Control Building) – 2 2.15.11 (Turbine Building) – 5