

JUL 27 1984

Docket Nos. 50-259/260/296

DISTRIBUTION
Docket File

Mr. Hugh G. Parris
Manager of Power
Tennessee Valley Authority
500 A Chestnut Street, Tower II
Chattanooga, Tennessee 37401

NRC PDR
Local PDR
ORB#2 Rdg
DEisenhut
OELD
EJordan
JNGrace
WLong
DClark
SNorris
ACRS (10)
Gray File

Dear Mr. Parris:

SUBJECT: NUREG-0737, TMI ACTION PLAN ITEM II.K.3.22 - AUTOMATIC SWITCHOVER
OF REACTOR CORE ISOLATION COOLING (RCIC) SYSTEM SUCTION

Re: Browns Ferry Nuclear Plant, Units 1, 2 and 3

We have reviewed the information presented in your letter of November 23, 1983 on the above subject. Your letter reiterated your previous position that considering the design of the Browns Ferry units, the modification to provide automatic RCIC suction switchover is of marginal safety benefit and that an objective cost-benefit analysis would show the modification to be unnecessary.

Based on the enclosed Safety Evaluation, we find the manual switchover of the RCIC suction on low water level in the condensate storage tank to be an acceptable design for the Browns Ferry units. This resolves Item II.K.3.22 of NUREG-0737.

Sincerely,

Original signed by:

Domenic B. Vassallo, Chief
Operating Reactors Branch #2
Division of Licensing

Enclosure:
As stated

cc w/enclosure

DL:ORB#2
SNorris:jk
7/27/84

DL:ORB#2
WLong W
7/27/84

DL:ORB#2
DClark
7/27/84

DL:ORB#2
DVassallo
7/27/84

8408160155 840727
PDR ADDCK 05000259
PDR

487

SECRET

[illegible]

2. The following information is provided for the year ended 31/12/2019:

[illegible]

RECEIVED
JAN 11 1964
U.S. DEPARTMENT OF JUSTICE
FEDERAL BUREAU OF INVESTIGATION
WASHINGTON, D.C. 20535

2

10-10-68

Figure 6

2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042 2043 2044 2045 2046 2047 2048 2049 2050 2051 2052 2053 2054 2055 2056 2057 2058 2059 2060 2061 2062 2063 2064 2065 2066 2067 2068 2069 2070 2071 2072 2073 2074 2075 2076 2077 2078 2079 2080 2081 2082 2083 2084 2085 2086 2087 2088 2089 2090 2091 2092 2093 2094 2095 2096 2097 2098 2099 2100 2101 2102 2103 2104 2105 2106 2107 2108 2109 2110 2111 2112 2113 2114 2115 2116 2117 2118 2119 2120 2121 2122 2123 2124 2125 2126 2127 2128 2129 2130 2131 2132 2133 2134 2135 2136 2137 2138 2139 2140 2141 2142 2143 2144 2145 2146 2147 2148 2149 2150 2151 2152 2153 2154 2155 2156 2157 2158 2159 2160 2161 2162 2163 2164 2165 2166 2167 2168 2169 2170 2171 2172 2173 2174 2175 2176 2177 2178 2179 2180 2181 2182 2183 2184 2185 2186 2187 2188 2189 2190 2191 2192 2193 2194 2195 2196 2197 2198 2199 2200 2201 2202 2203 2204 2205 2206 2207 2208 2209 2210 2211 2212 2213 2214 2215 2216 2217 2218 2219 2220 2221 2222 2223 2224 2225 2226 2227 2228 2229 2230 2231 2232 2233 2234 2235 2236 2237 2238 2239 2240 2241 2242 2243 2244 2245 2246 2247 2248 2249 2250 2251 2252 2253 2254 2255 2256 2257 2258 2259 2260 2261 2262 2263 2264 2265 2266 2267 2268 2269 2270 2271 2272 2273 2274 2275 2276 2277 2278 2279 2280 2281 2282 2283 2284 2285 2286 2287 2288 2289 2290 2291 2292 2293 2294 2295 2296 2297 2298 2299 2300 2301 2302 2303 2304 2305 2306 2307 2308 2309 2310 2311 2312 2313 2314 2315 2316 2317 2318 2319 2320 2321 2322 2323 2324 2325 2326 2327 2328 2329 2330 2331 2332 2333 2334 2335 2336 2337 2338 2339 2340 2341 2342 2343 2344 2345 2346 2347 2348 2349 2350 2351 2352 2353 2354 2355 2356 2357 2358 2359 2360 2361 2362 2363 2364 2365 2366 2367 2368 2369 2370 2371 2372 2373 2374 2375 2376 2377 2378 2379 2380 2381 2382 2383 2384 2385 2386 2387 2388 2389 2390 2391 2392 2393 2394 2395 2396 2397 2398 2399 2400 2401 2402 2403 2404 2405 2406 2407 2408 2409 2410 2411 2412 2413 2414 2415 2416 2417 2418 2419 2420 2421 2422 2423 2424 2425 2426 2427 2428 2429 2430 2431 2432 2433 2434 2435 2436 2437 2438 2439 2440 2441 2442 2443 2444 2445 2446 2447 2448 2449 2450 2451 2452 2453 2454 2455 2456 2457 2458 2459 2460 2461 2462 2463 2464 2465 2466 2467 2468 2469 2470 2471 2472 2473 2474 2475 2476 2477 2478 2479 2480 2481 2482 2483 2484 2485 2486 2487 2488 2489 2490 2491 2492 2493 2494 2495 2496 2497 2498 2499 2500 2501 2502 2503 2504 2505 2506 2507 2508 2509 2510 2511 2512 2513 2514 2515 2516 2517 2518 2519 2520 2521 2522 2523 2524 2525 2526 2527 2528 2529 2530 2531 2532 2533 2534 2535 2536 2537 2538 2539 2540 2541 2542 2543 2544 2545 2546 2547 2548 2549 2550 2551 2552 2553 2554 2555 2556 2557 2558 2559 2560 2561 2562 2563 2564 2565 2566 2567 2568 2569 2570 2571 2572 2573 2574 2575 2576 2577 2578 2579 2580 2581 2582 2583 2584 2585 2586 2587 2588 2589 2590 2591 2592 2593 2594 2595 2596 2597 2598 2599 2600 2601 2602 2603 2604 2605 2606 2607 2608 2609 2610 2611 2612 2613 2614 2615 2616 2617 2618 2619 2620 2621 2622 2623 2624 2625 2626 2627 2628 2629 2630 2631 2632 2633 2634 2635 2636 2637 2638 2639 2640 2641 2642 2643 2644 2645 2646 2647 2648 2649 2650 2651 2652 2653 2654 2655 2656 2657 2658 2659 2660 2661 2662 2663 2664 2665 2666 2667 2668 2669 2670 2671 2672 2673 2674 2675 2676 2677 2678 2679 2680 2681 2682 2683 2684 2685 2686 2687 2688 2689 2690 2691 2692 2693 2694 2695 2696 2697 2698 2699 2700 2701 2702 2703 2704 2705 2706 2707 2708 2709 2710 2711 2712 2713 2714 2715 2716 2717 2718 2719 2720 2721 2722 2723 2724 2725 2726 2727 2728 2729 2730 2731 2732 2733 2734 2735 2736 2737 2738 2739 2740 2741 2742 2743 2744 2745 2746 2747 2748 2749 2750 2751 2752 2753 2754 2755 2756 2757 2758 2759 2760 2761 2762 2763 2764 2765 2766 2767 2768 2769 2770 2771 2772 2773 2774 2775 2776 2777 2778 2779 2780 2781 2782 2783 2784 2785 2786 2787 2788 2789 2790 2791 2792 2793 2794 2795 2796 2797 2798 2799 2800 2801 2802 2803 2804 2805 2806 2807 2808 2809 2810 2811 2812 2813 2814 2815 2816 2817 2818

| | | | |
|--------|--------|--------|--------|
| 0897 | 0907 | 0916 | 0925 |
| 112254 | 112255 | 112256 | 112257 |
| 112258 | 112259 | 112260 | 112261 |

Mr. Hugh G. Parris
Tennessee Valley Authority
Browns Ferry Nuclear Plant, Units 1, 2 and 3

cc:

H. S. Sanger, Jr., Esquire
General Counsel
Tennessee Valley Authority
400 Commerce Avenue
E 11B 330
Knoxville, Tennessee 37902

Mr. Ron Rogers
Tennessee Valley Authority
400 Chestnut Street, Tower II
Chattanooga, Tennessee 37401

Mr. Charles R. Christopher
Chairman, Limestone County Commission
Post Office Box 188
Athens, Alabama 35611

Ira L. Meyers, M.D.
State Health Officer
State Department of Public Health
State Office Building
Montgomery, Alabama 36130

Mr. H. N. Culver
249A HBD
400 Commerce Avenue
Tennessee Valley Authority
Knoxville, Tennessee 37902

James P. O'Reilly
Regional Administrator
Region II Office
U. S. Nuclear Regulatory Commission
101 Marietta Street, Suite 3100
Atlanta, Georgia 30303

U. S. Environmental Protection
Agency
Region IV Office
Regional Radiation Representative
345 Courtland Street, N. W.
Atlanta, Georgia 30308

Resident Inspector
U. S. Nuclear Regulatory Commission
Route 2, Box 311
Athens, Alabama 35611

Mr. Donald L. Williams, Jr.
Tennessee Valley Authority
400 West Summit Hill Drive, W10B85
Knoxville, Tennessee 37902

George Jones
Tennessee Valley Authority
Post Office Box 2000,
Decatur, Alabama 35602

Mr. Oliver Havens
U. S. Nuclear Regulatory Commission
Reactor Training Center
Osborne Office Center, Suite 200
Chattanooga, Tennessee 37411



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

TENNESSEE VALLEY AUTHORITY

BROWNS FERRY NUCLEAR PLANT, UNIT NOS. 1, 2 AND 3

DOCKET NOS. 50-259/260/296

NUREG-0737; II.K.3.22

1.0 Introduction

NUREG-0737, TMI Action Plan Item II.K.3.22 requires the automatic switchover of the Reactor Core Isolation Cooling (RCIC) system suction from the Condensate Storage Tank (CST) to the suppression pool. Part "a" of this item required, as an interim measure, that existing procedures for manual switchover be verified to assure that clear and cogent procedures existed. Part "b" of the item proposed that plant modifications for automatic switchover be completed by January 1, 1982. By letter dated September 1, 1981, we approved TVA's interim procedures for manual switchover.

By letter dated December 23, 1980, TVA informed us of its decision to not incorporate the automatic switchover feature and provided supporting information. TVA concluded that the addition of an automatic switchover of RCIC was unnecessary and that existing procedures were fully adequate. Our Generic Letter 82-05, dated March 17, 1982, again requested TVA's schedular commitment for completion of these modifications. By letter dated April 22, 1983, TVA reaffirmed its decision to not implement the requested modification.

Our letter of October 20, 1983 requested TVA to either provide additional justification for its position or to provide plans and schedules for implementing the modification. In a letter dated November 23, 1983 the licensee provided a discussion of why they concluded the modification was not necessary or cost-beneficial considering the design of the Browns Ferry facilities.

2.0 Evaluation

In the letter of November 23, 1983, the licensee provided several reasons (numbered (1) through (6) below) for not implementing the modifications recommended in Item II.K.3.22. Each reason is given below followed by an evaluation of the reason.

- (1) "RCIC is an auxiliary system designed primarily to provide relatively low flow (rated 600 gpm) vessel makeup during isolation events when normal feedwater supply is unavailable. During events that require significant amounts of high-pressure coolant injection, the 5000-gpm safety-grade HPCI system is relied upon. Failure of HPCI to operate during these events would result in operation of the ADS and LPCI systems; therefore, RCIC is not needed or useful during events requiring large amounts of high-pressure coolant injection."

The staff agrees with the statement that RCIC is not needed but disagrees with the statement that it is not useful. The Browns Ferry FSAR discusses the relative importance of the RCIC system in preventing the excessive release of radioactive materials to the environs.

The Browns Ferry FSAR states in Section 4.7.2 (Safety Objective) that the RCIC system provides makeup water to the reactor vessel during shutdown and isolation and following certain pipe break accidents to prevent the excessive releases of radioactive materials to the environs as a result of inadequate core cooling.

Furthermore, the system shall operate automatically in time to maintain sufficient coolant in the reactor vessel so that the integrity of the radioactive material barrier is not compromised. Piping and Equipment, including support structures, shall be designed to withstand the effects of an earthquake without a failure which could lead to a release of radioactivity in excess of the guideline values given in 10 CFR 100. The pump suction is normally lined up to the condensate storage tank which is a non-seismic category I suction source. The modifications recommended by Item II.K.3.22 would automatically provide a seismic category I suction source (e.g., suppression pool).

- (2) "It should be understood that the above condition of remaining on full 600-gpm RCIC flow for such an extended period of time is highly unlikely. The only required injection is that necessary to provide makeup for the inventory lost due to decay heat and pressure relief to the suppression pool. The 135,000 gallons are sufficient to provide for makeup for more than seven hours. With the normal water level of greater than 344,000 gallons, makeup is available for approximately 35 hours. These times are within the recovery mode of operation, and the operator will be under low stress conditions."

This statement tends to ignore the high pressure coolant injection (HPCI) and its somewhat larger flow capacity. However, the staff agrees that other systems which use the condensate storage tank as a water source are restricted by a standpipe to the use of water in the upper portion of the tank.. About 135,000 gallons are below the standpipe in each condensate tank. This quantity represents the conservatively calculated amount of water required to maintain reactor vessel level for at least 8 hours in hot shutdown conditions. A level indicator for each of the three tanks is located on panel 9-20 in the Unit 1 control room. The technical specification minimum level for the CST is 135,000 gallons at which a low-level alarm (non-Class 1E) is annunciated in the control room. The FSAR states that standard practice is to maintain a reserve of 135,000 gallons per operating reactor and that the only normal requirements drawn from this reserve volume are a substantially continuous flow of about 300 gpm for the control rod drive pumps.

Using these figures and assuming HPCI doesn't operate, RCIC would have approximately 2 1/2 hours of suction supply at the CST. Therefore, there is adequate time for the operator to perform the manual alignment of suction from the suppression pool. Although not absolutely required, the modification would be a desirable improvement in plant operations, eliminate the probability of an operator error and minimize the number of actions the operator had to perform.

- (3) "In addition to the above discussion, if only RCIC were running and the water level decreased in the CST suction supply, HPCI would realign to the suppression pool at the switchover setpoint. In the event of RCIC trip, there would be several hours before the water level decreased to the HPCI initiation point again. HPCI would then begin injecting to the vessel from the suppression pool if RCIC were not manually realigned to the suppression pool and restarted."

The staff is in agreement with the information discussed above. However, it should be noted that the RCIC system is the preferred system that is used by the operator to control reactor vessel level because RCIC flow more nearly matches boil-off due to decay heat than does HPCI flow. Therefore, vessel water level control is easier with RCIC than with HPCI. Thus, RCIC is the preferred make-up system for isolated conditions and automatic suction switchover would facilitate continuous operation.

- (4) "Further analysis of long-term events in NUREG/CR-2973, "Loss of Decay Heat Removal (DHR) Sequences at Browns Ferry Unit 1 - Accident Sequence Analysis," and NUREG/CR-3719, "The Effect of Small Capacity, High-Pressure Injection Systems on TQUV Sequences at Browns Ferry Unit 1," show that after approximately four hours, RCIC is no longer needed and CRD flow will maintain sufficient injection to the vessel. In practice, RCIC would probably be tripped off or realigned to the CST-to-CST test mode for pressure control with CRD supplying makeup after several hours. This would therefore negate the necessity for a RCIC suction switchover."

The staff generally agrees with this comment. We have not verified the four hour time requirement but, on a realistic basis, it appears to be reasonable.

- (5) "We additionally believe that it is more prudent to rely on the suction switchover only for HPCI to prevent a potential common mode failure causing both high pressure systems to inadvertently and irreversibly realign from the available CST to the suppression pool which could be at an elevated temperature. The desirability of protecting the condensate storage system as an external coolant source is clearly recommended in the NRC Severe Accident Sequence Analysis (SASA) program using Browns Ferry Unit 1 as the model plant."

The staff believes that design criterion number (7) that was transmitted (Memorandum from D. B. Vassallo to the Tennessee Valley Authority dated August 1982) to the licensee would preclude any potential common mode failures causing both high pressure injection systems to inadvertently and irreversibly realign from the CST to the suppression pool.

Design Criteria 7 states that the design shall be such that no single failure within any equipment added to accomplish the automatic switchover of RCIC will interfere with operation of the HPCI system or interfere with the transfer of HPCI suction from the condensate storage tank to the suppression pool.

- (6) "Finally, the costs associated with performing this modification cannot be justified since any safety benefit derived can only be classified as marginal if not nonexistent."

Without available cost figures to utilize in a cost-benefit analysis, it is difficult to refute this particular justification. However, because the time available for operator action is long, the risk is small.

CONCLUSION

Automatic switchover of the RCIC suction on low water level in the condensate storage tank would be a desirable feature because of the frequent use of the system. However, because of the time available for operator action, there is no basis for requiring the switchover to be automatic. We agree with TVA that manual switchover of the RCIC suction is adequate.