Met-Ed / GPU

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Writer's Direct Dial Number

January 14, 1981
TLL 672

Office of Nuclear Reactor Regulation
Attn: R. W. Reid, Chief
Operating Reactors Branch No. 4
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Sir:

Three Mile Island Nuclear Station, Unit 1 (TMI-1)
Operating License No. DPR-50
Docket No. 50-289
Additional Justification for TSCR No. 90
Vessel Internal Vent Valves

This letter and attachment are to supply additional justification for Technical Specification Change Request No. 90. This change requested modification of the Reactor Vessel Internal Vent Valve Surveillance to permit Cycle 5 operation without reperformance of the surveillance.

This additional justification should be reviewed in conjunction with that justification already supplied.

Sincerely,

H. D. Hukill
Director, TMI-1

HDH:DGM:lma

Attachment

cc: B. H. Grier
B. J. Snyder
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Three Mile Island Nuclear Station, Unit 1 (TMI-1)
Operating License No. DPR-50
Docket No. 50-289

Additional Safety Analysis Justifying Change

Met-Ed requests that the NRC grant an extension on the surveillance interval for specification 4.16.1. Removal of R.V. Head does include some risk as there are personnel safety concerns with any major lift and the personnel radiation exposures to perform these evolutions are significant. Removal/ Replacement of the RV Head presents the following adverse effects:

- o Significant Additional Man Rem (> 7.3)
- o Significant Additional Man Hours (> 740)
  @ $10.00/hr. reg. time
  15.00/hr. overtime
- o Material Cost (> $20,000) for replacement of O Rings, seals, etc.
- o Involvement of numerous plant systems in a very significant, complex evolution which, as with any major lift (RV Head 157 tons, Upper Plenum (Internals) 62 tons), although safely and properly controlled, certainly introduces some degree of risk.

Since initial criticality was achieved in June 1974, the eight internal vent valves have each been tested four times for a total of 32 functional tests without a single failure.

Due to concerns about vent valve wear at other B&W units, one vent valve was given a detailed examination during the Cycle 5 refueling. No noticable wear was found. This verified the excellent performance of the vent valves in Unit 1. The cause of the wear at the other units was subsequently correlated to characteristic resonant flow pulsations uniquely caused by RCP's different than those at TMI.

Industry records indicate that in the 7 other operating B&W reactors (total of 40 reactor years of operation), not a single Internal Vent Valve has ever failed to demonstrate satisfactory operability as required by T.S. 4.16.1 which verifies freedom of movement (both open and shut) and that no Internal Vent Valve has stuck open. Furthermore, all the possible modes of valve failure have been analyzed and are presented as follows:

- o Mechanical Hydraulic Category

  The Internal Vent Valves were specifically designed for this application. The plant records demonstrate that the Equipment Specification (B&W) No. CS-3-76 for Internal Vent Valves was thoroughly scrutinized by B&W, GPU and GPU Consultants for completeness, accuracy and applicability prior to use at TMI in 1969-1970. Specifically, materials for the valve body and disc are castings; the journals, shafting fasteners and locking devices were specifically selected on the basis of their corrosion resistance, anti-galling characteristics, and surface hardness; with the balance of the valve components - shaft bushings, retaining rings,

ring jack screws, and jackscrew bushings, manufactured from similarly comparable materials. Internal Vent Valve materials information is as follows:

Valve Part Name	Material and Form	Material Spec. No.
Valve Body	304 S.S. Casting*	ASTM A351-CF8
Valve Disc	304 S.S. Casting*	ASTM A351-CF8
Disc Shaft	431 S.S. Bar**	ASTM A276, Type 431 Cond.
Shaft Bushings	Stellite No. 6	(1)
Retaining Rings (Top and Bottom)	15-5 pH (H 1100) S.S. forgings	AMS 5658
Ring Jack Screws	"A-286 Superalloy" S.S.***	AMS 5737 C
Jackscrew Bushings	431 S.S. Bar	ASTM A276 Type 431 Cond. A
Misc. Fasteners, covers, locking devices, etc.	304 S.S. plate bar, etc.*	ASTM A240, ASTM A276

The valves were designed to provide self-alignment betwen the valve disc and its seat by means of ample diametrical clearance between the disc hinge shaft and its bushings. A total of eight rotational clearances are used to minimize impairment of disc free motion in service.

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* Carbide solution annealed, $C_{max.}$ 0.08%, $Co_{max.}$ 0.2%

** Heat treated and tempered to Brinell Hardness Number (BHN) range of 290-320

*** Heat treated to produce a BHN of 248 min.

(1) Trade name Stellite No. 6 Rockwell hardness C68, 45% Cobalt, 32% Chromium, 17% Tungsten, 1.5% Iron, 1.5% Silicon, 2.7% Carbon Ten Str - 100,000 psi, Comp Str - 325,000 psi

The potential mechanical modes of failure are:

1. Valve leakage due to excessive valve body/disc wear.

   This type of failure in the Internal Vent Valve can only result from Forced Reactor Coolant Flow. The duration that the valves will be placed under the conditions of forced RC flow is not dependent upon the calendar days between inspection but upon the length of actual operation. The length of Cycle 5 has not been changed from its original length which is bounded by past cycles and therefore will not subject the valves to more RC flow than previously reviewed and accepted by the NRC.

2. Failure of fasteners or locking devices due to vibration.

   Vibration can only occur with forced RC flow.* There has been no forced RCP flow condition since February 1979, and decay heat removal flows present have been <1% normal RC flow--not nearly significant enough to cause any change in the Internal Vent Valve's positions. As in Item 1 above, the duration in which the valves will be subjected to forced flow is not dependent on the calendar time between surveillances. This mode is thereby eliminated from consideration.

   * Note: All fasteners (locking devices) are Class A type specified to maintain position/integrity during operations.

3. Valve stuck open.

   The normal closing force on the Internal Vent Valves during flow conditions (Reactor Coolant Pumps running) is 29-43 psi. For these 14" diameter valves, this equates to a 4,466 to 6,622 lb. force. Also, these valves will remain closed without this closing force. By design, the valves hang closed by gravity without any differential pressure or mechanical device. Each vent valve was visually inspected and videotaped at the end of Cycle 4 during the exercising of the valve for freedom of movement, complete closure and indication of wear. All valves were seen to move freely, close completely, and showed no significant wear. This mode is thereby eliminated from consideration.

4. Failure of valve components due to overload or fatigue.

   The absence of any pressure stress from RC flow or even from RC system pressure eliminates this mode from consideration. Again, the time under these conditions is dependent on time of operation and not the time between inspections.

5. Damage from non-hydraulic manipulation (i.e. seismic or maintenance)

   There has been no outside manipulation of any of the Reactor Vessel Internals during the time since the Internal Vent Valves were last successfully examined and tested in February 1979, eliminating this mode from further consideration.

SUMMARY--A thorough examination of possible failure modes in the Mechanical/Hydraulic category has demonstrated that the valves will not be subjected to the conditions necessary for a failure in this category for a longer than usual period.

Chemical/Thermal Category

1. General Corrosion Attack

As previously illustrated, all materials used in the valve consideration were selected to most effectively resist corrosion under Reactor Coolant System conditions. Proper performance under these conditions was explicitly specified. There is excellent inherent corrosion resistance of these materials and no change in the major contributing factors to corrosion* - high temperature (>140°F) and stress (>100 psi pressure). The Internal Vent Valves current environment is therefore not as severe as that to which they were exposed during the five years of power operation. Physical inspection of a Vent Valve during the 1979 refueling outage verified that no noticeable corrosion is occurring under operating conditions. It is, therefore, concluded that corrosion attack during the extended shutdown will be insignificant.

* Note: Included general, intergranular stress, pitting and chloride stress corrosion.

2. Boric Acid Attack

Review of plant chemistry records reveal the pH/Conductivity, Hydrazine, Boron, Flouride, Crud and all required activity levels (Gross B-γ, Primary Coolant Isotope, Tritium) have been maintained in normal bands during the entire time since February 1979. Chloride levels have remained below specified maximum levels (.1 ppm) with the exception of anticipated, brief intervals during maintenance procedures - equipment insertion/removal. (Resulted in levels of .2-.3 ppm for <1% of time - not potentially significant levels). It is, therefore, postulated that the probable adverse affects of the boric acid attack during this time have been insignificant.

3. Boric Acid Precipitation

Under present reactor coolant conditions a continuous beneficial circulation via the decay heat removal system precludes adverse concentration conditions and eliminates formation of significant levels of boric acid precipitation.

SUMMARY--It can, therefore, be seen that, due to the extreme corrosion resistance of the valve materials, the pronounced lack of significant corrosion including contributing factors, and the condition of the chemical/thermal environment, the effect of this environment on the Internal Vent Valves is not of a magnitude to cause any significant change in their operability characteristics, physical condition or functional effectiveness.

The present mode of operation, which will continue until Cycle 5 Startup, places the valves in a favorable environment. The low RC flow rates, tight chemistry controls, and absence of power operation will not cause any wear, and little if any crud disposition. The valves will not be subject to the major cause of wear, high RC flow, for a longer than usual period.

CONCLUSION--The RV Head Removal/Replacement evolution as outlined above, presents various known adverse effects. The accomplishment of this evolution becomes necessary to refuel the Reactor. However, considering the analyzed status of the Internal Vent Valves in relation to their actual environment during the time since February 1979, the issue of required surveillance changes perspective. The

logical analysis of this situation dictates that the emphasis be on actual conditions to date, perceived with the knowledge and application of all known factors. We must conclude that the known adverse effects of a Reactor Vessel Head Removal/ Replacement coupled with the low probability of any appreciable change in the valves' operability characteristics, physical condition or functional effectiveness provide more than ample justification for extending the RV Vent Valve Surveillance interval to the next refueling outage.