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

September 1, 1989

TO: ALL HOLDERS OF OPERATING LICENSES FOR NUCLEAR POWER REACTORS WITH MARK I CONTAINMENTS

SUBJECT: INSTALLATION OF A HARDENED WETWELL VENT (GENERIC LETTER 89-16)

As a part of a comprehensive plan for closing severe accident issues, the staff undertook a program to determine if any actions should be taken, on a generic basis, to reduce the vulnerability of BWR Mark I containments to severe accident challenges. At the conclusion of the Mark I Containment Performance Improvement Program, the staff identified a number of plant modifications that substantially enhance the plants' capability to both prevent and mitigate the consequences of severe accidents. The improvements that were recommended include (1) improved hardened wetwell vent capability, (2) improved reactor pressure vessel depressurization system reliability, (3) an alternative water supply to the reactor vessel and drywell sprays, and (4) updated emergency procedures and training. The staff as part of that effort also evaluated various mechanisms for implementing of these plant improvements so that the licensee and the staff efforts would result in a coordinated coherent approach to resolution of severe accident issues in accordance with the Commission's severe accident policy.

After considering the proposed Mark I Containment Performance Program (described in SECY 89-017, January 1989), the Commission directed the staff to pursue Mark I enhancements on a plant-specific basis in order to account for possible unique design differences that may bear on the necessity and nature of specific safety improvements. Accordingly, the Commission concluded that the recommended safety improvements, with one exception, that is, hardened wetwell vent capability, should be evaluated by licensees as part of the Individual Plant Examination (IPE) Program. With regard to the recommended plant improvement dealing with hardened vent capability, the Commission, in recognition of the circumstances and benefits associated with this modification, has directed a different approach. Specifically, the Commission has directed the staff to approve installation of a hardened vent under the provisions of 10 CFR 50.59 for licensees, who on their own initiative, elect to incorporate this plant improvement. The staff previously inspected the design of such a system that was installed by Boston Edison Company at the Pilgrim Nuclear Power Station. The staff found the installed system and the associated Boston Edison Company's analysis acceptable.

A copy of Boston Edison Company's description of the vent modification is enclosed for your information. For the remaining plants, the staff has been directed to initiate plant-specific backfit analyses for each of the Mark I plants to evaluate the efficacy of requiring the installation of hardened wetwell vents. Where the backfit analysis supports imposition of that requirement, the staff is directed to issue orders for modifications to install a reliable hardened vent.

The staff believes that the available information provides strong incentive for installation of a hardened vent. First, it is recognized that all affected plants have in place emergency procedures directing the operator to vent under certain circumstances (primarily to avoid exceeding the primary containment pressure limit) from the wetwell airspace. Thus, incorporation of a designated capability consistent with the objectives of the emergency procedure guidelines is seen as a logical and prudent plant improvement. Continued reliance on pre-existing capability (non-pressure-bearing vent path) which may jeopardize access to vital plant areas or other equipment is an unnecessary complication that threatens accident management strategies. Second, implementation of reliable venting capability and procedures can reduce the likelihood of core melt from accident sequences involving loss of long-term decay heat removal by about a factor of 10. Reliable venting capability is also beneficial, depending on plant design and capabilities, in reducing the likelihood of core melt from other accident initiators, for example, station blackout and anticipated transients without scram. As a mitigation measure, a reliable wetwell vent provides assurance of pressure relief through a path with significant scrubbing of fission products and can result in lower releases even for containment failure modes not associated with pressurization (i.e., liner meltthrough). Finally, a reliable hardened wetwell vent allows for consideration of coordinated accident management strategies by providing design capability consistent with safety objectives. For the aforementioned reasons, the staff concludes that a plant modification is highly desirable and a prudent engineering solution of issues surrounding complex and uncertain phenomena. Therefore, the staff strongly encourages licensees to implement requisite design changes, utilizing portions of existing systems to the greatest extent practical, under the provisions of 10 CFR 50.59.

As noted previously, for facilities not electing to voluntarily incorporate design changes, the Commission has directed the staff to perform plant-specific backfit analyses. In an effort to most accurately reflect plant specificity, the staff herein requests that each licensee provide cost estimates for implementation of a hardened vent by pipe replacement, as described in SECY 89-017. In addition, licensees are requested to indicate the incremental cost of installing an ac independent design in comparison to a design relying on availability of ac power. In the absence of such information, the staff will use an estimate of $750,000. This estimate is based on modification of prevalent existing designs to bypass the standby gas treatment system ducting and includes piping, electrical design changes, and modifications to procedures and training.

The NRC staff requests that each licensee with a Mark I plant provide notification of its plans for addressing resolution of this issue. If the licensee elects to voluntarily proceed with plant modifications, it should be so noted, along with an estimated schedule, and no further information is necessary. Otherwise, the NRC staff requests that the above cost information be provided. In either event, it requests that each licensee respond within 45 days of receipt of this letter.

This request is covered by Office of Management and Budget Clearance Number 3150-0011, which expires December 31, 1989. The estimated average burden hours are 100 person hours per licensee response, including searching data sources, gathering and analyzing the data, and preparing the required letters. These estimated average burden hours pertain only to the identified response-related matters and do not include the time for actual implementation of the requested actions. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to the Record and Reports Management Branch, Division of Information Support Services, Office of Information Resources Management, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555; and to the Paperwork Reduction Project (3150-0011), Office of Management and Budget, Washington, D.C. 20503.

If you have any questions regarding this matter, please contact the NRC Lead Project Manager, Mohan Thadani, at (301) 492-1427.

Sincerely,

James G. Partlow
Associate Director for Projects
Office of Nuclear Reactor Regulation

Enclosures:
1. Description of Vent Modification at the Pilgrim Nuclear Power Station
2. List of Most Recently Issued Generic Letters

Enclosure 1

**BOSTON EDISON**
Pilgrim Nuclear Power Station
Rocky Hill Road
Plymouth, Massachusetts 02360

Ralph G. Bird
Senior Vice President — Nuclear

BECo 88-126
August 18, 1988

U. S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

License DPR-35
Docket 50-293

REVISED INFORMATION REGARDING PILGRIM STATION
<u>SAFETY ENHANCEMENT PROGRAM</u>

Dear Sir:

Enclosed is a description of a revised design for the Direct Torus Vent System (DTVS) that was described in the "Report on Pilgrim Station Safety Enhancements" dated July 1, 1987 and transmitted to the NRC with Mr. Bird's letter (BECo 87-111) to Mr. Varga dated July 8, 1987. This revision supersedes in its entirety the Section 3.2 included in the July 1, 1987 report.

On March 7, 1988 Boston Edison Company (BECo) personnel met with Dr. Murley, Mr. Russell, and Dr. Thadani and provided a tour of SEP modifications and an informal presentation of the quantification of competing risks associated with venting the containment and conclusions drawn from these results. This presentation provided BECo the opportunity to respond to questions posed under Item 1 Section 3.2 - "Installation of A Direct Torus Vent System (DTVS)" in Mr. Varga's letter to Mr. Bird of August 21, 1987 "Initial Assessment of Pilgrim Safety Enhancement Program". The material presented was made available to the resident inspector and was included as Attachment II in NRC Inspection Report #88-12, dated May 31, 1988.

As you are aware from plant inspections we have installed the DTVS piping and portions of related control wiring. Currently, the DTVS is isolated from the Standby Gas Treatment System (SBGTS) by blind flanges installed in place of Valve AO-5025 and the DTVS rupture disk. This configuration was inspected by NRR in the performance of a technical review which focused on System, Mechanical Design and Structural Design issues. The review took place on March 2-3, 1988 as documented in NRC Inspection Report #88-07, dated May 6, 1988 and determined the installation configuration to be acceptable. We now plan to remove these blind flanges and proceed with installation of Valve AO-5025 and the DTVS rupture disk. We conclude the valve and rupture disk provide equivalent physical isolation of the DTVS piping from the SBGTS and appropriately ensure the operational integrity of the SBGTS under design basis accident conditions. Following completion of this work, we will perform a local leak rate test to verify that Valve AO-5025 is acceptably leak tight using the same method previously utilized in testing the blind flange. We also plan to complete all remaining electrical work on the DTVS in accordance with the revised design.

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On the basis of the revised Section 3.2, we conclude that the DTVS design as described in the enclosure does not require any change to the Technical Specifications and that we can proceed with installation without prior NRC approval.

Please feel free to contact me or Mr. J. E. Howard, of my staff at (617) 849-8900 if you have any questions pertaining to the design details of the DTVS.

R. G. Bird

Attachment: Section 3.2 Revision 1 "Installation Of A Direct Torus Vent System (DTVS)"

JEH/amm/2282

cc: Mr. D. McDonald, Project Manager
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Senior NRC Resident Inspector
Pilgrim Nuclear Power Station

Attachment to BECo Letter 88-126

Section 3.2 Revision 1 "Installation Of A Direct Torus Vent System (DTVS)"

pages 14, 15, 16, 17, 18, 19, 19A, 19B

## 3.2 INSTALLATION OF A DIRECT TORUS VENT SYSTEM (DTVS)

### 3.2.1 Objective of Design Change

This design change provides the ability for direct venting of the torus to the main stack. Containment venting is one core damage prevention strategy utilized in the BWR Owners Group Emergency Procedure Guidelines (EPGs) as previously approved by the NRC and is required in plant-specific Emergency Operating Procedures (EOPs). The torus vent line connecting the torus to the main stack will provide an alternate vent path for implementing EOP requirements and represents a significant improvement relative to existing plant vent capability. For 56 psi saturated steam conditions in the torus, apporoximately 1% decay heat can be vented.

### 3.2.2 Design Change Description

This design change (Figure 3.2-1) provides a direct vent path from the torus to the main stack bypassing the Standby Gas Treatment System (SBGTS). The bypass is an 8" line whose upstream end is connected to the pipe between primary containment isolation valves AO-5042 A & B. The downstream end of the bypass is connected to the 20" main stack line downstream of SBGTS valves AON-108 and AON-112. An 8" butterfly valve (AO-5025), which can be remotely operated from the main control room, is added downstream of 8" valve AO-5042B. This valve acts as the primary containment outboard isolation valve for the direct torus vent line and will conform to NRC requirements for sealed closed isolation valves as defined in NUREG 0800 SRP 6.2.4. The new pipe is ASME III Class 2 up to and inclusive of valve AO-5025. Test connections are provided upstream and downstream of AO-5025.

The design change replaces the existing AC solenoid valve for AO-5042B with a DC solenoid valve (powered from essential 125 volt DC) to ensure operability without dependence on AC power. The new isolation valve, AO-5025, is also provided with a DC solenoid powered from the redundant 125 volt DC source. Both of these valves are normally closed and fail closed on loss of electrical and pneumatic power. One inch nitrogen lines are added to provide nitrogen to valves AO-5042B and AO-5025. New valve AO-5025 will be controlled by a remote manual key-locked control switch. During normal operation, power to the AO-5025 DC solenoid will also be disabled by removal of fuses in the wiring to the solenoid valve. This satisfies NUREG 0800 SRP 6.2.4, Containment Isolation System acceptance criteria for a sealed closed barrier. An additional fuse will be installed and remain in place to power valve status indication for AO-5025 in the main control room.

NUREG 0800, SRP 6.2.4, Item II.6.F allows the use of sealed closed barriers in place of automatic isolation valves. Sealed closed barriers include blind flanges and sealed closed isolation valves which may be closed remote-manual valves. SRP 6.2.4 calls for administrative control to assure that sealed closed isolation valves cannot be inadvertently opened. This includes mechanical devices to seal or lock the valve closed, or to prevent power from being supplied to the valve operator.

Consistent with SRP 6.2.4, valve AO-5025 will be a sealed closed remote manual valve under administrative control to assure that it cannot be inadvertently opened. Administrative control will be maintained by a key-locked remote manual control switch and a fuse removed to prevent power from being supplied to the valve operator. In accordance with NUREG 0737, Item II.E.4.2.7 Position 6, AO-5025 will be sealed closed and verified as such at least every 31 days.

A 20" pipe will replace the existing 20" diameter duct between SBGTS valves AON-108, AON-112 and the existing 20" pipe to the main stack. The existing 20" diameter duct downstream of AO-5042A is shortened to allow fitup of the new vent line branch connection.

A rupture disk will be included in the 8" piping downstream of valve AO-5025. The rupture disk will provide a second leakage barrier. The rupture disk is designed to open below containment design pressure, but will be intact up to pressures equal to or greater than those which cause an automatic containment isolation during any accident conditions.

The two Primary Containment Isolation Valves (PCIVs) AO-5042B and AO-5025 are placed in series with the rupture disk. No single operator error in valve operation can activate the DTVS. The rupture disk has a rupture pressure above the automatic containment high pressure trip point. Thus, the inboard PCIV (AO-5042B) will receive an automatic isolation prior to disk rupture. The inboard PCIV (AO-5042B) requires physical electrical jumper installation to open at primary containment pressure above the automatic high pressure trip point.

Valve AO-5025 will be closed whenever primary containment integrity is required and DC power to its solenoid control valve will be disconnected. Indication of valve position will be provided in the main control room even with the valve power removed. Use of the direct torus vent will be in accordance with approved EPG requirements and controlled by EOPs in the same manner as other existing containment vent paths. Prior to opening the vent valves the SBGT system will be shutdown and valves AON-108 and AON-112 (the outlet of SBGT) placed in a closed position.

New 8" vent pipe (8"-HBB-44), including valve AO-5025 is safety related. Vent piping downstream of AO-5025, including SBGTS discharge piping to main stack, is also safety related. All safety related piping will be supported as Class I. Nitrogen piping is non-safety related and will be supported as Class II/I.

The interpretation of the Class II/I designation through this report is given below:

All Class II items which have the potential to degrade the integrity of a Class I item are analyzed. Such Class II items do not require dependable mechanical or electrical functionality during SSE, only that all of the following conditions prevail:

1. The Class II items create no missiles which impact unprotected Class I items safety functions.

2. The Class II item does not deform in a way which would degrade a Class I item.

3. If the Class II item fails, then the Class I item is protected against the full impact of all missiles generated by the assumed failure of Class II items.

All electrical portions of this design are safety related except for the indicating lights on the MIMIC panel C904, the tie-ins to the annunciator, and interface with the plant computer.

### 3.2.3 Design Change Evaluation

#### 3.2.3.1 Systems/Components Affected

Containment Atmospheric Control System (CACS)

The torus purge exhaust line inboard isolation valve AO-5042B and the associated 8" pipe are the components of the CACS affected by the design modification. With incorporation of the subject modification, the CACS will depend on both essential AC (for valve AO-5042A) and essential DC (for AO-5042B) to perform its purging function.

The new 8" torus vent line will be connected to existing 8" CACS piping between valves AO-5042B and AO-5042A.

Standby Gas Treatment System (SBGTS)

The SBGTS fan outlet valves (AON-108 and AON-112), ductwork from these valves to the 20" line leading to the main stack, and the 20" line leading to the main stack are the components of this system affected by the proposed change.

Valve AON-108 is normally closed, fail-open. Valve AON-112 is normally closed, fail-closed, and these valves are provided with essential DC power and local safety related air supplies.

Primary Containment Isolation System (PCIS)

Valve AO-5042B is affected by the change from AC to DC power for the solenoid and by replacement of the existing air supply with nitrogen. The addition of containment outboard isolation valve (AO-5025) will not affect the PCIS.

Primary Containment System (PCS)

Valve AO-5025 acts as the primary containment outboard isolation valve for the direct torus vent line and will conform to NRC requirements for sealed closed isolation valves as defined in NUREG 0800 SRP 6.2.4.

3.2.3.2 Safety Functions of Affected Systems/Components

Containment Atmospheric Control System

This system has the safety function of reducing the possibility of an energy release within the primary containment from a Hydrogen-Oxygen reaction following a postulated LOCA combined with degraded Core Standby Cooling System.

Standby Gas Treatment System

This system filters exhaust air from the reactor building and discharges the processed air to the main stack. The system filters particulates and iodines from the exhaust stream in order to reduce the level of airborne contamination released to the environs via the main stack. The SBGTS can also filter exhaust air from the drywell and the suppression pool.

Primary Containment Isolation System

This system provides timely protection against the onset and consequences of design basis accidents involving the gross release of radioactive materials from the primary containment by initiating automatic isolation of appropriate pipelines which penetrate the primary containment whenever monitored variables exceed pre-selected operational limits.

Primary Containment System

The primary containment system, in conjunction with other safeguard features, limits the release of fission products in the event of a postulated design basis accident so that offsite doses do not exceed the guideline values of 10 CFR 100.

3.2.3.3 Potential Effects on Safety Functions

Containment Atmospheric Control System, Standby Gas Treatment System, Primary Containment Isolation System and Primary Containment System

The improvements change the AO-5042B solenoid control from AC to DC enabling it to open (from its normally closed position) with no dependence on AC power availability. The existing air supply to AO-5042B is being replaced by nitrogen.

Ductwork at the outlet of the SBGTS is replaced with pipe and the new vent line is connected to the 20" line at the outlet of the SBGTS.

Addition of a new 8" vent line with containment isolation valve AO-5025 off the existing torus vent line could introduce a flow path under design basis conditions that could vent the containment directly to the stack bypassing the SBGTS.

3.2.3.4 Analysis of Effects on Safety Functions

An analysis of the effects on the safety functions of CACS, SBGTS, PCIS and PCS for the installation of the direct torus vent is described as follows:

The change from AC to DC control and the replacements of air with nitrogen on AO-5042B does not adversely affect the ability to open AO-5042B when the containment is being purged, or to isolate under accident conditions.

The modifications to the ductwork and 20" line leading to the main stack do not affect the design basis safety function of any of the safety related systems.

During normal plant operations, the CACS and the SBGTS do not use the torus 20" purge and vent line to perform their safety functions. The containment isolation valves are in their normally closed position, thus maintaining primary containment boundary integrity.

There are no adverse affects on the primary containment system by the addition of the DTVS. Valve AO-5025 will conform to NRC criteria for sealed closed isolation valves as defined in NUREG 0800 SRP 6.2.4 and will not affect design basis accidents. Use of the DTVS will be in accordance with the containment venting provisions of EPGs as approved by the NRC and controlled by EOPs in the same manner as other existing containment vent paths. The effects on the torus of the new 8" piping and AO-5025 have been evaluated for Mark I program loadings, using ASME BPVC Section III criteria. The remaining piping including the rupture disk was evaluated using ANSI B31.1 requirements.

During plant startup and shutdown (non-emergency condition) when the purge and vent line is in use, valve AO-5025 remains closed. In addition, the rupture disk downstream of valve AO-5025 will provide a second positive means of preventing leakage and prevent direct release up to the stack during containment purge and vent at plant startup or shutdown.

During containment high pressure conditions, the torus main exhaust line is automatically isolated by the PCIS. There is no change to the existing primary containment isolation system function for AO-5042A or AO-5042B. The sealed closed position of valve AO-5025 and the additional assurance added by the rupture disk downstream will prevent any inadvertent discharge up the stack for all design basis accident conditions.

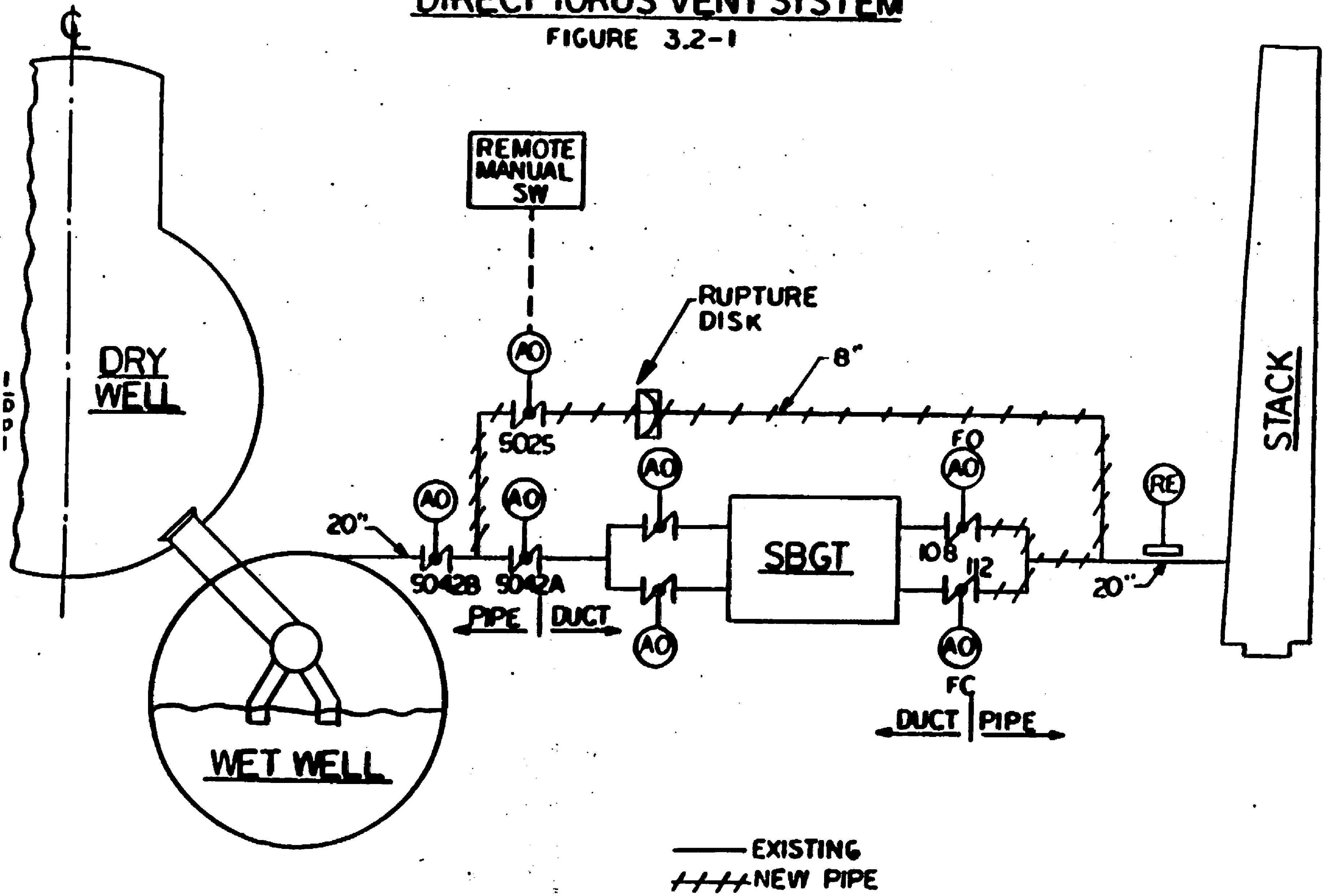
3.2.3.5 Design Change Evaluation Summary Conclusions

Installation of the DTVS does not adversely affect the safety functions of the CACS, SBGTS, PCIS or the integrity of primary containment or any other safety related systems.

Use of the DTVS will be in accordance with the containment venting provisions of EPGs as approved by the NRC and controlled by EOPs in the same manner as other existing containment vent paths. The DTVS provides an improved containment venting capability for decay heat removal which reduces potential onsite and offsite impacts relative to the existing containment venting capability.

# DIRECT TORUS VENT SYSTEM

FIGURE 3.2-1




REV. 1 (July 25, 1988)