BWR OWNERS' GROUP

K. S. Putnam, Chairman
Tel: (319) 851-7238
Fax: (319) 851-7364
Ken.putnam@nmcco.com

Nuclear Management Company • Duane Arnold Energy Center • 3277 DAEC Road • Palo, IA, 52324

BWROG-04035
December 13, 2004

US Nuclear Regulatory Commission
Document Control
Washington, DC 20555-0001

SUBJECT: **BWR OWNERS' GROUP LICENSING TOPICAL REPORT NEDO-33160, "REGULATORY RELAXATION FOR THE POST ACCIDENT SRV POSITION INDICATION SYSTEM" DATED DECEMBER 2004**

Attachment: NEDO-33160 "Regulatory Relaxation for the Post Accident SRV Position Indication System"

The BWR Owners' Group has completed an evaluation regarding the benefits of a separate post accident safety relief valve (SRV) position indication system that are installed in U.S. BWRs. The result of this review is that the installed post accident SRV position indication systems do not provide safety benefits for BWRs as expected. Such requirements resulted from the inclusion in Regulatory Guide 1.97 Revision 2 and 3 of SRV position for BWRs and the subsequent commitments by BWR Owners to the provisions of the Regulatory Guide.

Our evaluation concludes that maintaining this post accident system and meeting the requirements of the Regulatory Guide is a high cost for several BWR Owners with little operational benefits and no identified safety benefits. The existing separate SRV discharge pipe thermocouples also provide SRV position indication for operational purposes and post accident. Having regulatory requirements imposed for this post accident system at BWRs is not justified. The information provided by the system does not perform a safety function, is not used for accident detection, is not an indication of boundary integrity, nor is it essential for operator decisions in mitigating the consequences of design basis accidents. Several BWR Owners may choose to retain their post accident system but they should not be required to meet the requirements of Regulatory Guide 1.97 "Category 2" which includes environmental qualification (10CFR50.49) requirements. Other BWR Owners intend to remove their system after NRC approval of the Licensing Topical Report.

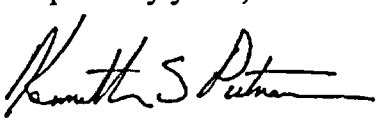
The BWR Owners' Group requests that this Licensing Topical Report be reviewed and approved. After approval, participating BWR Owners will pursue changes to their Plant Technical Specifications, Technical Requirements Manual, FSAR and regulatory commitments, as appropriate.

TOD

This letter has been endorsed by a substantial number of the members of the BWR Owners' Group. However, it should not be interpreted as a commitment of any individual member to a specific course of action. Each member must formally endorse the BWR Owners' Group position in order for that position to become the member's position.

The BWR Owners' Group is looking forward to your timely review of this Licensing Topical Report. If you desire to discuss this information in more detail, please contact J. M. Kenny at (610) 967-4461 or the undersigned.

Respectfully yours,



Kenneth S. Putnam
BWR Owners' Group Chairman

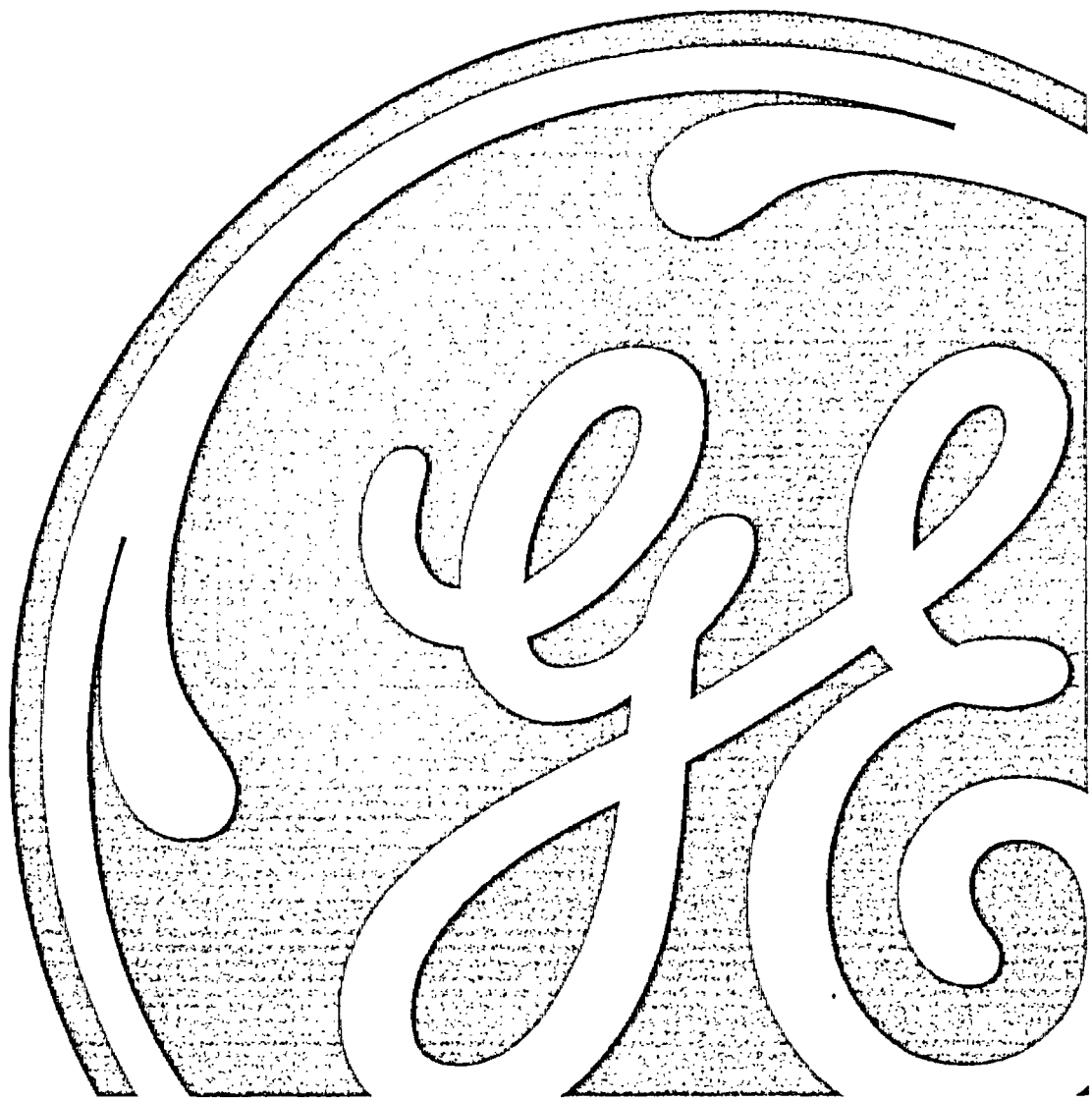
CC: J. E. Conen, BWROG Vice Chairman
BWROG Primary Representatives
BWROG Executive Oversight Committee
BWROG SRV Position Indication Committee
B. Pham, NRC
T. G. Hurst, GE
J. M. Kenny, GE

GE Nuclear Energy

NEDO-33160
Class I
DRF 0000-0032-1589
December 2004

BWR Owners' Group Licensing Topical Report

Regulatory Relaxation For The Post Accident SRV Position Indication System



GE Nuclear Energy

General Electric Company
175 Curtner Avenue, San Jose, CA 95125

NEDO-33160
Class I
DRF 0000-0032-1589
December 2004

BWR Owners' Group
Licensing Topical Report

REGULATORY RELAXATION FOR THE POST ACCIDENT SRV POSITION INDICATION SYSTEM

Approved by: _____
J. Kenny, Project Manager

IMPORTANT NOTICE REGARDING THE CONTENTS OF THIS REPORT

Please Read Carefully

DISCLAIMER

The only undertakings of the General Electric Company (GE) respecting information in this document are contained in the contract between the company receiving this document and GE. Nothing contained in this document shall be construed as changing the applicable contract. The use of this information by anyone other than a customer authorized by GE to have this document, or for any purpose other than that, for which it is intended, is not authorized. With respect to any unauthorized use, GE makes no representation or warranty, and assumes no liability as to the completeness, accuracy or usefulness of the information contained in this document, or that its use may not infringe privately owned rights.

TABLE OF CONTENTS

Acronyms and Abbreviations

ADS	Automatic Depressurization System
ALARA	As Low As Reasonably Achievable
AOO	Anticipated Operational Occurrence
ATWS	Anticipated Transient Without Scram
BWR	Boiling Water Reactor
BWROG	Boiling Water Reactor Owners' Group
CFR	Code of Federal Regulations
CRT	Cathode-ray tubes
DBA	Design Basis Accident
ECCS	Emergency Core Cooling System
EQ	Environmental Qualification
ESF	Engineered Safety Feature
GDC	General Design Criteria
HPCI	High Pressure Coolant Injection
HPCS	High Pressure Core Spray
LERF	Large Early Release Frequency
LOCA	Loss Of Coolant Accident
LTR	Licensing Topical Report
LVDT	Linear variable differential transformer
NOED	Notice Of Enforcement Discretion
NRC	Nuclear Regulatory Commission
NSSS	Nuclear Steam Supply System
PWR	Pressurized Water Reactor
PRA	Probabilistic Risk Assessment
RCPB	Reactor Coolant Pressure Boundary
RCIC	Reactor Core Isolation Cooling
RPV	Reactor Pressure Vessel
RG	Regulatory Guide
SPTMS	Suppression pool temperature monitoring system
SRV	Safety Relief Valve
STS	Standard Technical Specifications
TMI	Three Mile Island
TRM	Technical Requirements Manual
TS	Technical Specifications

1. INTRODUCTION

This generic Licensing Topical Report (LTR) addresses the post-accident safety relief valve (SRV) position indication system. It provides the basis for relaxation of current burdensome regulatory commitments by a review of regulatory guidelines and criteria, a summary of current plant operating experience, an evaluation of system performance from a design basis perspective and the current system operating and maintenance costs.

The Boiling Water Reactor Owners' Group (BWROG) has evaluated the current regulatory requirements and licensing commitments for post-accident SRV position indication system, and has concluded that the requirements are inconsistent with the safety benefits. Regulatory requirements for post-accident SRV position indication, resulting from the Three Mile Island (TMI) accident, are imposed on both Pressurized Water Reactors (PWRs) and Boiling Water Reactors (BWRs). The BWROG review concludes the TMI requirement for SRV position indication should not be applied to BWRs, because there is no identified safety benefit. As a result, the continued cost to maintain the separate post-accident system to imposed regulatory requirements is not justified.

The type of SRV position indication instrumentation used for post-accident monitoring varies within the BWR fleet as does the design function and operational use. Most plants have either tail pipe mounted pressure switches or acoustic monitors as their post-accident SRV position indication system. BWRs also have commercial grade SRV discharge pipe thermocouple instrumentation to provide position indication for normal operation. Such thermocouples provide similar information as the post-accident instruments for SRV position, and are the normal source for information on SRV leakage at most plants. Regardless of the type of SRV monitoring system, for the BWR, the knowledge of SRV position provides no essential information for ensuring a post-accident safety-related function.

Due to poor operating experience, many plants with acoustic monitors have incurred costly repair and replacements. At least one plant has replaced their system with a linear variable differential transformer (LVDT) system, which is mounted on the SRVs. The cost of the replacement exceeded $2.5 million as the system was required to meet their TMI imposed regulatory commitments. Some of the plants with tail pipe pressure switches use those switches to perform a separate design function called "Low-Low Set" which is intended to ensure SRV related containment loads are within analyzed limits.

For the plants whose design function for post-accident SRV position indication system is limited to meeting the regulatory requirements imposed by their TMI lessons learned commitments (Reference 1), an elimination of requirements can be supported including, but not limited to, environmental qualification (EQ).

In general, compliance to Regulatory Guide (RG) 1.97 (Reference 2) is generically imposed by 10 CFR 50.49 (Reference 3). Because regulatory guides are not regulations, if adequately justified, taking an exception to a specific regulatory guide position, is acceptable. This LTR justifies eliminating licensing commitments to provide a post-accident SRV position indication system, as directed by RG 1.97.

This approach minimizes the resource demand on the licensee for developing individual justifications and on the NRC for conducting numerous regulatory reviews. For BWRs that have

the SRV position indication system in their Technical Requirements Manual (TRM), it is expected that the system can be removed via the 10 CFR 50.59 process after the NRC approves this generic LTR. For plants that have these requirements in their Technical Specifications (TS), plant specific license amendments will be required. Plants will need to review their licensing and design basis for post-accident SRV position indication, and (if needed) submit a license amendment request that references this LTR (after NRC acceptance).

2. EXECUTIVE SUMMARY

The TMI accident and resulting lessons learned, resulted in the promulgation of new regulatory requirements for both PWRs and BWRs, including requirements to provide dedicated systems for post-accident SRV position indication. A major contributor to the TMI accident was a stuck open relief valve, which for a PWR has safety implications as it can affect core cooling and operator accident response. A stuck open SRV is a mild depressurization transient for a BWR resulting in a reduction in power with operator action directed at the resulting increase in suppression pool temperature. While SRV position indication is not a safety issue for BWRs due to design differences, similar regulatory requirements were imposed on both BWRs and PWRs.

Prior to the TMI accident, most operating BWR's and those under construction relied upon commercial grade SRV discharge pipe temperature thermocouples to provide indication of SRV position. To satisfy regulatory requirements resulting from TMI (Reference 1), BWR Owners committed to provide a separate post-accident monitoring system for SRV position indication. Several BWRs who were under construction at the time of the TMI accident added safety grade acoustic monitoring systems. BWRs in operation at the time of the accident relied upon use of tail pipe pressure switches sometimes combined with other existing instrumentation to meet their TMI lesson learned commitment. As a result of poor operational experience, some BWRs have changed their original post-accident system and have installed different designs to satisfy their regulatory commitment, but all BWRs have multiple methods for determining SRV position.

As part of their commitment, BWRs were expected to meet as a minimum the guidelines of RG 1.97, which has design and qualification categories imposed based on the nuclear safety importance of the different instruments. The SRV position indication was established as Category 2, which has lesser requirements than Category 1, but many plants went beyond Category 2 and committed to Category 1 designs. Per Section C.1 of RG 1.97, Category 2 includes the imposition of EQ requirements as well as requirements for reliable power, "augmented quality" and control room instrumentation features, however, it specifically excludes requirements for seismic qualification, redundancy and continuous display.

No BWR post-accident SRV position indication system performs or ensures any safety-related function. The BWROG has reviewed the potential safety functions and purpose for the post-accident SRV position indication system, as described in RG 1.97, and has concluded that there is no technical basis for requiring a BWR to have a separate system for post-accident conditions. Members of the BWROG SRV Position Indication Committee and the BWROG Integrated Risk Informed Regulation (IRIR) Committee report that their probabilistic risk assessments (PRAs) do not rely upon or address post-accident SRV position indication, and therefore, quantitative risk assessments cannot be made.

The additional monitoring system added as a result of TMI does provide additional operator information on SRV position at some plants, and it provides a backup to the discharge pipe thermocouples, but it does not provide a safety function nor is it relied upon for post-accident operator action.

Certain plants with Mark I Containments rely on their SRV position indication pressure switches to provide an input to the "Low-Low Set" circuitry, which is used to ensure SRV suppression pool discharges are within containment design loads assumptions. BWRs, who utilize the Low-

Low Set function, can reduce their original post-accident SRV position indication commitment, however, the change must be reviewed to assure that the Low-Low Set function and any associated analysis are not adversely affected.

The cost burden for maintaining the SRV position indication system varies among participating BWR Owners and the type of system used. Several BWRs, who use acoustical monitors, have experienced high system replacement in-kind costs (e.g., $300k plus 640 man-hours of installation labor for an in-kind system replacement at one plant), due to the environmental qualification costs of replacement equipment. One BWR installed a totally new system at a cost exceeding $2.5 million. The yearly maintenance costs are about $20k per year. However, due to obsolescence, obtaining replacement parts that meet regulatory requirements is a challenge. This is particularly true for those plants that have or will pursue License Renewal who must expect a total system replacement at some time in the future. BWRs with acoustic monitors have an additional challenge during outages to prevent system damage due to work inside their drywell. To prevent such damage, acoustic monitor cabling is disconnected and stored which adds to outage activities and personnel exposure at some plants.

Several participating BWR Owners find the information provided by their post-accident SRV position indication system to be useful for normal operations. Therefore, they plan to retain their current systems, but (after this LTR has NRC acceptance) will reclassify their systems as nonsafety-related (i.e., commercial grade), thus reducing maintenance and replacement costs. Other participating Owners plan to remove the system.

3. REGULATORY GUIDELINES AND PLANT LICENSING COMMITMENTS

As a result of the TMI accident, most BWR's were required to commit to RG 1.97 Category 2 criteria for a post-accident SRV position indication system. Category 2 imposes design criteria for EQ (10 CFR 50.49), augmented quality, reliable power and indication. Some plants went beyond the Category 2 criteria to over classify and commit to design criteria similar to RG 1.97 Category 1, including seismic, single failure, uninterruptible power, etc. RG 1.97 lists the BWR variables to be monitored. SRV position indication is included as a Type D, Category 2 variable, whose purpose is defined as "Detection of accident; boundary integrity indication."

Type D Variables are "those variables that provide information to indicate the operation of individual safety systems and other systems important to safety. These variables are to help the operator make appropriate decisions in using the individual systems important to safety in mitigating the consequences of an accident." However, for a BWR, knowledge of SRV position is not used by the operator to "*make appropriate decisions in using the individual systems important to safety in mitigating the consequences of an accident.*" Therefore, deleting SRV position indication from the RG 1.97 Type D Variables would not affect the intent of RG 1.97 or plant safety.

A review of emergency procedures confirms that the SRV position indication system is not a primary source for required information. RPV pressure and suppression pool temperature, which are RG 1.97 Category 1 monitored variables, are the key variables for determining post-accident SRV operation. RPV pressure and suppression pool temperature instrumentation (in combination with others e.g., RPV water level) satisfy the *accident detection* and *boundary integrity indication* purpose specified in RG 1.97 for the SRV position variable. The design and qualification requirements for this instrumentation exceed the requirements for the Type D SRV position indication instrumentation. SRV position indication (closed - not closed) is of little importance for post-accident operator information, and is not relied on for accident mitigation. In addition, the SRV discharge pipe thermocouples also provide SRV position indication both for normal operation and for accident conditions. Therefore, with respect to safety, the post-accident SRV position indication system is superfluous, and thus, should not be required.

BWRs were required to provide commitments to the NRC to satisfy TMI Lessons Learned including commitments for SRV position indication (Reference 1, item II.D.3). The need to commit to the provisions of RG 1.97 for Category 2-Type D variables, which includes EQ requirements, resulted in many BWRs going beyond the Category 2 requirements and designing their SRV position indication instrumentation to meet the more stringent Category 1 requirements. In the 1990's, the shutdown requirement in the original TS resulted in numerous licensee requests and NRC approvals for Notices of Enforcement Discretion (NOEDs) to avoid unnecessary plant shutdowns due to inoperable SRV position indication instrumentation. Subsequently, many BWRs adopted the improved Standard Technical Specifications (STS) (References 4 and 5). This allowed the licensees to relocate and control operability requirements for SRV position indication instrumentation outside of TS. Adoption of the improved STS also allowed licensees to eliminate the shutdown requirement for this instrumentation.

Post-accident monitoring instrumentation for Category 2 variables need not be powered from essential power supplies, need not be single failure tolerant, do not require seismic qualification, and may be indicated in the control room exclusively by cathode-ray tubes (CRTs). Thus, the

instrumentation system may be allowed to fail under accident conditions for any of a number of random and Design Basis conditions. Designing the instrumentation to ensure its ability to operate under harsh (post-accident) environmental conditions without also including provisions to ensure it would be available on the loss of offsite power or in the event of random events is inconsistent and contributes little to nuclear safety. As a consequence, certain Category 2 instruments, including post-accident SRV position indication at some BWRs, were designed consistent with the more stringent Category 1 criteria. This was particularly true for BWRs that were under construction at the time of the TMI accident.

The issue of requiring an operable post-accident SRV position indication system has been generically addressed in NUREG-1433 and NUREG-1434 (References 4 and 5). As noted above, those BWRs that have converted to improved STS, have relocated operability requirements for their post-accident SRV position indication system from the TS to their TRMs. Thus, these plants no longer have a TS requirement to shutdown if their post-accident SRV position indication system is inoperable, nor obtain NRC approval to continue to operate. Therefore, the issue of requiring an operable SRV position indication system has been generically resolved with the NRC.

The post-accident SRV position indication system was removed from the STS on the basis of NRC deterministic screening criteria, as part of the improved Technical Specifications upgrade program. Because SRV position does not qualify as a Type A or Category 1 variable under Regulatory Guide 1.97, it is not considered to be needed by the Operator to perform "necessary normal actions" under accident conditions. Removal from the TS is justified as follows at one plant:

CTS 3/4.4.2 requires the S/RV acoustic monitors be Operable and requires the performance of a Channel Functional Test and a Calibration. The S/RV acoustic monitors provide a monitoring function only to detect an open S/RV and do not impact the Operability of the S/RVs. ITS 3.4.3 requires the Operability of the S/RVs, but does not require that the acoustic monitors are Operable. This is acceptable because the requirements for the acoustic monitors do not impact the ITS requirement to maintain the S/RVs Operable...This change is a less restrictive administrative change with no impact on the margin of safety.

4. JUSTIFICATION FOR ELIMINATION OF LICENSING COMMITMENTS

The following reviews plant abnormal events, assesses the regulatory imposed RG 1.97 Type D classification for SRV position indication, assesses the accident detection and boundary integrity indication purpose, and reviews SRV position indication related procedures. The conclusion is that a Type D classification and associated Category 2 requirements are not needed for the post-accident SRV position indication system, and that BWRs should be allowed to relax their related commitments.

Prior to TMI, the normal operating method for SRV position indication was provided by SRV discharge pipe thermocouples. The thermocouples provide information on valves being open and indication of valve leakage during normal operation. The addition of a post-accident SRV position indication system only provides an alternate means for determining the valves are open, but it does not provide information on leakage at most BWRs. Some plants note that their post-accident system does provide advantages over the pipe thermocouples in post scram reviews of SRV openings and is a better indicator of SRV cycling, but the BWR design does not rely on the instruments for the purpose stated in the RG. Some plants use their post-accident SRV position indication system for purposes other than accident detection and boundary integrity indication, and thus, those plant may retain the system for reasons other than stated in RG 1.97.

4.1 Review of Plant Events

The SRV position indication system does not perform or ensure any safety-related function, it is not relied upon for accident detection or mitigation, and boundary integrity indication for SRVs is not a safety concern for a BWR. The PWR design relies on heat transfer through steam generators as their primary means for core cooling. Loss of integrity in the primary system by an open relief valve can result in loss of steam generator circulation and thus their primary heat removal pathway. Unlike the PWR, the BWR core is cooled by maintenance of RPV water level for normal operation, anticipated operational occurrences (AOOs), and accident conditions, regardless of SRV position.

A stuck open SRV occurring during normal operation for a BWR would result in RPV pressure reduction, a reduction in power, heat up of the suppression pool and an initial reduction in RPV water level. The feedwater control system instrumentation would detect the reduced water level and adjust the feedwater flow to restore and maintain RPV water level. Heat up of the suppression pool represents an operational challenge (i.e., not exceeding the suppression pool operating limit) and is an indication of SRV position. Increasing suppression pool temperature would be detected by the suppression pool temperature monitoring system (SPTMS) instrumentation. Operator actions based on SPTMS indication would result in plant shutdown, if the suppression pool temperature exceeds the specified TS limit. A post-accident SRV position indication system is not needed or used in mitigating a stuck open SRV event.

A BWR is specifically designed to depressurize the RPV during different accident scenarios, and thus, loss of "boundary integrity" due to SRV operation is not a safety concern. Depressurization allows the initiation of low-pressure ECCS loops to provide core cooling. Low-pressure ECCS initiation and operation is independent of what causes the RPV to depressurize (e.g., line break or ADS actuation). SRV position indication is not used for accident detection and mitigation (e.g., low-pressure ECCS initiation). ECCS initiation and

operation are primarily based on RPV water level, RPV dome pressure, containment pressure and suppression pool temperature. Knowledge of SRV position or its indication does not affect automatic or manual low-pressure ECCS operation, and thus, does not affect short or long term core cooling.

4.2 Accident Detection and Mitigation

The SRV position indication instrumentation provides direct indication of flow through a Main Steam Safety/Relief Valve. This can occur as the result of:

- deliberate (planned) manual opening of the valve under operating conditions;
- deliberate (planned) manual opening of the valve under shutdown conditions (pressure control);
- as the result of primary reactor system pressure exceeding the valve 'relief' function setpoint during power operation (AOO);
- as an effect of a system isolation and reactor shutdown;
- as the result of a spurious actuation of the valve while at power (stuck open relief valve); and
- as the result of manual or automatic operation of the Automatic Depressurization System (ADS) function.

Only the last item is associated with an "accident" within the context of the guidance in RG 1.97.

A stuck open SRV is an AOO with the worst case being the valve stays open. This is considered a mild depressurization transient resulting in a reduction of power with operator action being to respond to the resulting increase in suppression pool temperature. The SRV pipe thermocouples may be used by the operator to detect this event.

There is no event where the SRV position indication function is relied upon for accident detection. The function of ADS is to provide the capability to reduce reactor pressure to allow low-pressure ECCS to function to provide core cooling.

While the SRV position indication system provides positive indication of flow through the SRV/ADS valves, that information is of secondary importance to the operator during operation of the ADS function. Successful indication of the ADS actuation is provided (via RPV pressure and suppression pool temperature) by RG 1.97 Category 1 instruments. RPV pressure and suppression pool temperature indicate the safety function of the ADS and the primary effect of that operation (i.e., suppression pool heat up).

Flow indication through the SRVs does not give the operator a unique indication of ADS actuation, a positive indication that an accident has occurred, or an essential confirmation that an accident mitigation function has occurred.

4.3 Boundary Integrity Indication

PWRs rely on heat transfer through steam generators as their primary means of core cooling. Loss of integrity in the primary system can result in loss of the natural or forced circulation through the steam generators, and thus loss of the primary heat removal pathway. Unlike the

PWR, the BWR core is cooled by maintenance of water level either during normal operation, for shutdown cooling, or when maintaining adequate core cooling in accident conditions.

Loss of primary coolant inventory under normal operation or shutdown conditions, including SRV leakage while clearly undesirable, is not necessarily a "safety" issue as long as reactor water level is maintained (the primary effect being suppression pool heat up, which is adequately indicated directly by suppression pool temperature). Loss of primary coolant inventory through a breach of the reactor coolant pressure boundary (RCPB) is the essence of a LOCA. Because the bounding hypothetical "accident" breach is from a pipe located below the top of the core (i.e., recirculation suction line break), which causes the RPV to depressurize, the position of the SRVs is irrelevant. Therefore, for the limiting LOCA, the indication of SRV position for determining RCPB integrity is not important to safety, and provides no indication of any accident mitigation (e.g., ADS actuation) function.

ADS initiates to depressurize the RPV, for any abnormal event (which does not depressurize the RPV) where ECCS is required. For all events that require ADS initiation, the fact that RPV pressure deceases and suppression pool temperature increases provides adequate indication that ADS has successfully initiated.

4.4 Plant Procedures

Many BWRs have an operating procedure, which addresses ADS and SRV and governs operation of their SRV position indication system. The procedures differ among the BWR fleet but most identify SRV position indication as one of several methods to verify SRV operation including discharge pipe temperature, suppression pool temperature, and RPV pressure. SRV position indication is referenced in these procedures as the means for verifying the SRVs are closed, but this is not a safety issue and is not the only means available to determine that the SRVs are closed.

BWR emergency operating procedures (EOPs), which are based on BWROG emergency procedure guidelines (EPGs), provide proper guidance on actions to take in the event of a loss of SRV position indication, whether that failure is detected or not. Typical EOPs from one Plant include:

> Rapid Depressurization credits the post-accident SRV position indication system (acoustic monitor system) with only providing one of several acceptable methods of determining SRV position. SRV position is one of several decision point inputs used to judge whether all ADS valves are open; there is no adverse effect if a failed acoustic monitor system (false 'no flow' indication) causes unnecessary action to open more valves.
>
> If at least four (4) SRVs are open, the RPV depressurizes and remains depressurized, thus providing further direct evidence of SRV actuation, independent of the acoustic monitor function. ADS is used as a recourse if a failed indication (< 4 S/RV's are open - no flow indicated) exists with a pressurized vessel.
>
> RPV Control governs the use of SRVs under accident and AOO conditions. The abnormal indications directs the manual operation of the SRVs for vessel pressure control, without specifically identifying the specific monitors or any other related symptom or plant condition for verification of open/closed status. Accomplishment of the procedure intent is sufficient for the protection function.

Other Functions noted in Procedures

The post-accident SRV position indication system or the SRV thermocouples can be used to detect flow through the SRVs for other (i.e., non-accident) conditions, including detection of flow during alternate shutdown cooling and for detection of flow during other plant pressurization events, including Anticipated Transients Without Scram (ATWS) scenarios. However, none of these functions is safety-related, and none generate the harsh environmental conditions that are the basis for the EQ program. In addition, no credit is taken for the function of the post-accident SRV position indication system in the plant Individual Plant Evaluation (IPE).

4.5 Conclusion

The stated purpose for a RG 1.97 Type D post-accident SRV position indication system is not needed for BWRs, and the indications of RPV pressure and suppression pool temperature are sufficient for all SRV related post-accident and post-AOO indications.

5. SRV POSITION INDICATION ANNUAL COST BURDEN

The SRV position indication system annual cost burden varies among the fleet based on the type of system. BWRs that utilize acoustic monitors have experienced significant cost to maintain their equipment including the need for replacements to meet EQ requirements. Replacement kits for these BWRs can cost $300k depending on the number of monitors. This cost, added to the labor cost (640 man hours) and required engineering support costs, can exceed $400k for replacement of existing equipment. Much of the work involves inside containment activities, resulting in an ALARA estimated dose of 4.8 man-REM, and the potential for increasing outage durations. BWRs with acoustic monitors have an additional challenge during outages to prevent system damage due to work inside the drywell. To prevent damage, acoustic monitor cabling is disconnected and stored, which adds to outage activities and personnel exposure. One plant, that had acoustic monitors, chose to replace the equipment due to poor operational experience and costly repairs. They replaced the system at a cost in excess of $2.5 million driven by the need to meet their existing design requirement and meet licensing commitments.

Another plant experienced a shutdown for inoperable acoustic monitors prior to their conversion to improved STS, which eliminated their need to shutdown for inoperable monitors. That plant experienced the cost of equipment replacement and the loss of generation resulting from the shutdown.

BWRs that utilize pressure switch type position indication instruments do not experience the same cost for repair/replacements, but they still need to expend additional cost to meet current requirements including EQ for such systems. Future concerns with equipment obsolescence will also contribute to costs for these owners who should be able to utilize commercially available equipment existing at the time for such replacements.

6. CONCLUSIONS AND RECOMMENDATIONS

As a result of the TMI accident and resulting lessons learned, regulatory commitments were imposed on BWRs and PWRs to have a post-accident SRV position indication system. This system must meet the design and qualification requirements of Regulatory Guide 1.97 Category 2, which includes EQ requirements. The BWR SRV's principal safety function is RPV pressure control (RPV overpressure, ADS). SRV discharge causes containment suppression pool temperature to increase. Safety grade instrumentation indicates RPV pressure and suppression pool temperature, and additional instrumentation (SRV discharge line thermocouples) is provided to monitor SRV position for normal operations and AOOs.

For the BWR, a post-accident SRV position indication provides no safety benefit, and thus, should not be a RG 1.97 Type D indication. With respect to safety, the post-accident SRV position indication system only is a secondary (i.e., redundant) indication system. It provides operators with information on SRV discharges and indicates if an SRV has closed after discharging. Neither of these functions is important to safety for a BWR.

Some BWRs use the SRV position indication system for normal operation and shutdown purposes, and may choose to retain this instrumentation. However, this system should not be subject to the current design and qualification requirements of RG 1.97 Category 2.

A review of the post-TMI requirements imposed by licensee commitments to the NRC versus what is contained in RG 1.97 has been completed by the BWROG SRV Position Indication Committee. The conclusion is that a reduction in requirements is justified including but not limited to EQ. The stated purpose of detection of an accident and boundary integrity indication is fulfilled by other RG 1.97 Category 1 instrumentation, including RPV pressure and suppression pool temperature.

The imposition of RG 1.97 Category 2 requirements has for some BWRs resulted in their commitments going beyond Category 2 to Category 1 in order to ensure requirements are met. BWRs that choose to continue to utilize their post-accident SRV position instruments for normal operation purposes and as a redundant source for accident information should be permitted to treat the instruments as commercial grade, and as performing the same function as the SRV pipe thermocouples. Others may choose to eliminate their post-accident SRV position instrumentation commitment, because (1) its function is provided by other instruments, which are currently required by RG 1.97, and (2) its normal operating system function is adequately provided by other instruments.

The cost of maintaining a post-accident SRV position indication system varies among plants, based on the type of system. Many plants with acoustic monitors report significant cost to maintain and replace their equipment. At one plant, costs in excess of $2.5 million have been expended to replace the system, and continuing system reliability problems are reported at others. Those BWRs that have pressure switch type designs also experience replacement costs and are expected to have to address future obsolescence challenges.

Each plant will need to evaluate their SRV position indication system to support plant-specific regulatory reduction under their change program (10 CFR 50.59 or Regulatory Commitments) before proceeding with implementation of revised requirements.

7. REFERENCES

1. USNRC, "Clarification of TMI Action Plan Requirements," NUREG 0737, November 1980.
2. USNRC, "Instrumentation for Light-Water-Cooled Nuclear Power BWRs to Assess Plant and Environs Conditions During and Following an Accident," Regulatory Guide 1.97, Revision 2, December 1980, and Revision 3, May 1983.
3. USNRC, 10 CFR 50.49, "Environmental qualification of electric equipment important to safety for nuclear power plants."
4. USNRC, "Standard Technical Specifications General Electric Plants, BWR/4," NUREG-1433, Revision 3, June 2004.
5. USNRC, "Standard Technical Specifications General Electric Plants, BWR/6," NUREG-1434, Revision 3, June 2004.

NE26019