THE BWR VESSEL AND INTERNALS PROJECT - 2001 AND BEYOND

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Background

The BWR Vessel and Internals Project (BWRVIP) is an international association of utilities owning boiling water reactors (BWRs). Figure 1 contains a list of current BWRVIP member utilities. The association was formed in 1994 with the following objectives: to lead the BWR industry toward generic resolution of reactor pressure vessel and internals material condition issues; to identify or develop generic, cost-effective strategies from which each operating plant will select the most appropriate alternative; to serve as the focal point for the regulatory interface with the industry on BWR vessel and internals issues; and to share information and promote communication and cooperation among participating utilities.

The initial issue faced by the BWRVIP was core shroud cracking that had been observed in a number of BWRs. The BWRVIP reacted by quickly developing a set of industry guidelines to assist utilities in inspecting, evaluating, and, if necessary, repairing cracked shrouds. Subsequently, the BWRVIP proactively developed a comprehensive set of guidelines for managing degradation in other reactor internal components, including the reactor pressure vessel itself. The major components addressed by the BWRVIP are included in Figure 2. In addition, the program has sponsored related work such as: experimental determination of crack growth rates in various BWR materials; mitigation of intergranular stress corrosion cracking (IGSCC) through hydrogen water chemistry, zinc addition and noble metal chemical application (NMCA); development of repair techniques for various internal components; and development and documentation of inspection techniques.

The initial goals of the BWRVIP have been met. The program has published over 90 reports that are available for use by utilities to develop plant-specific programs to manage component degradation. Key reports have been submitted for approval by the US Nuclear Regulatory Commission (NRC) for use by utilities on a generic basis. Some

United States Companies

Alliant-IES Utilities
AmerGen Energy Co.
Carolina Power & Light Co.
Detroit Edison
Energy Northwest
Entergy Nuclear Northeast
Entergy Operations Incorporated
Exelon Corp.
First Energy
Nebraska Public Power District
Niagara Mohawk Power Co.
PPL (Pennsylvania P & L)
PSEG Nuclear
Southern Company
Tennessee Valley Authority
Vermont Yankee
Xcel Energy

International Companies

Chubu Electric Power Co., Japan
Chugoku Electric Power Co., Japan
Comision Federal de Electricidad, Mexico
Forsmark Kraftgrupp, Sweden
Iberdrola Generacion, S. A., Spain
Japan Atomic Power Co., Japan
OKG Aktiebolag, Sweden
Taiwan Power Company, Taiwan
Tohoku Electric Power Co., Japan
Tokyo Electric Power Co., Japan

Figure 1. BWRVIP Member Companies

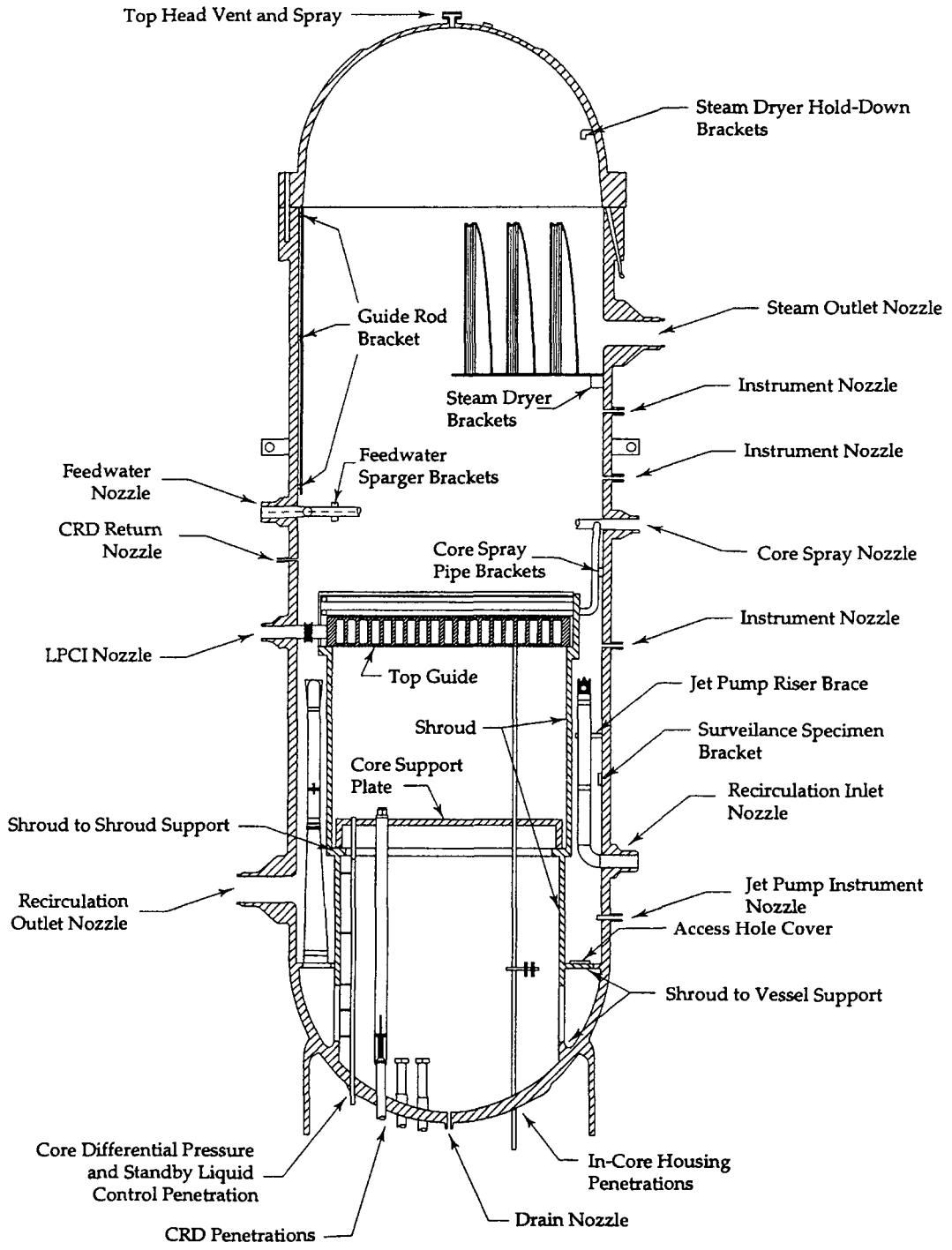

Figure 2 BWR Reactor Internal Components

of the submitted reports contain information for internals management during license renewal periods. NRC approval of BWRVIP reports is nearing completion.

Future Program Focus

For 2001 and beyond, the focus of the BWRVIP is changing. Up to this point, the primary goal has been to develop and obtain NRC consensus on products to manage degradation. This has required a large-scale effort with participation from well over one hundred utility representatives serving on five BWRVIP Technical Committees. In the future, one of the key program goals will be to maintain the existing set of BWRVIP guidelines and to update them as necessary.

As utilities implement the various guidelines, it is anticipated that feedback on their implementation will be communicated to the BWRVIP. The feedback may be spontaneously provided by a utility or may be generated through other activities such as utility self-assessments that are currently being performed, or through interaction at symposiums or BWRVIP training sessions. This feedback must be evaluated by a group of experts and, if appropriate, incorporated into the guidelines. This activity will require that key members of the current BWRVIP technical committees remain involved in the maintenance mode of the program. This "maintenance mode" activity must be managed with care and diligence to ensure that the guidelines remain useful; however, it will not require the massive development effort that has been required to date.

In addition to the maintenance mode activities, another activity of the BWRVIP will be to respond, as needed, to new generic concerns related to BWR materials issues. In the past, the focus of the BWRVIP has been on the reactor pressure vessel and internal components. In the future, the BWRVIP will continue to resolve issues and enhance products associated with these components and to interact with the NRC on behalf of the participating members. However, a small number of prior BWRVIP products have related to issues that were outside the original scope of the program. One example is a project undertaken in 1999 to develop a technical basis for revisions to inspection requirements for stainless steel piping. While not within the program scope, parts of the technical bases were interconnected with ongoing BWRVIP activities. The BWRVIP Executive Committee agreed that the talent for addressing the issue resided within the BWRVIP structure and that it would be to the benefit of industry as a whole to have the project performed within the program. The result of the project was a technical justification for a reduction in the number of welds to be examined in some piping categories and an increase in time between inspections in others. A second example is the ongoing Integrated Surveillance Program in which large cost savings will be realized by the industry by coordinating the removal and testing of surveillance capsule samples to meet 10CFR50, Appendix H, requirements. Again, the project was not specifically within the scope of the original program, but the BWRVIP structure provided an effective mechanism for meeting the project goals.

Other major focus areas of BWRVIP activities in 2001 will be:

- crack growth model for highly irradiated stainless steels
- fracture toughness of highly irradiated stainless steels
- reduced nozzle inspection requirements
- fluence calculation methodology for BWRs
- post-Noble Metal Chemical Application (NMCA) poolside surveillance of Peach Bottom 2 fuel
- optimizing coolant chemistry using depleted zinc oxide and NMCA

In the future, it is anticipated that additional material-related issues will arise and that the BWRVIP will be asked to coordinate their resolution. This coordinated resolution is beneficial for issues that arise from within the industry, as well as those initially recognized by the regulatory authorities.

Future BWRVIP Structure

In order to accommodate the two future goals of maintaining existing BWRVIP products and responding to new generic concerns for BWR material issues, a number of interim changes to the BWRVIP organizational structure are being implemented for 2001. The previous organization included five technical committees. The Assessment Committee has been responsible for developing guidelines for inspecting components and for evaluating any degradation found. The Inspection Committee has focused on specifying appropriate inspection techniques and developing new techniques when required. The Repair Committee has published design criteria for repairs to internal components and has worked with industry to ensure that repair methods are available for all components. The Mitigation Committee has addressed methods for reducing or eliminating IGSCC degradation with hydrogen water chemistry or other methods. And finally, the Integration Committee has coordinated the activity of the other four committees and has acted as the primary interface with the US NRC. Overseeing this entire activity was the BWRVIP Executive Committee which consisted of one executive from each participating utility. The Executive Committee established the annual project scope and budget. This previous structure was effective in meeting the program goals.

To meet future program needs, a more streamlined structure with formal interfaces with other industry organizations is appropriate. The new organization will combine the Inspection, Assessment and Repair Committees into a single technical committee. A sufficient number of members from the former committees will be assigned to the new committee in order that adequate representation is maintained from each of the technical disciplines. The Integration and Mitigation committees will continue in their current form. This new organization will ensure continuity for the program and will minimize the cost to the industry for support of the overall program. This revised technical committee organization shown in Figure 3 will be phased in beginning in 2001.

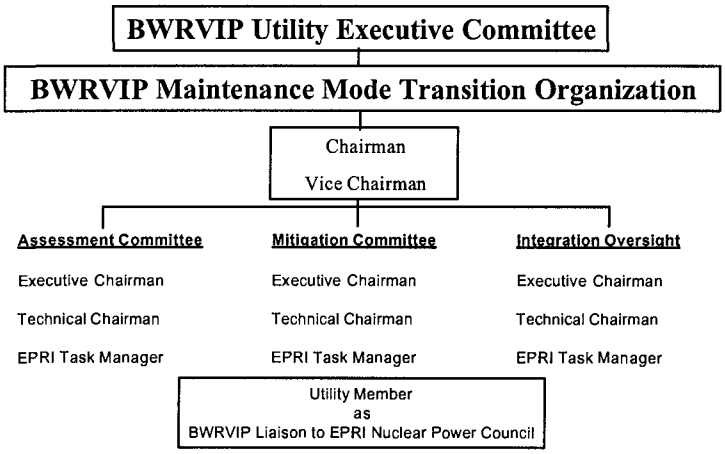

Figure 3 BWRVIP Organizational Structure for 2001 and Beyond

Formal interface with other industry organizations, namely the BWR Owners' Group (BWROG) and the EPRI Nuclear Power Council, has already been established. Beginning in 2000, meetings of the BWRVIP and BWROG Executive Committees have been collocated to ensure coordination of activities. Additional coordination with other industry groups may be appropriate in the future.

The BWRVIP has enjoyed a successful history of responding to and solving industry issues. These organizational changes will ensure that the BWRVIP is able to respond to future utility needs.