Program Management Office
102 Addison Road
Windsor, Connecticut 06095

August 16, 2012

OG-12-330

To: PWROG Executive Committee Members

Subject: PWR Owners Group
Generic Guidance for Valves that have Seal Encapsulation Devices Installed

References: **1. Endorsement of Generic Guidance for Valves that have Seal Encapsulation Devices Installed, OG-12-305, dated August 1, 2012**

This letter transmits the subject guidance and starts the implementation schedule as provided in this letter. The Executive Committee has approved the "Needed" guidance by a vote of 36 Yes to 0 No (Reference 1).

The recommendations have been discussed with the NRC and they are in agreement with the approach. The NRC has recently issued Information Notice 2012-15 relative to seal encapsulation devices (Enclosure 1). This guidance supports the Information Notice.

The guidance below provides "Needed" and "Good Practice" recommendations as defined by the NEI 03-08 protocol – "Needed" recommendations must be "implemented wherever possible, but alternative approaches are acceptable" and "Good Practice" recommendations are expected to provide significant operational and reliability benefits, but the extent of use is at the discretion of the individual utility.

It should be noted that currently 6 sites with 8 units have these devices installed. They are WCNOC, STP 1 and 2, Harris, Vogtle 1 and 2, Seabrook and Robinson. There are 25 seal caps installed at various locations at the 8 units. Currently out of the 25 installed caps, plants plan or have initiated Work Orders to remove 13 seal caps. This is based on feedback from the entire fleet of PWRs.

BACKGROUND

Seal caps, also known as leakage encapsulation devices, have been installed on some valves in the nuclear fleet, as a means to arrest or prevent leakage at the body to bonnet flange (e.g., gasket leakage). Encapsulation devices may have been installed during plant start up to prevent leakage from the valve or later in plant life after leakage from the main flange joint had already begun.

Functionally, a seal cap collects leakage from the leaking flange until it becomes water solid; at which point, the leakage is arrested. As such, its intended purpose is to act in lieu of a seal weld. An unintended result of utilizing a seal cap, in lieu of a seal weld, is that the main flange bolting has the potential to be submerged for long periods of time in

Reactor Coolant System (RCS) effluent when the flange does leak. This submergence could increase the potential for intergranular stress corrosion cracking (IGSCC) in the main flange bolting.

Operating experience (OE) from Callaway indicated that after removing the seal cap and de-torquing the studs on an encapsulated check valve, three (3) of the twelve (12) studs on a check valve had cracks and failed during de-torquing that was performed during shutdown. The other nine (9) studs were in good condition with no cracks. Other check valves with seal caps installed at Callaway were also disassembled, and no stud failures were observed. A total of 48 studs were removed, and there were only the three (3) stud failures, which were in the same seal cap.

The PWROG-MSC has reviewed this OE and concludes that in order to support continued use of these devices, inspection of the bolting is required. The logical objective is to discontinue use of these devices for any purpose other than temporary leakage barriers, the PWROG-MSC recognized that resolution may not be readily achievable in the short term and that plants may choose an inspection regimen to ensure structural integrity of the bolted connection is maintained. These recommendations are thus being issued for plants which will continue use of seal caps as leakage capturing devices in order to allow some flexibility for design, procurement, and planning activities needed to implement a permanent resolution which eliminates the concern.

SCOPE

The covered valves with respect to this letter are ASME Class 1 or 2 Nuclear Steam Supply System (NSSS) bolted bonnet valves, utilizing high strength ($Sy \geq 90$ ksi) stainless steel bolting fabricated from wrought or precipitation hardened austenitic stainless steel or martensitic stainless steel material and having stainless steel enclosures (also known as seal caps; see Figure 1 for an example) which are not credited to maintain pressure boundary integrity and not intended as temporary devices. Temporary devices are defined as those installed under a temporary modification process with a duration intended to be used until the next refueling outage.

It is expected that the majority of affected valves will be Westinghouse-ElectroMechanical Division (W-EMD) 3” and 4” Check Valves located in the Chemical & Volume Control System (CVCS) charging lines or alternate charging lines, in locations which cannot be isolated from the

Reactor Coolant System (RCS) and which utilize SA-453 Grade 660 (A-286) bolting. However, affected valves could also be located in the Residual Heat Removal (RHR), Safety Injection (SI) and Emergency Core Cooling Systems (ECCS) on valves manufactured by W-EMD or other Original Equipment Manufacturers (OEMs). Plants may contact the OEM of affected valves for further valve specific guidance.

A fundamental assumption by the PWROG Materials Subcommittee in limiting scope as described above is that no plant has installed an encapsulation device that would have structural bolting material susceptible to wastage from boric acid corrosion in any application other than as a temporary measure.

NEEDED RECOMMENDATIONS (Shown in Bold).

1.0 Prior to September 1, 2012, all plants shall perform a review their ASME Class 1 and 2 NSSS bolted bonnet check valves and identify the population of valves employing encapsulation devices[1].

2.0 Prior to October 1, 2012, an examination plan shall be documented for all valves that will be left in service with encapsulation devices installed. The examination plan shall have the following elements:

Examinations shall include visual (VT-3) and ultrasonic examination (UT) of valve bonnet bolting to confirm structural integrity. Removal of the bolting is allowed but not required for either examination. UT examination shall be per approved procedure and is expected to detect but not size crack-like indications in the bolting. The examination plan shall require the re-inspection of bolting in all in-service encapsulation devices during each successive refueling outage. The UT examination is required only if borated water leakage affecting the bolting is detected upon removal of the seal cap.

3.0 Plants with refueling outages that begin after September 1, 2012 but prior to September 1, 2013 shall examine at least one[2] encapsulation device that will be left in-service.

4.0 Plants with refueling outages that begin on or after September 1, 2013 shall examine all encapsulation devices that will be left in-service.

If bolting degradation is detected during the examinations[3] conducted in accordance with paragraphs 3.0 and 4.0:

- **a. the results shall be entered into the plant's corrective action program and an evaluation completed which takes into account susceptibility of remaining bolting to SCC degradation,**
- **b. replace bolting as necessary to ensure continued joint integrity based on the results of (a.) and**
- **c. expand the inspection to the entire population of valves with encapsulation devices (as applicable).**

Notes:

1. An encapsulation device is any non structural addition to an in-scope valve for the purpose of preventing external leakage and that would potentially result in submergence of structural bolting from captured leakage. Plants which have documented this review in their Corrective Action Programs in response to the PWROG survey request may have already completed this element.

2. The most limiting device shall be selected for initial inspection. Selection shall be based of engineering consideration including factors listed below. The original equipment supplier (valve and or encapsulation device) and/or the PWROG MSC may be consulted for recommendations in selecting a device from the identified population.

   - the duration (time) that the seal cap has been installed on the valve,
   - the duration (time) the main flange bolting has been submersed (if known),
   - the design and service conditions of the valve, including operating temperature and bolting operating stresses
   - Observation of external leakage from encapsulation device.

3. Bolting examination results that would require further actions a. b. or c. would be any visual or volumetric indication which exhibits evidence of cracking. Supplemental examinations may be utilized to confirm or refute potential uncertain NDE results.

These requirements are expected to remain in effect unless superseded by new or revised ASME Code Section XI requirements. Notification will be made to PWROG members in the event this occurs.

GOOD PRACTICE RECOMMENDATIONS (shown in Bold)

1.0 Metallurgical analysis should be performed on removed bolting to determine failure mechanism and enhance future guidance.

2.0 A permanent resolution that eliminates the potential for SCC of encapsulation devices should be implemented.

Examples of measures that can be taken to permanently resolve the potential for degradation of structural bolting due to encapsulation devices are:

- Remove the seal cap in its entirety, replace the gasket and install a bonnet with a canopy seal weld capability, such that the bonnet can be seal welded to the body to eliminate the main flange leakage without submerging the main flange bolting in oxygenated RCS effluent. This is a long term fix intended to eliminate the potential for body-to-bonnet flange leakage.

- Remove the seal cap in its entirety and replace the gasket if necessary eliminate the main flange leakage. This eliminates the SCC susceptibility of the bolting but does not address the future gasket leakage issue.

- Install a seal cap qualified for service as the pressure boundary.

- Evaluate and install bolting that can be determined to not be susceptible to SCC or other potential degradation mechanisms under all service conditions.

If you have any questions, please do not hesitate to contact me by email at njstring@southernco.com by telephone at (205) 992-7037. You may also contact Jim Molkenthin in the PWROG Project Office (molkenjp@westinghouse.com, (860) 731-6727).

Sincerely,

Norman Jack Stringfellow, SNOC
Chairman, PWR Owners Group

NJS:JPM:las

Attachments (1) – Figure 1

Enclosures (1) – NRC Information Notice IN 2012-15

cc: PWROG Management Committee Representatives
PWROG Materials Subcommittee Members

PWROG PMO	R. Crane, INPO
W. Bamford, W	M. Richter, NEI
R. Becse, W	B. Hardies, NRC
B. Densmore, W	T. Lupold, NRC
I. Ezekoye,	

Figure 1 – Example of a Seal Cap Installation Device