Nuclear Safety Advisory Letter

Westinghouse Electric Company

This is a notification of a recently identified potential safety issue pertaining to basic components supplied by Westinghouse. This information is being provided so that you can conduct a review of this issue to determine if any action is required.
P.O. Box 355, Pittsburgh, PA 15230

Subject: **Barton Model 763, 763A and 764 Transmitters With Defective External Lead Wire Connectors**	Number: **NSAL-06-13**
Basic Components: Barton Model 763 and 763A Gauge Pressure Transmitters and Model 764 Differential Pressure Transmitters	Date: 10/24/2006
Affected Plants: All plants using Barton Model 763, 763A or 764 transmitters	
Substantial Safety Hazard or Failure to Comply Pursuant to 10 CFR 21.21(a) Transfer of Information Pursuant to 10 CFR 21.21(b) Advisory Information Pursuant to 10 CFR 21.21(d)(2)	Yes ☐ No ☐ Yes ☐ Yes ☒
References: See page 10	

INTRODUCTION

There are two issues associated with connector assembly external lead wires manufactured by PRIME Measurement Products after May 31, 1982. As discussed in References 1 and 2, the first issue is the uncontrolled depth of lead wire insulation into the epoxy. The second issue (discussed in Reference 3) is the removal of the heat shrink tubing from the connector leads.

SUMMARY

Westinghouse has been informed by PRIME Measurement Products, formerly Barton Instrument Systems & ITT Barton, of a potential issue with Model 763 and 763A gauge pressure transmitters and Model 764 differential pressure transmitters via Reference 1. Transmitters having external lead wire connectors manufactured after May 31, 1982 and prior to April 1, 2006 are potentially impacted by this issue.

PRIME identifies that some of these transmitters may have been assembled, factory repaired or field modified using defective external lead wire connector assemblies that may affect the performance of the transmitters during accident conditions that results in a harsh environment. The defect is that the insulation on the external lead wire may not be embedded deeply enough into the epoxy potting to provide an electrical connection that would not be affected by a harsh accident environment. This issue has been reported to the NRC (by a utility) pursuant to 10 CFR Part 21 Report 2006-13-00 (Reference 4). The NRC recently visited PRIME and Westinghouse to investigate this issue.

Additional information, if required, may be obtained from Jeffrey L. Zielinski. Telephone (724) 722-5547

Originator:(s)

W. J. Smoody
Regulatory Compliance and Plant Licensing

Approved:

J. A. Gresham, Manager
Regulatory Compliance and Plant Licensing

ENCLOSURE

During this investigation, a second issue was raised about the removal of the heat shrink tubing (embedded in the epoxy) from the connector assembly external lead wires occurring after May 1982 and the impact of this change on the connector assembly qualification. The connector was originally qualified with heat shrink on the individual external lead wires embedded in the epoxy. PRIME and Westinghouse were not able to produce rigorous documentation of the assessment of this change.

The resolution for these issues requires that all affected connector assemblies without heat shrink tubing on the connector assembly external lead wires penetrating the epoxy to be replaced. See the Recommended Actions section for additional information.

This issue is applicable to all Westinghouse and CE NSSS plants that have these transmitters and the Temelin and Sizewell plants.

ISSUE DESCRIPTION

There are two issues affecting the connector assemblies of the Model 763, 763A and 764 transmitters. First, PRIME Measurement Products has identified that the process (implemented in June 1982) of attaching the external lead wires to the hermetically sealed connector was not controlled in a manner that ensured a connection would not be affected by a harsh accident environment. Specifically, the insulation of the external lead wires may not be embedded deep enough into the epoxy potting to ensure that the connections will not short to each other or to the transmitter case when exposed to a harsh environment associated with a loss-of-coolant accident (LOCA) or high-energy line break (HELB).

The second issue is that Westinghouse has been unable to locate a detailed evaluation that served as the basis of a 1982 design change that removed the embedded heat shrink from the external lead wires. Indication that such an evaluation was performed is evidenced by the design approval issued by Westinghouse to PRIME approving the change. Missing or inadequate documentation of the change, however, does not affect the performance of the equipment. While the current configuration (post-May 1982) qualification cannot be demonstrated due to the unavailability of documentation, it does not mean the connector configuration could not be qualified but only that qualification can not be confirmed. It is possible that elimination of the heat shrink is actually an improvement in the ability of the connector to resist adverse environments, in that it removes a potential leak path to the metal conductors.

Westinghouse had reviewed and approved the design change that eliminated the embedded heat shrink tubing from each wire of the connector assembly. Elimination of the heat shrink tubing may have been a product enhancement that would eliminate a potential adverse environment leak path to the solder connections in the connector assembly. Westinghouse followed the same baseline design change approval process for elimination of the heat shrink tubing from the connector assembly as they had for approval of all other changes implemented on Westinghouse qualified Barton instrumentation however, in this specific instance, documentation supporting qualification can not be located. Failure to demonstrate the environmental qualification of the post-May 1982 connector assemblies, without the embedded heat shrink tubing on the individual external lead wires extending into the epoxy material, is a nonconformance.

Westinghouse has a reasonable expectation that the post-May 1982 connector design could pass a qualification test however, such a test would be of limited benefit since there does not exist a nondestructive method of verifying adequate lead wire insulation penetration into the epoxy on transmitter connector assemblies presently installed in the field. Westinghouse is currently working on identifying a replacement connector. Additional information will be provided when it is available.

TECHNICAL EVALUATION

External lead wire connector assemblies are installed and supplied as part of new and in some cases factory repaired transmitters. Connector assemblies may have also been supplied as replacement parts. Connector assemblies manufactured prior to June 1982 or after April 1, 2006 are not affected by these issues. Therefore, if the licensee can confirm that the installed transmitters utilize a pre-June 1982 connector assembly (regardless of when the transmitter was manufactured) then that connector need not be replaced (see Figure 1). Transmitter installations that include environmentally sealed conduit connectors or transmitters that are located in an area that would not be subject to the harsh environment from a LOCA or HELB are not affected by these issues.

Connector assemblies are designed to be field replaceable. Westinghouse was made aware that licensees may replace the transmitter but retain the installed connector assembly. It is also possible that a transmitter built prior to the June 1982 date may have a replacement connector that was manufactured post-June 1982 during maintenance of the transmitter in the field or as part of maintenance done on transmitters returned to the factory.

SAFETY SIGNIFICANCE

Potential shorting of the external lead wires of these transmitters was evaluated in 1992 in response to References 5 and 6. The 1992 external lead wire shorting issue is similar to the first of the current issues. Transmitter failure due to shorting of the connector assembly lead wires (at the wire insulation/epoxy interface) in a harsh environment does not prevent the transmitter from performing its safety function to provide a reactor trip or an engineered safety feature (ESF) actuation. The trip function would have been provided prior to the transmitter being affected by the accident environment. Some examples of reactor trip and ESF actuation times following primary and secondary breaks are provided in the Background Information for ERG E-1, "Loss of Reactor or Secondary Coolant", and ERG E-2, "Faulted Steam Generator Isolation".

The current connector configuration does not affect the ability of the transmitters to perform their reactor trip functions or engineering safety feature actuation system (ESFAS) actuations, as these functions would occur prior to the transmitter being exposed to an adverse environment. The exit wiring on the transmitter is protected by conduit. While this is not a sealed environment, the conduit helps to delay the connector being exposed to any post-accident conductive fluid. The conductive post-accident fluid would also have to penetrate the mechanical bond between the epoxy potting and the lead wire insulation and reach the bare wires before the transmitter performance could be affected. The ability of the instruments to provide post-accident indication is the only function identified that could potentially be affected by these two connector issues. Following a reactor trip or safety injection (SI), the unit would be in Mode 3, and Mode 4 would be entered following cooldown using the plant emergency operating procedures (EOPs).

The installation configuration may also help to preclude a transmitter failure during a harsh post-accident event. These transmitters are normally installed with the connector directed downward which would help prevent pooling of any post-accident condensate on the connector surface that could short-out the wires. There is also typically a conduit attached to the transmitter that leads to a junction box. This conduit would provide a certain amount of dry air that would be trapped around the connector and provide some degree of protection to the connector from the conductive post-accident fluid. Redundant transmitter failures would have to occur to affect the post-accident monitoring (PAM) functions provided by these instruments.

The transmitters and connectors impacted by these issues are expected to perform their reactor trip and ESFAS actuation functions as intended. The PAM transmitter installation configuration and redundancy reduces the likelihood of failure of the PAM functions in a harsh accident environment. Missing or inadequate connector qualification does not affect the performance of the equipment. While the post-May 1982 connector qualification cannot be demonstrated due to unavailability of documentation, it does not mean that the connector could not be qualified. It is possible that elimination of the heat shrink tubing is a product enhancement. Therefore there is a low probability that post-accident monitoring functions would be affected by these issues. Additionally, alternate instrumentation can be used to monitor plant conditions in the unlikely event that these PAM indications are not available for a given parameter.

Westinghouse has reviewed the PAM functions provided by the potentially affected transmitters and compared them to those contained in NUREG-1431, Table 3.3.3-1 (Reference 7). The following discussion identifies potential alternate or diverse means to obtain the post-accident information provided by the potentially affected transmitters.

PAM Technical Specification (3.3.3) in NUREG-1431 requires all Regulatory Guide 1.97 Type A and non-Type A Category I variables to be included in the PAM Technical Specification. A generic PAM list was generated based on a review of representative Westinghouse plants. Based on this review, the following PAM indications were determined to be potentially affected by the Barton transmitter issues:

- Reactor Coolant System (RCS) Pressure (Wide Range)
- Containment Sump Water Level (Wide Range)
- Containment Pressure (Wide Range)
- Pressurizer Level
- Steam Generator (SG) Water Level (Wide Range)

In addition to the above list, other Barton Model 763, 763A and 764 transmitters that could potentially be affected by this qualification issue are not used as the only source of information for a function. Affected plants will have to determine, on a plant specific basis, the applicability of this list to their plant specific instrumentation and revise it accordingly. The generic list was analyzed to determine alternative or backup parameters that would be available to the operator in the event that the primary indication was not available.

RCS Pressure (Wide Range)

RCS wide range pressure provides information for operator action for a steam generator tube rupture (SGTR) break flow termination for which no automatic control is provided. Together with SG pressure, RCS wide range pressure provides information to the operator to verify that break flow through a ruptured SG tube is terminated thereby satisfying the inventory safety function. However, for a SGTR, adverse or harsh containment conditions are not expected and failure of the RCS wide range pressure indication is not a concern for a SGTR.

RCS pressure indication is also used for determining RCS subcooling following an accident or receipt of a reactor trip signal. Depending on the pressure range, there are several potential methods to measure RCS pressure in the event the RCS wide range pressure fails.

Pressurizer Pressure

An alternate means of measuring RCS pressure is via the pressurizer pressure. The pressurizer pressure indication is limited in range (e.g., 1700 to 2500 psig) and its usefulness would be to confirm the need to depressurize the RCS and to terminate SI in the event of a feed or steamline break.

Accumulator Pressure

The accumulator pressure indication also has a limited range (e.g., 0 to 700 psig) that could be useful for lower RCS pressures. The accuracy is typically ±4%, or 28 psig, making this instrument one of the most accurate for this range of pressures. However, the accumulators are generally isolated when they are nearly empty to prevent introduction of nitrogen (a noncondensable gas) into the RCS. Upon accumulator isolation, the accumulator pressure does not follow the RCS pressure.

Safety Injection Header Pressure

The safety injection header pressure is another potential means of estimating the RCS pressure. This indication covers a broad range of pressures (e.g., 0 to 2000 psig) with a relatively good accuracy (e.g., ±1% or 20 psi). However, this would only be a viable method if all the valves between the sensor and the RCS are open, which is unlikely unless water is being injected via that pathway.

ECCS Flowrates

If water is being injected into the RCS, and if the emergency core cooling system (ECCS) pumps are operating in a non-degraded condition, the pump delivery curve (flow versus pressure) can be used to determine the RCS pressure. Although the accuracy of this method is limited by whether the pumps are operating as designed, this is still a method that could provide a general estimate to confirm other instrument indications.

As discussed above, sufficient alternatives are available for determining RCS pressure.

Containment Sump Water Level (Wide Range)

The containment water level parameter is needed primarily to determine if ECCS in the recirculation mode is possible.

Containment water level is generally inferred by measurement of the differential pressure created by the static head of water in the containment. One measurement is generally available at the ECCS recirculation sump for determination that a sufficient water level is available to meet net positive suction head (NPSH) requirements of the low head safety injection pumps. This measurement can be limited in range due to its purpose. Another containment water level measurement is generally available for the determination of water level in the containment with respect to the "flooding level". The "flooding level" is that containment water level below which no critical instrumentation or equipment needed in the long term accident recovery will be submerged (except for plant-specific submersible equipment). The flooding level definition may vary from plant to plant. For this evaluation, it is defined to be greater than the level that would be achieved by putting one refueling water storage tank (RWST) volume plus one condensate storage tank (CST) volume plus all of the ECCS accumulator volume into the containment. (For ice condenser containments, the melted volume of water from all of the ice in the ice chest is also included).

A generic containment water level issue is the limited range of level instrumentation relative to some of the accident management strategies. As noted above, if more than one RWST water volume is used for core cooling or recovery of core cooling, the upper range instrumentation may be challenged.

If containment water level cannot be directly measured, it may be estimated by using Computational Aid-5 (CA-5), "Containment Water Level and Volume", found in the Severe Accident Management Guidelines (SAMG). Therefore, if the water volume that has been injected can be estimated, along with an estimate of the inventory that has been displaced from the RCS and other tanks inside containment, the water level can be estimated.

Containment Pressure (Wide Range)

The wide range containment pressure indication provides information to identify a fission product barrier challenge. It provides direct verification of containment cooling to maintain the containment fission product barrier critical safety function. Containment pressure indication is required following an accident or receipt of a reactor trip signal.

There are generally two sets of containment pressure detectors in Westinghouse PWRs: pre-Three Mile Island (TMI) detectors with a range from a slight vacuum to just above the design pressure and a post-TMI detector with a range from a slight vacuum to about three times the containment design pressure. The sensors and transducers are typically located outside containment, in the auxiliary building. The fluid conditions which they measure should not be so severe as to result in failure of the sensors or transducers. Thus, the containment pressure indication is expected to be useful for all accident scenarios.

For several Westinghouse plants, the sensors and transducers are located inside containment and may be subjected to a harsh environment. For plants that fall into this category, an estimate of containment pressure can be obtained from containment temperature. Containment temperature sensors are typically not safety-grade, and thus are not often considered for accident scenarios. Nevertheless, they may be useful during accident management. The containment temperature is typically measured using RTDs (Minco air mounted RTDs). These RTDs can be a platinum or nickel type, both with a measurement range that can extend from 0 to 750°F. The platinum RTDs are typically calibrated to operate with 0.5°F accuracy from 32°F to approximately 150 or 200°F. If the nickel type is used, they are also calibrated to operate with 0.5°F accuracy, but with a range that may extend up to 200 or 250°F. Per Regulatory Guide 1.97, Table 3 (Reference 8), the containment temperature range is 40°F to 400°F. By assuming saturation conditions inside containment, an estimate of containment pressure is possible. For plants with multiple containment temperature indications, an average temperature should be used to estimate the saturation pressure.

Estimating containment pressure using containment temperature is an acceptable alternative in the event containment pressure indication is not available.

Pressurizer Level

Pressurizer level provides information needed to permit operators to take specified manual actions to terminate SI. It provides information related to satisfying the RCS inventory safety function to permit SI termination.

The pressurizer is assumed to have at least three channels of a delta P level measurement system. The instruments provide level indications for approximately the total height of the pressurizer. The range of the measurement system is 0 to 100 percent of span. This instrumentation is assumed to be subject to adverse containment conditions. When determining the level values for the ERGs, the values must be compensated for errors attributed to the calibration conditions and reference leg heatup effects.

If pressurizer level is unavailable, the reactor vessel level indication system can be used.

Westinghouse RVLIS

The Westinghouse reactor vessel liquid inventory system (RVLIS) provides useful indication during all phases of an accident. The generic Westinghouse RVLIS uses differential pressure (d/p) transmitters to measure vessel level or relative void content of the circulating RCS fluid. The Westinghouse-designed RVLIS transmitters are typically located in an area not subject to adverse conditions. The system is redundant and includes automatic compensation for potential temperature variations of the impulse lines. Essential information is displayed in the main control room in a form directly usable by the operator.

SI Termination

Two separate indications of RCS inventory are used in SI termination criteria steps in the ERGs: pressurizer level and reactor vessel level. In cases where pressurizer level indication is not available and SI termination is necessary to mitigate a potential critical safety function (CSF) challenge, RVLIS can be used. The value corresponding to the top of the core with instrument uncertainties should be used.

RVLIS provides an adequate alternative indication for satisfying the RCS inventory challenge and ensuring the SI termination criteria can be met.

SG Water Level (Wide Range)

Steam Generator water level provides information for operator action to maintain a heat sink for which no automatic control is provided. It provides direct verification that the heat sink safety function is satisfied. The SG level indication is also used for the diagnosis of a SGTR accident.

Heat Sink Requirements

An alternate indication of SG wide range level to satisfy the heat sink requirements is auxiliary feedwater (AFW) flow rate. If the minimum safeguards AFW flow is established to the intact SGs, the heat sink critical safety function is satisfied and the operator does not need to initiate feed and bleed. The minimum safeguards AFW flow requirement for heat removal, including allowances for normal channel accuracy is typically the capacity of one motor-driven AFW pump at SG design pressure. This flow is equivalent to the minimum AFW flow design requirement that must be delivered to the intact steam generators as assumed in the main feed line break safety analysis. This would be a beyond design basis event.

SGTR Diagnosis

For diagnosing a SGTR, secondary radiation and SG chemistry samples are used to confirm a tube rupture. Symptoms evident after reactor trip which identify steam generators with failed tubes include high or increasing secondary side activity and uncontrollably increasing steam generator levels in the affected steam generator. For a SGTR event, harsh containment conditions are not expected and the SG wide range level would be functional. However if a harsh containment does exist and SG wide range level is not available, the main steamline radiation monitors together with high SG activity would be used to identify the affected SG. This would be a beyond design basis event.

The heat sink criteria and SGTR diagnosis can be determined using the alternate indications and actions described above.

CONCLUSION

Westinghouse has been unable to locate the basis of a detailed evaluation of the design change that removed the heat shrink from the external lead wires. Indication that such an evaluation was performed is evidenced by the design approval issued by Westinghouse to PRIME approving the change. Missing or inadequate documentation of the change, however, does not affect the performance of the equipment. While the current configuration (post-May 1982) qualification cannot be confirmed due to the unavailability of documentation that does not mean the connector configuration could not be qualified, only that confirmation that it is qualified can not be confirmed. Rather, it is possible that the elimination of the heat shrink is actually an improvement in the ability of the connector to resist harsh environments, in that it removes a potential leak path to the metal conductors. These connectors represent a nonconforming condition related to environmental qualification.

Neither the reactor trip nor ESFAS functions are impacted, since these functions would be accomplished prior to experiencing a harsh environment. The PAM functions that include these transmitters contain multiple channels for a given function which would all have to be exposed to harsh environment to lose the function.

The above information would support a determination that these transmitters are operable, but non-conforming. The alternate indications discussed above would be available to reduce the significance of the potential qualification issue associated with these transmitters. When Westinghouse has identified a replacement connector, additional information will be provided.

NRC AWARENESS

The NRC is aware of the wire insulation embedment in epoxy issue via 10CFR Part 21 Report 2006-13-00 (Reference 4). The NRC has issued Information Notice 2006-14 (Reference 2) on this issue.

The NRC is aware of the equipment qualification issue. The NRC has issued Information Notice 2006-14, Supplement 1 (Reference 3) on this issue

RECOMMENDED ACTIONS

Connector assemblies installed on transmitters that are not subject to a potentially harsh environment associated with a LOCA or HELB environment or have installations that include environmentally sealed conduit connectors are not subject to the replacement recommendation discussed below.

For connector assemblies that are installed on transmitters that could be subjected to a potential harsh environment associated with a LOCA or HELB environment and include installations that do not include environmentally sealed conduit connectors, Westinghouse recommends that customers replace the external lead wire connector assemblies manufactured and supplied after May 1982 and before June 1, 2006 during their next scheduled outage after parts are available. The inspection defined in Reference 1 is not required, since Westinghouse is recommending replacement of all post-May 31, 1982 connector assemblies in these specific installations. Westinghouse also recommends that the licensee evaluates the potential impact on the safety-related functions provided by Westinghouse qualified Barton Model 763, 763A and 764 transmitters.

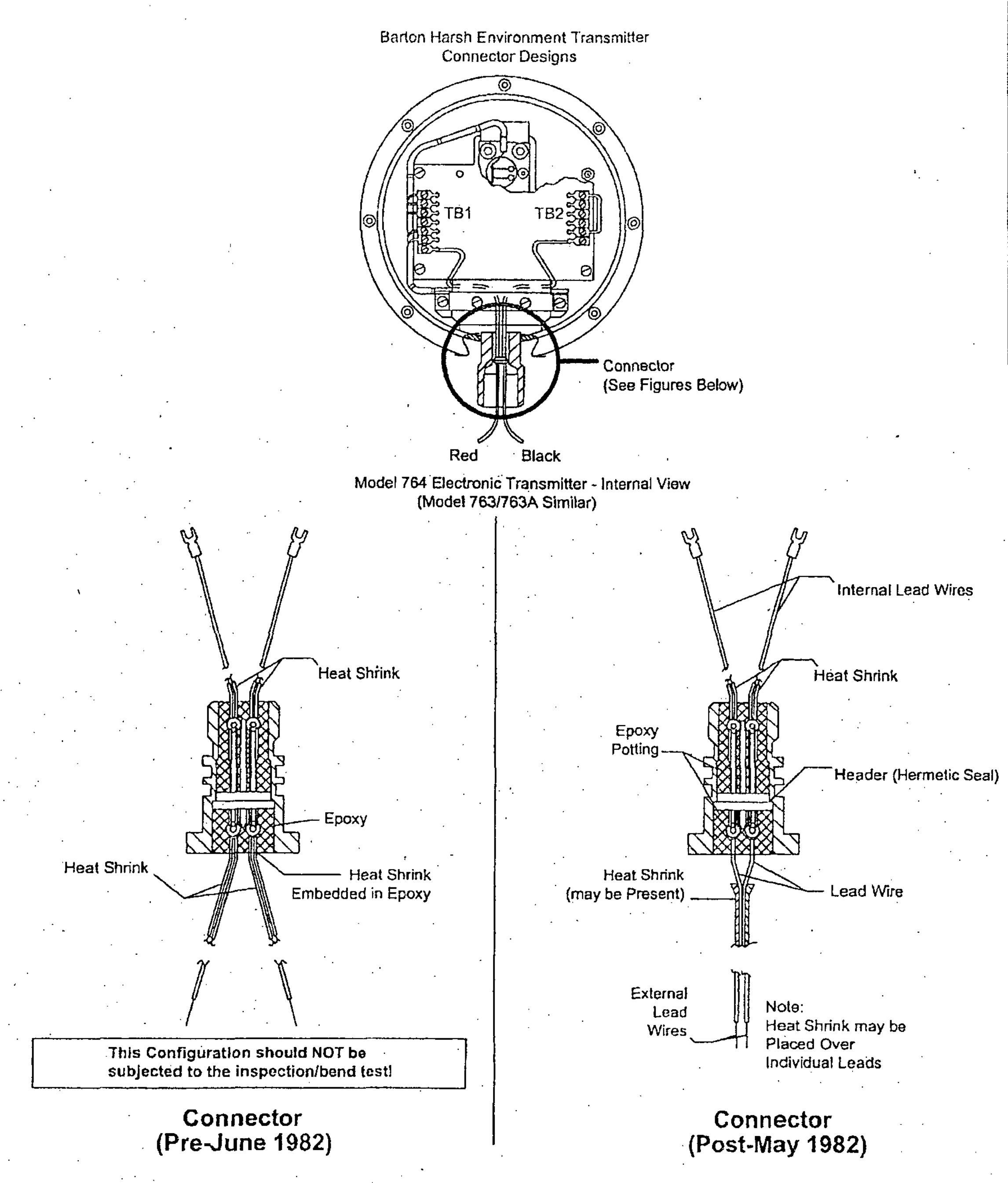

Figure 1: Connector Assemblies That Do and Do Not Need to be Inspected

REFERENCES

1. PRIME Measurement Products, LLC, Nuclear Industry Advisory, "Barton Transmitter Defective Connectors" May 18, 2006 (Attachment 1)
2. NRC Information Notice 2006-14 – "Potentially Defective External Lead Wire Connections in Barton Pressure Transmitters", July 10, 2006
3. NRC Information Notice 2006-14, Supplement 1– "Potentially Defective External Lead Wire Connections in Barton Pressure Transmitters", September 25, 2006
4. 10 CFR Part 21 Report 2006-13-00 – "Barton Pressure Transmitter Exposed Wiring", May 21, 2006
5. 10 CFR Part 21 Report – "Report of Potential Defects in Model 763, 763A, 764 and 765 Transmitters", November 13, 1991
6. 10 CFR Part 21 Report – "Follow-up of Our Notification of November 13, 1991 Potential Defects in Model 763, 763A, 764 and 765 Transmitters", January 27, 1992
7. NUREG-1431, "Standard Technical Specifications for Westinghouse Plants", Table 3.3.3-1, "Post Accident Monitoring Instrumentation", Rev. 3.1, 12/01/05 (Attachment 2)
8. Regulatory Guide 1.97, "Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident", Table 3, "PWR Variables", Revision 3, May 1983

PRIME
Measurement Products

May 18, 2006

Westinghouse Electric Company
Route 286
1740 Golden Mile Highway
Monroeville, PA 15146

David K. Rohm
QA Manager

Subject: Nuclear Industry Advisory

PRIME Measurement Products, formerly Barton Instrument Systems & ITT Barton, is a supplier of basic components to the commercial nuclear power industry. The specific components being reported are Barton Model 763 and 763A Gage Pressure Transmitters and Model 764 Differential Pressure Transmitters.

PRIME has identified that some of the listed products may have defective external lead-wire connectors that could affect the performance of the instruments during an accident.

The attached advisory identifies a condition that might be reportable under 10CFR21 depending on the specific application using the instruments manufactured by PRIME. We are notifying you of this situation to allow a determination of the safety significance to be made. PRIME Measurement Products apologizes for any inconvenience this situation causes.

The attached notification identifies the specifics of our concerns and recommends inspection and replacement of any defective connector assemblies for transmitters shipped from the factory after May 1982 and before April 2006.

Questions regarding this issue should be addressed to Mark Larson, Nuclear & Government Product Engineering Manager, at (626) 961-2547, extension 228.

Sincerely,

Thomas Roide
Quality Manager

cc: David Baker, President and CEO

Attachment: 2 pages

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PRIME Measurement Products, LLC
NUCLEAR INDUSTRY ADVISORY

May 18, 2006

Barton Transmitter Defective Connectors

PRIME Measurement Products, formerly Barton Instrument Systems & ITT Barton, is a supplier of basic components to the commercial nuclear power industry. The specific components being reported are Barton Model 763 and 763A Gage Pressure Transmitters and Barton Model 764 Differential Pressure Transmitters manufactured after May of 1982 and shipped from the factory prior to April 1, 2006.

PRIME has identified that some of the listed products may have been assembled with defective external lead-wire connectors that could affect the performance of the instruments during an accident condition.

The external lead wires enter the electronics enclosure through a hermetic seal called a connector assembly. The external lead wires are soldered to the glass sealed pins of the hermetic seal and epoxy potting is used to structurally support the soldered wire connections and establish a seal to protect the solder connections from shorting that could be caused by an electrically conductive accident environment. The defect is that the insulated portions of the wires in connectors manufactured after May of 1982 may not be embedded deeply enough into the epoxy potting to provide an electrical connection that would not be affected by an accident environment. In some cases, stress during the normal manufacturing process has pulled the insulated portion of the wires from the epoxy potting leaving the conductors exposed directly to the environment. In other cases the wires have actually severed due to the stress imposed on these wire connections. It may be possible that handling of the transmitters in the field may have also caused the wire conductors to become exposed.

Connector assemblies manufactured prior to June of 1982 were assembled with heat shrink on the external lead wires where they are embedded into the epoxy potting. This configuration is the as-tested configuration and is not subject to the concerns of this Advisory. Any connector assembly with heat shrink applied to each wire individually that enters the epoxy potting is not considered defective and need not be replaced. In June of 1982 the heat shrink on each of the two wires was eliminated as a design improvement.

Recently, there have been a small number of units where defective lead wires have been identified. One unit with a severed wire was discovered at a nuclear power plant during receiving inspection activities and another with a severed lead wire was discovered during cleaning activities under PRIME's control prior to shipment of the unit to a customer. Inspection of connector assemblies in the factory inventory identified some connectors with a single exposed wire, but no connectors with damaged wires were discovered. PRIME immediately stopped shipment of all transmitters until the connector manufacturing process was revised and acceptable connector assemblies were available.

PRIME has now improved the connector assembly manufacturing and inspection processes. The revised manufacturing process involves the use of enhanced manufacturing fixtures and more detailed assembly instructions. The revised inspection process will ensure the adequacy of the assembly by verifying that the insulated portions of the wires are deep enough into the assembly to provide a quality bond with the epoxy.

Conductors exposed to an accident environment could result in degraded instrument performance. However, the actual transmitter installation may preclude shorting of exposed conductors due to the existence of conduit, conduit seals and special wire connectors that could protect exposed wires at a defective connector from conductive moisture.

PRIME recommends that all connectors in transmitters manufactured after May of 1982 be inspected for exposure of the external lead-wire conductors at the surface of the connector. This inspection will necessitate that the connector be unscrewed from the transmitter following the instructions in the Installation and Operation Manual using a special connector removal/installation tool (PRIME P/N 0764-1174B). The external lead wires should be flexed during this inspection to assure that the insulated proportions of the wires are securely embedded into the epoxy. The external wires can be flexed 90° such that the insulated portion of the wires touches the flange of the connector assembly. The area of the insulated wire penetration into the epoxy potting should be visually inspected for any evidence of the wire conductors while the wires are flexed. The 90° flex test should be repeated by flexing the external lead wires in the opposite direction. Any connector where the conductors of either wire are observable should be considered defective and replaced.

New connector assemblies manufactured under the revised processes are manufactured with external lead lengths of 8 feet (PRIME P/N 0764-1221B which replaced identical P/N 0764 1062B in January of 1982), 15 feet (PRIME P/N 0764-1250B) and 60 feet (PRIME P/N 0764-1271B). Each connector assembly has two O-rings (PRIME P/N 0001-1051R) which should also be replaced. O-rings should be lightly lubricated with a silicone grease (PRIME P/N 0002-1003U) before a connector assembly is installed.

Care should be taken during the connector installation process to avoid stressing the potted wiring joints. Counter-clockwise winding of the external lead wires such that they unwind during the process of screwing the connector assembly into the transmitter conduit connection is highly recommended to limit the stress during the connector assembly installation process. Temporary removal of the potentiometer assembly by removing the two potentiometer bracket mounting screws will significantly improve connector removal and replacement accessibility to the internal lead wires that attach directly to the circuit board.

Any new Barton Model 763, 763A or 764 transmitter shipped from the PRIME factory after April 1, 2006 have connector assemblies installed that have been manufactured under the revised processes described above and are not subject to the concerns identified in this notification. Barton Model 763, 763A or 764 transmitters recently at the factory for repair activities and shipped from the factory after April 1, 2006 have had their connector assemblies inspected and replaced, if necessary.

Questions regarding this issue should be addressed to Mark Larson, Nuclear & Government Product Engineering Manager, at (626) 961-2547, extension 228. To order transmitter replacement connector assemblies please contact Mabel Loo, Contracts Administration Manager, at (626) 937-0335.

Table 3.3.3-1 (page 1 of 1)
Post Accident Monitoring Instrumentation

	FUNCTION	REQUIRED CHANNELS	CONDITION REFERENCED FROM REQUIRED ACTION D.1
1.	Power Range Neutron Flux	2	E
2.	Source Range Neutron Flux	2	E
3.	Reactor Coolant System (RCS) Hot Leg Temperature	2 per loop	E
4.	RCS Cold Leg Temperature	2 per loop	E
5.	RCS Pressure (Wide Range)	2	E
6.	Reactor Vessel Water Level	2	F
7.	Containment Sump Water Level (Wide Range)	2	E
8.	Containment Pressure (Wide Range)	2	E
9.	Penetration Flow Path Containment Isolation Valve Position	2 per penetration flow path[(a)(b)]	E
10.	Containment Area Radiation (High Range)	2	F
11.	Pressurizer Level	2	E
12.	Steam Generator Water Level (Wide Range)	2 per steam generator	E
13.	Condensate Storage Tank Level	2	E
14.	Core Exit Temperature - Quadrant [1]	2[(c)]	E
15.	Core Exit Temperature - Quadrant [2]	2[(c)]	E
16.	Core Exit Temperature - Quadrant [3]	2[(c)]	E
17.	Core Exit Temperature - Quadrant [4]	2[(c)]	E
18.	Auxiliary Feedwater Flow	2	E

(a) Not required for isolation valves whose associated penetration is isolated by at least one closed and deactivated automatic valve, closed manual valve, blind flange, or check valve with flow through the valve secured.

(b) Only one position indication channel is required for penetration flow paths with only one installed control room indication channel.

(c) A channel consists of two core exit thermocouples (CETs).

---REVIEWER'S NOTE---

Table 3.3.3-1 shall be amended for each unit as necessary to list:

1. All Regulatory Guide 1.97, Type A instruments and
2. All Regulatory Guide 1.97, Category I, non-Type A instruments in accordance with the unit's Regulatory Guide 1.97, Safety Evaluation Report.
