May 2006 DRAFT responses to letter from Engineering Planning and Management, Inc. dated March 29, 2006 (ADAMS Accession ML061250036) to the U.S. Nuclear Regulatory Commission (NRC)
Prepared for Discussion with Public During the Meeting on June 9, 2006

Boiling-Water Reactor (BWR) QUESTIONS AND RESPONSES:

1. Automatic Depressurization System (ADS)

Assume that a BWR plant is provided with a total of eight (8) ADS valves, a minimum of three (3) of the ADS valves are required to actively operate for safe shutdown. That means that these three have been protected to remain free of fire damage. The remaining five (5) ADS valves are not protected and could potentially spuriously operate during certain postulated fire scenarios.

Since the three ADS valves are protected, can manual actions be credited to mitigate the spurious operation of the non-credited ADS valves, provided that such manual operator actions are feasible?

Response:

The use of safety relief valves (SRVs) in conjunction with a low pressure injection system (SRV/LPI) has been found acceptable for both Appendix R, Section III.G.2 (redundant) and III.G.3 (alternative or dedicated) shutdown methods. See note in BWR Answer 2. The "feasible operator manual action" acceptance criteria must be evaluated in accordance with the requirement to "achieve and maintain hot shutdown conditions."

Previous staff guidance exists which provides guidance that considers that the circuits for these valves are "associated circuits" for Appendix R, Section III.G.3 (Alternative Shutdown) and a manual action would be acceptable. Feasible and reliable manual actions must also be shown to meet the thermal-hydraulic demands of the system such that the operator manual actions can be performed in time to ensure that the reactor is recoverable if the unprotected SRVs open.

Appendix R, Section III.G.2 states:

> where cables or equipment, including associated non-safety circuits that could prevent operation or cause maloperation due to hot shorts, open circuits, or shorts to ground, of redundant trains of systems necessary to achieve and maintain hot shutdown conditions are located within the same fire area outside of primary containment, one of the following means of ensuring that one of the redundant trains is free of fire damage shall be provided

Assuming the three protected SRVs and their circuits are separated from the unprotected SRVs in accordance with III.G.2, and the appropriate detection and suppression required by III.G.2 are provided, then III.G.2 may be satisfied.

2. Reactor Core Isolation Cooling (RCIC) System:

Assume that RCIC is protected and is the credited system for safe shutdown. However, due to cable damage, a non-credited system like high-pressure coolant injection (HPCI) may be subject to spurious start due to cable damage in the fire area. For such a scenario, can a manual action be credited to mitigate spurious start of HPCI provided that such manual operator action is feasible (i.e., the action can be taken in a timely manner such that RCIC operation is not affected)?

Response:

It is assumed that a protected redundant train is provided by protecting the RCIC system in accordance with III.G.2. Manual actions may therefore be credited if they can accomplish the requirement of achieving and maintaining hot shutdown conditions.

NOTE: In both of the above instances redundant trains are protected as required to meet Section III.G.2. A licensee relying on this level of protection and on manual actions to assure achieving and maintaining hot shutdown needs to have adequate instrumentation to determine that the maloperations have occurred and to assure that the proper manual actions are taken to defeat the maloperation. Manual actions must be feasible (they can be performed in the time available) and reliable (the actions are dependably repeatable by different crews), implicit is that the actions are effective in meeting regulatory requirements.

3. Residual Heat Removal (RHR) System

Assume that RHR low-pressure coolant injection (LPCI) Train A is protected and is the credited system for safe shutdown, however, a non-credited flow path like the LPCI Train A header to drywell spray may be subject to spurious operation, (in this case we have two valves in series that are normally closed). Due to cable damage, there is potential that during the postulated fire, eventually both motor-operated valves (MOVs) may spuriously open. For such a scenario, can a manual action be credited to mitigate the spurious operation of these MOVs provided that such manual operator action is feasible?

Response:

No. One of these valves must remain closed to ensure that a train of equipment required for safe shutdown remains free of fire damage. In this example, the LPCI system would not be able to perform the required function, of maintaining reactor cooling system (RCS) inventory, and be free of fire damage. An exemption would be required for a pre-1979 licensee.

A post-1979 licensee who uses operator manual actions without NRC approval may or may not be in compliance with applicable fire protection requirements. Compliance depends on the specific license conditions, the change control process, and how the change was justified and analyzed to demonstrate that the operator manual actions do not adversely affect the ability to achieve or maintain safe shutdown. However, post-1979 licensees who do not seek prior NRC approval may be requested to demonstrate, as part of the NRC Reactor Oversight Process, that the use of an operator manual action would not adversely affect the ability to achieve and maintain safe shutdown in the event of a fire.

As above, a licensee relying on this level of protection and on manual actions to assure achieving and maintaining hot shutdown needs to have adequate instrumentation to determine that the maloperations have occurred and to assure that the proper manual actions are taken to defeat the maloperation.

In this specific example, the flow diversion from LPCI to the spray header could result in no makeup water going the reactor due to pressure in the RCS being 100 or more pounds per square inch greater than drywell pressure. This would result in operator detection and response times being critical. Consequently, at least one of the isolation valves, including power and control circuits, must remain free of fire damage.

Pressurized-Water Reactor (PWR) QUESTIONS AND RESPONSES

1. Power-Operated Relief Valve (PORV) and the Block Valves

Assume that one PORV and its associated block valve are protected and are required to actively operate to achieve safe shutdown. However, the other PORV and associated block valve are not required for safe shutdown and are not protected therefore; they can be subject to spurious operation.

In this scenario, can manual action (e. g., pulling fuses or closing the block valve from the MCC) be credited to mitigate spurious operation of the non-credited PORV valve provided that the manual action is feasible?

Response:

First, we do not agree that the PORV and its associated block valve, when actively operated, may be credited to achieve safe shutdown. This approach is usually termed “feed and bleed” and is unacceptable. We also do not agree that the non credited PORV and block valve are not required to satisfy Section III.G.2 of Appendix R in all situations. For some plant designs, a spuriously opened PORV and block valve may not allow the operators sufficient time to maintain pressure and inventory control of the RCS in order to achieve and maintain hot shutdown. Some licensees also classify these valves as “high-low pressure interface valves.” Therefore, protection in accordance with III.G.2 may be necessary for all trains of PORV/block valves.

However, other pre-1979 licensees may have a plant design whose thermal-hydraulic analysis demonstrates there may be sufficient time to implement feasible and reliable operator manual actions. For these situations, the operator manual actions must also be shown to meet the thermal-hydraulic demands of the system such that the reactor is recoverable if additional PORVs open until manually closed. An exemption would be required from III.G.2.

A post-1979 licensee who uses operator manual actions without NRC approval may or may not be in compliance with applicable fire protection requirements. Compliance depends on the specific license conditions, the change control process, and how the change was justified and analyzed to demonstrate that the operator manual actions do not adversely affect the ability to achieve or maintain safe shutdown. However, post-1979 licensees who do not seek prior NRC

approval may be requested to demonstrate, as part of the NRC Reactor Oversight Process, that the use of an operator manual action would not adversely affect the ability to achieve and maintain safe shutdown in the event of a fire.

As above, a licensee needs to have adequate instrumentation to determine that the maloperations have occurred and to assure that the proper manual actions are taken to defeat the maloperation.

Generic Letter 81-12 provides guidance which considers that these are "associated circuits" for Appendix R, Section III.G.3 (Alternative Shutdown) and a manual action would be acceptable. Feasible and reliable manual actions must also be shown to meet the thermal-hydraulic demands of the system such that the reactor is recoverable if additional PORVs open until manually closed. Manual actions must be feasible (they can be performed in the time available) and reliable (the actions are dependably repeatable by different crews), implicit is that the actions are effective in meeting regulatory requirements. Again, adequate instrumentation would be required to properly analyze and defeat the maloperation.

2. Charging and Volume Control System

Assume that the Charging Train A System is protected and is the credited charging system for fire in area X. During a postulated fire in area X, Train A charging is unaffected. However, there is the potential that the other two Charging Pumps may spuriously operate. Can manual actions be taken to mitigate spurious operation of the non-credited Charging Pumps provided that manual operator actions to secure these non-credited pumps are feasible?

Response:

Yes, the protected train remains free of fire damage, so III.G.2 is satisfied (if required detection and suppression is provided). Manual actions on the fire-damaged train can therefore be credited to achieve and maintain hot shutdown conditions. Manual actions must be feasible (they can be performed in the time available) and reliable (the actions are dependably repeatable by different crews), implicit is that the actions are effective in meeting regulatory requirements.

3. Auxiliary Feedwater (AFW) System

Assume that the Turbine-Driven Auxiliary Feedwater (TDAF) pump is protected and is the credited safe shutdown system for a fire in area X. During a postulated fire in area X, the TDAF pump and the associated safe shutdown flow path components are all protected and unaffected by the fire. However, there is the potential that the other two Motor-Driven AFW Pumps (which are not credited for safe shutdown in this area) may be subject to spurious operation. Can manual actions be credited to mitigate spurious operation of the non-credited AFW Pumps provided that such manual actions are feasible?

Response:

Yes, the protected train remains free of fire damage, so III.G.2 is satisfied (if required detection and suppression is provided). Manual actions on the noncredited AFW pumps can therefore be credited to achieve and maintain hot shutdown conditions. Manual actions must be feasible

(they can be performed in the time available) and reliable (the actions are dependably repeatable by different crews), implicit is that the actions are effective in meeting regulatory requirements.

4. Reactor Coolant Pumps (RCPs)

Operation of the RCPs is not required for safe shutdown. However, in most plants tripping of the RCPs may be required. Therefore the circuits for tripping the pumps are identified as required circuits for safe shutdown and are protected up to the switchgear. However, there is no way to protect the tripping circuits that are in the switchgear itself. A fire at the switchgear can prevent tripping the breaker that feeds the RCP. In some cases, there may be the mechanism to trip the upstream breaker either from the control room or from the switchgear itself. In this scenario, can manual action be taken to trip the upstream breaker at the switchgear?

Response:

Yes, the protected train remains free of fire damage, so III.G.2 is satisfied (if required detection and suppression is provided). RCPs are not in a protected train. Manual actions can therefore be credited to achieve and maintain hot shutdown conditions. Manual actions must be feasible (they can be performed in the time available) and reliable (the actions are dependably repeatable by different crews), implicit is that the actions are effective in meeting regulatory requirements.

GENERIC TO BOTH PWR AND BWR

1. 4 kilovolt (kV) Switchgear

A 4kV safe shutdown switchgear can have both safe shutdown loads as well as loads not required for safe shutdown (i.e., non-safe shutdown loads).

As a result of fire, due to cable damage, there is the potential that some of the non-safe shutdown loads may fail (spuriously operate or mal-operate) in such a way that can prevent the 4kV switchgear from being re-energized post-loss of offsite power and, consequently, prevent the required safe shutdown loads from operation. Can manual actions be credited to trip the non-required load breakers and re-energize the 4kV switchgear to power the required safe shutdown loads assuming that the manual operator actions are feasible and can be performed in a timely manner?

Response:

The circuits described are a common power supply issue and is an associated circuit of concern as defined in GL 81-12. By definition:

> where cables or equipment, including associated non-safety circuits that could prevent operation or cause maloperation due to hot shorts, open circuits, or shorts to ground, of redundant trains of systems necessary to achieve and maintain hot shutdown conditions are located within the same fire area outside of primary containment

they must be separated in accordance with Appendix R, Section III.G.2 requirements. In this case, the faulted cables would prevent operation of SSD equipment. Manual actions may be feasible and reliable but would require prior staff approval.

Unless the fire could cause a loss of offsite power, it is not necessary to assume that one occurs for III.G.2 compliance.

2. Main Feedwater

In most plants the Main Feedwater System is not a credited safe shutdown system, and, as such, not protected from the effects of fire. However, tripping of the motor-driven feedwater pumps post-fire may be required to prevent a reactor (or steam generator) overfill condition. Since the Main Feedwater System is not a credited system (and is not a protected train), can manual actions be credited to trip the main feedwater pumps post-fire provided that the manual operator actions are feasible and can be performed in a timely manner?

Response:

Yes, the protected train remains free of fire damage, so III.G.2 is satisfied (if required detection and suppression is provided). Manual actions can be credited to achieve and maintain hot shutdown conditions. Manual actions must be feasible (they can be performed in the time available) and reliable (the actions are dependably repeatable by different crews), implicit is that the actions are effective in meeting regulatory requirements.