APPENDIX H
REQUIRED FOR HOT SHUTDOWN VERSUS IMPORTANT TO SSD COMPONENTS

H.1 INTRODUCTION

The purpose of this appendix is to define required for hot shutdown components versus important to safe shutdown components. The reason for the distinction between these two (2) groups of components is that a required for hot shutdown component's fire protection features are governed specifically by the requirements of Appendix R Sections III.G.1.a and III.G.2, whereas, an important to safe shutdown component's fire protection features are not directly addressed in terms of specific fire protection features under Appendix R III.G.1. For plants required by 10CFR50.48 to meet the requirements of Appendix R Section III.G, the only available mitigating actions for addressing fire-induced impacts to the circuits for the required for hot shutdown components governed by Appendix R Section III.G.1, other than re-design, re-routing, exemptions or deviations, is protection of these circuits using the specific fire protection features required by Appendix R Section III.G.2. Although the use of the Standard License Condition is available for Plants licensed post-1979, the use of measures other than those described above for required for hot shutdown components will be heavily scrutinized by NRC relative to the justification for no adverse impact. For fire-induced impacts to circuits for components classified as important to safe shutdown components, additional mitigating strategies are available as defined in this appendix and within the body of NEI 00-01.

H.2 DEFINITIONS

This appendix provides a definition of the required for hot shutdown components and important to safe shutdown components.

- The required for hot shutdown components are those components on the required safe shutdown path for a particular fire area that are designated to perform the following safe shutdown functions: reactivity control, pressure control, inventory control, decay heat removal, process monitoring, as defined in NRC information Notice 84-09 and support systems, including electrical power, component cooling and lube oil cooling.

- Based on the BWROG White Paper on NRC IN 2007-07, due to the impracticality of protecting circuits required for the RPS/RTS scram function, post-fire safe shutdown procedures rather than circuit analysis are required to assure the reactivity control function. Refer to Appendix E for a discussion of this operator manual action in support of post-fire safe shutdown.

- For the remaining required for hot shutdown functions, fire-induced impacts to circuits for any required for hot shutdown components must be protected by a means meeting the requirements of the appropriate section of Appendix R or approved licensing basis for post-1979 Plants.. The use of operator manual actions is not allowed to mitigate the effect of fire-induced circuit damage resulting from a hot short, a short-to-ground or an open circuit. Re-routing or re-design of components and/or circuits may be used to eliminate safe shutdown impacts. Deviation or exemption requests may also be used.

- Those HVAC Components for which an analysis cannot demonstrate the feasibility of longer term manual actions such as opening a door to provide room cooling are classified are required for hot shutdown components. Refer to Section 3.1.2.6.3 of this document for a more detailed discussion of this issue.

- Fire-induced circuit damage to valves resulting in a flow diversion from the main flow path for a required for hot shutdown systems are classified as required for hot shutdown components. Only when an engineering evaluation concludes that a flow diversion will not impact the required safe shutdown function can these components be re-classified as important to safe shutdown. Each flow path is to be evaluated individually. To be re-classified as an important to safe shutdown component, the flow diversion must meet the following criteria:

    - If as a result of the flow diversion, assuming the valve in the flow diversion path opens at the start of the fire, i.e. time zero, it must take longer than 1 hour[33] for any of the following threshold conditions to be met, then the valve would be classified as important to safe shutdown. For multiple series valves in a flow diversion path, in the absence of technical justification to the contrary, all valves in the series are assumed to be opened at the start of the fire, i.e. time zero. Fire modeling, however, may be used to determine the amount of time required to open any subsequent valves for cases involving the need to open series valves to cause the flow diversion. Since the threshold criteria listed below will not be exceeded until all series valves in a given flow diversion path are opened, the time determined through fire modeling to open subsequent valves may be credited as part of the required time to exceed the threshold criteria. [Note: Information on the definition of time zero for the fire is contained in Appendix E.]

        - Core Damage (PCT $\geq 1800^{o}$F) – Reference NUREG 0562

        - Rupture of the Primary Coolant Boundary

        - Rupture of the Primary Containment

[33] The 1 hour criterion is based on NUREG 1852.

When performing thermal-hydraulic analysis in support of post-fire safe shutdown scenarios, best estimate values along with the core damage measurement of PCT $\geq 1800^{o}$F may be used. These criteria are similar to those used for the Internal Events PRA thermal hydraulic analysis. The use of these same criteria for post-fire safe shutdown provides for a consistent approach and a cost effective use of the information developed on plant response to various transient conditions.

- If the evaluation indicates that there is no impact, for an unlimited amount of time, to the required hot shutdown system to perform its required safe shutdown function, then it the flow diversion is classified as "non-impacting". The lack of impact can be as a result of a quantitative evaluation addressing the parameters described above or as a results of a qualitative evaluation related to the small size of the flow diversion path, e.g. flow diversion paths $\leq$ 1", or the flow diversion path having no adverse consequence, e.g. flow diversion through the Suppression Pool Spray line in a Mark II BWR when RHR is being used in the Suppression Pool Cooling mode. The flow diversion through a 1" line is considered to provide and insignificant loss of inventory when compared to the capacities of any of the systems with the capability to provide adequate make-up to the reactor during shutdown conditions. For the flow diversion through the Suppression Pool Spray line with the RHR System operating in the Suppression Pool Cooling mode of operation, the is no impact to the function of the system since water is still being taken from the Suppression Pool, run through the RHR Heat Exchanger and returned to the Suppression Pool.

- The threshold criteria described above should be viewed as a measure of risk of the flow diversion to post-fire safe shutdown as opposed to an acceptable time frame for performing an alternate mitigating strategy. Even though the threshold criteria described above may not be exceeded for a period in excess of 1 hour, the use of an operator manual action as a mitigating measure for a particular flow diversion must still justify that there is sufficient time to diagnose and perform the operator manual action. For example, if the threshold criteria are not exceeded for 2 hours, but the only available operator manual action would take 2.5 hours to accomplish, the use of the operator manual action would not be justified in this case.

- Any impacts associated with simultaneous flow loss through multiple flow diversion paths on the same required safe shutdown system should be captured as a part of the MSO review.

- In evaluating flow diversions, consideration should also be given to the effect of the flow diversion on voiding in the discharge piping and the potential for a subsequent waterhammer.

- In evaluating flow diversions, consideration should also be given to the effect of the flow diversion on the suction path for a pump required for hot shutdown resulting in pump damage due to cavitation.

- Fire-induced damage to associated circuits of concern for a breaker off of a bus for a required component requires that the breaker feeding the associated circuit of concern be classified as a required for hot shutdown component. Coordination is required for these breakers.

- Circuits for required for hot shutdown components are classified as required for hot shutdown circuits.

- Important to safe shutdown components are all components not classified as required for hot shutdown components. Important to safe shutdown components can impact post-fire safe shutdown in other ways, e.g. flow diversions off of tanks providing a suction source for a required for hot shutdown pump.

- Circuits for important to SSD components are classified as important to SSD circuits.

Refer to Figure H-1 for a pictorial presentation of this information.

H.3 REGULATORY BASIS

H.3.1 Required for Hot Shutdown Components

The origin for the requirements associated with required for hot shutdown components is Appendix R Section III.G.1.a. Appendix R Section III.G.1.a requires that one train of systems necessary to achieve and maintain hot shutdown be "free of fire damage".

The information in italics is intended to be wording taken verbatim from the Code of Federal Regulations.

III. G. Fire protection of safe shutdown capability.

1. Fire protection features shall be provided for structures, systems, and components important to safe shutdown. These features shall be capable of limiting fire damage so that:

a. One train of systems necessary to achieve and maintain hot shutdown conditions from either the control room or emergency control station(s) is free of fire damage; and

b. Systems necessary to achieve and maintain cold shutdown from either the control room or emergency control station(s) can be repaired within 72 hours.

If circuits for the components required to perform the hot shutdown functions on the systems selected for safe shutdown in any fire area could be damaged by the fire, then protection of these circuits in accordance with the requirements of Appendix R Section III.G.2 is required.

H.3.2 Important to Safe Shutdown Components

Important to Safe Shutdown components are described in Paragraph III.G.1 of Appendix R not specifically addressed in Appendix R. Paragraph III.G.1 reads as follows:

Fire protection features shall be provided for structures, systems, and components important to safe shutdown.

Paragraph III.G.1, however, does not specifically describe the requirements for the fire protection features to be provided for important to safe shutdown components. Because of this, there is some latitude in selecting the fire protection features that can be used to mitigate the affects of fire-induced damage with the potential to impact the required components.

H.4. REQUIRED FOR HOT AND IMPORTANT TO SAFE SHUTDOWN COMPONENTS

H.4.1 Criteria for Segregating

Required Safe Shutdown Components

- Review the safe shutdown methodology for each fire area.
- Identify those systems being used to support each of the required hot shutdown functions. Refer to the guidance in Section 3.1.2 for a more detailed discussion on the definition of components required for post-fire safe shutdown.
- Identify the components required for those systems to be able to perform the required safe shutdown function for the system.
- Identify the potential flow diversion off of the systems being used to perform the required safe shutdown functions.
- Evaluate whether or not the size of the flow diversion can impact the ability to achieve and maintain safe shutdown based on the threshold criteria provided above.
- For flow diversions where the flow diversion size exceeds the threshold criteria in less than or equal to 1 hour, classify the flow diversion component as a required for hot shutdown component. Classify the remaining flow diversion components as important to safe shutdown or non-impacting depending on whether the flow diversion needs to be isolated using an operator manual action or its affect can be tolerated.
- Identify the power supplies for each of required safe shutdown components.

- Identify the circuits for all breakers coming off of a bus powering a required safe shutdown component.
- Determine if these circuits represent associated circuits of concern.
- Provide breaker coordination for all breakers associated with associated circuits of concern.

For any component classified as a required component, classify its power supplies for both motive and control power as required safe shutdown components for the particular fire area under review. Any cable required for the operation of this set of components is a required safe shutdown cable.

Important to Safe Shutdown Components

- Component, other than those described above, whose fire-induced spurious operation can cause a flow diversion with the potential to impact a system performing one of the required safe shutdown functions is an important to safe shutdown component.
- Any component whose fire-induced spurious operation can cause a flow loss from the RPV or from a tank providing a suction source for a system performing a required safe shutdown function is an important to safe shutdown component.
- Any component with the potential to impact a system performing a required safe shutdown function that is not classified as a required component is classified as an important to safe shutdown component.

Cables associated with the important to safe shutdown components described above are classified as important to safe shutdown circuits.

H.4.2 Acceptable Mitigating Tools

Required Safe Shutdown Components

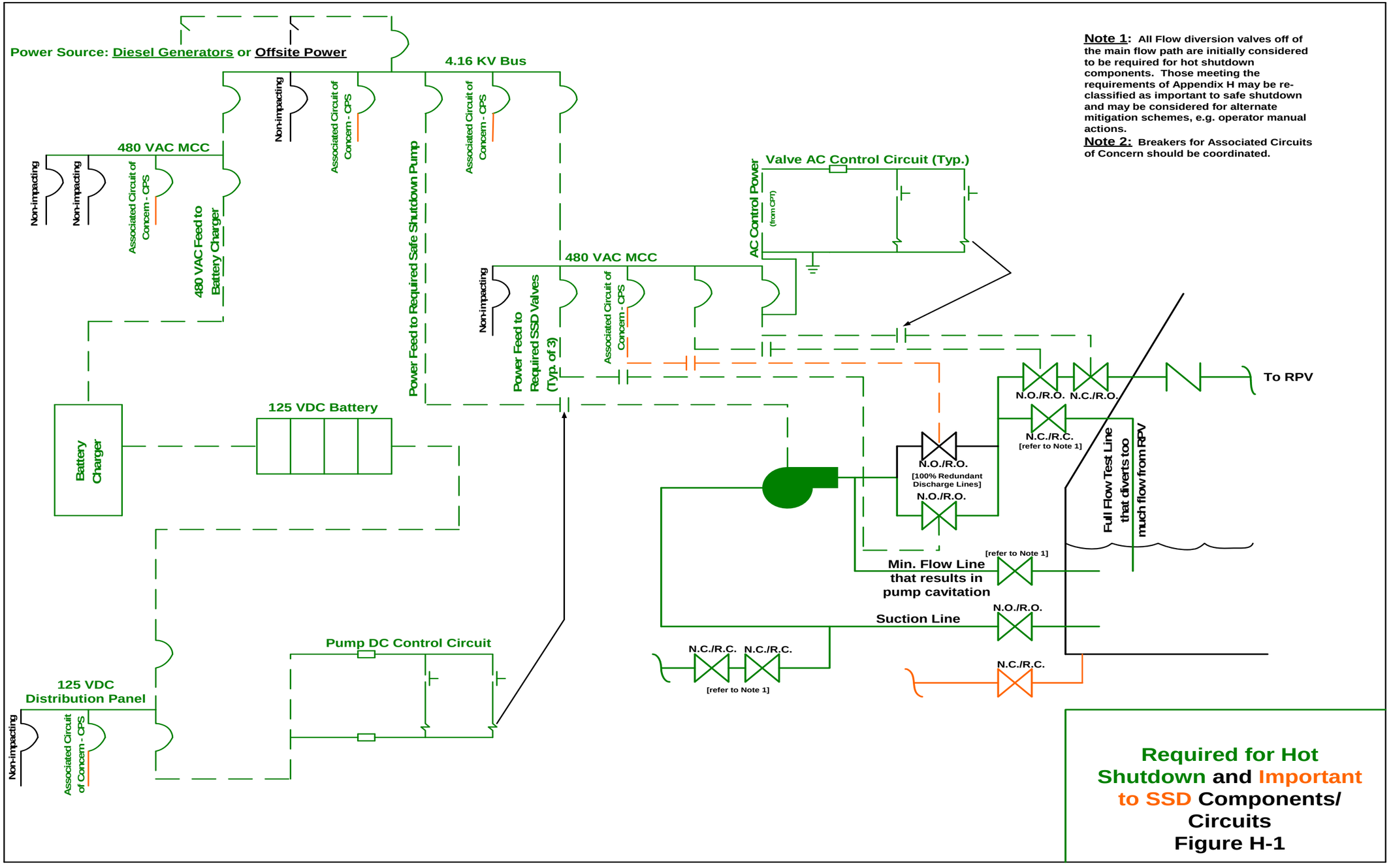
- Assure they are free of fire damage by re-routing or re-designing the component or circuit.
- Protect the circuits in accordance with Appendix R Section III.G.2.a, b or c.
- Process a licensing change in accordance with the licensee's current licensing basis (CLB) to demonstrate the acceptability of the condition. Depending on change and the licensee's CLB, NRC approval of the change may be required. Plants licensed to operate after January 1, 1979 with standard license condition for their Fire Protection Program may make changes to their approved Fire protection Program as long as the change does not adversely impact the ability to achieve and maintain safe shutdown in the event of a plant fire. Plants licensed to the requirements of 10CFR50.48 must obtain NRC approval prior to making changes governed by the requirements of Appendix R Section III.G.1 and II.G.2.
- Perform a risk informed analysis using the tools available for important to safe shutdown components in accordance with Regulatory Guide 1.174 and 1.200. This approach requires a license amendment.

Important to Safe Shutdown Components

- Either protect as outlined for required safe shutdown components above, or
- Use a feasible and reliable operator manual action with defense-in-depth.
- Use fire modeling analysis with defense-in-depth, or
- Use a focused-scope fire PRA to justify the acceptability of the condition using the criteria in Section 5. A licensing basis change or license amendment may be required to use a focused-scope fire PRA.

Non-Impacting Components

- No mitigating action beyond the analysis demonstrating that there is no impact to post-fire safe shutdown is required.


Power Source: Diesel Generators or Offsite Power
4.16 KV Bus
Non-impacting
Associated Circuit of Concern - CPS
Associated Circuit of Concern - CPS
480 VAC MCC
Non-impacting
Non-impacting
Associated Circuit of Concern - CPS
480 VAC Feed to Battery Charger
Power Feed to Required Safe Shutdown Pump
Valve AC Control Circuit (Typ.)
AC Control Power
(from CPT)
480 VAC MCC
Non-impacting
Power Feed to Required SSD Valves (Typ. of 3)
Associated Circuit of Concern - CPS
125 VDC Battery
Battery Charger
To RPV
N.O./R.O.
N.C./R.O.
N.C./R.C.
[refer to Note 1]
N.O./R.O.
[100% Redundant Discharge Lines]
N.O./R.O.
Full Flow Test Line that diverts too much flow from RPV
[refer to Note 1]
Min. Flow Line that results in pump cavitation
N.O./R.O.
Suction Line
N.C./R.C.
N.C./R.C.
[refer to Note 1]
N.C./R.C.
Pump DC Control Circuit
125 VDC Distribution Panel
Non-impacting
Associated Circuit of Concern - CPS
Note 1: All Flow diversion valves off of the main flow path are initially considered to be required for hot shutdown components. Those meeting the requirements of Appendix H may be re-classified as important to safe shutdown and may be considered for alternate mitigation schemes, e.g. operator manual actions.
Note 2: Breakers for Associated Circuits of Concern should be coordinated.
Required for Hot Shutdown and Important to SSD Components/ Circuits
Figure H-1