

# BWR OWNERS' GROUP

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Mr. Michael Lesar  
Chief, Rules and Directives Branch  
Division of Administrative Services  
Office of Administration  
U.S. Nuclear Regulatory Commission  
Mail Stop T6-D59  
Washington, DC 20555-0001

SUBJECT: BWR Owners' Group Comments on NUREG-1852, *Demonstrating the Feasibility and Reliability of Operator Manual Actions in Response to Fire, Draft Report for Comment*

ENCLOSURE: Comments on NUREG-1852

Dear Mr. Lesar:

We appreciate the opportunity to provide comments on NUREG-1852. This is an important document since it provides guidance for determining whether operator manual actions can be relied on to carry out the intended safe shutdown actions. High-level comments are summarized below, and detailed comments are provided in the enclosure.

## High Level Comments

1. The NRC is asking for more than is required for design basis events and EOPs

Many of the requirements exceed what is required for operator actions for design basis actions. These include requirements for a diagnosis for a failed recovery action (3.2.5, first paragraph and others), determination of crew differences (4.2.2, item b), and others.

2. What the NRC is asking for is not justified by the risk avoided

The requirements applied by this NUREG do not consider the fact that there is a high degree of defense-in-depth inherent in current fire protection and safe shutdown requirements. These defense-in-depth measures (including fire prevention, mitigation through automatic and manual suppression, and safe shutdown measures) offer a high degree of risk reduction. All operator manual actions should be demonstrated as feasible, but the imposition of excessively conservative requirements does not significantly improve the risk reduction provided by these actions.

3. What the NRC is asking for is very difficult to do in some cases

The determination of the need to perform a manual operator action in support of post-fire safe shutdown is an analytical artifact resulting from a series of bounding, theoretical, and

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F-RIDS = ADM-03  
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conservative assumptions related to plant fires, their initial size, their ability to be sustained, their ability to spread without being suppressed and, ultimately, their impact on circuitry in the affected area. The inferred boundary conditions forming the backdrop for many of the requirements of NUREG-1852 are in great contrast to those used for post-fire safe shutdown analysis. When the many theoretical requirements in NUREG-1852 are layered upon the bounding and conservative analytical assumptions already used for the post-fire safe shutdown analysis, the requirements of NUREG-1852 become very difficult to apply. Such requirements include:

- The determination of all possible delays for an action (3.2.2, Item 2, bullet 1), determination of all temporary conditions (3.2.2, Item 2, Bullet 3) affecting an operator action
- The determination of Alarm Effectiveness (3.2.5: Paragraph starting "Analogous..."), which indicates a determination of the failure rate of the alarm
- The determination that a fire will not cause "electrical interference" (4.2.6, bullet 1).

Addressing the comments that we provide here, and those provided separately by NEI, will provide guidance will be much more useful.

4. In some cases NUREG-1852 seems to be providing new staff positions

NUREG-1852's reference to Reg Guide 1.33 Appendix A specifically requiring post-fire safe shutdown procedures appears to represent a new staff position, as it is inconsistent with Generic Letter 86-10, staff position 5.2.3. Previously, RG 1.33 Appendix A item 6.v had generally been interpreted as applying to the Fire Fighting/Brigade activities. Considering the previous staff position provided in GL 86-10 position 5.2.3, it is clear that NUREG-1852 is re-interpreting RG.1.33.

Should you have any questions about these comments, please contact Greg Krueger (BWROG Risk-Informed Regulation (IRIR) Committee Chair) at 610-765-5973, or Fred Emerson (IRIR Project Manager) at 910-675-5615.

Sincerely,



R. C. Bunt  
BWR Owners' Group Chair

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BWROG IRIR Committee  
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## Detailed BWROG Comments on NUREG-1852

### Section 1

Paragraph 1: Traditional fire protection defense-in-depth (DID) includes prevention of fires from occurring, detection and suppression, and safe shutdown given that a fire is not suppressed. If safe shutdown fails, Appendix R and additional fire protection programs do not prevent radioactive releases to the environment, since they are based on the deterministic requirement that adequate core cooling be maintained. Only risk-informed fire protection programs provide some analysis in this area, and it is focused only on the fire fighting activities, not on typical release protection such as containment closure. We recommend removing item 2 from the discussion and changing the DID discussion to the traditional DID discussion.

Paragraph 2: The words “rather than on Fire Barriers or separation...” infer that plants are not using Fire Barriers or separation. These words should be modified to better describe the actual situation in the plants. We recommend removing the words from “rather than” to the next comma, since the wording does not add anything to the manual action discussion.

Paragraph starting “If any one...” We recommend changing “contain no redundant” to “do not contain redundant.” Since a III.G.1 fire area contains one of two or more trains, the wording needs to accurately affect that multiple trains are not affected rather than any trains.

### Section 3

Section 3.1: The term Operator Manual Action as defined is limited to hot shutdown actions. However, there are manual actions that are for cold shutdown, but they are typically considered non-risk significant. NRC should modify the definition and discussion to reflect that cold shutdown manual actions are allowed by regulation

Page 3-1, bullet 3: The operator feasibility criteria appear to require analysis of safe shutdown requirements. In fact, the operator feasibility analysis supports the safe shutdown analysis, not the reverse. NRC should reword the bullet to clarify that the additional requirements listed are needed for feasibility, and are part of the demonstration that cables and equipment required for safe shutdown are not damaged by a fire.

Section 3.2.2, Item 1: In most cases, variations affecting the fire growth and damage time are conservatively addressed in the timing for operator manual actions. NRC should note in the NUREG that although timing variations need to be considered, the use of a conservative timing should be acceptable, without the

further complication of determining multiple time-lines and running multiple operator timing scenarios.

3.2.2, Item 2, bullet 1: NRC should remove the requirements in the NUREG for taking into account all the possible delays in determining operator action timing. It is literally impossible to determine both all of the possible delays and the variation in the operator action timing due to the delay. For example, listed in the example are locked doors, stiff hand wheels, or difficulty with communication devices.

- With doors, we would need to identify all of the doors, estimate the likelihood that each door is locked, and then determine the possible delay (accounting for alternate routing) for each door.
- For stiff hand wheels, we would need to determine the possible delay time for a stiff hand wheel for each valve type and location. For example, if the valve were on a platform above the floor, the timing to loosen that valve would be different than a valve at ground level.
- For difficulty with communication devices, we would need to look at an array of difficulties, including dead batteries, areas of the plant where communications are difficult or radios are intermittent, dropping a radio, etc.

All of this would be impossible to consider in the analysis. Additionally, most of these are low probability events and are within the established conservatism for the overall reliability of the action. The imposition of these random impediments is also inconsistent with previous NRC guidance for performing safe shutdown analyses, which assumes that components or systems required for FSSD are not out of service prior to the fire and that components are in their normal operating position or status prior to the fire. "Worst case" fires need not be postulated simultaneously with nonfire-related failures in safety systems, plant accidents, or the most severe natural phenomena." (BTP CMEB 9.5.1 rev 3, position C.1.b).

3.2.2, Item 2, Bullet 3: NRC should remove any requirement for considering temporary conditions that may be present. These conditions, being temporary, are low probability events especially when considered in conjunction with a fire. Present requirements for 10CFR50.59 allow for temporary changes of a maximum of 90 days, with typical temporary conditions of only a few days. With a range of 1-90 days (low and high range), this represents a spectrum of probabilities between a 7E-05 and 6E-03 of a temporary condition being present when an action is needed. This range should have a minor effect on the overall manual operation human error probability for most manual operations. Additionally, it would be impossible to determine all of the possible temporary conditions that may occur at the plant. Overall, these temporary conditions should have no impact on the overall risk associated with manual actions. The imposition of these random impediments is also inconsistent with previous NRC guidance, as discussed above.

3.2.3, Third Paragraph: We recommend removing this paragraph. NUREG-1852 appears to be attempting to re-classify a post-fire safe shutdown as an "Anticipated Operational Occurrence" (AOO), based on an example provided in Table 3-3 of ANSI/ANS 51.1 and 52.1. The NUREG then goes on to impose various new requirements based on this classification as an AOO. As discussed in ANSI/ANS 51.1/52.1 Section 3.2, the actual frequency of each initiating occurrence must be determined and the plant condition code assigned based on its best estimate frequency (Table 3-3 provides examples only). Since (as discussed below) a fire requiring post-fire safe shutdown and manual operation occurs at a much lower frequency than once per year (PC-2), the classification of these actions as AOOs is inappropriate. Current Regulatory guidance classifies a Post Fire Safe Shutdown as a "Special Event" (refer to ANSI/ANS 58.6, ANSI/ANS 58.14).

Based on the generic fire frequencies in NUREG/CR-6850, the sum of all fire frequencies for a plant is around 0.44/year. This translates into a typical CDF for a PWR of around 1E-05/year and a CDF for a typical BWR of around 1E-06/year, based on previous fire PRAs and IPEEEs. Of the fire PRAs reviewed for NUREG-1852, none included significant fire area results requiring local manual actions. All results were either dominated by control room abandonment and operator failure to properly perform remote shutdown, or by control room shutdown with mechanical failure of the remaining available train. In addition, NEI 00-01 pilot studies did include scenarios requiring local manual actions. All scenarios included in the NEI 00-01 results were shown to be below 1E-06/year.

As can be seen from these examples, a fire requiring a local manual action (i.e., a "Worst Case" fire per BTP CMEB 9.5.1 rev 3, position C.1.b) is expected to be very low in probability, and much lower than the "one or more times during the lifetime of the nuclear power unit" stated in the NUREG and in 10 CFR 50 Appendix A. Some of the scenarios included in the PRAs reviewed did include performance of procedures that included manual actions. When the results of the PRAs are reviewed to determine the frequency of the large and damaging fire where the procedural actions are performed, these results indicate a maximum value of around 1E-04/year. The NEI 00-01 pilot results show a limiting damaging fire resulting in procedural actions, based on step 2 results, of around 1E-06/year per fire area. Using conservative fire frequency estimates for a typical fire area of 1E-02/year (0.44 as noted above divided by 40 fire areas), a severity factor of 0.1, a non-suppression probability of 0.1, and a damaging fire frequency of 1E-04/year are estimated. This is far below the 1/40 frequency as required by 10CFR50, Appendix A.

Further, the incorrect regulatory classification of fire safe shutdown manual operations as AOO's has been cascaded into an inappropriate imposition of 10CFR20, section 20.1201. Radiation dose to the operators should meet the requirements of GDC-19, as discussed in NEI 96-07, instead of referring to 10 CFR Part 20. NRC may be able to better clarify this item by consulting previous guidance provided in NUREG-0737, Item III.B.2 regarding plant shielding for post-accident operations. NUREG-0737 Item III.B.2 contemplated the need for local actions in the plant, and imposed a 5-rem whole body limit, for the duration of the event (based on GDC-19).

3.2.3, Paragraph 4: NRC should remove this paragraph. The statement referring to NUREG-0800 stating “Although this guidance addressing fire fighting, it is clear that some of these also be relevant to operator manual actions” is an interpretation of the guidance in NUREG-0800. Although it is understood that operator manual actions need to be demonstrated as feasible and reliable, this should not include meeting the guidance in NUREG-0800 regarding fire fighting activities, which involve potentially dangerous activities and activities resulting in potential water spray on plant equipment.

3.2.3, last paragraph: This paragraph and references to inspection guidance in other paragraphs should be removed from Chapter 3. Inspection guidance is not part of regulation, nor is it subject to review in a similar way to other regulatory documents. Additionally, the inspection guidance should be based on existing regulation. As such, it is not a reasonable reference for providing a basis for requirements on operator manual actions. Finally, it is likely the current inspection guidance will be revised once NUREG-1852 is published, thus making the discussion inaccurate.

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3.2.4: This section seems to require the verification that SSEs are free of fire damage. This is already a requirement for the plant’s fire Safe Shutdown Analysis, which was where the local manual action was likely identified. Requiring an additional verification that equipment is available would basically require a SSA supporting the operator manual actions. NRC should reword this section to focus on the requirement the equipment needed to be manipulated be accessible, and remove any statement requiring additional verification that the equipment is available.

3.2.5, First Paragraph: Diagnosis is needed in order to identify an action is needed. Item 3 refers to indication to recover a failed action, which is not typically considered part of the diagnosis phase of an action. This diagnosis may need to be provided, but only if the confirmation of the action is needed to continue performance of a procedure or performance of additional actions. Additionally, unless the action is considered highly un-reliable, the indication that the recovery action has failed should not affect the overall reliability of the action. Finally, the availability of indication of a failed procedural step is only needed if credit will be taken in the probability calculation for the failure to perform the action, which is not a concern for a deterministic approach as provided in NUREG-1852. NRC should remove item 3 from the diagnosis requirements.

3.2.5, Paragraph 4: As stated above, Inspection Guidance should not be listed as a reference for providing a list of requirements for operator manual actions. NRC should remove the inspection guidance references in NUREG-1852.

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3.2.5: The paragraph starting “Analogous...” requires an assessment of several things.

- First, alarm effectiveness, although interesting in a risk-informed approach (for actions where the operator failure rates are as reliable as typical alarm circuits), is neither presently required nor of interest in assessing feasibility or reliability. Additionally, there is no similar requirement for other operator actions, such as for emergency response for a design basis accident. For these types of actions, the requirements are to ensure the alarm remains operable, but there is no “assessment of effectiveness” which indicates a determination of the failure rate of the alarm. The requirements to assess effectiveness of an alarm should be removed.
- Second, the paragraph requires the assessment of “each operator’s knowledge of his or her role.” Training requirements for all procedures require regular training and testing on procedural actions. However, this does not include the assessment for particular actions on each operator’s knowledge. Assessment would seem to indicate again a determination of failure probability, rather than the present requirement of having an approved training program (with all of the required program attributes). The requirements should be reworded to assess each operator’s knowledge on his or her role.
- Finally, the last requirement is an assessment that the procedure is current and adequate. While procedures have to be current, a separate assessment should not be required here. Self-assessments and other audits look at this issue extensively. Determining whether a procedure is adequate is subjective, and it would be difficult to assess this. Procedures are required to go through an extensive review, and adequacy would be determined by both the programmatic requirements as well as the required walkthroughs of the procedural actions by each crew. Therefore, a separate assessment is not needed, and the requirement to ensure a procedure is current and adequate should be removed.

3.2.11, Paragraph starting “For this Criterion, ...” This paragraph requires the demonstrations for operator manual actions to be performed under simulated fire conditions. There is no requirement for this, nor is there a similar requirement for operator actions performed for Design Basis Events. This requirement should be removed. The basis provided refers to fire brigade drills, however this section also shows a mis-interpretation of requirements for fire brigade drills. Brigade drills conducted in the plant are “strenuous”, however they do not “simulate actual fire conditions” as NUREG-1852 implies. Brigades experience “actual fire conditions” during controlled training evolutions at separate live burn facilities, not in the plant.

## Section 4

4.2.2.a, bullet 1: See comment above for 3.2.2, item 2, bullet 1. It is impossible to estimate delays for all possible conditions listed.

4.2.2.a, bullet 2: See the Section 3.2.2 comments on “temporary” conditions. All temporary conditions cannot be estimated, and temporary conditions are by definition, low probability since they are short lived. NRC should remove requirements to assess temporary conditions for each operator action.

4.2.2, item b: It is not possible to demonstrate all of the listed crew differences. As such, listing all of the possible differences does not support the guidance. Finally, the demonstration in Item 3 under 4.2.1 does not account for these uncertainties, since quantification of these issues (such as emotional responses to fire/smoke) are not possible. NRC should remove the requirement to assess listed crew differences.

4.2.5: See the comment on 3.2.5 above on needing indication for successful complete of an action. In most cases, this is not needed to ensure feasibility or reliability.

4.2.6, bullet 1: There are two concerns here.

- First, it is not possible to demonstrate that the effects of a fire will not cause “electrical interference.” There is no method for demonstrating this.
- Second, it is likely that many fires will damage some communications equipment.

The statement should be re-written to require that an undamaged communications method is available, rather than require that a fire will not damage communications equipment.

4.2.6 General: It is common to have communications performed prior to putting on protective gear with confirmation given once the operator has left the area and removed the gear. This possibility should be allowed, given the timeline for actions and verification allow for this. In most cases, once the action is complete, the protection to the core is provided so that the verification and communication back to the control room does not affect the overall fire and plant risk.

4.2.9.1: The section describing the procedural requirements, including review guidance, is redundant to already existing requirements for developing plant procedures (see paragraph 2 in 4.2.11). In particular, the guidance in paragraphs 2, 4, and 5 should be simplified or eliminated, since requirements for procedural development at the plant already provide detailed instruction on these issues.

4.2.9.2: Similar to 4.2.9.1, once an action is put into a procedure, training is required. Much of the discussion in 4.1.9.2 is redundant to existing operator training requirements, and should be removed from this guidance. It is enough to just state that any local manual actions are placed in the training program and are therefore treated similarly to other procedural actions. However, the guidance should be limited to specific guidance related to local manual actions only.

4.2.11, bullet 2: The wording is vague: "... many steps... that require careful thought..." The NRC should indicate which steps require careful thought.

4.2.11, bullet 4: NRC should remove this bullet as it may be interpreted to apply to all actions. All emergency actions require a high degree of mental effort.

4.2.11: General: The imposition of these random impediments is also inconsistent with previous NRC guidance for performing safe shutdown analyses, as stated above. The requirements within this section should be verified to be consistent with other operator actions in the emergency operating procedures at a plant. It appears that the specific requirements listed are over and above those required in response to already required operator actions, such as local actions following a LOCA, Loss of Offsite Power, etc. For example, requiring noise level to be simulated, requiring handwheels that may be stiff to be included in the simulation, etc. are over and above the long standing requirements for demonstrating EOP actions. The requirements listed should be reviewed by NRC and Industry operations and training experts to determine where the requirements go beyond the existing requirements, and to determine if this extension makes sense for fire actions only.

4.2.11.7. Last Paragraph: The guidance here, to consider when a crew has received training, goes against previous guidance to randomly select the crew. The last sentence indicating not automatically using the latest trained crew is reasonable, but if a crew selection is truly random, then this process should not try to include other aspects.

Appendix A, Items 3 and 4: Item 3 lists that the analyst should include a "worst case time" while item 4 suggests adding margin to account for uncertainty. For the model presented in the appendix to work, either the margin needs to be removed, or the worst-case time needs to be a best estimate time. Now, the best estimate time can be based on conservative assumptions, where assumptions are needed. However, the worst-case time should not be used for all steps in the timeline. If a worst-case time were used, this would already represent the upper bound, removing the need to include additional margin.

4.2.11 and Appendix A General: In the document, the requirement is that the worst-case time for damage (including spurious operation) should be assumed. However, this may result in unrealistic scenarios if damage is assumed too soon. An option should be considered if the damage time is calculated, based on a worst-case fire location and an upper bound (see Fire SDP) fire size. If for example, a cable is located 7 feet above the nearest cabinet (thermoset cables, with no possible cable fires for this example), and

the fire modeling of a 200 kW fire determines 12 minutes to damage, then the 12-minute number should be used for any time-line. This is the earliest time that damage would occur with the largest likely fire, and would be better than assuming damage occurs immediately. Immediate damage may be possible for explosive fires, but is not likely for all other fire types. Therefore, conservative fire modeling should be allowed for determining the expected upper bound damage time for timelines.