

**PUBLIC COMMENTS AND RESPONSE AND RESOLUTION ON APPENDIX 18-A
CREDITING MANUAL OPERATOR ACTIONS IN DIVERSITY AND DEFENSE-IN-DEPTH ANALYSIS**

Section	Location	Comment	Response and Resolution
C. Staff Position	First paragraph	The last sentence ("Manual operator actions for these scenarios should be based upon, and ultimately included within, the Emergency Operating Procedures (EOPs) and executed from the main control room (MCR)") presents two issues. One is that the statement regarding EOPs prescribes a particular set of implementing procedures without allowing the NUREG-0711 process to determine the most effective vehicle that supports the tasks using the subject architecture. Second is that the statement specifies that actions should be implemented from the main control room. Specifying the location of performing the action in the MCR may be too limiting for certain situations. The guidance should specify only that analysis and validation of the operator action conclude that it can be completed in the time required, regardless of the location of the action. Further regarding the location of actions, the intent of system-level manual action is to use a minimum number of controls in the MCR without operators activating or controlling equipment at various plant locations (Ref: DI&C-ISG-02, Rev. 2, June 2009, pg. 7). This is a prudent approach that avoids the risks and complexity of coordinating dispatched personnel, and the licensee burden of demonstrating/validating an approach that relies on dispatched personnel at different locations in the plant. By citing the MCR location, NUREG-0800 18-A is consistent with DI&C-ISG-02, which is effectively consistent with Clause 6.2 of IEEE Std 603-1991. However, IEEE Std 603-1991 was not developed expressly for addressing diversity and defense-in-depth. Rather, manual action from the MCR was intended to ensure the operator retained an	The staff disagrees with the proposed recommendations. The methodology described in Appendix 18-A was developed with the objective of obtaining a high level of assurance that the manual actions to be credited can be performed correctly and reliably within the time available. Inclusion of the actions in the EOPs and performance of the actions from within the MCR is consistent with these objectives and with the safety-significance of the protective function to be performed using manual action(s). Regarding the safety-significance, the staff notes that the subject manual action to be credited under the this guidance have been proposed by the applicant as all or part of the diverse means responding to a postulated common cause failure (CCF) of an automated protection function. Also, although an EOP may not be available for every specific potential (CCF), there is a high probability that there will need to be an EOP to handle the symptoms and effects a CCF may cause including certain credible spurious actuations. EOPs are generally subject to more extensive verification and validation activities than other classes of plant procedures and thereby afford a high level of assurance that the credited manual action(s) can be performed reliably and that the capability will be maintained. In addition, the guidance in Appendix 18-A was developed to provide a general methodology applicable to crediting operator action in lieu of automated back-up functions, including cases in which the protective action was required in less than

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		on demand, discretionary capability to initiate a safety function, not as a defense against common cause failure (CCF).	30 minutes. Requiring the actions to be completed within the MCR reduces the uncertainty in human performance associated with operator transit times to local control stations and the potential adverse impact of local environmental conditions on accessibility and work conditions. Whereas action outside the MCR might be justifiable on a case by case basis, as this is guidance, one might ask about addressing CCF from the Remote Shutdown System (room or panel). Unless the MCR is made uninhabitable by the effect of the Chapter 15 event or the effects of the CCF itself, then the action would be expected to be from the MCR based on the single failure criteria. Regarding the commenter's assertions concerning IEEE Std 603-1991, the staff acknowledges that IEEE Std 603-1991 was not developed expressly for diversity and defense-in-depth analyses. Nevertheless, considering that the need for a diverse means is based on a postulated CCF of an automated protection function, it is the staff's position that the operator must retain a reliable discretionary capability to initiate safety-functions, including those functions affected by the CCF. Although IEEE-603, 1991 does not provide a direct basis for the staff position that CCF manual actions should be performed from within the MCR, the rational for using a manual action strategy that does not rely on coordination with/of field operators remains applicable and valid. It should also be noted that whereas the commenter inferred a relationship between the staff position and IEEE Std 603-1991, Appendix 18-A does not cite the standard. Nor was BTP 7-19 based on IEEE Std 603-1991, since the diverse means can be non-safety. If

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			the diverse means selected is an automated system that is designated as a safety system or the manual action uses safety equipment, then that equipment is subject to IEEE Std. 603-1991.
C. Staff Position	First paragraph	Furthermore, if the manual action is used to meet a diversity need as part of D3 compliance, then the action can accomplish either the same function as the safety system function that is vulnerable to CCF or a different function that provides adequate protection. Thus, the action can use a non-safety system if the system is of sufficient quality. (Ref: BTP 7-19, Rev. 5, March 2007, Point 3 on page BTP 7-19-4).	The staff agrees that the manual actions can be performed using a non-safety system if the system is of sufficient quality. In this instance the staff considers the manual actions to be a critical element of the system and that the methodology described in Appendix 18-A to be consistent with the position that the non-safety system be of "sufficient quality."
1 .A. Method	Second paragraph	The third sentence states that the HFE analysis should evaluate the documented sequences of operator actions and clarifies that sequence is "based on task analysis, vendor-provided generic technical guidelines for emergency operating procedure development, or plant-specific EOPs, depending on the maturity of the design." The evaluation would necessitate task analysis regardless of the state of design development. To remove ambiguity and avoid confusion, the discussion should include only those items necessary for analysis and should not provide examples of inputs that may be available (e.g., EOPs). This comment also applies to the same statement in the second bullet of Subsection 11.B. Alternatively, if the statement is intended to address both new and operating plants, consider replacing the statement with: "The basis of the documented sequences of operator actions can be task analysis, vendor-provided generic technical guidelines for emergency operating procedure development, or plants-specific EOPs, depending on the maturity of the design"	The statement is intended to address both new plant designs and operating plants. The staff has incorporated the commenter's proposed clarification in both the method and review criteria.

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1 .B. Review Criteria	Fourth Bullet	The review criterion specifies actions using only alarms, controls, and displays in the main control room. Specifying the location of actions may be too limiting in some instances. The guidance should specify only that analysis and validation of an action conclude that it can be completed in the time required (see similar comments on "C. Staff Position").	The staff disagrees. See response to comment regarding "C. Staff Position, First Paragraph."
1 .B. Review Criteria	Fourth Bullet	The review criterion refers to a "Failure Modes and Effects Analysis." It is unclear whether this refers to the D3 analysis per the guidance of BTP 7-19 or and an additional analysis to be reviewed against the criteria of Appendix 18-A. Consider providing further clarification.	The staff agrees that clarification is needed. The phrase "failure modes and effects analysis" is found in the paragraph under the 4 th bullet in Section 1.B., "Review Criteria." This bullet section will be revised to state, "The sequence of actions uses only alarms, controls, and displays that would be available in the MCR (MCR equipment) and operable during the assumed CCF scenario(s). Here operable means the MCR equipment that would still be available based on the D3 analysis of the postulated CCF associated with each event that is evaluated in the accident analysis section of the safety analysis report (SAR)."
1 .B. Review Criteria	Fifth Bullet	The text refers to "applicable steps in the symptom/function-based EOPs." This seems to contradict the second bullet of the same section (and text in Section 1 .A), which refer to "plant-specific EOPs, depending on the maturity of the design." The "maturity of the design" implies that EOPs may not be available during the analysis phase, which is addressed in Subsection 1.B. Consider using similar statements regarding the EOPs in the bullets of this subsection.	The staff agrees that bullet 5 can be interpreted to contradict bullet 2. The intent of the criterion described at the fifth bullet is for the estimated time to be sufficient to allow implementation of the symptom/function-based EOPs, when the EOPs are available. It is recognized that this analysis may be performed before EOPs are available. The staff will footnote this criterion to more clearly state the intent.
2.A. Method	Fourth Bullet	"Use of control/display mockups" is actually representative of tools rather than methods. Consider whether this subsection should be entitled "Tools and	The staff agrees that control/display mockups are tools, but considers the use of such tools to derive time required estimates to be a method

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		Methods" (this may also apply to Subsection 3.A. for consistency).	and therefore has determined not to revise the draft text.
2.B. Review Criteria	Third Bullet	The review criterion specifies that a preliminary validation use two or more methods. With the analysis and a validation using diverse methods and independent personnel, specifying two or more validation methods is excessive. This is further supported by the stipulation that testing is also performed during Integrated System Validation (ISV). Additional testing may be warranted on a case-by-case basis when there are concerns with the margins between the time required for a task and the allowable task time. This margin threshold could be specified in the criterion. Also, performing validation through two or more methods is not always industrially practical in terms of technical justification or need and may be onerous with respect to budget or schedule needs.	The staff agrees that, in some circumstances, an acceptance criterion of using two or more diverse methods to conduct a preliminary validation may be excessive. The staff has revised the criterion to state: "The preliminary validation uses methods appropriate to assessing time required for the task. For complex situations and for actions with limited margin, such as less than 30 minutes between time available and time required, the preliminary validation uses two or more methods to validate the analysis."
3.A. Method	First Paragraph	Third sentence states that operator response times should be measured for "all licensed operating crews". The number of operating crews could vary, depending on the plant. For Integrated System Validation as part of a 10 CFR Part 52 process, the operating crews would not be licensed. The Integrated System Validation should include the personnel, the number of crews, and other testing aspects specified by the validation plan developed using the guidance of NUREG-071 1.	The criterion for all crews to participate reflects the objective of achieving a reasonable assurance that manual actions can be completed reliably within the time available and consideration that with such a small sample size it is important for all crews to participate to best characterize the range of performance times that can be anticipated. However, the staff acknowledges that crews will not be licensed for designs being validated as part of the 10 CFR Part 52 licensing process. Accordingly, the staff has removed the word "licensed" from the third sentence of Section 3.A Method. In addition, the staff has revised a "Personnel" review criterion under 3.B to state: "For vendor/applicants using the 10 CFR Part 52 process the minimum number of crews should be established in accordance with the guidance of NUREG-0711 (e.g., as specified in the vendor's/applicant's NRC-

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			approved integrated system validation implementation plan)."
3.B. Review Criteria	"Personnel," Second bullet	Review criterion states that actions to be performed by licensed operators are validated using individuals holding a current operating license for the unit on which the actions are to be credited. For ISV performed as part of a 10 CFR Part 52 licensed plant process, the operating crews performing the evaluation may not be licensed on the unit when the ISV is performed. The ISV should include the personnel, the number of crews, and other testing aspects specified by the validation plan developed using the guidance of NUREG-071 1. Considering changing the statement to appropriately address existing operating reactors and new reactors.	The staff agrees with the comment. The staff has revised a "Personnel" review criterion under 3.B to state: "With the following exception, actions to be performed by licensed operators are validated using individuals holding a current operating license for the unit on which the actions are to be credited. For vendor/applicants using the 10 CFR Part 52 process for a design for which there are currently no licensed operators, the crews may be composed of individuals who hold or have held an NRC-issued license to operate a commercial nuclear reactor of the same type (i.e., pressurized water reactor or boiling water reactor) for which the design is being validated." See also the resolution of comment on 3.A Method for changes related to the number of crews required for the validation.
3.B. Review Criteria	"Personnel," Fifth bullet	Review criterion states that all crews are included as part of the ISV. Number of operating crews could vary depending on the plan site. The Integrated System Validation should include the personnel, the number of crews, and other testing aspects specified by the validation plan developed using the guidance of NUREG-071 1. The text needs changing in order to be appropriately applied to existing reactors and new reactors.	The staff agrees with the comment. The staff has revised the fifth "Personnel" review criterion under 3.B to state: "For vendor/applicants using the 10 CFR Part 52 process the minimum number of crews should be established in accordance with the guidance of NUREG-0711 (e.g., as specified in the vendor's/applicant's NRC-approved integrated system validation implementation plan)."
3.B. Review Criteria	"Simulator"	The guidance appropriately refers to ANSI/ANS 3.5 functional and fidelity requirement. It is noted that all possible nuanced failure modes for a specific digital technology platform will not be modeled in a plant	The staff agrees with the comment. No change to draft Appendix 18-A necessary.

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		training simulator for all CCFs and digital failure modes. However, the guidance appropriately does not state specify "all" in the first sub-bullet.	
		From ACRS letter of November 14, 2011 on BTP 7-19 Rev. 6: ACRS Recommendation 2: The discussion of the difference between time available and time required in SRP Chapter 18, Appendix 18A, "Crediting Manual Operator Actions in Diversity and Defense-in-Depth (D3) Analyses," should be revised to be consistent with Recommendation 1 for Sections 3.5 and 4.6.	From EDO response of JANUARY 27, 2012 to the ACRS letter: As part of resolving comments on draft Appendix A, "Crediting Manual Operator Actions in Diversity and Defense-in-Depth Analyses," to Chapter 18, "Human Factors Engineering," of NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition," the staff will revise the draft to include text that is consistent with the resolution of ACRS Recommendation 1 for Sections 3.5 and 4.6 of BTP 7-19, Revision 6. That recommendation concerned guidance regarding the evaluation of uncertainties in both time available and time required. Specifically, the staff will revise the text on the Phase 1 analysis, described in Section C, "Staff Position," of Appendix A. The Phase 1 analysis establishes the time available for the operator action and the initial estimate of the time required for operator action. In addition, the staff will make conforming changes to Chapter 18, Appendix A, Phase 2, which provides guidance for preliminary validation of the Phase 1 analysis.