INTERIM STAFF GUIDANCE - COMPUTER-BASED PROCEDURES

DESCRIPTION

The purpose of this interim staff guidance is to provide additional review guidance for computer-based procedure systems and computer-based procedures for use by NRC Staff. This guidance is intended to complement existing guidance for procedure review that can be found in NUREG-0700 and NUREG-0899 (see Ref 1 and 2). This additional guidance should minimize any inconsistencies in the staff review of design-specific or plant-specific computer-based procedure systems and computer-based procedures.

This guidance may be generalized to any procedure type that is presented on a video display unit.

STAFF POSITION

Applicants and licensees that plan to implement a computer-based procedure system should provide a description of the computer-based procedure system that includes discussion of:

1. Interaction between the operator and the computer-based procedure,
2. Interaction between the computer-based procedure system and the control and process systems,
3. The use of plant data, if any, in the computer-based procedure system,
4. The use of automation, if any, in the computer-based procedure system,
5. The use of soft controls, if any, in the computer-based procedure system,
6. Presentation of procedures on the computer-based procedure system, and
7. Implementation of backup system to the computer-based procedure system.

<u>Computer-Based Procedures Systems</u>

General Review Criteria:

1. A computer-based procedure system that displays operations procedures should be designed as an integral part of the Main Control Room.

2. The procedure user (e.g., operators) should always be in control of the procedure system. The computer-based procedure system should be designed to provide the user with sufficient information for the user to know they are in control.

3. The computer-based procedure system should indicate its current operating mode (e.g., waiting for user input; implementing a procedure step, continuously monitoring a plant parameter). The computer-based procedure system should indicate if there is a mode change. Mode errors should be minimized by limiting the number of modes a computer-based procedure system can have.

4. The computer-based procedure system should always present the most recent approved and issued version of a procedure.

5. Measures should be provided to ensure that the computer-based procedure system will display the selected procedure. Measures should be provided to inform the operator, if the selected procedure is not displayed.

6. The design of a computer-based procedure system should allow the operator to easily transition from one procedure to another procedure, at any time.

7. A computer-based procedure system should meet all the applicable regulatory requirements for equipment qualification and quality.

Plant Data Review Criteria:

The display of plant data may or may not be incorporated into the design of a computer-based procedure system.

8. Computer-based procedure systems that require the user to enter data should provide a method for data entry.

9. Measures should be provided to ensure that plant data, displayed in a computer-based procedure system, is correct. Measures should be provided to inform the operator if the plant data presented is unvalidated or invalid.

Automation Review Criteria:

The use of automation may or may not be incorporated into the design of a computer-based procedure system.

10. Automation of procedure steps should be predictable. The automation should be initiated by the operator. The operator should be able to easily interrupt the automated sequence and step, one-by-one, through each procedure step.

11. Automation should not select the procedure to be used. The user should be responsible for selecting the procedure. However, a computer-based system can recommend (e.g., via prompts) a procedure.

12. The computer-based procedure system should not automatically initiate control actions without first receiving a command from the operator to do so. The computer-based system can prompt the operator to take a specific manual action if an automatic control function fails

13. Hold points should be established to allow operators to effectively monitor automation progress, maintain adequate situation awareness, and evaluate decisions at critical points in the procedure.

14. If emergency operating procedures are designed to include automation the following guidance is appropriate. The computer-based procedure should:

    a. Inform the operator when presenting concurrent steps, such as steps in

two different legs of a BWROG flowchart emergency operating procedures.

b. Inform the user of "Result Not Obtained" and present contingency actions.
c. Monitor procedure entry conditions, cautions, warnings, branches, and exits.
d. Be integrated with alarms, system status, and critical safety functions.
e. Continuously applicable steps should be identified to the operator.
f. Concurrent use of multiple procedures should be addressed.

Soft Control Review Criteria:

The use of soft controls may or may not be incorporated into the design of a computer-based procedure system.

15. A computer-based procedure system should contain concise set of soft controls whose meaning should be obvious to the user. Soft controls have a single control function.

16. Soft controls should provide needed feedback to the user regarding the state of the control.

17. The control of plant equipment by an operator should take at least two discrete actions.

18. Soft control behavior should not violate stereotypes, of hard or soft controls, already in place in a Main Control Room.

19. A computer-based procedure system should provide a simple method to allow the operator to retract a command once issued.

Modernization Review Criteria:

20. When implementing a computer-based procedure system into a Main Control Room via a modernization project, the human system interface conventions should include plant-specific standards that are in place at the site where the computer-based procedure system will be implemented. Additional: Failure to understand local conventions can result in conflicting sets of mental models and lead to an operational error.

<u>Computer-Based Procedures</u>

General Review Criteria:

21. Computer-based procedures should be written and formatted to be readable and usable on the display device of choice. If the procedure is presented on more than one "page" then continuous scrolling should be implemented. The computer-based procedure system should only allow up/down scrolling.

22. The computer-based procedure should be written and verified in its entirety, per station procedure, prior to being turned over to the respective user group. The computer-based procedure system should not change the approved procedure.

23. Computer-based procedures should provide the user with a minimum set of information to allow the user to know the state of the procedure system and the plant as appropriate to the procedure. The minimum set of information should include:

    a. The procedure title should be continuously displayed on the screen at all times.
    b. Each procedure should be organized into sections of related steps.
    c. emergency operating procedures entry conditions should be continuously displayed at all times.
    d. Verification steps are used to ensure that objective(s) of a task or sequence of actions has been met.
    e. If the computer-based procedure is such that conclusions or recommendations are presented, the computer-based procedure should provide easily retrievable information regarding how it reached its conclusions.

24. The computer-based procedures should provide a means to access all meta-data (e.g., author, plant name, Unit, procedure type, etc.). However, the meta-data does not need to be presented to the operator.

Backup Procedures Review Criteria:

25. Back-up procedures should be maintained to ensure the ability to perform all emergency operating procedures and safety-related functions. The backup procedures can be paper-based or on another computer-based procedure system that is safety-related.

26. Backup procedures should be available to those who need them in a manner and location that is timely for their use.

27. Backup procedure systems should be subject to the same procedural controls as the primary computer-based procedure system.

28. Backup procedures and the primary computer-based procedure system should have a consistent presentation.

29. A means should be provided to ensure the primary computer-based procedure system and the backup are consistent.

30. A means should be provided to ensure that the correct procedure and step will be displayed to the operator that needs to use the backup procedure.

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STAFF RATIONALE

The staff review of an applicant's or licensee's computer-based procedure system will be multi-disciplinary consisting of inputs from human factors engineering, instrumentation and controls, and electrical engineering.

In the past, procedures were typically written documents (including both text and graphic formats) that present a series of decision and action steps to be performed by plant personnel (e.g., operators and technicians) in order to accomplish a goal safely and efficiently. Procedures are used for a wide variety of tasks from administration to testing, and plant operation. Computer-based procedure systems were developed as an alternate to paper-based procedures to assist personnel in performing their tasks in order to increase the likelihood that the goals of the tasks would be safely achieved.

The content and development of paper-based and computer-based procedures can be essentially the same. Both should be easy to use. However, there can be significant differences in how the procedures are presented, the method for providing information to operators, and how operators interact with the procedure. The differences (e.g., automation) possible with computer-based procedures should not limit the control or situational awareness of licensed operators, to have full knowledge of the plant.

REFERENCES

1. NUREG-0700
2. NUREG-0899
3. NUREG-0800
4. NUREG-0696
5. NUREG-0835
6. RG 1.47

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