
NEI COMMENTS ON THE USE OF DOORS ON SAFETY-RELATED ELECTRICAL CABINETS

Issue:

The Regulatory Issues Task Force (RITF) was asked to examine an apparent trend in NRC inspection findings related to the opening of cabinet doors for routine plant operations and maintenance activities. The findings cite licensee shortfalls in addressing aspects of operability of Technical Specification (TS) electrical components installed within the cabinets and/or managing risk in accordance with the 10 CFR 50.65(a)(4) (i.e., the maintenance rule).

Inspection Findings Related to Open Cabinet Doors:

A search of NRC inspection findings identified five in the past 24 months that concern open cabinet doors. The five issued findings are summarized below.

1. **Cooper (IR 2013-05) Finding 1:** In December 2013, the NRC identified a green non-cited violation of 10 CFR 50.65(a)(4) for the licensee's failure to implement required risk management actions during maintenance activities affecting the seismic qualification of the safety-related (SR) 4160 VAC Bus F and G when the cabinet doors were opened during under voltage relay testing. The inspectors conducted a walk down of the work area and reviewed the risk assessment and risk management actions associated with under voltage relay testing of safety-related 4160 VAC Bus F. Inspectors noted that the cabinet doors were opened during under-voltage relay testing and asked the following questions: (1) Are the safety-related 4160 VAC Bus F and G switchgear seismically qualified when the cabinet doors are open? and (2) If the buses are not seismically qualified with the doors open, what risk management actions are in place, and where are they documented, to ensure they are returned to their seismically qualified condition and, thereby, maintained available? The licensee informed the inspectors that the 4160 VAC Bus F and G had only been evaluated for seismic qualification with the doors closed, therefore, when the doors were opened, the switchgear was not seismically qualified. The licensee also cited a station housekeeping procedure which requires that unsecured open panel access doors shall be attended by workers at all times and, based on this, they considered the 4160 VAC Bus F and G available when the doors are open. Inspectors noted that the procedure allowed operators to declare equipment available, provided that restoration was directed by a procedure, restoration could be done in a few simple actions, restoration did not require diagnosis, and the function could be promptly restored either by an operator in the control room or by a dedicated operator stationed locally for that purpose. Inspectors also noted that neither the procedure nor the work order instructions associated with the work activity contained specific directions to restore the buses to their seismically qualified condition for event response. In response, the licensee implemented the required additional risk management action through a revision to the station procedure which ensured workers are briefed to close panel access doors in the event of an emergency or as directed by control room personnel.
2. **Cooper (IR 2013-05) Finding 2:** In December 2013, the NRC inspector identified a green non-cited violation of 10 CFR Part 50, Appendix B, Criterion V, "Instructions, Procedures, and Drawings," associated with the licensee's failure to perform an adequate operability determination in accordance with station procedures. While reviewing material associated with NCV 05000298/2013005-02, (Finding 1 above), inspectors determined that there were other safety-related relays on the 4160 VAC Bus F and G cabinet doors and questioned why they were not

inoperable with the cabinet doors open. Operations evaluated the inspectors' questions within their corrective action program and determined that the relays in question had not previously been evaluated for operability, so an evaluation was performed and documented within the corrective action program. Operators concluded that no other relay's operability was affected by opening the cabinet doors. During discussions with operators, inspectors questioned this determination. Specifically, inspectors questioned why the high pressure trip relay associated with the auto position of the service water pumps on the G bus, having the potential to change state during a seismic event and potentially affecting the ability of the pump to start on a low pressure signal, did not affect operability during testing. Operators responded that the auto position on the switch was not discussed in the USAR nor the technical specifications. Therefore, this switch position did not have a credited function and thus, no operability concerns existed and no further evaluations were required. Inspectors subsequently reviewed the USAR and technical specifications. During this review, they noted that a technical specification surveillance requirement required the licensee to verify that the service water pumps would start on a low pressure signal when in the auto position. Inspectors determined that operators had failed to adequately evaluate the service water pump relays on the G bus cabinet doors for operability.

3. Cooper (IR 2014-02): On January 20, 2014, the licensee performed a maintenance activity which involved opening the cabinet doors on the G bus of the 4160 VAC switchgear. The NRC questioned if the opening of the doors would affect the seismic qualification of the high pressure trip relays associated with the auto position of the service water pumps on the G bus. It was postulated that with the door open the relays have the potential to change state during a seismic event which would affect the ability of the pump to start, as required by Technical Specifications. The relays are mounted on the cubicle door. Operators recognized that the maintenance activity could affect the operability of the relays, but incorrectly concluded that the configuration did not affect operability. The failure to properly assess and document the basis for operability resulted in a condition of unknown operability for a degraded nonconforming condition. The inspectors issued a green non-cited violation of 10 CFR Part 50, Appendix B, Criterion V, "Instructions, Procedures, and Drawings," associated with the licensee's failure to perform an adequate operability determination in accordance with station procedure for taking electrical relays out of their seismically qualified configuration. To correct this issue, in the future, the licensee will declare the service water pumps inoperable during activities that involve opening the switchgear doors, pending further engineering evaluation.
4. Callaway (IR 2014-08): In August 2014, during a PI&R Inspection the NRC team conducted a walk down of safety-related Division I, 4160 VAC switchgear and noted that the switchgear doors were opened during maintenance activities and asked the following questions: (1) Are the safety-related 4160 VAC switchgears NB01 and NB02 and other safety related electrical cabinets seismically qualified when the cabinet doors are open? (2) If the safety-related electrical cabinets and switchgear are not seismically qualified with the doors open, how is operability assessed when safety-related electrical cabinet doors are opened during maintenance activities? The licensee informed the team that the safety-related electrical cabinets and switchgear were only seismically qualified with the doors closed, therefore, when the doors are opened, the safety-related electrical cabinets were not seismically qualified. Additionally, the station did not assess operability of safety-related electrical cabinets and switchgear for maintenance activities that required opening the doors during the work control process. The inspectors issued a green non-cited violation of 10 CFR Part 50, Appendix B, Criterion V, "Instructions, Procedures, and Drawings," associated with the licensee's failure to assess operability when taking safety-related electrical cabinets and switchgear out of their seismically qualified configuration during maintenance activities.

5. Wolf Creek (IR 2015-01): On January 29, 2015, while troubleshooting an intermittent power potential transformer fuse blown alarm for an emergency diesel generator, maintenance personnel opened the doors to an electrical panel to gain access to a relay per a work order. During the maintenance, inspectors noted that the doors were not restrained and there was not a dedicated person attending the door. The door associated with the panel contained safety-related under-voltage and under-frequency relays. The inspectors asked the licensee if the safety-related relays were seismically qualified with the door open. The licensee informed the inspectors that the safety-related relays were not seismically qualified with the panel door open. The inspectors were concerned that in the event of a seismic event, the doors could suddenly shut and cause the relays to change state, impacting the reliability of emergency diesel generator B at a time when it was required to perform its safety function. The inspectors concluded that the licensee should have declared the emergency diesel generator inoperable and entered the appropriate technical specification limiting condition for operation prior to the commencement of the maintenance. The inspector reviewed a station procedure for on-line risk management and determined that the licensee failed to identify the worst case consequences (i.e., seismic event) and have appropriate mitigating actions for the emergent work activity when planning the emergent work activities for emergency diesel generator B. In response to the issue, the licensee initiated a standing order which outlined expectations for opening safety related electrical cabinets. Specifically the standing order required; (1) control room permission prior to opening any safety related cabinets; (2) the doors shall be attended at all times; (3) the doors shall be restrained, and the doors to be shut immediately if a seismic event were to occur. The inspectors issued a green non-cited violation of Technical Specification 5.4.1.a which requires, in part, that written procedures be established, implemented, and maintained for safety-related maintenance activities.

Summary of the Inspection Findings and Regulatory Position:

When safety-related (SR) equipment housed within an electrical cabinet is seismically qualified, it is tested in specific bounding configurations (e.g., typically with the cabinet doors closed). The testing or qualification is conducted to ensure the SR equipment enclosed within the cabinet meets its design function under specific seismic conditions. When the doors are opened, the cabinet is in an untested configuration. In the findings referenced above, the NRC has identified the open door (i.e., untested) configuration as an unqualified and therefore non-conforming condition that must be assessed for operability. The following definitions from Inspection Manual Chapter (IMC) 0326, "Operability Determinations and Functionality Assessments for Conditions Adverse to Quality or Safety", support NRC expectations for the determination:

Fully Qualified: An SSC [structure, system or component] is fully qualified when it conforms to all aspects of its current licensing basis (CLB), including all applicable codes and standards, design criteria, safety analyses assumptions and specifications, and licensing commitments. An SSC is considered "not fully qualified," i.e., degraded or nonconforming, when it does not conform to all aspects of its CLB, including all applicable codes and standards, design criteria, safety analyses assumptions and specifications, and licensing commitments.

Nonconforming Condition: A nonconforming condition is a condition of an SSC that involves a failure to meet the CLB or a situation in which quality has been reduced because of factors such as improper design, testing, construction, or modification.

In most of the referenced findings the licensee was cited for not addressing some aspect of operability of the installed SR components when the cabinet doors were opened (i.e., in a nonconforming

condition). Typically, the violations cited failure to implement an approved procedure for operability evaluation or failure to establish appropriate procedural control for the work evolution. One finding was based on failure to properly manage the risk (i.e., maintenance rule) associated with the activity. In only one finding (i.e., Wolf Creek, IR 2015-01) did the NRC conclude that a Technical Specification LCO should have been entered, and in no case was the affected SSC determined to be inoperable.

Industry Assessment and Position

Taken to its logical conclusion, the NRC position on open cabinet doors appearing to emerge from the five inspection findings could require licensees to declare inoperable all SSCs linked to equipment inside the cabinet any time the door is open. However, cabinet doors, in general are intended to support maintenance by allowing ease of access to components inside the cabinet. Routine cabinet door access should not equate with inoperability. Routine plant access through fire doors and high energy line break (HELB) doors was a similar situation and one where the NRC addressed the question of a threshold for duration and impact on plant configuration.

The violations referenced above do not acknowledge a threshold between routine cabinet door openings of some reasonable duration and those that establish a temporary plant configuration and a potential nonconforming condition. While several of the violations were cited when the cabinet doors were being opened for what appeared to be more extended maintenance activities and would imply a threshold, it is not articulated within the violations. The nuclear industry concern is primarily based on the collective evaluation and extension of these findings where no reasonable threshold has been defined.

If a regulatory/industry concern exists, it should be focused on when the use of the door puts the cabinet into a temporary configuration or a potential nonconforming condition. In some comparable industry examples, specific programmatic controls exist for such temporary plant configurations. For example, fire doors, when required to be left open beyond normal ingress and egress from a room, are controlled under a fire impairment process. Similarly, the removal of hazard barriers (e.g., HELB doors) are controlled by plant-specific programs consistent with guidance provided in RIS 2001-09, "Control of Hazard Barriers". In these cases, there are defined processes that establish compensatory measures to manage the temporary plant configuration and the associated plant risk. In the case of cabinet doors such an accepted regulatory treatment does not exist.

Review of the five cabinet door findings did identify common shortcomings in licensee performance. In the NRC cited violations, the licensees appeared to not fully acknowledge the temporary plant configuration created with the cabinet door being open for an extended time period and as a result, appropriate compensatory actions to manage the temporary configuration were not taken. Ultimately this industry issue can be summarized as follows:

1. An accepted industry threshold has not been established for cabinet door openings necessary for short-term, non-intrusive operational and maintenance activities.
2. The industry has not demonstrated a consistent set of actions to be taken for temporary plant configurations when a panel door is open for intrusive work activities or for extended durations to manage risk and/or operability.

While this NEI RITF white paper addresses a broad industry concern regarding the control of open cabinet doors, it is recognized there are many unique, licensee-specific panel and cabinet door configurations that may provide more complex configuration characteristics that will need to be addressed on a case by case basis (e.g., panel access covers that are not designed for routine access and cabinet doors with seismically sensitive door-mounted electrical components).

Threshold for Routine Cabinet Access:

There is no indication from within the industry or from the NRC that any licensees have been challenged regarding routine cabinet door access in support of normal plant operations and maintenance activities. However, the referenced cabinet door violations are silent on such a threshold and there is no known written regulatory guidance on routine cabinet access. The long history of accepted operating practice associated with cabinet door access and the use of fire doors and HELB doors for routine plant operations and maintenance ingress/egress establishes an instructive precedent.

It is the industry position that the temporary attended opening of a cabinet door for short-term, non-intrusive plant activity is acceptable without compensatory action. If any intrusive work is conducted either for surveillance testing or maintenance or if extended opening of a door is required, then compensatory actions should be taken in accordance with existing regulatory guidance to address the temporary configuration risk.

Regulatory Guidance:

Plant technical specifications and the Maintenance Rule (10CFR 50.65) are the two primary regulatory requirements that must be addressed for cabinet doors that are maintained open for an activity that exceeds the nominal threshold.

1. Technical Specifications and Operability:

When a door is used for its intended purpose, opening the door should not be assumed immediately to make the associated SSCs inoperable, even when opened for more intrusive or extended work activities. However, NRC regulations and the plant-specific operating license, including technical specifications, establish specific requirements for SSCs, and challenge licensees to ensure that plant operation does not pose an undue risk to public health and safety. For the example of opening a cabinet door beyond a short-term, non-intrusive activity, the temporary open door configuration has been challenged by the regulator to constitute a potential nonconforming condition. Accordingly, the licensee basis of operability must be established and understood.

IMC 0326 requires that SSC operability be established based on a set of facts that reasonably address the capability of the SSCs to perform their specified safety functions and provides that it may invoke the use of engineering judgement and that compensatory measures can be used as a primary basis to demonstrate an SSC's ability to maintain its specified safety functions. IMC 0326 defines reasonable expectation:

Reasonable Expectation: The discovery of a degraded or nonconforming condition may call the operability of one or more SSCs into question. A subsequent determination of operability should be based on the licensee's "reasonable expectation," from the evidence collected, that the SSCs are operable and that the operability determination will support that expectation. Reasonable expectation does not mean absolute assurance that the SSCs are operable. The SSCs may be considered operable when there is evidence that the possibility of failure of an SSC has increased, but not to the point of eroding confidence in the reasonable expectation that the SSC remains operable. The supporting basis for the reasonable expectation of SSC operability should provide a high degree of confidence that the SSCs remain operable. It should be noted that the standard of "reasonable expectation" is a high standard, and that there is no such thing as an indeterminate state of operability; an SSC is either operable or inoperable.

It is the industry position for the opening of cabinet doors beyond short-term, non-intrusive activities, that compensatory measures form the basis for a reasonable expectation of operability of potentially affected SSCs. Examples of appropriate compensatory measure may include:

- a. Establishing positive operational control prior to conduct of work.
- b. Minimizing the period of time the door is open.
- c. Managing the work activity risk (use of door attendant and/or a door restraint)
- d. Establishing defined recovery actions upon occurrence of a seismic event.

Each licensee is responsible to establish a plant-specific program for cabinet doors that will define necessary compensatory actions for temporary configurations for open cabinet doors that establishes a reasonable assurance of operability for cabinet installed SSC's

2. Maintenance Rule:

The scope of each licensee's maintenance rule program and the conduct of the various maintenance work activities is unique to each licensee. However, the opening of cabinet doors beyond short-term, non-intrusive plant activities is generally bound within the scope of the maintenance rule. The maintenance rule requires licensees to manage the risk associated with maintenance activities involving SSCs. In the context of the opening of cabinet doors beyond short-term, non-intrusive plant activities, this can take the form of a licensee program which manages the attendant risk of the open cabinet door. These procedural controls should, in fact, be the same as those considered above as they relate to compensatory measures for addressing SSC operability.

Summary:

In summary, the following industry position is proposed for addressing the opening of safety-related, seismically qualified cabinet doors for normal plant operations and maintenance activities:

- 1. The temporary attended opening of a cabinet door for short-term, non-intrusive plant activity is acceptable without compensatory action.
- 2. If any intrusive work is conducted either for surveillance testing or maintenance or if extended opening of a door is required, then compensatory actions should be taken in accordance with existing regulatory guidance to address the temporary configuration risk and to maintain operability. Examples of appropriate compensatory measure may include:
 - a. Establishing positive operational control prior to conduct of work.
 - b. Minimizing the period of time the door is open.
 - c. Managing the work activity risk (use of door attendant and/or a door restraint)
 - d. Establishing defined recovery actions upon occurrence of a seismic event (e.g., maintain the door in a stable configuration, and inspect the configuration and report any unusual observations to the control room following the seismic event).