EFCOG Best Practice #253
NFPA 70B Impact Analysis

Facility: DOE Complex

Best Practice Title: NFPA 70B Impact Analysis

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Brief Description of Best Practice: National Fire Protection Association (NFPA) 70B, *Recommended Practice for Electrical Equipment Maintenance*, is being transitioned from a reference document to a standard in the 2023 Revision. NFPA 70B was evaluated for potential impacts to the Department of Energy (DOE) operations and maintenance if it were to become a contractual requirement. This best practice provides guidance for implementing NFPA 70B as a standard and provides additional references to the requirements identified within NFPA 70E, Standard for Electrical Safety in the workplace, 2018 and NFPA 70, National Electrical Code, 2020.

Why the best practice was used: NFPA 70B, 2023 revision is expected to transition the recommended practice to a standard. This change has the potential to affect how electrical maintenance is performed within the DOE complex.

What are the benefits of the best practice: Provide guidance regarding the implementation of NFPA 70B as a standard.

What problems/issues were associated with the best practice: N/A (New best practice)

How the success of the Best Practice was measured: N/A (New best practice)

Description of process experience using the Best Practice: N/A (New best practice)

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INTRODUCTION

The purpose of an Electrical Preventative Maintenance (EPM) Program is to reduce hazards to life and property resulting from the failure or malfunction of electrical systems and equipment. NFPA 70B provides the planning and development considerations that can be used to establish such a program.

This best practice provides a recommended approach for each DOE site to implement the applicable electrical maintenance requirements of 70B.

NFPA 70 and NFPA 70E both contain requirements to perform electrical preventative maintenance:

NFPA 70 contains references throughout for conditions of maintenance. Specific maintenance is not prescribed, however the purpose states that the code contains provisions that are considered necessary for safety and compliance therewith and proper maintenance result in an installation that is essentially free from hazard.

NFPA 70E addresses maintenance directly associated with employee safety. Article 205.3 states in part that electrical equipment shall be maintained in accordance with manufacturers' instructions or industry consensus standards to reduce risk of associated failure. Equipment owner is responsible for maintenance and documentation. Maintenance activities are not specified in 70E, but does refer the reader to NFPA 70B, ANSI/NETA MTS, *Standard for Maintenance Testing Specifications for Electrical Power Equipment and Systems* and Institute of Electrical and Electronics Engineers (IEEE) 3007.2 *Recommended Practice for the Maintenance of Industrial and Commercial Power Systems* for guidance on maintenance frequency, methods, and tests. It is the employer's responsibility to choose from the various maintenance methods available to satisfy the requirements of Chapter 2, "Safety-Related Maintenance Requirements."

NFPA 70B is currently used as a reference to assist in implementing a successful EPM Program and provide supplementary guidance when manufacturer instructions are vague or unavailable (ex. for legacy equipment).

BACKGROUND AND DISCUSSION

NFPA 70B, *Recommended Practice for Electrical Equipment Maintenance*, is expected to transition from a reference document to a standard in the 2023 revision. Much of the content in the chapters is expected to be moved to informational appendices. The content remaining in the chapters will change from "should" to "shall" wording. This may have impacts on requirements of electrical maintenance programs across the DOE complex.

Electrical equipment deterioration is normal, and equipment failure is inevitable. However, equipment failure can be delayed through appropriate EPM. Benefits of an effective EPM program include reduced cost of repairs, reduced equipment downtime, and improved safety.

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Conclusion

The EFCOG Electrical Safety Task Team recommends DOE sites consider adopting NFPA 70B as a standard. The potential impacts in appendix A should be carefully evaluated for cost/schedule based on each site's specific environment, and a graded approach applied to implementation. Each site should have an electrical preventative maintenance program in place to define how they implement NFPA 70B/electrical preventative maintenance.

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APPENDIX A: POTENTIAL IMPACTS IDENTIFIED

Numbers represent NFPA 70B, 2019 Chapters:

1. Administration
    a. Serviceable/Non-Serviceable definitions.

    Summary: No impacts noted.

2. Reference Publications
    a. No Impacts Noted.
    b. Existing DOE Orders for Maintenance:
        i. 420.1C; Facility Safety
        ii. 433.1B; Maintenance Management Program for DOE Nuclear Facilities
        iii. 430.1C; Real Property Asset Management
3. Definitions
    a. No Impacts Noted.
4. Why an Effective Electrical Preventive Maintenance (EPM) Program Pays Dividends.
    a. No Impacts Noted.
5. What is an Effective Electrical Preventive Maintenance (EPM) Program?
    a. No Impacts Noted.
6. Planning and Developing an Electrical Preventive Maintenance (EPM) Program
    a. Sites will have to develop an EPM program if they have not done so already.
    b. Existing programs will have to be evaluated/revised to ensure they meet all requirements of NFPA 70B.
    c. 6.2.2 Requires maintaining up-to-date, accurate, and complete wiring diagrams. This could include both power and control circuits.
    d. 6.4.3 Equipment history should be maintained for systems vital to facility operations. Each facility must determine which systems are vital.
    e. 6.4.4.2 Operating environment must be considered to define maintenance intervals.
7. Personnel Safety
    a. No Impacts Noted.
8. Fundamentals of Electrical Equipment Maintenance
    a. No Impacts Noted.
9. System Studies
    a. Need to clearly identify cutoffs for when calculations are required (ex. Fractional horsepower motors).
    b. Where a recognized hazard exists, a design study shall be performed to include ways to reduce the risk.
10. Power Quality
    a. No Impacts Noted.
11. Testing and Test Methods
    a. Frequency (Engineering can shorten the time):

   b. Once a grounding ring has been installed there is no effective way of testing with any meter on the market today. Must be done analytically using modeling software, per NFPA 780 *Standard for the installation of Lightning Protection* and (IEEE) 142 *Recommended Practice for Grounding of Industrial and Commercial Power Systems.*
   c. 11.18 Fuse Testing – no mandatory language currently. Some sites test fuses that are in safety switches.
   d. EPM programs require clear definitions of which specific requirements apply to each type of equipment.
   e. NFPA 70B will continue to specify recommended tests and how to perform them, but each EPM Program is required to determine which equipment needs to be included and what maintenance will be performed.
12. Maintenance of Electrical Equipment Subject to Long Intervals Between Shutdowns
   a. No Impacts Noted.
13. Ground-Fault Protection
   a. 13.2.3.2 Results, and dates of tests should be recorded on the test record label or card supplied with each permanently installed Ground Fault Circuit Interrupter (GFCI) unit.
   b. Most sites currently have a GFCI testing program.
14. Grounding
   a. A grounding program will be required, specifics are not listed. Overlap with NFPA 70 Requirements.
15. Substations and Switchgear Assemblies
   a. Aimed at medium voltage equipment.
16. Motor Control Equipment
   a. No Impacts Noted.
17. Insulated-Case/Molded-Case Circuit-Breakers
   a. Most sites have an existing program following manufacturer's requirements to meet 10 CFR 851 Worker Safety and Health Program Technical Amendment.
18. Fuses
   a. No Impact Noted.
19. Power Cables
   a. Some sites have programs for after natural phenomena inspections. No sites have a full inspection for facility electrical.
20. Cable Tray and Busway
   a. It is unclear if this is only applicable when it's used as a ground path. Most sites inspect upon installation, but no periodic inspections.
   b. 20.2.3 "The number, size, and voltage of cables in the cable…" – if this changes to a "shall" it will be very large scope.
   c. 20.4.8.2 busway testing.
21. Power and Distribution Transformers
   a. No Impacts Noted. Sites that own a utility maintain the utility equipment.
22. Electronic Equipment
   a. This section is expected to be deleted in the next revision.
23. Lighting

   a. This is applicable to general lighting only. Most sites only perform spot replacement except for security lighting.
24. Wiring Devices
   a. Sites do not currently have a formal inspection/testing program. They perform installation/reactivation testing, inspection before use, otherwise run to failure.
   b. Most of the chapter is expected to be moving to annex.
25. Rotating Equipment
   a. Mostly mechanical inspections in this chapter. Most sites have non-electrical workers performing this maintenance (ex. Millwrights).
26. Vibration
   a. This section is expected to be combined with rotating equipment.
   b. Some sites have a program in place for larger motors.
27. Hazardous (Classified) Location Electrical Equipment
   a. This chapter addresses the safety aspects of working in a hazardous location. Maintenance is covered in other sections.
   b. No Impacts Noted.
28. Uninterruptible Power Supply (UPS) Systems
   a. Sites follow manufacturer's instructions.
   b. No Impacts Noted.
29. Portable Electrical Tools and Equipment
   a. 29.5.1 could drive needing to have an electrician perform the visual inspection: "Before an extension cord is placed into service, the plug and connector should be checked for proper polarity, and the grounding conductor should be tested for continuity and integrity."
30. Reliability-Centered Maintenance (RCM)
   a. Section Expected to be removed, no impacts noted.
31. EPM from Commissioning (Acceptance Testing) Through Maintenance
   a. Section Expected to be removed, no impacts noted.
32. Electrical Disaster Recovery
   a. Expected to be moved to the annex, no impacts noted.
33. Photovoltaic Systems
   a. Renewable energy moved to a new annex.
   b. Applicable to labs with larger solar installations.
34. Electric Vehicle (EV) Charging Systems
   a. Sites with EV Charging have the service subcontracted, no impacts noted.
35. Wind Power Electric Systems
   a. Only currently affects the National Renewable Energy Laboratory (NREL), NREL has a maintenance program in place.
   b. No Impacts Noted.