



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D.C. 20555-0001

February 27, 2024

MEMORANDUM TO:

Wendell Morton, Branch Chief  
Electrical Engineering Branch  
Division of Engineering and External Hazards  
Office of Nuclear Reactor Regulation

Jason Paige, Branch Chief  
Long Term Operations and Modernization Branch  
Division of Engineering and External Hazards  
Office of Nuclear Reactor Regulation

FROM:

Kayleh Hartage, Electrical Engineer */RA/*  
Electrical Engineering Branch  
Division of Engineering and External Hazards  
Office of Nuclear Reactor Regulation

Matthew McConnell, Senior Electrical Engineer */RA/*  
Long Term Operations and Modernization Branch  
Division of Engineering and External Hazards  
Office of Nuclear Reactor Regulation

SUBJECT:

REPORT ON THE INSTITUTE OF ELECTRICAL AND  
ELECTRONICS ENGINEERS ENERGY STORAGE AND  
STATIONARY BATTERY COMMITTEE MEETING IN SAN  
DIEGO, CALIFORNIA

**MEETING DATE:** JANUARY 31<sup>st</sup> – FEBRUARY 2<sup>nd</sup>, 2024

**PURPOSE:**

To participate in the Institute of Electrical and Electronics Engineers (IEEE) Energy Storage and Stationary Battery (ESSB) Committee meeting.

**SUMMARY OF TRIP:**

The IEEE Power & Energy Society's ESSB Committee hosted its winter meeting in San Diego, California from January 31<sup>st</sup> - February 2<sup>nd</sup>, 2024. The purpose of the meeting was to collectively work with conference participants to improve IEEE Standards (Stds.) applicable to nuclear power plants. Specifically, the staff participated in developing and revising IEEE Stds. related to the design, maintenance/testing, and installation of storage batteries and battery chargers. Ms. Hartage and Mr. McConnell attended the meeting in person.

Enclosure:

Trip Highlights

CONTACTS: Kayleh Hartage, NRR/DEX  
301-415-3563

Matthew McConnell, NRR/DEX  
301-415-1597

SUBJECT: REPORT ON THE INSTITUTE OF ELECTRICAL AND ELECTRONICS  
ENGINEERS ENERGY STORAGE AND STATIONARY BATTERY COMMITTEE  
MEETING IN SAN DIEGO, CALIFORNIA DATED: February 27, 2024

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K.Hartage, NRR  
M.McConnell, NRR  
W.Morton, NRR  
B.Correll, NRR  
S.Ray, NRR  
Cook, RES  
K.Kavanagh, NRR

ADAMS Accession No.: ML24060A190

\*via email

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OFFICE	NRR/DEX/EEEE	NRR/DEX/ELTB
NAME	K.Hartage*	MMcConnell*
DATE	2/27/2024	2/27/2024

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## TRIP HIGHLIGHTS

1. On January 31, 2024:

Ms. Hartage and Mr. McConnell participated in the ESSB general meeting, several topics were discussed such as the logistics, budget, and updates on working groups.

a) Standby Stationary Battery (SB) Subcommittee Reports

- IEEE Std. 450–Recently reissued/Last published in 2020. No updates.
- IEEE Std. 484–No current activity. No updates.
- IEEE Std. 485–Last published in 2020. No updates.
- IEEE Std. 535–Last published in 2023. No current activity.
- IEEE Std. 1106–Currently making revisions. Expires in 2025.
- IEEE Std. 1115–Invalid/ No current activity. Expires in 2025.
- IEEE Std. 1184–Published in 2022. Expires in 2031. No current activity.
- IEEE Std. 1187– Ballot will get submitted in near future.
- IEEE Std. 1188–Undergoing 1<sup>st</sup> ballot resolution. Expires in 2024. See below for details.
- IEEE Std. 1189–The PAR expired at the end of 2023. See below for details.

b) DC Power Equipment and other Related Systems (DCRS) Subcommittee Reports

- IEEE Std. 946–The working group met this week. See below for details.
- IEEE Std. 1491–The working group met this week. PAR expired December 2023. Looking to resubmit in 2024. See below for details.
- IEEE Std. 1578–Last published in 2018. No current activity.
- IEEE Std. 1635 – The working group met this week. Published in 2022.
- IEEE Std. 2405–Published in 2022. No current activity.
- IEEE Std. 1657 –Reissued in 2018. No current activity.
- IEEE Std. P3189- Meeting virtually February 20, 2024
- IEEE Std. 2685–PAR extended to December 2025. See below for details.

c) The Energy Storage subcommittee (ES) committee reported on the standards it owns, however, these standards are not currently applicable or relevant to the nuclear power industry; and therefore, no updates are provided for these standards in this report. The staff will continue observing activities in the ES committee for potential applicability in the future.

d) Ms. Hartage and Mr. McConnell participated in the ESSB Safety Code and Standards Working Group Symposium. The statement of objectives were:

- Review past emphasis of ESSB Codes WG on NFPA 855 and relationship of standard to the fire and electrical codes for Standby and Energy Storage batteries and systems.

**Enclosure**

- Understand the role of ICC & NFPA for these three major codes/standards [NFPA 855, NFPA 1 and IFC] and current efforts of NFPA 855, IFC and NFPA 1.
  - How the FCAC/BCAC roles work to define IFC/IBC/IRC and integral relationships with current efforts of FCAC/BCAC and the three I-Codes as well as ICC vs. NFPA differences.
  - How UL plays a key role with both SDO's and provide latest updates on UL 1973, UL 9540 and UL 9540A.
  - Assuring safety against fire and explosions due to rash of incidents in many parts of the world in the last several years (especially with Lithium)
  - The changing role of the Electric Grid- New applications such as DER, micro-grids, EV
- e) The next ESSB meeting will be held July 15th- July 18th, 2024, at PNNL in Richland, WA.
2. On February 1, 2024:
- Ms. Hartage and Mr. McConnell participated in the IEEE Std. IEEE Std. 1491, "IEEE Guide for Selection and Use of Battery Monitoring Equipment in Stationary Applications," meeting. The PAR has expired. The working group chair is in the process of opening a new PAR. During the meeting, the working group chair discussed what will need to be addressed and completed to revise the standard if the PAR is approved.
  - Ms. Hartage and Mr. McConnell participated in the IEEE Std. 946/1375, "IEEE Recommended Practice for the Design of DC Power Systems for Stationary Applications," meeting. The working group continued the development of the revised merged standard.
  - Ms. Hartage and Mr. McConnell participated in the nuclear working group meeting. Mr. McConnell presented the NRC Liaison report (attached below). A nuclear utility representative discussed recent relevant operational experience. The working group openly discussed the potential qualification and use of alternative battery technologies for use in nuclear power plants and other nuclear facilities.
3. On February 2, 2024, Ms. Hartage and Mr. McConnell were slated to participate in the IEEE Std. 485, "IEEE Recommended Practice for Sizing Lead-Acid Batteries for Stationary Applications," meeting but it was canceled at the last minute due to the working group chair needing more time to complete his assessment of areas of the standard that need to be addressed in the next revision.

**U.S. NUCLEAR REGULATORY COMMISSION LIAISON REPORT**  
**ELECTRICAL AND ELECTRONICS ENGINEERS NUCLEAR POWER**  
**ENGINEERING COMMITTEE, SUBCOMMITTEE 2, ENERGY STORAGE**  
**AND STATIONARY BATTERIES, INSULATED CONDUCTORS COMMITTEE,**  
**POWER SYSTEMS RELAYING COMMITTEE AND EQUIPMENT**  
**QUALIFICATION TRAINING MEETING – JANUARY 2024**

**1. General**

- a. Vogtle 3 has generated electricity for the first time, and the unit has successfully synchronized and connected to the electric grid.  
  
Vogtle 4 has started the process for loading fuel. Commercial operations expected in the first quarter of 2024. Start date pushed back due to a fault in the motor of a reactor coolant pump.
- b. NRC Standards Forum occurred September 13, 2023. This meeting was at NRC Headquarters in Rockville with virtual participation as an option. (Meeting Summary and slides at <https://www.nrc.gov/about-nrc/regulatory/standards-dev/standards-forum/2023.html>)
  - The objective of this meeting was to facilitate strategic discussions on codes and standards needs and priorities.

**2. Operating Reactors**

- a. Open Phase Condition – All inspections are completed (bulletin closure letters issued for individual plants); Bulletin 2012-01 was closed on March 06, 2023 (See Federal Register Notice <https://www.federalregister.gov/documents/2023/03/06/2023-04501/nrc-bulletin-2012-01-design-vulnerability-in-electric-power-system>).
- b. The Power Operated Valve (POV) inspections started at the beginning of 2020 and no major EQ issues have been identified to date. There was a public meeting on December 8, 2020, to share with Industry and the Public the findings and lessons learned while implementing IP 71111.21N.02, "Design-Basis Capability of Power-Operated Valves Under 10 CFR 50.55a Requirements," inspections in 2020. The inspectors will continue to look at EQ as part of the design basis and licensing conditions of components they inspect. NRC Information Notice 2021-01 (May 6, 2021) discusses lessons learned from initial POV inspections. The inspections have been completed.
- c. Commercial Grade Dedication inspections began in January 2023.
- d. Subsequent License Renewal (St. Lucie, Monticello, and VC Summer) and initial License Renewal (Comanche Peak, Diablo Canyon, and Perry) reviews currently underway.

- e. A proposed revision to GALL-SLR was issued for public comment in July 2023. The comment period has expired. The staff is currently reviewing the comments.
- f. Vendor Inspections – Inspection reports for various vendor inspections that have been performed over the past year can be found on the NRC website - <https://www.nrc.gov/reactors/new-reactors/how-we-regulate/oversight/quality-assurance/vendor-insp/insp-reports.html>

### 3. New Reactors

- a. NuScale submitted their standard design approval (SDA) application for a US460 Small Modular Reactor in December 2022. The NRC has accepted the application and continuing its review. The status of the review can be found at <https://www.nrc.gov/reactors/new-reactors/smr/licensing-activities/current-licensing-reviews/nuscale-us460.html>

### 4. Advanced Reactors

- a. The NRC is evaluating technical reports from multiple advanced reactor designs (i.e., pre-application stage). <https://www.nrc.gov/reactors/new-reactors/advanced/licensing-activities/pre-application-activities.html>
- b. Under an MOU with DOE that was signed in early 2021, the NRC has provided 2 staff members on rotation to Idaho National Labs to support the National Reactor Innovation Center. The staff is working on different projects related to Advance reactors, including the Advance Construction Technology Initiative, to assess ways of reducing cost and schedule for new nuclear power plant builds (e.g., SMRs and Advanced Reactors).

### 5. Research Reactors

- a. The NRC completed the safety evaluation of the Hermes construction permit application in June 2023. Kairos Power LLC is a U.S. based company developing a fluoride salt cooled high temperature reactor (KP-FHR) using TRISO fuel in pebble form. The Commission hearing was held in October 2023. <https://www.nrc.gov/reactors/non-power/hermes-kairos.html>
- b. The NRC is currently engaged in review activities of the Hermes 2 construction permit application of two low-power test reactors to support development of Kairos Power's fluoride salt-cooled, high-temperature reactor technology. The application was accepted in July 2023 and the review is ongoing.
- c. The NRC accepted for review a construction permit application from Abilene Christian University, which requests permission to build its Molten Salt Research Reactor facility on the university's campus in Abilene, Texas.
- d. The NRC has concluded the National Institute of Standards and Technology has satisfied the requirements to safely restart the NIST research reactor in Gaithersburg, Maryland.

## 6. Rulemaking

- a. The NRC staff is developing 10 CFR Part 53, “Risk Informed, Technology-Inclusive Regulatory Framework for Advanced Reactors” rulemaking, which will establish a new framework for licensing and regulating advanced nuclear reactors. On September 30, 2022, the NRC staff released the draft proposed Part 53 rulemaking package.

The NRC staff has provided the draft proposed Part 53 rulemaking package, SECY-23-0021: Proposed Rule: Risk-Informed, Technology-Inclusive Regulatory Framework for Advanced Reactors, dated March 1, 2023, to the Commission requesting approval to publish the draft proposed rule in the Federal Register.

Pending Commission approval, the NRC staff would provide the final rule package, including key guidance, to the Commission by December 2024, and would expect to issue the Final Rule by July 2025.

Additional Part 53 info can be found at: <https://www.nrc.gov/reactors/new-reactors/advanced/rulemaking-and-guidance/part-53.html>

## 7. Regulatory Guide (RG) Status

- Environmental Qualification: RG 1.89, Rev 2
  - Endorsement of IEC/IEEE Std. 60780-323-2016
  - Issued April 2023
- Environmental Qualification of Connection Assemblies: RG 1.156
  - Endorsement of IEEE Std. 572-2019
  - Issued in Feb 2023
- Environmental Qualification of Safety-Related Battery Chargers, Inverters, and UPSs: RG 1.210
  - Endorsement of IEEE Std. 650-2017
  - Draft Guide published for public comment in Feb 2023
- Risk-Informed Categorization of Electrical and Electronic Equipment
  - Endorsement of IEEE Std. 1819-2016
  - Staff is deferring this work and will consider endorsement of the next revision of IEEE Std. 1819
- Maintenance, Testing, and Replacement of Vented Lead-Acid Batteries for Stationary Applications: RG 1.129
  - Endorsement of IEEE Std. 450-2020
  - Issued in March 2023

- Criteria for the Protection of Class 1E Power Systems and Equipment: new RG
  - Endorsement of IEEE Std. 741-2022
  - Draft comment resolution in progress
- Sizing lead-acid batteries: RG 1.212
  - Endorsement of IEEE Std. 485-2020
  - Issued June 2023
- Installation Design & Installation of Vented Lead-Acid Batteries: RG 1.128
  - Endorsement of IEEE Std. 484-2019
  - Periodic Review issued May 2023 – ML23102A032
  - Draft Guide issued for public comment in January 2024. Comments due February 7, 2024.
- Guidelines for Lightning Protection: RG 1.204
  - Endorsement of various IEEE, UL, and NFPA standards
  - Draft Guide 1409 issued May 2023 (public comments were due 6/2)
- Environmental Qualification of Safety-Related Actuators: RG 1.73
  - Endorsement of IEEE Std. 382-2019
  - Published January 2024
- Criteria for Class 1E Power Systems: RG 1.32 and incorporate RG 1.41
  - Endorsement of IEEE Std. 308-2020
  - Draft in development
- Installation, Inspection and Testing of Instrumentation and Electric Equipment: RG 1.30
  - Endorsement of IEEE Std. 336-2020
  - DG1419 published in December 2023; Comments due Jan 19
- Motor-Operated Valve Motor Application, Protection, Control, and Testing: new RG
  - Endorsement of IEEE Std. 1290-2015
  - Draft in development
- Criteria for Programmable Digital Devices in Safety-Related Systems of Nuclear Power Plants: RG 1.152
  - Endorsement of IEEE Std. 7-4.3.2-2016
  - Issued July 2023
- Seismic Qualification of Electrical and Active Mechanical Equipment: RG 1.100



- Endorsement of IEC/IEEE 60980-344, Edition 1.0, 2020-10, IEEE Std C37.98-2023, and reformatted ASME QME-1
- Draft RG for public comment in 2024

## 8. Research

a. NRR submitted user need requests (UNR 2011-014 and UNR 2016-012) to RES to perform research on aging cables and methods of condition monitoring.

- A research project contract was awarded to NIST to perform the following tasks: confirm the adequacy of the condition-monitoring methods, including: (a) mechanical conditions of tensile test (elongation at break), and compressive modulus (indenter method); (b) dielectric condition indicators (insulation resistance, and frequency domain reflectometry) (c) chemical indicators (oxidation time/temperature, Fourier transform infrared spectroscopy, mass loss Thermogravimetric analysis).
- The objective of the research project was to confirm the adequacy of commonly used condition monitoring methods to track the aging of cables.

The NIST Project contract was completed, and final report (ML22298A160) was issued in September 2021.

- A research project contract was awarded to Kinectrics to perform the following tasks: 1) perform a Loss-of-Coolant Accident (LOCA) Test on the cables aged during the NIST Project to simulate 50, 60, and 80 years of operation, 2) Determine if the condition monitoring techniques evaluated during the NIST Project are suitable to perform Condition Based Equipment Qualification.
- Kinectrics conducted the 150Mrads (plus 10% margin) Radiation Accident Dose at the Southwest Research Institute (SWRI).
- Once the Radiation Accident Dose and Post-Radiation Accident Dose Functionality Tests were completed, the LOCA and Post-LOCA Tests were completed by Kinectrics.

The final NUREG report (NUREG/CR-7300, "Radiation Accident Dose and Simulated Loss-of-Coolant Accident Test of Low Voltage Cables") (ML23237B247) for the Kinectrics project was published in August 2023.

- The EPRI tan delta approach to management of submerged cable confirmatory research was completed, and the final Research Information Letter (RIL 2021-11) (ML22019A007) was published in Jan 2022.

b. NRR submitted a research assistance request (RAR-NRR-2022-003) to RES to conduct a literature search on the Assessment of the Harmonics Effects on Voltage Relays in Nuclear Power Plants (NPPs). The final Technical Letter Report (ML23173A019) was published July 2023.

## 9. Part 21 Reports

- a. The following Part 21 Reports were issued in the past year (more information is available on the NRC website under the Part 21 Reports webpage - <https://www.nrc.gov/reading-rm/doc-collections/event-status/part21/index.html>):
- 2023-01-00/01 - Interim Report Notification Pursuant to 10 CFR Part 21.21, Regarding Deviation or Failure to Comply Associated with a Limitorque Actuator
  - 2023-02-00 - Interim Report Notification Pursuant to 10 CFR Part 21.21, Regarding Siemens Medium Voltage Circuit Breakers
  - 2023-03-00/01 - Report Notification Pursuant to 10 CFR Part 21.21 Defect identified in Automatic Transfer Switch PN: NLI-ATS480A400X1
  - 2023-04-00 - Initial Report Notification Pursuant to 10 CFR Part 21.21 Defect identified in Automatic Transfer Switch PN: NLI-ATS480A400X1
  - 2023-05-00 - Initial Report Notification Pursuant to 10 CFR Part 21.21, Regarding DS-206DC/416/632/II-516 Breakers – Erroneous Change of State (Eaton Corporation Breakers)
  - 2023-06-00 - Interim Report Notification Pursuant to 10 CFR Part 21.21, Regarding Deviation or Failure to Comply Associated with a GE HFA Relay
  - 2023-07-00 - Interim Report Notification Pursuant to 10 CFR Part 21.21, Regarding Limitorque Actuator Motor Pinion Installation
  - 2023-08-00 - Interim Report Notification Pursuant to 10 CFR Part 21.21, Regarding Woodward EGB-35P Governor
  - 2023-09-00/01 - Interim Report Notification Pursuant to 10 CFR Part 21.21, Regarding Mechanical Draft Cooling Tower Fan Brakes Design Flaw
  - 2023-10-00/01 - Interim Report Notification Pursuant to 10 CFR Part 21.21, Regarding Potential Defect with Trane External Auto/Stop and Emergency Stop Relay Card PN: X13650728-06
  - 2023-11-00 - Initial Report Notification Pursuant to 10 CFR Part 21.21, Regarding Voltage Regulator Chassis – Bus Bar Installation
  - 2023-13-00/01 - Interim Report Notification Pursuant to 10 CFR Part 21.21, Regarding Motor Driven Relay Failed Testing
  - 2023-15-00/01 - Interim Report Notification Pursuant to 10 CFR Part 21.21, Regarding Defect with Eaton/Cutler Hammer Size 4 and 5 Freedom Series Contactors

- 2023-16-00/01 - Interim Report Notification Pursuant to 10 CFR Part 21.21, Regarding Certain GE-Hitachi HGA Relays
- 2023-17-00/01 - Interim Report Notification Pursuant to 10 CFR Part 21.21, Regarding Tyco (Agastat) Relay Failures
- 2023-18-00/01 - Interim Report Notification Pursuant to 10 CFR Part 21.21, Regarding Potential Defect with Eaton JD and HJD Series Molded Case Circuit Breakers
- 2023-19-00 - Interim Report Notification Pursuant to 10 CFR Part 21.21, Regarding a Deviation Associated With a SMB-1 Geared Limit Switch Assembly
- 2023-21-00 - Interim Report Notification Pursuant to 10 CFR Party 21.21, Regarding an issue with an Emergency Diesel Generator (EDG) Digital Reference Unit (DRU) supplied by Engine Systems Incorporated
- 2023-22-00 - Interim Report Notification Pursuant to 10 CFR Part 21.21, Regarding a Deviation in the Calibration Certificates for an Acoustic Emission Instrument
- 2024-01-00/01 - Interim Report of a Deviation Associated with an Electro-Motive Diesel (EMD) Cylinder Liner with Bore Deficiency, P/N 9318833 (component of power assembly P/N 40124897), S/N 20M0938.
- 2024-02-00 - Interim Report of a Deviation Associated with an Crompton Instruments Type 077 Ammeter
- 2024-03-00 - Interim Report of a Deviation Associated with a Manufacturing Defect Affecting a Field Flash Contactor (K2) relay on its 'B' Emergency Diesel Generator
- 2024-04-00 - Interim Report of a Deviation Associated with a Manufacturing Defect Affecting a Control Power Circuit Monitor (CP1) Relay on its 'B' Emergency Diesel Generator
- 2024-05-00 - Interim Report of a Deviation Associated with Emergency Diesel Generator Fuel Oil Piping

## **10. Generic Communications**

- Information Notice (IN) 23-01, "Risk Insights from High Energy Arcing Fault Operating Experience and Analyses"
- IN 21-01, Supplement 1, "Lessons Learned from U.S. Nuclear Regulatory Commission Inspections of Design-Basis Capability of Power-Operated Valves at Nuclear Power Plants," July 24, 2023