C&D TECHNOLOGIES, INC.
Power Solutions

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September 22, 2014
VIA FACSIMILE
Nuclear Regulatory Commission
Operations Center
301-816-5151

VIA REGULAR MAIL
Document Control Desk
US Nuclear Regulatory Commission
Washington, DC 20555-0001

VIA OVERNIGHT DELIVERY
US Nuclear Regulatory Commission
11555 Rockville Pike
Rockville, MD 20852-2746

Subject: Final Report 10CFR Part 21 Evaluation Regarding Misaligned Separators in LCR-25 Standby Batteries, Revision 1 - Original letter did not include the list of affected utilities.

The purpose of this letter is to provide the NRC a report in general conformity to the requirements of 10CFR Part 21.21 (a)(2). On February 14, 2012 C&D Technologies, Inc. ("C&D") was informed by Entergy Operations that an LCR-25 battery installed at the Palisades Nuclear Power Plant had shown signs of misaligned separators (also known as shifted separators) of between 1/8 to ¼". This was identified by the Palisades plant on or about November 4, 2011. On January 16, 2012, three additional cells were identified as experiencing separator misalignment.

C&D requested that Palisades return the affected batteries for evaluation of this anomaly and issued a Return Material Authorization for that purpose. But since voltage readings were acceptable for all units involved, Palisades determined that an operability issue did not exist and opted to keep the batteries in service until their refuel outage scheduled for Fall, 2013. C&D inadvertently closed the internal corrective action without providing an Interim Report as required by 10CFR, Part 21. An interim report was submitted 3/27/14 while the product was being returned for analysis.

C&D has performed an analysis of the returned product, and is submitting this report to the NRC and notifying affected C&D customers to the possibility of separator misalignment in LCR, KCR, and LCY products.

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NRR

Required information per 10CFR Part 21.21(d)(4) follows:

(i) Name and Address of the individual or individuals informing the Commission

Christian Rheault (or Designee)
President and Chief Executive Officer
C&D Technologies, Inc.
1400 Union Meeting Road
Blue Bell, PA 19422-0858

(ii) Identification of the facility, the activity, or the basic component supplied for such facility or such activity within the United States which fails to comply or contains a defect.

LCR, KCR, and LCY products. The specific analysis involved LCR-25 batteries; however, due to similarity in manufacturing, separator misalignment may occur in other flooded battery products.

(iii) Identification of the firm constructing the facility or supplying the basic component which fails to comply or contains a defect.

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(iv) Nature of the defect or failure to comply and the safety hazard which is created or could be created by such defect or failure to comply.

Separator misalignment was discovered in installed LCR batteries at the Palisades Nuclear Power Plant. Analysis of the batteries and manufacturing systems showed that these products with misaligned separators escaped through final battery inspection and incoming inspection at Palisades, and if the problem had gone undetected, contact between battery plates may have occurred. This would affect the operability of the battery by reducing cell voltage and capacity. Analysis of warranty data since January 2007 provides an approximate frequency of this issue in nuclear and similar commercial product of 40 ppm (0.004%).

(v) The date on which the information of such defect or failure to comply was obtained.

February 14, 2012. Interim report issued March 2014.

(vi) In the case of a basic component which contains a defect or fails to comply, the number and location of these components in use at, supplied for, being supplied for, or may be supplied for, manufactured or being manufactured for one or more facilities or activities subject to the regulations in this Part.

Listing attached. Due to similarity in design, all LCR, KCR, and LCY products may be affected, and C&D is notifying all applicable nuclear plants of this issue.

(vii) The corrective action which has been, is being, or will be taken; the name of the individual or organization responsible for the action; and the length of time that has been or will be taken to complete the action.

- Provided guidance to Palisades and the industry on the detection of misaligned separators in installed batteries (Palisades in 2012 via warranty response, industry via report issued March 2014).
- Continuous improvement activities in the production facility have resulted in the implementation of more effective inspection processes. Specific actions include:
    - Nov. 2012 – Revised product flow in assembly area – The new flow eliminated a section of conveyor that was limiting the Inspector's ability to fully view each battery before the cover was installed. This allowed top view inspection of the element and more effective determination of separator misalignment.
    - April 2013: Added high intensity lighting to in-process and final inspection processes to increase inspection effectiveness.
    - May 2014 – Revised the flow of products through final inspection to a multi-lane setup in order to maintain part number/lot integrity and improve the spacing between cells, to allow for more effective visualization of separator alignment.

(viii) Any advice related to the defect or failure to comply about the facility, activity, or basic component that has been, is being, or will be given to purchasers or licensees.

U.S. Licensees using batteries possibly containing the potential defect are being notified of the filing of this final report with recommendations that they examine their batteries for any signs of similar problems. See attached notification letter and attached list of affected plants.

(ix) In the case of an early site permit, the entities to whom an early site permit was transferred.

Not applicable.

If you have any questions or wish to discuss this matter or this report, please contact:

Robert Malley
VP Quality and Process Engineering
bmalley@cdtechno.com
(215) 619-7830

Sincerely,

Robert H. Malley for C. Rheault

Christian Rheault
President and Chief Executive Officer
C&D Technologies, Inc.

Attachment – C&D Letter to Users of LCR, KCR, and LCY batteries entitled "Separator Misalignment KCR and LCR batteries dated 9/12/14

Attachment - Separator Misalignment LCR, KCR, and LCY batteries List of Affected Plants

Cc: D. Anderson
J. Miller
R. Malley
S. DiMauro
L. Carson
J. Anderson

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September 22, 2014

Customer Name and Address (see attached list)

Ref: Separator Misalignment LCR, KCR, and LCY batteries

Dear Sir/Madam:

C&D Technologies, Inc. ("C&D") is filing a report with the NRC for an incident that occurred with a safety related product at Palisades Nuclear Power Plant.

Background: In February 2012 C&D was notified by Palisades Nuclear Power Plant that a routine inspection of their 2010 LCR-25 batteries showed misalignment in the separators, as shown on Figure 1a and 1b. This issue had not been detected in previous inspections at Palisades and was not detected in outgoing inspection of the battery on shipment from C&D. The initial conclusion was that the separator had shifted in service.

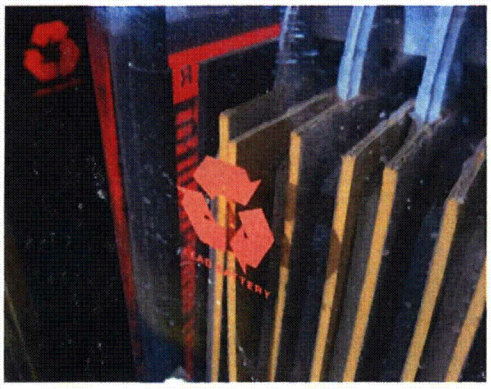

Figure 1a
Prior to Disassembly

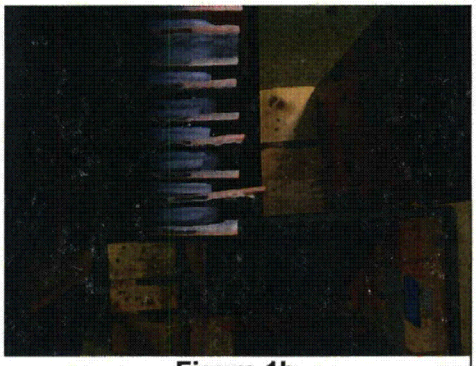

Figure 1b
After Jar Removal

The immediate critical aspect of misaligned separators is whether the plate edges were exposed, allowing development of contact between the plates. In this case the edges were not exposed, and the battery remained in service until an outage in 2014. The battery was returned for analysis and an interim report for this issue was issued in March 2014. The initial report by C&D field service personnel suggested that the separator had shifted in service, leading to the conclusion that the separators could move spontaneously, or under the forces present in a stationary and normally operated battery.

Evaluation: The batteries were returned to C&D for disassembly and evaluation. The misaligned separator was in the same location as photographed at the site. Other than the misaligned separator there were no anomalies or defects present in the batteries, and no contact or shorting had developed around the misaligned separator. The battery had remained operable until removal from the site.

The nature of the assembly process, cell design, battery plate dimensional and mechanical properties, and separator design and mechanical properties prevent the movement of the separator parallel to the plates, once the element is seated in the jar, regardless of the forces applied to the battery or cell. Friction between the separator (specifically the glass fiber mat on the separator) and the plate surfaces prevents movement of the separator in the completed unit.

Analysis of warranty and customer input databases show a total of seven units being returned from product lines used for nuclear applications (LCR, KCR, and LCY), including the four units returned from Palisades since January 2007. The report rate for this type of issue is less than 40 parts per million.

Conclusion: The conclusion drawn from the return and analysis is that the misaligned separator was present from the time of assembly in the C&D facility through installation and initial operation. During assembly misalignment between the separators and the plates can occur during the stacking operations and/or while the battery element is lifted and placed into the container. The visual inspection of the element at the factory did not detect the misaligned separator, and the C&D field service manual and other documentation do not describe misaligned separators as a potential defect for customer inspection.

Recommendations: C&D recommends that operators of nuclear batteries perform an inspection of their batteries to detect misaligned separators. Inspection may be performed visually, and with the aid of mirrors as necessary. The criteria are based on the distance between the edge of the separator and the edge of the positive plate. Nominal distance for K and L cells is 0.3". Criteria are:

- 0.125" to 0.3" – Nominal. No replacement required.
- 0" (Flush with edge of positive plate) to 0.125": Monitor appearance and cell voltage at monthly intervals. Any changes in cell voltage or development of material deposits (mossing) in the affected area warrant timely replacement. Replace at the next available outage if no changes in appearance or cell voltage behavior occur.
- Flush or less than flush (separator edge between the plates) – immediately contact C&D for guidance on necessary actions as applicable.

Battery replacements can be arranged by contacting C&D. Any questions regarding interpretation of inspection results can also be directed to C&D for assistance.

Corrective Actions: C&D has enhanced both in-process and final battery inspection processes to detect and eliminate misaligned separators from shipment. C&D is also preparing an enhanced incoming inspection work form for nuclear battery operators that will better enable the operators to detect and segregate batteries with misaligned separators from use.

Further Reporting: No further reporting is anticipated.

C&D Contacts: Further information on this issue can be obtained from:

Larry Carson – Nuclear Product Manager
Office Phone 215-775-1314
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Robert Malley – VP Quality and Process Engineering
Office Phone 215-619-7830
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Best Regards,

Larry Carson
Nuclear Product Manager
C&D Technologies, Inc.

cc: C. Rheault – President and CEO
D. Anderson – VP General Counsel
J. Miller – VP Operations
R. Malley – VP Quality and Process Engineering
J. Anderson – VP New Technology and Battery Design
L. Carson – Nuclear Product Manager
S. DiMauro – Quality Systems Manager

Separator Misalignment LCR, KCR, and LCY batteries
List of Affected Plants

Company	Plant Name
Bruce Power	Bruce
CFE	Laguna Verde
Constellation	Nine Mile Point
Dominion	Kewaunee
Dominion	Millstone
DTE Electric Company	Fermi
Duke Energy	Oconee
Electric Boat	KAPL
Entergy Operations, Inc.	Arkansas Nuclear One
Entergy Operations, Inc.	Grand Gulf
Entergy Operations, Inc.	Indian Point
Entergy Operations, Inc.	Palisades
Entergy Operations, Inc.	Vermont Yankee
Entergy Operations, Inc.	Waterford
Exelon	Braidwood
Exelon	Byron
Exelon	Clinton
Exelon	LaSalle
Exelon	Limerick
Exelon	Three Mile Island
First Energy	Beaver Valley
First Energy	Perry
FP&L	St. Lucie
Indiana-Michigan Power	Cook
NB Power	Point Lepreau
NEK	Krsko
NextEra Energy	Duane Arnold
NextEra Energy	Point Beach
NPPD	Cooper
NPPD	Cooper
NPPD	Cooper
OPG	Darlington
OPG	Pickering
OPPD	Fort Calhoun
PG&E	Diablo Canyon
PPL	Susquehanna
Progress Energy	Crystal River

Progress Energy	Crystal River
Progress Energy [redacted]	Harris
Progress Energy	Harris
Progress Energy	Robinson
Progress Energy	Robinson
PSEG Nuclear, LLC	Salem
PSEG Nuclear, LLC	Hope Creek
SCANA	Summer
Southern Nuclear Operating Co.	Farley
Southern Nuclear Operating Co.	Hatch
Southern Nuclear Operating Co.	Vogtle
Taiwan Power	Chin Shan
Taiwan Power	Kuosheng
Taiwan Power	Maanshan
Taiwan Power	Lungmen
Tennessee Valley Authority	Browns Ferry
Tennessee Valley Authority	Sequoyah
Tennessee Valley Authority	Watts Bar
Xcel Energy	Monticello
Xcel Energy	Prarie Island