Exelon Generation®

200 Exelon Way
Kennett Square, PA 19348

www.exeloncorp.com

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Ms. Cindy Bladey
Office of Administration
Mail Stop: OWFN–12–H08
U.S. Nuclear Regulatory Commission
Washington, DC 20555–0001

Subject: Comments on Draft NUREG/CR-7179, *"Heat Release Rates of Electrical Enclosure Fires (HELEN-FIRE)"* (Federal Register 80FR24981, dated May 1, 2015, Docket ID NRC–2015–0060)

This letter is being submitted in response to the U.S. Nuclear Regulatory Commission's (NRC's) request for comments concerning the subject draft NUREG/CR-7179, *"Heat Release Rates of Electrical Enclosure Fires (HELEN-FIRE)*," published in the Federal Register (i.e., 80FR24981, dated May 1, 2015).

This draft NUREG/CR documents an experimental program to quantify the heat release rate and burning behavior of electrical enclosures commonly found in nuclear power plants. Fires in electrical enclosures have the potential to disrupt power, instrumentation, and control in the plant.

Exelon Generation Company, LLC (Exelon) appreciates the opportunity to comment on the subject draft NUREG/CR and offers the attached comments for consideration by the NRC. Exelon also supports the comments submitted by the Nuclear Energy Institute (NEI) on behalf of the industry related to this draft NUREG.

If you have any questions or require additional information, please do not hesitate to contact Richard Gropp at (610) 765-5557.

Respectfully,

James Barstow
Director, Licensing and Regulatory Affairs
Exelon Generation Company, LLC

Attachment

SUNSI Review Complete
Template = ADM – 013
E-RIDS= ADM-03
Add= D. Stroup (dss04)

Comments Concerning Draft NUREG/CR-7179, *Heat Release Rates of Electrical Enclosure Fires (HELEN-FIRE)"*

General Comments

1. Although the intent/objective of the testing that was performed was to generate "more realistic distribution of Heat Release Rates (HRRs) than that of previous tests," Exelon Generation Company, LLC (Exelon) believes that this objective might have been unsuccessful. Numerous tests are described as "cabinet doors closed" and yet, the doors were opened mid-test and the contents agitated with a crowbar in order to increase the intensity of the fire. This would seem to bias the tests towards producing large fires, and would likely be contrary to the test objective described in Section 1.4. Also, by reporting the peak HRR of these tests as "doors closed," the resulting data is skewed towards excessive HRRs, and affects down-stream products like NUREG-2178, *"Refining and Characterizing Heat Release Rates from Electrical Enclosures During Fire (RACHELLE–FIRE), Volume 1: Peak Heat Release Rates and Effect of Obstructed Plume."*

2. Exelon recommends that the U.S. Nuclear Regulatory Commission (NRC) consider providing further information regarding the origin of all cables tested, particularly their Institute of Electrical and Electronics Engineers (IEEE) Standard IEEE-383 ("IEEE Standard for Qualifying Class 1E Electric Cables and Field Splices for Nuclear Power Generating Stations") qualification, manufacturer, and part number. Testing cables of indeterminate origin could potentially distort the value of the test results for subsequent study and data reduction.

3. Exelon believes that the test program does not appear to resolve significant differences between Industry and NRC opinions of the potential severity of electrically-initiated fires in control cabinets. For example, it would have been beneficial if the tests would have yielded some insights to produce better agreement with events like those discussed in an industry inspection report (reference ML112270513), where a 125 VDC control circuit short-circuited. Unfortunately, it appears that was not the case with the testing. In the cited case, the NRC appears to have been forced to use a value in NUREG/CR-6850, "EPRI/NRC-RES Fire PRA Methodology for Nuclear Power Facilities," for a cabinet fire, even though there was overwhelming evidence that no such fire was credible. This draft NUREG/CR appears to provide the evidence necessary to dispel the over conservative guidance in NUREG/CR-6850; however, if specific actions are not taken to revise NUREG/CR-6850, then Exelon believes these issues will continue to occur.

4. In several cases, cables are reported as being IEEE-383; however, a review of the CAROLFIRE report that donated the cables suggests that the cables are in-fact not IEEE-383. This would significantly change HRR profiles attributable to qualified and unqualified cables (both in this report, and in draft NUREG-2178). Other cables that were donated for testing are not described in enough detail to clearly understand if they are IEEE-383 or not; Exelon recommends that the NRC consider further clarification.

5. Exelon believes that the tests involving circuit cards appear to be misrepresented as cable fires. In some cases, the photos clearly show no cables participating in the fire, just circuit cards arranged in a "crib" configuration that appears to be optimal for intense burning. Exelon believes that the HRR for these tests should not be reported or attributed to cables.

6. Exelon is requesting further clarification related to the discussion regarding the attempts to get fire to propagate between panels. This is an area where NUREG/CR-6850 imposes some significant conservatisms, and numerous NRC Requests for Additional Information (RAIs) are being generated for NFPA 805 plants; however, the testing in this report, as well as NUREG/CR-4527, *"An Experimental Investigation of Internally Ignited Fires in Nuclear Power Plant Control Cabinets,"* and GE NEDO-10466-A, "*Licensing Topical Report, Power Generation Control Complex, Design Criteria and Safety Evaluation,"* all show a resistance to fire propagation between cabinets.

More specific comments are provided on the following pages.

Specific Comments

NUREG/CR-7179 - *Heat Release Rates of Electrical Enclosure Fires (HELEN-FIRE)*

No.	Page #	Line #	Change Text From	Change Text To	Comment Basis
1	Exec Sum	4	Key parameters affecting fire in an electrical enclosure include its size, openings, electrical voltage, and combustible load.	Key parameters affecting fire in an electrical enclosure include its size or enclosure geometry, ventilation, door, and cable openings, electrical voltage or other ignition sources, and combustible load.	Exelon suggests that the NRC consider revising the wording as noted. Refer to lines 14 through 25 on the same page.
2	Exec Sum	18 - 20	Ventilation, mainly via opening or closing the enclosure doors. Some of the enclosures had a false bottom which could be removed. One enclosure had vertical conduits through its top.	Ventilation, mainly via opening or closing the enclosure doors. Some of the enclosures had a false bottom which could be removed. One enclosure had vertical conduits through its top. Some enclosures had fans (forced ventilation); however, the fans were not used.	Exelon suggests that the NRC consider revising the wording as noted, since later discussions mention the fans that were not used.
3	Exec Sum	21 - 22	Ignition strength, i.e., the amount of energy necessary to start the fire. A small propane burner and various size pans of acetone were used.	Ignition strength, i.e., the amount of energy necessary to start the fire. The ignition sources used were primarily substitutes for electrical ignition. Cartridge heaters, line burners, a couple of small propane burners and various size pans of acetone were used.	Exelon suggests that the NRC consider revising the wording as noted, as further discussed in Section 4.2 of the report.
4	Exec summary	30 - 32	Describes HRR varied from 0.3 kW to 576 kW, mean, median, etc.	Remove text, or expand to summarize based on physically similar test setups. Or Revise to simply state whether the test program met the objectives it set out to accomplish.	Many factors varied between tests (e.g., cable type, cable qualification, cable arrangement (loose vs tight), fuel source, etc.). Exelon believes that the summary statement is too simplistic to convey any meaningful information, and this could potentially lead to a misinterpretation if left as currently written.

No.	Page #	Line #	Change Text From	Change Text To	Comment Basis
5	General			Provide a sketch (or sketches) showing the steel partition that the acetone was put behind.	Several tests state that the acetone pan was placed "behind a steel partition." Exelon suggests that the NRC consider adding a sketch (or sketches) to illustrate this configuration.
6	General		HRR charts and Temperature Charts		Exelon recommends that the NRC consider placing HRR charts and Temperature charts together in the report, possibly on same plot with dual axes.
7	General			Provide provenance of all cables tested, particularly their IEEE-383 qualification.	Exelon suggests that the NRC consider providing further information regarding the origin of all cables tested, particularly their IEEE-383 qualification. Testing cables of indeterminate origin could possibly distort the value of the test results for subsequent study and data reduction. Exelon believes that cables that were originally installed in the cabinets obtained from TVA should have their origin information available from TVA, as this would have been a Quality Assurance (QA) requirement during construction to have these records. Brookhaven National Laboratory may also have this information for the cables they provided. Cables that were purchased for the test series can be tested to IEEE-383, or the manufacturer could provide this certification.
8	General				Exelon believes that very little discussion is provided about the contribution that the non-cable contents of the cabinets might be making to the fire. For example, were the circuit cards contributing to the severity of the fire? Can this information be provided (qualitatively) based on the amount of non-cable materials that were consumed during each test?

No.	Page #	Line #	Change Text From	Change Text To	Comment Basis
9	General				In some of the tests, there is a significant variation in the duration and intensity of the 1-liter acetone pan's contribution. For example: Test 31 – 18 min, 25 kW Test 32 – 16 min – 30 kW Test 33 – 20 min – 21 kW Test 40 – 33 min – 12 kW Exelon requests that the NRC consider providing additional clarification to further explain this variation.
10	General				Exelon suggests that the NRC consider annotating the graphs with the times that the "crowbar" occurred, and the times that doors were opened and closed.
11	General				Exelon is unclear as to whether the test program resolves significant differences between Industry and NRC opinions on the potential severity of electrically-initiated fires in control cabinets. For example, it would have been beneficial if the tests yielded some insights to produce better agreement on events like those discussed in an industry inspection report (reference ML112270513), where a 125 VDC control circuit short-circuited. Unfortunately, it appears that was not the case with the testing.

No.	Page #	Line #	Change Text From	Change Text To	Comment Basis
12	General				When cable jackets were removed and individual conductors arranged in cabinets, the report does not describe what was done with the filler material. Was the filler material removed from the conductors, or was it left in the test? For example, Tests 89 and 104 both show the individual conductors neatly twisted together. Removing the filler material would tend to require the cables be untwisted, which would tend to cause more disarray than what is shown in the photos. If the filler material has been left in for these tests, Exelon believes that it should be discussed, since it provides its own contribution to the fire, and also would not be representative of what would exist in the plant.
13	2	Sect 1.4	Section 1.4 states that the intent of the test was to generate "more realistic distribution of heat release rates than that of previous studies"		Based on a review of the test details, the use of the "crowbar" seems to conflict with the stated goal of the test series. The test data shows numerous cases where flare-ups only occurred after the "crowbar" was used. There is no discussion in the test methodology section explaining the crowbar, or why this is "realistic." Exelon believes further clarification is needed. The use of the crowbar could possibly bias the test towards producing large fires. This was the same critique that was provided for the SANDIA/Chavez tests, and Section 1.4 of the draft NUREG/CR indicates that this test program was supposed to remove this bias.

No.	Page #	Line #	Change Text From	Change Text To	Comment Basis
14	12	4 - 5	Plastic conduits (labelled "Panduit") was used to route the wire to the switches.	Plastic conduits (labelled "Panduit") were used to route the wire to the switches. There is a fan on top of the enclosure, but forced ventilation was not credited.	Exelon suggests that the NRC consider revising the wording as noted, since the report discusses that the fans were not used.
15	15	1	Figure 2-10 shows opening in bottom of cabinet.	Describe what was done with the floor opening in the cabinet for the purposes of this test series.	Cabinets with openings in the bottom are typically sealed once cables are installed. If the test left the bottom open, then it would be non-representative of what is installed in the plant; Exelon suggests further clarification.
16	17	1	Figure 2-12 shows opening in the bottom of cabinet.	Describe what was done with the floor opening in the cabinet for the purposes of this test series.	Cabinets with openings in the bottom are typically sealed once cables are installed. If the test left the bottom open, then it would be non-representative of what is installed in the plant; Exelon suggests further clarification.
17	18	4	States "Additionally, its floor was largely open."	Expand to explain how the open floor was dealt with during the tests.	Control cabinets with open floors are typically sealed once installed in the plant, with cables entering thru fire-rated or HVAC-rated sealed floor penetrations. If the cabinet tested by NIST had its floor open, then this would not be representative of a similar cabinet in the plant; Exelon suggests further clarification.
18	20	Fig 2-15	External photos of Enclosure 7 shown	Please provide a photo showing internal view of cabinet.	Exelon recommends that the NRC consider providing additional detail.
19	22	5 - 6	To mimic this configuration, a 1.2 m (4 ft) section of cable tray was mounted 45 cm (18 in) above the enclosure to collect the exiting cables.	To mimic this configuration, a 1.2 m (4 ft) section of cable tray was mounted 45 cm (18 in) above the enclosure to collect the exiting cables. The seals at the top of the panel were not sealed like in many NPPs due to conservatism.	The report does not seem to mention the seals needed at the top of the panel; Exelon suggests the NRC consider adding further discussion regarding any seals.

No.	Page #	Line #	Change Text From	Change Text To	Comment Basis
20	28 thru-29			Expand Table 3-1 to provide additional information that is relevant to the test program.	Exelon requests further discussion in the report to better understand the information being portrayed in Table 3-1. Users need to lookup detailed cable properties in the CAROLFIRE report. Exelon believes that relevant information should be provided in this document. In particular, the insulation type, and the IEEE-383 qualified/unqualified status. Other information may also be helpful (control versus instrument, wire gauge, etc.), since this information appears to have an influence on the test results, and will be needed for subsequent data reduction and analysis.
21	28	Cable 807			Based on CAROLFIRE report, Cable 807 appears to be PE/PVC cable, and it appears unlikely that this is an IEEE-383 qualified cable. In various tests, Cable 807 is described as being qualified, and in other instances it is described as unqualified. Exelon believes that any inconsistency in how the cable is reported (i.e., qualified/unqualified) should be resolved. This could also affect the discussion in draft NUREG-2178.

No.	Page #	Line #	Change Text From	Change Text To	Comment Basis
22	33	5 - 9	This facility has a 6.1 m by 6.1 m (20 ft by 20 ft) large-scale calorimeter that is designed to measure the heat release rate of fires ranging from approximately 100 kW to 10 MW. However, its instruments are not sensitive enough to measure accurately the HRR of the small fires that were expected in many of the enclosure experiments.	This facility has a 6.1 m by 6.1 m (20 ft by 20 ft) large-scale calorimeter that is designed to measure the heat release rate of fires ranging from approximately 100 kW to 10 MW. However, its instruments are not sensitive enough to measure accurately the HRR of the small fires that were expected in many of the enclosure experiments. Fires in the range of 100 kW to 10 MW should be uncommon in electrical enclosures simply due to the power rating of the electrical cable as an ignition source and the type and configuration of the panel combustibles. This was witnessed as only 11 of 112 tests exceeded an HRR of 100 kW.	Exelon recommends clarifying the discussion as noted.
23	35	17 - 20			Lines 17-20 discuss the use of an Annubar®. The flow coefficient (C) was set to 0.75 rather than the recommended value of 0.61. This coefficient value was not the value recommended by the manufacturer. Exelon recommends that the NRC provide additional clarification to explain how the 0.75 value was selected versus the recommended value by the manufacturer and what (if any) affect this would have on the test results.

No.	Page #	Line #	Change Text From	Change Text To	Comment Basis
24	35	28 - 29	...the acetone pan fires that were used to preheat the electrical enclosures provided a second set of calibration burns.	Please add a sentence following this one that states how the smoke from the preheat times does not affect the outcome. Consider the re-flash capability of smoke coating and suspended in the air around the cables. A statement is needed that the panels were ventilated and/or the smoke was removed from the cable surfaces or there was not a significant amount of smoke released during the warm up period that would negatively affect the outcome.	Exelon recommends that the NRC consider the changes noted, since smoke generation and coatings on cables and equipment would increase the combustibles and ionization effects.
25	36	3	Uncertainty of HRR is "estimated to be approximately 10%."		Exelon is unclear regarding the basis for the statement that uncertainty is 10%. It appears to be meaningless, since no units or other factors are applied to provide context. Is the report saying uncertainty is 10% of full scale? If so, what is full scale? Exelon believes that further clarification is warranted. In addition, given this accuracy, does this make the smaller HRR values reported in Table 5-1 suspect?
26	36	5	amount of amount of	amount of	Exelon believes this to be a typographical error.

No.	Page #	Line #	Change Text From	Change Text To	Comment Basis
27	36	8 - 10	The pan fire is a surrogate for a relatively large fire whose origin is difficult to specify exactly, but most likely due to an event such as a high energy arcing fault or similar malfunction resulting in the ignition of a relatively large amount of combustible material.	The pan fire is a surrogate for a relatively large fire whose origin is difficult to specify exactly, but most likely due to an event such as a high energy arcing fault or similar malfunction resulting in the ignition of a relatively large amount of combustible material. For comparison, cables are the primary ignition sources for electrical enclosures and the cable insulation has a power rating that can be used to judge where the protection is available. For a typical 480 V panel the power rating is approximately 25 kVA, so an ignition source much higher than 25 W should not be expected in most cases.	Exelon recommends that the NRC consider the changes as noted in order to include discussions on cable power ratings and estimating the magnitude of power in a cable used as an ignition source for a 120 V control panel or a 480 V panel.
28	37	1		It would be helpful to have a picture of a propane line burner so the reader can better understand how it works. Also show a picture of how it is configured within a cable bundle.	An example of a cartridge heater is provided in Section 4.2.1. Exelon believes that a similar picture would be helpful in Section 4.2.2 and should be provided.
29	38	5 - 6	Thus, 1 L releases approximately 22,650 kJ of energy.	Thus, 1 L releases approximately 22,650 kJ of energy, which averages to approximately 18.87 kW for 1200 sec. This is well within the range of what can be expected for electrical cable ignitions.	Exelon recommends that the NRC consider the changes as noted. This was based on using the same equation with a 20-minute fire.

No.	Page #	Line #	Change Text From	Change Text To	Comment Basis
30	39	10	These same pans of alcohol were sometimes used to ignite the combustibles directly.	These same pans of alcohol were sometimes used to ignite the combustibles directly but for the purposes of preheating, the smoke produced had an insignificant impact on the HRR in later testing when the alcohol was used as an ignition source.	Exelon recommends that the NRC consider the changes as noted, since smoke production during heating can make conditions worse during the actual testing.
31	39	28 thru 31	It was observed that "loose" or non-bundled cables or wires led to higher heat release rates, even though bundling was necessary to accumulate enough combustible mass in the vicinity of the igniter to facilitate fire spread.	It was observed that "loose" or non-bundled cables or wires led to higher heat release rates, even though bundling was necessary to accumulate enough combustible mass in the vicinity of the igniter to facilitate fire spread. This was likely due to the increased amount of oxygen available and exposing the individual cables.	Exelon recommends that the NRC consider the changes as noted.
32	40	Test 8			Page 52 shows that in Test 8, the primary fuel was circuit boards; however, in Summary Table 5-1, the fuel is described as "Qualified" Cable. Exelon believes that, given the way the fire was encouraged to burn in the circuit cards (arranged in a crib fashion), the presence of cable in this test appears irrelevant, and should not have its HRR attributed to qualified cables.

No.	Page #	Line #	Change Text From	Change Text To	Comment Basis
33	40	Test 2, Test 8, Test 26			In Table 5-1, the "Time to Peak HRR" for Test 2 appears to be a data artifact. Exelon believes 15 minutes to be a more reasonable number. In Table 5-1, the "Time to Peak HRR" for Test 8 appears to be a data artifact, since no combustion was reported to have occurred. Exelon suggests replacing the value with "N/A." In Table 5-1, the "Time to Peak HRR" for Test 26 appears to be a data artifact, since the fire did not spread. Exelon suggests replacing the value with "N/A."
34	40	Test 4	Enclosure 2	Enclosure 4	Page 48 states Enclosure 4 and matches picture/diagram on Pages 16 and 17, so reference to Enclosure 2 perhaps is a typographical discrepancy.
35	40 thru 44	Table 5-1	The ignition HRRs are less than 54 kW for all 112 tests. If this is the case, we should be able to compare all of the tests to an expected set of electrical cable ignition rates in kW or kVA.	Use the results in Table 5.1 to make some criteria for cable ignition sizes.	Exelon suggests that the NRC consider using Table 5-1 (column of ignition HRR cable ratings) to do a comparative review between the fuel sources used and the actual fuel sources available.
36	40 thru 44	Table 5-1			Exelon requests that the NRC provide additional information on Table 5-1. Specifically, adding a column for maximum temperature would be helpful.

No.	Page #	Line #	Change Text From	Change Text To	Comment Basis
37	41 thru 42	Table 5-1			Exelon believes that Tests 16, 20, 21, 35, 36, 37, 38, 39, 46, 47, 48, 49, 52, 53, 61, 62, 63 appear to be based on unqualified cable (#807), but are shown as using qualified cable. Exelon requests further clarification.
38	41				Page 85 shows that in Test 41, the primary fuel was circuit boards; however, in Summary Table 5-1, the fuel is described as "Qualified" Cable. Exelon believes that, given the way the fire was encouraged to burn in the circuit cards (i.e., arranged in a crib fashion), the presence of cable in this test could be considered irrelevant, and should not have its HRR attributed to qualified cables.
39	41				In Table 5-1, the "Time to Peak HRR" for Tests 27 and 28 seems misleading and Exelon requests further clarification. The time being reported as Peak HRR corresponds to the ethanol pan fire used at the beginning of the test, and not the combustion of cables.
40	41				Table 5-1 reports Test 32 Peak HRR of 6 kW at 4 minutes. When a net HRR is considered (i.e., subtracting the pilot fire), then it appears that the Peak HRR occurred at approximately 20 minutes and may have been slightly greater than 6 kW. Table 5-1 reports Test 34 Peak HRR of 6 kW at 7 minutes. When a net HRR is considered (i.e., subtracting the pilot fire), then it appears that the Peak HRR occurred at approximately 28 minutes, and was approximately 35 kW.

No.	Page #	Line #	Change Text From	Change Text To	Comment Basis
41	42	Table 5-1. Test 72		Delete Peak HRR, Time to Peak HRR, and Total Energy Release for Test 72.	Page 116, Test 72 states that the HRR measurement experienced an error and is clearly invalid. However, Table 5-1 still shows the peak HRR value, when this data is noted to be invalid.
42	44	Table 5-1. Test 109			With regard to Test 109, Exelon is requesting that the NRC confirm that this cable is IEEE-383 qualified.
43	44	Table 5-1 Test 109			With regard to Cable 108 used in Test 109, Exelon is requesting that the NRC confirm that this cable is IEEE-383 qualified. Based on the CAROLFIRE description, this cable may not be IEEE-383 qualified.
44	45	Table 5-2		Add a red or bold circle around the fire's point of origin. It is hard to decipher based on the size of the picture. This same comment holds true for most Table 5-X pictures.	Exelon is requesting further clarification and perhaps adding the noted annotation might be helpful.
45	49	1	Enclosure 2	Enclosure 4	Exelon believes that the picture/diagram on Pages 16 and 17 is Enclosure 4. If confirmed, this change would likely need to be made on Page 40 as well.
46	59	Table 5-16		Describe the location of the burner. It cannot be seen from the pictures.	Exelon is requesting further clarification with regard to the location of the burner.
47	61	Table 5-18		Describe the location of the burner. It cannot be seen from the pictures.	Exelon is requesting further clarification with regard to the location of the burner.

No.	Page #	Line #	Change Text From	Change Text To	Comment Basis
48	69	Table 5-26	The fire spread approximately 20 cm (8 in) above the burner. The door was opened at approximately 20 min to check progress. The fire did not spread beyond the vicinity of the burner.	Unknown	Exelon believes that this wording might be contradictory and perhaps it should be reworded for further clarification.
49	97	Test 53			The text description appears to have been clipped or truncated.
50	112	Test 68			Exelon believes that the installation practice for this test is not representative of nuclear power plant wiring.
51	113	Test 69			Exelon believes that the test summary for Test 69 does not describe what type of cable was used in the test. Table 5-1 states that the cable was unqualified, but additional information would be helpful. Exelon recommends that the NRC update Page 113 to clarify what cable was used in the test.
52	115	Test 71			Exelon believes that the installation practice for this test is not representative of nuclear power plant wiring.
53	115	Test 71			Exelon believes that the photo shown in Test 71 appears identical to the photo shown for Test 70.
54	123	Test 79			Exelon believes that the installation practice for this test is not representative of nuclear power plant wiring.

No.	Page #	Line #	Change Text From	Change Text To	Comment Basis
55	60 thru 64	Table 5-1		Please provide an additional column of HRR values that distinguish between "Crowbar" and "no-Crowbar" perturbations of the test, and changes from doors-closed to doors-open.	The purpose of the test is stated to be to determine the HRR in cases without intervention. To achieve that, the HRR in the tests should be published without masking the results by the perturbations with a crowbar or opening and closing doors in mid-test. The data from this test is being used verbatim in NUREG-2178, where they have taken Peak HRR from several tests that are described as "doors closed" even though the Peak HRR happens after the doors have been opened in mid-test or the contents disturbed with a crowbar. For example: Test 44 – Peak HRR reported (after doors opened) = 31. Peak HRR before doors opened = ~13. Test 12 – Peak HRR reported (after doors opened) = 52. Peak HRR before doors opened = ~4. Test 14 – Peak HRR reported (after doors opened) = 4. Peak HRR before doors opened = negligible. Test 111 – Peak HRR reported (after doors opened) = 268. Peak HRR before doors opened = ~75. As shown in these 4 examples given above, there are increases of from 4 to 10 times the HRR due to the opening of doors in mid-test, which are not summarized in Table 5-1 and are subsequently not acknowledged in NUREG-2178.

No.	Page #	Line #	Change Text From	Change Text To	Comment Basis
56	127	Test 83			Exelon believes that the installation practice for this test is not representative of nuclear power plant wiring.
57	135	Test 91			Exelon is requesting further clarification to describe the cable in additional detail (i.e., beyond "SIS"). Additional information is considered necessary regarding cable's origin, traceable part number, IEEE-383 qualification, and other qualifications (e.g., IPCEA, etc.). Without providing additional detail, the application of the results for the "SIS" wire to a specific plant could be considered meaningless. For example, at many Boiling Water Reactors (BWRs), panelboard wire is typically vendor (GE) part number SI-57275 or SI-57279 (Vulkene) and has been shown to pass IEEE-383 testing, but under ordinary circumstances would not be procured to the IEEE-383 specification, since IEEE-383 does not strictly apply to panelboard wire. This wire has also been shown to pass IPCEA S-19-81 vertical test, UL horizontal and vertical test, IEC 92-3 test, and can be considered "SIS FR-1" rated.
58	136	Test 92			Exelon requests that the NRC consider providing more information to better describe the cable in additional detail (i.e., beyond "SIS"). Exelon believes that information regarding the cable's origin, IEEE-383 qualification, etc. would be helpful.

No.	Page #	Line #	Change Text From	Change Text To	Comment Basis
59	158	Section 5.2.3			Exelon is requesting that the NRC consider further clarification describing what was done regarding the floor openings in the cabinets. Normally these openings would be sealed when installed in the plant, after cables were pulled.
60	158	Section 5.2.4			Exelon is requesting that the NRC expand its discussion of Peak HRR to slice/dice results based on similar configurations (e.g., IEEE-383 vs. non-IEEE-383, loose vs. tight bundles, etc.).
61	158	Section 5.2.2	Two vertical enclosures (#4 and #5) were connected together, and there was a fairly wide opening connecting the two. In none of the experiments did the fire spread from one enclosure to the other, even though many of these experiments were deliberately set up to test whether this was possible.	Add additional detail describing how experiments were "deliberately set up to test" the spread between cabinets. Add additional detail to test summaries explaining what was observed. If a test was deliberately set up to test fire spread and it still did not occur, that is noteworthy and should be thoroughly documented.	Exelon is requesting that the NRC expand its discussion of fire spread to adjacent cabinets. There appears to be no discussion in the methodology section or experiment section that provides any information concerning how the experiment was used to examine fire spread, and it also appears that there were no observations recorded in the test summary section. Exelon believes that it is noteworthy that several tests (i.e., NUREG/CR-7197, NUREG/CR-4527, and GE NEDO-10466-A) have attempted to force fire spread to adjacent cabinets through openings or thermal damage due to conduction, yet none have succeeded. Despite this lack of fire spread evidence, NUREG/CR-6850 requires the user to assume horizontal fire spread unless cabinets are perfectly sealed with double-walls and an air-gap between them. It appears that the tests discussed in Section 5.2.2 refute the position taken in NUREG/CR-6850; however, Exelon believes that insufficient detail is documented in draft NUREG/CR-7179 to support this position. Exelon suggests that the NRC consider adding additional information to *further enhance the report.*

No.	Page #	Line #	Change Text From	Change Text To	Comment Basis
62	158	21-23			Exelon suggests that the NRC consider enhancing and strengthening the discussion on the removable plates not impacting fire behavior by acknowledging the fact that a typical plant configuration has the underside of these cabinets protected by a qualified fire barrier. This is supported by the photographs presented in Section 2 of the report. This reduces/eliminates air flow into the underside of the cabinet.