



CoC 1004, Amendment 14

LG-19-068

August 8, 2019

ATTN: Document Control Desk  
Director, Division of Spent Fuel Management  
Office of Nuclear Material Safety and Safeguards  
U.S. Nuclear Regulatory Commission  
Washington, DC 20555-0001

Limerick Generating Station (LGS), Units 1 and 2  
Renewed Facility Operating License Nos. NPF-39 and NFP-85  
Docket Nos. 50-352, 50-353, and 72-65

- Subject: Response to Requested Supplemental Information for a One Time Alternative Request Pertaining to Dry Shield Canisters Equipped with BORAL<sup>®</sup> Neutron Absorber Plates
- Reference 1: Exelon Generation Company letter to the NRC, ALTERNATIVE REQUEST PERTAINING TO DRY SHIELDED CANISTERS EQUIPPED WITH BORAL<sup>®</sup> NEUTRON ABSORBER PLATES, DATED April 8, 2019
- Reference 2: NRC letter to Richard Libra, ALTERNATIVE REQUEST PERTAINING TO DRY SHIELDED CANISTERS EQUIPPED WITH BORAL<sup>®</sup> NEUTRON ABSORBER PLATES – SUPPLEMENTAL INFORMATION NEEDED, dated June 17, 2019.

In Reference 1 Exelon Generation Company, LLC (EGC) is requesting NRC approval of a one-time alternative for the Limerick Generating Station (LGS), Units 1 and 2 Independent Spent Fuel Storage Installation (ISFSI) pursuant to Standardized NUHOMS<sup>®</sup> CoC 1004 Renewed Amendment 14, Technical Specification (TS) 4.1. Specifically, the alternative request addresses use of two Dry Shielded Canisters (DSCs) equipped with BORAL<sup>®</sup> neutron absorber plates that were subject to different acceptance testing requirements than those specified in CoC 1004 Renewed, Amendment 14.

In Reference 2 the U.S. Nuclear Regulatory Commission requested supplemental information. The Attachment to this letter provides the response to the requested information.

There are no regulatory commitments contained in this letter.

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If you have any questions or need additional information, please contact Mr. Joe Dougherty at (610) 718-2630.

Respectfully,

A handwritten signature in black ink, appearing to read 'F. Sturniolo', with a stylized flourish at the end.

Frank Sturniolo  
Acting Vice President – Limerick Generating Station  
Exelon Generation Co., LLC

Attachment      Response to Requested Supplemental Information for a One Time  
Alternative Request Pertaining to Dry Shield Canisters Equipped with  
BORAL® Neutron Absorber Plates

cc: W. Allen  
J. McKirgan  
S. Rutenkroger

**Attachment: Response to Requested Supplemental Information for a One Time Alternative Request Pertaining to Dry Shield Canisters Equipped with BORAL® Neutron Absorber Plates**

1. Provide justification for 95% confidence level that 95% of the Boral material in the subject DSCs complies with the required Boron-10 content for Amendment 14 of the CoC 72-1004 and supports the conclusions in Section 3.0 of Enclosure 6, Appendix A, of the application.

The applicant made conclusions regarding the adequacy of the Boral material in the two (2) subject dry shielded canisters (DSCs) upon considering the non-compliance with some of the requirements per the Technical Specifications of Amendment 14 of CoC 72-1004. The applicant justified these conclusions by citing the reduced design-basis credit for the assumed Boron-10 concentration in the criticality safety analyses. Therefore, the staff considers that these conclusions are solely based on engineering judgement without presenting an appropriate statistical analysis based on operating experience. This approach is insufficient for the staff to make conclusions on adequate performance of the Boral material in the subject DSCs.

The applicant is asked to provide justification, such as an operating experience assessment with a rigorous statistical analysis, that:

- a) identifies any non-conformances on the Boron-10 content per measurements on the approved sampling rate of every 2000 square inches of product. The assessment should justify that decreasing the sample rate (to every 3200 square inches of product) does not reasonably increase the risk of non-conformance; and,

Response

There are no non-conformances identified on the Boron-10 content in the final document packages of these fabricated DSCs. Section 6.0 and Appendix F of the "Boral® In-process and Final Inspection" procedure (Reference 1) describe and justify the following process for demonstrating 95% confidence that 95% of the Boral inspected complies with the specified Boron-10 areal density. 100% of the sheets produced from the first 100 ingots were tested at the beginning of a production run. Individual sheets that failed the minimum areal density specification were rejected. If the average areal density minus two standard deviations ( $2\sigma$ ) of the first 100 ingots met the specification, subsequent sheets in the production run were subject to reduced inspection. If not, inspection continued at 100%. Reduced inspection started with twenty sheets out of one hundred. The sampling rate was increased until

$$(\text{average areal density}) - K\sigma \geq \text{minimum specified B10 areal density,}$$

where K is a factor that decreases with the increase of the sample size, taken from Natrella's *Experimental Statistics*, Table A-7, *Factors for One-Sided Tolerance Limits for Normal Distributions* at  $P = 0.95$  and  $\gamma = 0.95$ .

An excerpt of Table A-7 from "*Experimental Statistics*" is shown below for reference.

TABLES

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**TABLE A-7 (Continued). FACTORS FOR ONE-SIDED TOLERANCE LIMITS FOR NORMAL DISTRIBUTIONS**

\*The two starred values have been corrected to the values given by D. B. Owen in "Factors for One-Sided Tolerance Limits and for Variables Sampling Plans", Sandia Corporation Monograph SCR-607, available from the Clearing House for Federal Scientific and Technical Information, U.S. Department of Commerce, Springfield, Va. 22151. The Owen Tables indicate other errors in the table below, not exceeding 4 in the last digit.

P n	$\gamma = 0.95$					$\gamma = 0.99$				
	0.75	0.90	0.95	0.99	0.999	0.75	0.90	0.95	0.99	0.999
3	3.804	6.158	7.655	10.552	13.857	—	—	—	—	—
4	2.619	4.163	5.145	7.042	9.215	—	—	—	—	—
5	2.149	3.407	4.202	5.741	7.501	—	—	—	—	—
6	1.895	3.006	3.707	5.062	6.612	2.849	4.408	5.409	7.334	9.550*
7	1.732	2.755	3.399	4.641	6.061	2.490	3.856	4.730	6.411	8.348
8	1.617	2.582	3.188	4.353	5.686	2.252	3.496	4.287	5.811	7.566
9	1.532	2.454	3.031	4.143	5.414	2.085	3.242	3.971	5.389	7.014
10	1.465	2.355	2.911	3.981	5.203	1.954	3.048	3.739	5.075	6.603
11	1.411	2.275	2.815	3.852	5.036	1.854	2.897	3.557	4.828	6.284
12	1.366	2.210	2.736	3.747	4.900	1.771	2.773	3.410	4.633	6.032
13	1.329	2.155	2.670	3.659	4.787	1.702	2.677	3.290	4.472	5.826
14	1.296	2.108	2.614	3.585	4.690	1.645	2.592	3.189	4.336	5.651
15	1.268	2.068	2.566	3.520	4.607	1.596	2.521	3.102	4.224	5.507
16	1.242	2.032	2.523	3.463	4.534	1.553	2.458	3.028	4.124	5.374
17	1.220	2.001	2.486	3.415	4.471	1.514	2.405	2.962	4.038	5.268
18	1.200	1.974	2.453	3.370	4.415	1.481	2.357	2.906	3.961	5.167
19	1.183	1.949	2.423	3.331	4.364	1.450	2.315	2.855	3.893	5.078
20	1.167	1.926	2.396	3.295	4.319	1.424	2.275	2.807	3.832	5.003
21	1.152	1.905	2.371	3.262	4.276	1.397	2.241	2.768	3.776	4.932
22	1.138	1.887	2.350	3.233	4.238	1.376	2.208	2.729	3.727	4.866
23	1.126	1.869	2.329	3.206	4.204	1.355	2.179	2.693	3.680	4.806
24	1.114	1.853	2.309	3.181	4.171	1.336	2.154	2.663	3.638	4.755
25	1.103	1.838	2.292	3.158	4.143	1.319	2.129	2.632	3.601	4.706
30	1.059	1.778	2.220	3.064	4.022	1.249	2.029	2.516	3.446	4.508
35	1.025	1.732	2.166	2.994	3.934	1.195	1.957	2.431	3.334	4.364
40	0.999	1.697	2.126	2.941	3.866	1.154	1.902	2.365	3.250	4.255
45	0.978	1.669	2.092	2.897	3.811	1.122	1.857	2.313	3.181	4.168
50	0.961	1.646	2.065	2.863	3.766	1.096	1.821	2.269*	3.124	4.096

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The safety basis for developing the procedure and testing of the Boron-10 content for the subject DSCs was based on specifications in Chapter K.9 of CoC 1004, Amendment 9. All the requirements stated in CoC 1004, Amendment 9 were satisfied with no non-conformances.

- b) identifies the uncertainty in Boron-10 content as measured by wet chemistry and isotopic analysis relative to neutron attenuation measurements. This uncertainty should still provide an adequate safety margin upon considering the reduced design-basis credit of Boron-10 in the criticality analyses.

The information is needed to verify compliance with 10 CFR 72.124(a) and (b).

Response

The design basis credit of Boron-10 content for the Boral® plates used in the subject DSCs was based on requirements in the CoC 1004, Amendment 9 for a 61BT DSC. All the specifications and requirements identified in the CoC 1004, Amendment 9 were satisfied for taking 75% credit for the minimum Boron-10 content in the criticality evaluation of these DSCs. There is no requirement in the CoC 1004, Amendment 9 to perform a neutron attenuation measurement or to benchmark the wet chemistry and isotopic analysis. The safety basis for taking 75% credit for the minimum Boron-10 content in the criticality evaluation of the subject DSCs was based on specifications in Chapter K.9 of CoC 1004, Amendment 9. All the requirements stated in CoC 1004, Amendment 9 were satisfied without any exception.

References:

- 1) AAR Cargo Systems Procedure, BORAL® In-Process and Final Inspection, AAR-10012 QAP, Revision 24. This reference was provided as Reference 4 in Enclosure 4 to the Application dated April 8, 2019 (Reference 2).
- 2) Exelon Generation Company letter to the NRC, ALTERNATIVE REQUEST PERTAINING TO DRY SHIELDED CANISTERS EQUIPPED WITH BORAL® NEUTRON ABSORBER PLATES, DATED April 8, 2019.