**NRC Response to Public Comments on**
**Draft Generic Letter, "Monitoring of Neutron-Absorbing Materials in Spent Fuel Pools"**

This document presents the U.S. Nuclear Regulatory Commission's (NRC's) responses to public comments received on a proposed generic letter on monitoring the degradation of neutron-absorbing materials in spent fuel pools and other wet storage locations. The NRC published the proposed generic letter in the *Federal Register* for public comment (79 FR 13685; March 11, 2014).

Comments on this draft generic letter are available electronically at the NRC's electronic Reading Room at http://www.nrc.gov/reading-rm/adams.html. From this page, the public can gain entry into the Agencywide Documents Access and Management System (ADAMS), which provides text and image files of NRC's public documents. Comments were received from the following individuals or groups:

| Letter No. | ADAMS No. | Commenter Affiliation | Commenter Name | Abbreviation |
|---|---|---|---|---|
| 1 | ML14122A018 | NETCO/Curtiss Wright Flow Control Co. | Matthew Eyre | NET |
| 2 | ML14134A010 | Nuclear Energy Institute | Kristopher Cummings | NEI |
| 3 | ML14134A110 | Dominion Resources Services, Inc. | T.R. Huber | DOM |
| 4 | ML14136A401 | Southern Nuclear Operating Co., Inc. | C. R. Pierce | SNC |
| 5 | ML14136A402 | Florida Power & Light Company | James Petro | FPL |
| 6 | ML14136A400 | Nuclear Applications Company/ Energy Security Consulting Group | Alexander DeVolpi Mehdi Sarram | NAC |
| 7 | ML14139A452 | Virgil C. Summer Nuclear Station | Tracey Stewart | VCS |
| 8 | ML14139A453 | STARS Alliance, LLC | Scott Bauer | STA |
| 9 | ML14139A454 | Holtec International | Laszlo Zsidai | HOL |
| 10 | ML14140A078 | Entergy Operations, Inc./ Entergy Nuclear Operations, Inc. | Fred Smith | ENT |
| 11 | ML14154A115 | Exelon Generation Company, LLC | David Helker | EXE |

This document places each public comment into one of the following categories:

I. Time Estimated for Response to Generic Letter
II. Availability of Information
III. Safety Relevance
IV. Scope of Information Request
V. Terminology/Editorial Recommendations
VI. Other Comments

Within each category, the NRC has either repeated comments as written by the commenter or summarized the comments for conciseness and clarity. At the end of the comment or comment summary, the NRC references the specific public comments and the letters by which they were

provided to the NRC. Specific comments are referred to in the form [XXX]-[YYY], where: [XXX] represents the commenter abbreviation from the table on page 1 of this document, and [YYY] represents the sequential comment number from that commenter. For the purpose of this document, sequential comments may be bullet points, summaries of a point, or comments designated as such by the commenter. Some commenters were not referenced in this manner, because they submitted documents that endorsed the public comments provided by NEI in Letter No. 2, without any additional comments.

**I. Time Estimated for Response to Generic Letter**

*Comment: The effort required to respond to this generic letter would be expected to be significantly greater than that estimated by NRC staff, potentially involving a thousand man-hours or more of effort over a period of a year. [NET-1, NET-7, NEI-8, NEI-9, NEI-10, NEI-12, DOM-12, SNC-1, SNC-2, SNC-3, SNC-4, SNC-5, FPL-2, STA-1]*

NRC Response: The NRC disagrees with the comment. The NRC is not requesting new analyses, program development, or research from the licensees. The licensees should retrieve information contained in their records per the requirements of Criterion XVII, "Quality Assurance Records," in Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities." If the information being requested does not exist in licensee records, then the licensee should state this in its response. The NRC interprets some of the comments to suggest that the generic letter is not clear in this respect. In particular, several previous generic letters that required new evaluations and/or analyses are cited to support higher man-hour estimates. As a result, the final generic letter was changed by adding paragraphs to the **Requested Information from Power Reactor Addressees** section (bottom of Page 8 of the final generic letter) and to the beginning of Appendix A that includes language clarifying the NRC's expectations for the level of effort invested by licensees in responding to this generic letter.

*Comment: The estimates provided in the draft generic letter for the number of required man-hours in order to respond and the time frame provided to supply a response are inadequate to account for the administrative burden associated with affirmation. [NEI-11, DOM-1]*

NRC Response: The NRC agrees with the comment. The details provided in the public comments indicate that the administrative burden, for one licensee, associated with affirmation is at least 50 man-hours per unit. This was higher than estimated. Therefore, the NRC staff used the information provided in public comments as a rough estimate for the administrative burden. As stated in the generic letter, licensees that may be challenged by the time frame for a response may submit an alternative course of action for responding to the generic letter within 30 days. The final generic letter was changed by increasing the estimate of man-hours required to respond by 50 man-hours. The time frame for response was also extended to 120 days, consistent with the increase in man-hours.

**II. Availability of Information**

*Comment: Some of the information being requested may no longer be available to licensees because the original supplier of the neutron-absorbing material no longer exists. As a result, licensees may not be able to provide specific information maintained by the supplier (e.g., qualification test data). [NET-2]*

NRC Response: If the suppliers of neutron-absorbing materials no longer exist (i.e., have been dissolved), then the NRC is asking each licensee to provide information that it possesses regarding the acceptability of its plant-specific neutron absorbers. If a licensee does not have or cannot obtain information, such as qualification test data, for its materials, then it should state that in its response to the generic letter. No change was made to the final generic letter as a result of this comment.

*Comment: Some of the technical bases being requested may not exist because the NRC approved prior licensing of program parameters associated with spent fuel pool operation based on extensive engineering judgment, or the technical basis was not required to be formally documented. [NET-3]*

NRC Response: The NRC is not asking licensees to prepare any new analyses, program development, or research. Licensees need only provide information contained in records that should already be available to them, consistent with the requirements of Appendix B to 10 CFR Part 50, Criterion XVII, and 10 CFR 50.71, "Maintenance of Records, Making of Reports." The NRC staff recognizes that engineering judgment may have been used to set acceptance criteria and test intervals, and where that is the case, that would be the appropriate response to the generic letter. The NRC staff also recognizes that older vintage documents may not have the requisite level of detail necessary to fully answer the questions. However, the NRC expects licensees to respond as completely as possible, based on information available to each licensee. No change was made to the final generic letter as a result of this comment.

*Comment: Some licensees have provided most or all of the information being requested through approved license amendment requests or license renewal applications. In particular, information recently provided to the NRC for review should be readily available to the staff. [NEI-7, FPL-3]*

NRC Response: The NRC staff agrees with this comment. An acceptable response to this generic letter would be to reference an approved license amendment request or license renewal application that includes the requested information, along with an affirmation that the data provided remains accurate (i.e., no changes have been made to the information that answers the questions in the generic letter), and provides any requested information that is not included in the referenced documentation. The NRC revised the final generic letter to explicitly include the option of referencing information previously submitted on the docket as one possible way for licensees to provide a response to the generic letter.

**III. Safety Relevance**

*Comment: There is significant margin to criticality in spent fuel pools due to conservatisms inherent in licensee criticality analysis methods and the regulatory limit. As such, this issue does not have enough safety significance to warrant the use of 10 CFR 50.54(f) to require a response from licensees. [NET-6, NEI-2, NEI-6, SNC-6]*

NRC Response: The NRC staff disagrees with the comment. Ensuring adequate safety margins is a fundamental component of the NRC regulatory process. The NRC requirements as found in 10 CFR 50.68, "Criticality Accident Requirements," or equivalent, require substantial margin to avoid an inadvertent criticality. As such, licensees are required to be able to demonstrate that they have the subcriticality margin stipulated in the regulations. Licensees have submitted nuclear criticality safety analyses that demonstrate that the required subcriticality margin is maintained for a variety of credible scenarios, such as boron dilution

incidents, allowed spent fuel pool loading patterns, fuel assembly burnups, or plant operating conditions. The NRC does not consider it to be appropriate to credit margin that is already being used for other purposes.

Unidentified and unmitigated degradation of neutron-absorbing materials may challenge the subcriticality margins necessary to ensure compliance. This generic letter is intended to gather the information necessary to ensure continued regulatory compliance. No change was made to this generic letter as a result of this comment.

*Comment: There are no identified safety issues with metallic neutron-absorbing materials. The blistering identified in Boral® panels to date could theoretically have an effect on reactivity. However, this effect is quite small and the known issues are being adequately monitored and managed. There is no known significant degradation in newer metallic neutron-absorbing materials such as Metamic™ or Boralcan. [NEI-1, NEI-4, NEI-5, NEI-14, HOL-1]*

NRC Response: The NRC staff interprets this comment to suggest that licensees who credit metallic neutron-absorbing materials do not represent a potential compliance or safety concern. Therefore, the NRC staff disagrees with the intent of the comment. Appropriate performance monitoring is a component of the regulatory process for safety-related systems, structures, and components. All neutron-absorbing materials should have an appropriate surveillance program to identify potential problems associated with degradation, manufacturing, or the pool environment. This includes Boral®, which has known degradation to date that is limited to blisters and bulges, and metal matrix composite materials, with a limited service history that is too short to draw definite conclusions. The purpose of the surveillance program is to identify any degradation before it can compromise the intended function of the material. Without a surveillance program, identification of new or accelerated forms of degradation in neutron-absorbing materials will not occur in a timely manner.

However, the NRC staff does recognize that the known susceptibility of metallic neutron-absorbing materials is different from the nonmetallic neutron-absorbing materials. As a result, a tiered approach was adopted that focuses the scope of the required response on the issues for which the NRC currently has evidence or operating experience indicating that a significant concern exists. This tiered approach is described on page 8 of the final generic letter and is consistent with recommendations made by the Advisory Committee on Reactor Safeguards (ACRS).

*Comment: Licensees [who] have non-metallic neutron-absorbing materials (Boraflex, Carborundum, and Tetrabor) installed in their spent fuel pools have either revised their licensing basis to remove credit for the neutron-absorbing material, or have monitoring programs in place that were found to be acceptable by the NRC. [NEI-1]*

NRC Response: The NRC staff interprets this comment as suggesting that licensees who credit neutron-absorbing materials with known significant degradation issues are effectively managing their neutron-absorbing material, so there is no reason to suspect compliance issues. The NRC staff has information suggesting that this is not true for some licensees. The **Operating Experience** section of the generic letter provides several examples where existing programs failed to adequately manage the material condition. In addition, the technical letter reports (ADAMS Accession Nos. ML12216A307 and ML12254A064) identify uncertainties with current testing and modeling methods. Accordingly, this generic letter is requesting information from licensees to verify (among other things) if effective aging management—where necessary—is

occurring. The scope of the requested response from licensees crediting Boraflex or phenolic resins did not change, so no change was made to the generic letter as a result of this comment.

*Comment: The NRC has performed studies demonstrating that a large amount of degradation must occur before criticality becomes a concern. (The commenter referenced a presentation made by the NRC on March 13, 2013, at the Regulatory Information Conference.) [NEI-3]*

NRC Response: The NRC staff disagrees with this comment. The referenced NRC studies should not be used to provide generic quantitative conclusions about neutron-absorbing material performance after degradation. The reactivity worth of the neutron-absorbing material depends on much more than just the percentage of degradation that has occurred, including spent fuel pool geometries, fuel composition, and other factors. These studies were performed to demonstrate that, as the boron-10 areal density of absorber panels decreases, a point is reached at which the reactivity change accelerates significantly. Based on the complexities that exist, licensees should not depend on simple rules of thumb or generalizations in determining the safety margin. No change was made to this generic letter as a result of this comment.

*Comment: The NRC has not demonstrated that there is a potential safety or compliance issue for all licensees. [NEI-15]*

NRC Response: The NRC staff disagrees with this comment. The regulations require that adequate subcriticality margin be maintained. Unidentified and unmitigated degradation of neutron-absorbing material could challenge the margins necessary to ensure regulatory compliance, as discussed in the **Background** section of the generic letter. This generic letter is intended to gather information necessary to verify that all plants remain in compliance with NRC subcriticality requirements. The NRC does not believe this to be an immediate safety concern, but the multiple instances of operating experience identified in recent years related to previously unidentified degradation of neutron-absorbing materials in spent fuel pools (as discussed in the **Operating Experience** section) leads the NRC to be concerned about the potential for more compliance problems.

Therefore, the generic letter process is an appropriate resolution strategy (as opposed to issuing a Bulletin, which is used when there is an immediate safety issue). The NRC staff presented this generic letter and supporting documentation to ACRS for review, and its final recommendation supports the staff's position that this generic letter should be issued to all licensees. No change was made to the final generic letter as a result of this comment.

**IV. Scope of Information Request**

*Comment: The NRC has published significant evaluations of some existing neutron-absorbing materials, so there does not appear to be a need for some of the information included in Appendix A. [NET-4]*

NRC Response: The NRC staff disagrees with this comment. While the NRC does have information on neutron-absorbing material, including the nonmetallic materials mentioned, it does not have the site-specific information that is being requested. For each neutron-absorbing material, the NRC staff expects some information will be generally applicable from one site to another. However, the NRC staff also expects there to be degrees of variability for each neutron-absorbing material and application environment, such that the site-specific details could be important to tailoring a monitoring program to a given site. No change was made to the final generic letter as a result of this comment.

*Comment: Responding to Section 5 of Appendix A will require additional analyses and research. [NET-5]*

NRC Response: The NRC staff disagrees with this comment. The NRC approved final safety analysis reports and most license amendment requests based on an assumption that no neutron-absorbing degradation would occur. Over time, licensees updated their site-specific licensing bases as needed to address identified and projected degradation. The NRC staff recognizes the possibility that specific degradation mechanisms may accelerate during design-basis events, such as a seismic event, which may affect degradation projections. Consequently, the NRC is requesting information about how licensees currently account for this in their monitoring programs. If licensees do not currently incorporate such considerations in their monitoring program criteria, they may respond as such. No change was made to the final generic letter as a result of this comment.

*Comment: Providing the weight percent of neutron-absorbing material, as requested by item 1.b.i in Appendix A, is not necessary because it is redundant to providing the areal density and thickness as requested elsewhere in this Appendix. [NEI-18]*

NRC Response: The NRC staff disagrees with the comment. The material qualifications, as documented in accordance with the requirements of 10 CFR Part 50, Appendix B, Criterion XVII, may be recorded using different specifications. Each licensee should provide the information it has available. No change was made to this generic letter as a result of this comment.

*Comment: The minimum as-built and maximum as-built areal density values being requested in item 1.b.ii of Appendix A are not relevant to criticality safety. [NEI-19]*

NRC Response: The NRC staff disagrees with the comment. The minimum as-built and maximum as-built areal density values will provide the NRC staff with the range of as-built areal densities for the neutron-absorbing materials installed in the spent fuel pool. This would inform the NRC staff's determination of the applicability of the results from the monitoring program to the entire population of installed neutron-absorbing materials in the spent fuel pool. If such data is not available to a licensee, then it should state that it does not have sufficient records to provide a response to the question. No change was made to this generic letter as a result of this comment.

*Comment: Material characteristics such as porosity and density are not relevant to the safety issue under consideration. [NEI-20]*

NRC Response: The NRC staff disagrees with the comment. Physical characteristics such as porosity and density may affect the degradation mechanism of the material, which could, in turn, result in the need to enhance the surveillance program. For instance, Boral® material with higher porosity has been shown to be more susceptible to blistering. If such data is not available to a licensee, then it should state that it does not have sufficient records to provide a response to the question. No change was made to the generic letter as a result of this comment.

*Comment: The qualification testing approach for new materials are typically provided and approved by the NRC during the first application for the use of a new neutron-absorbing material. It would be redundant to request each individual licensee to provide this information,*

*as well as imposing a significant burden on licensees who relied on prior precedent rather than submitting their own qualification testing data. Elimination of the request for information related to qualification testing approaches is recommended. [NEI-21]*

NRC Response: The NRC staff disagrees with the comment. If a licensee relied on prior NRC approval, it may state as such in its response to this generic letter, by identifying the specific NRC approval. Information gathered from qualification testing will provide the NRC insight on the design and construction criteria used in approving the material for use. This information will be used to evaluate intended performance and disposition of potential degradation mechanisms by performing a comprehensive review of the qualification test results. No change was made to the generic letter as a result of this comment.

*Comment: The information being requested in items 2.a and 2.b of Appendix A goes well beyond what has been requested by the NRC during review and approval of new fuel storage rack submittals. If this information was not requested or required in order to support making a safety determination on a licensee submittal, then the NRC should justify that this information meets the criteria in 10 CFR 50.54(f) for sufficient safety significance to justify the burden imposed on the respondents. [NEI-26]*

NRC Response: The NRC staff disagrees with the comment. The information requested forms the essential elements of a program that the NRC staff reviews for any license amendment, to verify compliance with 10 CFR Part 50, Appendix B, Section XI, "Test Control."

The questions listed in the generic letter mirror the program elements described in NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," aging management programs XI.M22 and XI.M40. The NRC bases its judgment of neutron absorber surveillance programs on the technical basis for the surveillance or monitoring method to confirm that the neutron-absorbing material is performing its intended function. All of the information requested in Item 2.a and 2.b form the technical basis and justification for the program. Certain subitems are focused on specific surveillance methods and need only be addressed by licensees using those methods. No change was made to the generic letter as a result of this comment.

*Comment: Item 2.b.iv.3 of Appendix A requires licensees to address uncertainties from an NRC Technical Letter Report regarding the BADGER methodology. The bases for this report are outdated and inaccurate, and it would be inappropriate to require licensees to address apparent concerns that were identified based on assumptions which are not correct. [NEI-27]*

NRC Response: The NRC staff disagrees with this comment. The NRC has reviewed the results of BADGER test campaigns, observed BADGER testing at licensee facilities, and published an independent evaluation of the tool in a technical letter report (ADAMS Accession No. ML12254A064). If a licensee relies on BADGER tests to demonstrate compliance, the uncertainties associated with the BADGER tool should be addressed to ensure that adequate margin exists for licensees' criticality analyses.

The degradation of neutron-absorbing materials in spent fuel pools has prompted the NRC to undertake a review of the tools and methods used by the industry to ascertain the condition of panels. Nuclear criticality safety analyses submitted to support spent fuel pool license amendment requests over the past nine years suggest that the subcriticality margins that existed when neutron absorbers were first installed have decreased. Therefore, NRC requests information regarding the licensees' approach in addressing BADGER measurement uncertainties. The information being requested by the NRC in the generic letter is intended to

verify the continuing validity of the prior licensee documentation supporting the acceptability of the neutron-absorbing materials in spent fuel pools and other wet locations. No change was made to the generic letter as a result of this comment.

*Comment: This comment was made in reference to item 3 in the Appendix. Most licensees established the technical basis for the type and frequency of coupon testing or in-situ testing through discussions with the NRC based on past experience, recent observations, and expected future performance. Many licensees [who] use Boral® do not currently have a coupon testing program, based on prior NRC positions provided to the industry. (The licensee included references to two letters, dated 1995 and 2003, addressed from NRC staffers to industry representatives, explaining that the NRC does not have a formal surveillance requirement for Boral®.) [NEI-28]*

NRC Response: The NRC staff interprets this comment to imply that licensees who credit Boral® in their spent fuel pools do not need to maintain a monitoring program. The NRC staff disagrees with this comment. The two letters provided as references in the NEI letter state that the NRC has no specific requirement for in-service monitoring of Boral® in spent fuel pools. However, these letters did not exempt licensees from the requirement to demonstrate compliance with NRC subcriticality regulations. Operating experience in the past decade (i.e., Information Notice (IN) 09-26, "Degradation of Neutron-Absorbing Materials in the Spent Fuel Pool") has identified potential aging-related problems with neutron-absorbing materials other than Boraflex. Guidance related to non-Boraflex monitoring programs was incorporated in the GALL Report as acceptable approaches for aging management. Although there is still no formal NRC requirement for a specific type of coupon-testing program for Boral®, licensees still need to demonstrate compliance with the requirements. The NRC expects licensees to have a technical basis for the continued validity of their existing determinations that they (or their suppliers and contractors) are prepared to demonstrate the acceptability of the credited neutron-absorbing materials. No change was made to the generic letter as a result of this comment.

*Comment: This comment was made in reference to item 4.a in Appendix A. New spent fuel storage rack applications have always assumed that there is no degradation in any neutron-absorbing material. As degradation or deformation has been identified, the issues have been evaluated and addressed under 10 CFR 50.59, evaluated as a degraded or nonconforming condition, or led to submittal of a new License Amendment Request to address the change in material properties. This includes licensees who take partial credit for Boraflex. [NEI-29]*

NRC Response: The NRC staff interprets this comment as an attempt to provide a general response to the item, removing the need for inclusion in the generic letter. The NRC staff disagrees with this comment. To determine if the monitoring program demonstrates that any degradation is adequately bounded by the licensing basis, the NRC staff needs to understand how any degradation has been modeled in the criticality analysis of record. This provides context and applicability for the information provided in Item 4.b. If a licensee has already provided this information as part of its last approved license amendment request submittal and the information remains accurate, then they may reference it. Degradation or deformation of borated stainless steel and metallic matrix composites that is expected to have an impact on criticality has not yet been identified, so the tiered approach that was incorporated in the final generic letter does not require licensees crediting such materials to respond to this item.

*Comment: This comment was made in reference to item 4.c in Appendix A. The NRC has not previously required the bias and uncertainty of the monitoring program to be propagated in the spent fuel pool criticality analysis. For the most part, monitoring programs are designed to verify*

*that there has not been a loss of neutron-absorbing material, i.e., a verification of the as-manufactured neutron-absorber density. [NEI-30]*

NRC Response: The NRC staff interprets this comment as a suggestion to remove this item. The NRC staff disagrees with the comment. In response to this generic letter, licensees may respond, if appropriate, by stating that they are not propagating the bias and uncertainty of the monitoring program in their spent fuel pool criticality analysis. The NRC has identified areas of limited knowledge with respect to potential sources of uncertainty or nonconservatism in the use of monitoring programs to verify minimum acceptable performance standards for the neutron-absorbing material that correspond to the bounding parameters in the spent fuel pool criticality analysis. Degradation or deformation of borated stainless steel and metallic matrix composites that is expected to have an impact on criticality has not yet been identified, so the tiered approach that was incorporated in the final generic letter does not require licensees crediting such materials to respond to this item.

*Comment: This comment was made in reference to item 5.b in Appendix A. It is not the intent of the monitoring program to "ensure that the current material condition of the neutron-absorbing material will withstand the effects during a design-basis event and remain within the assumptions." The purpose of the program is to determine the behavior of the in-service neutron absorbing material. Any adverse conditions will be addressed by existing licensee processes to ensure that the neutron-absorbing material can continue to perform its intended function. [NEI-32]*

NRC Response: The NRC staff agrees with the comment in that a monitoring program cannot "ensure" the neutron-absorbing material will perform its function during and following a design-basis event. However, the licensee needs to have reasonable assurance that the neutron-absorbing material will perform its function during and following a design-basis event. A design-basis event will likely place additional stressors on the neutron-absorbing material. For there to be reasonable assurance that the neutron-absorbing material can accommodate those stressors and perform its function, the monitoring program should consider those stressors when establishing the appropriate tests and acceptance criteria. The generic letter was changed to replace the "…withstand the effects…" wording with "…accommodate the stressors…" to clarify the intent of the monitoring program.

*Comment: If this generic letter is issued, then licensees [who] do not use neutron-absorbing materials to meet NRC requirements or have addressed aging management through the license renewal process, should be exempted from responding to this generic letter. [STA-2]*

NRC Response: The NRC staff agrees with this comment, to the extent that it is unnecessary for licensees who meet the above conditions to provide a lengthy response to this generic letter. Licensees who do not credit neutron-absorbing materials may provide a simple response indicating that the generic letter does not apply to them. Licensees who have previously addressed these issues through prior license amendments or license renewal applications may reference the approved request in their response to this generic letter. However, licensees must still affirm that the information provided as part of the referenced license amendment request or license renewal application is still an accurate reflection of their current monitoring program. The final generic letter was changed to clarify the options for an acceptable response to this generic letter based on the current licensing basis for specific sites.

## V. Terminology/Editorial Recommendations

*Comment: The current minimum areal density of neutron-absorbing materials cannot be absolutely established. In item 1.e and 1.e.i of Appendix A, the NRC appears to be requesting the current areal density of every absorber panel in the spent fuel pool. This kind of information is not available and has never been required by the NRC. [NEI-11, NEI-23, NEI-25, DOM-15]*

NRC Response: The NRC staff agrees with this comment. The NRC's intent was for the licensee to provide the information that it is using to demonstrate continued compliance with the subcriticality requirements. The minimum areal density (or a correlated quantity) is typically one of the acceptance criteria of monitoring programs, so the NRC believes that licensees should be able to provide a current estimated value. The final generic letter was changed by revising the request for the "current minimum areal density" to refer to the "estimated current minimum areal density."

*Comment: The generic letter states that there are only two power reactors with several neutron-absorbing materials. In reality, there are many power reactors that have multiple neutron-absorbing materials. [NEI-13]*

NRC Response: The NRC staff agrees with the comment that there are more than two licensees who credit multiple neutron-absorbing materials in their spent fuel pools. However, based on this comment, the wording in the generic letter was not clear. The final generic letter was changed to use the phrase "more than two" instead of "several," and to refer to units rather than sites.

*Comment: The phrase "not limited to" is used in multiple places in Appendix A, and it is not clear what information the NRC is requesting. This type of open-ended terminology is open to interpretation and unclear, and should be removed. [NEI-16, DOM-13, DOM-14]*

NRC Response: The NRC staff agrees with the comment. The introduction to Appendix A already establishes that the enclosed list of items represents a minimum level of detail expected from licensees in their response to this generic letter. However, plant-specific licensing bases can vary significantly, so the NRC staff wanted to clarify that if the licensee identifies any additional information as being relevant to the regulatory compliance questions being asked, it should provide it as well. The generic letter was changed to remove the use of the phrase "…but not limited to", and to add a sentence to the beginning of Appendix A that clarifies that if an addressee has additional relevant information, it should provide it in its response.

*Comment: The phrase, "exposure of neutron-absorbing materials," as requested in item 1.d.ii of Appendix A, is not clear in its meaning. If this means radiation exposure, this cannot be determined without additional analysis. If it means time in the spent fuel pool, this can be determined from the date of installation, as provided elsewhere in Appendix A. [NEI-22]*

NRC Response: The NRC staff agrees with the comment. The phrase was intended to indicate the degree of exposure of the neutron-absorbing material to the spent fuel pool environment. Some neutron-absorbing materials are completely isolated from the spent fuel pool environment, while others are partially or completely exposed. The final generic letter has been changed to clarify that the information being requested is the degree of physical exposure of the neutron-absorbing materials to the spent fuel pool environment.

*Comment: Item 1.e.iii of Appendix A requests information on any recorded deformation and degradation. This request implies that it refers to panels that are in-service in the spent fuel pool. The common approved practice is to monitor coupons, not the actual in-service material. Clarify if this item was intended to apply only to recorded deformation and degradation observed from coupon-monitoring programs. [NEI-24, NEI-25]*

NRC Response: The NRC staff interprets this comment as a request to narrow the response to this item to focus on deformation and degradation identified as part of a coupon-monitoring program. The NRC staff disagrees with this recommendation. Item 1.e.iii is a general request for any recorded material or geometry changes identified by the licensee for neutron-absorbing material in the spent fuel pool. This may include results recorded as part of a coupon-monitoring program. However, sites also have recorded physical changes in neutron-absorbing panels that interfered with fuel assembly movement, deformations identified through visual inspections, and potential areal density changes as a result of in-situ measurements. No change was made to the generic letter as a result of this comment.

*Comment: The NRC has not defined what it means by "design-basis events" in item 5 of Appendix A. Please provide the specific design-basis events for which a technical basis should be provided. [NEI-31]*

NRC Response: The NRC staff interprets this comment as requesting clarification on what design-basis events would be considered to be relevant for this item. The NRC staff agrees with the comment. Typical design-basis events that may affect the neutron-absorbing material are: seismic events, loss of spent fuel pool cooling, and fuel assembly drop accidents. Design-basis events vary from site to site, so others may exist. Each licensee is responsible for identifying the plant-specific design-basis events that may affect neutron-absorbing materials. The final generic letter was changed to identify the above "typical" design-basis events and to state that any other plant-specific design-basis events that may affect the neutron-absorbing material as the events that should be considered when responding to these items.

*Comment: The generic letter cites 10 CFR 50.68 and General Design Criterion (GDC) 62 as the regulatory basis for NRC subcriticality requirements. Some plants are licensed under draft AEC GDCs, exemptions, and/or other equivalent regulatory criteria, not 10 CFR 50.68 and/or GDC 62. [DOM-2, DOM-7, SNC-8]*

NRC Response: The NRC staff agrees with the comment. As stated by the commenter, some plants are licensed under different, but equivalent, regulatory requirements to 10 CFR 50.68 and General Design Criterion 62. The final generic letter was changed to include a reference to "equivalent regulatory criteria" when 10 CFR 50.68 and GDC 62 are cited as the applicable regulations.

*Comment: There are several instances in the generic letter where the terms "safety function," "intended function," "design function," and other similar terminology is used to describe the neutron-absorbing function of the neutron-absorbing material. These terms are not defined terms, or are defined in other regulations in a way that does not apply to neutron-absorbing materials. Consistent use of the term "design-basis function" should be used instead. [DOM-3, DOM-4, DOM-5, DOM-6, DOM-8, DOM-9, DOM-11, DOM-16, DOM-17]*

NRC Response: The NRC staff agrees with the comment for the use of consistent terminology. The final generic letter has been changed to substitute "safety function" for all instances where "safety function," "intended function," "design function," or other similar terminology was used.

*Comment: On page 9 [of the draft generic letter], the generic letter discusses safety-related structures, systems, and components being used to maintain adequate cooling of the fuel. Some facility licensing bases do not credit or require "safety-related" structures, systems, or components to maintain adequate cooling of fuel in the spent fuel pool. The wording should be changed to reference "credited" structures, systems, or components instead. [DOM-10]*

NRC Response: The NRC staff agrees with this comment. The term "safety related" is defined in 10 CFR 50.2. The structures, systems, or components that bear primary responsibility for providing spent fuel pool cooling do not always fit within this definition. The final generic letter has been changed to refer to structures, systems, or components "credited" for spent fuel pool cooling.

*Comment: Items 5.a and 5.b of Appendix A request licensees to provide the technical basis for how their monitoring programs consider the performance of neutron-absorbing material during design-basis events. The phrasing of the request seems to imply that this request is intended to cover all neutron-absorbing material, not just the materials that are included in the licensing basis for criticality control. [DOM-18, DOM-19]*

NRC Response: The NRC staff interprets this comment as a recommendation to clarify the wording of the generic letter to make sure that it is only applicable to neutron-absorbing material being credited in meeting NRC subcriticality requirements. The NRC staff agrees with the comment. Any required response to this question should only pertain to material for which the safety function is to suppress a nuclear chain reaction in the spent fuel pool. The final generic letter has been changed to clarify that all items only apply to credited neutron-absorbing materials.

*Comment: The first item in the PURPOSE section should be revised due to confusing punctuation. [SNC-7]*

NRC Response: The NRC staff agrees with the comment. The final generic letter has been changed to clarify the punctuation, as suggested by the commenter.

*Comment: The generic letter is not clear regarding the intended function of Appendix A. The NRC should clarify if the information being requested in Appendix A is optional or required. [FPL-1]*

NRC Response: The NRC staff agrees with the comment. The text on page 7 of the draft generic letter and the text at the beginning of Appendix A give different impressions of whether the information request in Appendix A is required or optional. The NRC staff intended for Appendix A to provide guidance on what the NRC staff expects to see in licensee responses falling in Category 4 of the GL, and describes the level of detail of information that should be provided for each type of neutron-absorbing material. The final generic letter was changed to state that Appendix A describes information that should be included in the response.

## VI. Other Comments

*Comment: The generic letter treats all neutron-absorbing materials equally and applies the term "degradation" to cover a variety of observed conditions, including general corrosion, blistering, and deformation, without regard to how the mechanism may or may not affect neutron-absorption properties. The generic letter should discuss how each mechanism could lead to loss of neutron absorption and include the fact that the industry has monitoring programs in place. [NEI-17]*

NRC Response: The NRC staff disagrees with the comment. Any degradation or change in material properties or geometry represents a potential impact on its neutron absorption properties. For this reason, any degradation needs to be identified and assessed for any potential impact on the safety function of the neutron-absorbing material. These types of assessments form part of the technical basis of the monitoring programs' demonstration of continued regulatory compliance. The NRC staff does recognize that the known safety concerns and current operating experience vary for different materials, so a tiered approach was incorporated that considers these factors in the required level of detail in the response from specific licensees to this generic letter.

As for monitoring programs in use, the **Operating Experience** section of the generic letter provides several examples where existing programs failed to adequately manage the material condition. In addition, the technical letter reports (ADAMS Accession Nos. ML12216A307, ML12254A064, and ML13141A182) identify uncertainties with current testing and modeling methods that licensees have been asked to address in their generic letter responses. No change was made to the generic letter as a result of this comment, other than implementation of a tiered approach in the scope of the required response, based on material types, as recommended by ACRS.

*Comment: This public comment provides a 5-page discussion on the use of gamma radiation detectors installed in spent fuel pools to detect radiation being emitted by spent fuel. The paper discusses several areas where gamma radiation monitoring in spent fuel pools would be of potential use, such as neutron-absorbing material monitoring, monitoring of spent fuel pool water level, and measuring spent fuel burnup profiles. The section directly applicable to the topic of this generic letter discusses how any local increase in potential reactivity would result in added fission and capture radiation. This would then be observed as changes in the gamma radiation detected by the proposed monitoring system. [NAC-1]*

NRC Response: The NRC staff interprets this comment to suggest that gamma radiation detectors should be used to monitor neutron-absorbing materials. The NRC staff takes no position on this issue, since the NRC does not require that licensees adopt specific approaches for monitoring neutron-absorbing material. This generic letter is requesting information from the addressees to allow the NRC to determine how they are currently meeting the regulatory requirements. The NRC is not requiring or suggesting a specific approach for licensees to comply with NRC subcriticality requirements. No change was made in the final generic letter as a result of this comment.