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U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Clinton Power Station, Unit 1
Facility Operating License No. NPF-62
NRC Docket No. 50-461

Subject: Supplemental Safety Analysis Report Information Supporting the Request for a License Amendment to Modify Clinton Power Station Facility Operating License in Support of the Use of Isotope Test Assemblies

Reference: Letter from Mr. Jeffrey L. Hansen (Exelon Generation Company, LLC) to U. S. NRC, "License Amendment Request to Modify Clinton Power Station Facility Operating License in Support of the Use of Isotope Test Assemblies," dated June 26, 2009

In the Referenced letter, Exelon Generation Company, LLC (EGC) requested an amendment to the facility operating license for Clinton Power Station (CPS), Unit 1. Specifically, the proposed change would modify CPS License Condition 2.B.(6) and create new License Conditions 1.J and 2.B.(7) as part of a pilot program to irradiate cobalt (Co)-59 targets to produce Co-60. In addition to the proposed license condition changes, EGC also requests an amendment to Appendix A, Technical Specifications (TS), of the CPS Facility Operating License. This proposed change would modify TS 4.2.1, "Fuel Assemblies," to describe the Isotope Test Assemblies (ITAs) being used.

Attachment 3 to the referenced letter provided GE – Hitachi Nuclear Energy Americas, LLC (GEH) Report NEDC-33505P, "Safety Analysis to Support Introduction of GE14i Isotope Test Assemblies (ITAs) in Clinton Power Station," dated June 2009. This report provides a description of the ITAs (i.e., GE14i), as well as, descriptions of the nuclear core design and applicability of nuclear and safety analysis methods. NEDC-33505P also contains details relative to the licensing evaluations that were performed by Global Nuclear Fuel – Americas, LLC (GNF) and GEH in support of the introduction of these new fuel assemblies to the CPS core. A non-proprietary version of the GEH Report (i.e., NEDO-33505) was provided in Attachment 4 to the referenced letter.

Attachment 1 to this letter provides an errata and addenda sheet for NEDC-33505P and the associated revised pages documenting a number of corrections and additions to this document. The information in NEDC-33505P is being revised to document that the

description of the power peaking suppression analysis was modified to indicate that the analysis is based on the final bundle design. The analysis did confirm that adequate design margins for the ITAs were maintained. There were also a number of editorial changes made to clarify certain information, correct spelling errors, and make necessary changes to the use of certain terms to provide clarity and consistency. The revisions to these pages are indicated by sidebar markings in the right margin.

GEH considers NEDC-33505P, as well as the revised pages provided in Attachment 1 to this letter, to contain proprietary information. The proprietary information is identified by bracketed text. GEH requests that the proprietary information in Attachment 1 be withheld from public disclosure, in accordance with the requirements of 10 CFR 2.390, "Public inspections, exemptions, requests for withholding," paragraph (a)(4). A signed affidavit supporting this request is provided in Attachment 2 to this letter. Attachment 3 to this letter provides a non-proprietary version of the revised pages to GEH Report NEDO-33505.

EGC has reviewed the information supporting a finding of no significant hazards consideration previously provided to the NRC. The additional information provided in this submittal does not affect the bases for concluding that the proposed license amendment does not involve a significant hazards consideration. No new regulatory commitments are established by this submittal.

If you have any questions concerning this letter, please contact Mr. Timothy A. Byam at (630) 657-2804.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 9th day of December 2009.

Respectfully,

Jeffrey L. Hansen
Manager – Licensing
Exelon Generation Company, LLC

Attachments:

Attachment 1:	GEH Report NEDC-33505P, "Safety Analysis to Support Introduction of GE14i Isotope Test Assemblies (ITAs) in Clinton Power Station," Errata and Addenda, E&A Number 1, dated December 4, 2009 (Proprietary)
Attachment 2:	GEH Affidavit for Withholding Errata and Addenda Number 1 for NEDC-33505P from Public Disclosure
Attachment 3:	GEH Report NEDO-33505, "Safety Analysis to Support Introduction of GE14i Isotope Test Assemblies (ITAs) in Clinton Power Station," Errata and Addenda , E&A Number 1, dated December 4, 2009 (Non-Proprietary)

ATTACHMENT 2

GEH Affidavit for Withholding Errata and Addenda Number 1
for NEDC-33505P from Public Disclosure

GE-Hitachi Nuclear Energy Americas LLC

AFFIDAVIT

I, **James F. Harrison,** state as follows:

(1) I am Vice President, Fuel Licensing, Regulatory Affairs, GE-Hitachi Nuclear Energy Americas LLC ("GEH"). I have been delegated the function of reviewing the information described in paragraph (2) which is sought to be withheld, and have been authorized to apply for its withholding.

(2) The information sought to be withheld is contained in Errata and Addenda Sheet, E&A Number 1 to NEDC-33505P, *Safety Analysis Report to Support Introduction of GE14i Isotope Test Assemblies (ITAs) in Clinton Power Station*, Revision 0, dated December 4, 2009. The proprietary information in E&A Number 1 to NEDC-33505P, *Safety Analysis Report to Support Introduction of GE14i Isotope Test Assemblies (ITAs) in Clinton Power Station*, Revision 0, dated December 4, 2009, is identified by a [[dotted underline inside double square brackets$^{(3)}$]]. In each case, the superscript notation $^{(3)}$ refers to Paragraph (3) of this affidavit, which provides the basis for the proprietary determination.

(3) In making this application for withholding of proprietary information of which it is the owner or licensee, GEH relies upon the exemption from disclosure set forth in the Freedom of Information Act ("FOIA"), 5 USC Sec. 552(b)(4), and the Trade Secrets Act, 18 USC Sec. 1905, and NRC regulations 10 CFR 9.17(a)(4), and 2.390(a)(4) for "trade secrets" (Exemption 4). The material for which exemption from disclosure is here sought also qualify under the narrower definition of "trade secret", within the meanings assigned to those terms for purposes of FOIA Exemption 4 in, respectively, Critical Mass Energy Project v. Nuclear Regulatory Commission, 975F2d871 (DC Cir. 1992), and Public Citizen Health Research Group v. FDA, 704F2d1280 (DC Cir. 1983).

(4) Some examples of categories of information which fit into the definition of proprietary information are:

a. Information that discloses a process, method, or apparatus, including supporting data and analyses, where prevention of its use by GEH's competitors without license from GEH constitutes a competitive economic advantage over other companies;

b. Information which, if used by a competitor, would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product;

c. Information which reveals aspects of past, present, or future GEH customer-funded development plans and programs, resulting in potential products to GEH;

d. Information which discloses patentable subject matter for which it may be desirable to obtain patent protection.

The information sought to be withheld is considered to be proprietary for the reasons set forth in paragraphs (4)a. and (4)b. above.

(5) To address 10 CFR 2.390(b)(4), the information sought to be withheld is being submitted to NRC in confidence. The information is of a sort customarily held in confidence by GEH, and is in fact so held. The information sought to be withheld has, to the best of my knowledge and belief, consistently been held in confidence by GEH, no public disclosure has been made, and it is not available in public sources. All disclosures to third parties, including any required transmittals to NRC, have been made, or must be made, pursuant to regulatory provisions or proprietary agreements which provide for maintenance of the information in confidence. Its initial designation as proprietary information, and the subsequent steps taken to prevent its unauthorized disclosure, are as set forth in paragraphs (6) and (7) following.

(6) Initial approval of proprietary treatment of a document is made by the manager of the originating component, the person most likely to be acquainted with the value and sensitivity of the information in relation to industry knowledge, or subject to the terms under which it was licensed to GEH. Access to such documents within GEH is limited on a "need to know" basis.

(7) The procedure for approval of external release of such a document typically requires review by the staff manager, project manager, principal scientist, or other equivalent authority for technical content, competitive effect, and determination of the accuracy of the proprietary designation. Disclosures outside GEH are limited to regulatory bodies, customers, and potential customers, and their agents, suppliers, and licensees, and others with a legitimate need for the information, and then only in accordance with appropriate regulatory provisions or proprietary agreements.

(8) The information identified in paragraph (2), above, is classified as proprietary because it contains detailed results including the process and methodology for the design and analysis of the GE14i Isotope Test Assembly. The GE14i Isotope Test Assembly has been developed at a significant cost to GEH.

The development of the GE14i Isotope Test Assembly is derived from the extensive experience database that constitutes a major GEH asset.

(9) Public disclosure of the information sought to be withheld is likely to cause substantial harm to GEH's competitive position and foreclose or reduce the availability of profit-making opportunities. The information is part of GEH's comprehensive BWR safety and technology base, and its commercial value extends beyond the original development cost. The value of the technology base goes beyond the extensive physical database and analytical methodology and includes development of the expertise to determine and apply the appropriate evaluation process. In addition, the technology base includes the value derived from providing analyses done with NRC-approved methods.

GE-Hitachi Nuclear Energy Americas LLC

The research, development, engineering, analytical and NRC review costs comprise a substantial investment of time and money by GEH.

The precise value of the expertise to devise an evaluation process and apply the correct analytical methodology is difficult to quantify, but it clearly is substantial.

GEH's competitive advantage will be lost if its competitors are able to use the results of the GEH experience to normalize or verify their own process or if they are able to claim an equivalent understanding by demonstrating that they can arrive at the same or similar conclusions.

The value of this information to GEH would be lost if the information were disclosed to the public. Making such information available to competitors without their having been required to undertake a similar expenditure of resources would unfairly provide competitors with a windfall, and deprive GEH of the opportunity to exercise its competitive advantage to seek an adequate return on its large investment in developing and obtaining these very valuable analytical tools.

I declare under penalty of perjury that the foregoing affidavit and the matters stated therein are true and correct to the best of my knowledge, information, and belief.

Executed on this 4th day of December 2009.

James F. Harrison
Vice President, Fuel Licensing, Regulatory Affairs
GE-Hitachi Nuclear Energy Americas LLC

ATTACHMENT 3

GEH Report NEDO-33505, "Safety Analysis to Support Introduction of GE14i Isotope Test Assemblies (ITAs) in Clinton Power Station," Errata and Addenda, E&A Number 1, dated December 4, 2009 (Non-Proprietary)

HITACHI GE Hitachi Nuclear Energy

Errata and Addenda Sheet

Applicable to: Clinton Power Station (CPS) **E&A Number 1**

Publication No.: NEDC-33505P Revision 0 **Date:** December 4, 2009
NEDO-33505 Revision 0

Title: Safety Analysis Report to Support Introduction of GE14i Isotope Test Assemblies (ITAs) in Clinton Power Station

Issue Date: June 2009

Note: The corrected pages for the NEDC document are followed by the corrected pages for the NEDO document.

Item	(Section, Page Paragraph, Line)	Corrections And Additions (Supplied As Replacement Pages)
1.	Section 2.1 Page 4	Corrected the spelling of the connector material name in two places.
2.	Section 3.2.1.3 Page 21	Modified for power peaking suppression analysis using the final bundle design. Confirmed adequate design margins for ITA were maintained.
3.	Section 3.3 Page 24	Corrected 'cobalt isotope rod(s)' to 'target rod(s)'. The term 'target rod' in the text does not mean 'cobalt target' but rather a rod with the highest R-factor. So, the term 'target rods' should be used in this instance in lieu of 'cobalt isotope rods'.
4.	Section 3.3 Page 24	Clarified that target rods are the highest R-factor rods by adding a comma before and after 'the highest R-factor rods' and deleting the word 'or' before 'the highest R-factor rods'. Correction made in 2 places on this page.
5.	Figure 3-4 Page 32	Consistent with modifications in Section 3.2.1.3, replaced the existing figure with a figure providing the power spike in fuel rods adjacent to cobalt rod connectors at 00% in-channel void fraction.
6.	Section 4.7.1 Page 58	Corrected the 5th paragraph to use the term 'energy deposition rate' in lieu of 'incident radiation'. Although the terms are closely related, 'energy deposition rate' is more correct.
7.	Section 4.7.1 Page 58	Corrected the 6th paragraph to use the term 'integrated dose' in lieu of 'gamma heating'.

3.2.1.3 ITA Margin Considerations

For the CPS ITA design, additional margins will be applied to the Linear Heat Generation Rate limit and the cell Shutdown Margin Limit. The need for these additional margins stems from the use of Zircaloy-2 connector sections in the cobalt isotope rods. The neutron absorption cross section of the connector section is lower than the neutron absorption cross section of the cobalt bearing section. This is typical of segmented rod applications.

The connector/spacer zones will not be modeled in the 3-dimensional simulator PANAC11 in the CPS ITA program. However, 2 and 3 dimensional modeling of the connector/spacer zones was performed as part of design studies to determine the appropriate assumptions to accommodate cobalt isotope rod geometric modeling assumptions. The 2-dimensional models were evaluated with TGBLA06 and the 3-dimensional models were evaluated with PANAC11 and MCNP-05.

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The lower absorption cross section of the connector zone increases the reactivity of this section relative to the cobalt isotope bearing zone. This will potentially reduce the shutdown margin in the control rod cell that contains the GE14i bundle. An additional [[ ]] Δk shutdown margin in the control rod cell containing the GE14i bundle will provide the necessary margin to accommodate this geometric modeling assumption. This additional margin was determined by explicitly modeling all axial zones (connector and cobalt) in a GE14i bundle with PANAC11 and evaluating the change in control rod worth of control blades adjacent to the GE14i bundles. This evaluation was performed over the complete CPS Cycle 12 operation.

The measure of the capability of a boiling transition prediction correlation is its ability to predict the test data. The GEXL14 correlation has been demonstrated to be an accurate predictor of the GE14 fuel for wide ranges of fluid conditions, a number of different rod-to-rod power distributions, and different axial power shapes as provided in Reference 6.

The GE14i ITAs are identical to the GE14 fuel bundles except for the cobalt isotope rods in GE14i. Due to the similarity between GE14i and GE14, the GEXL14 correlation can be applied to the GE14i ITAs. The applicability of the GEXL14 correlation to the GE14i ITAs is demonstrated by comparing the GEXL14 prediction to the critical power data with zero-power rods in the GE14 bundle.

Full-scale critical power and pressure drop testing for a simulated GE14 fuel bundle was performed in the Stern Laboratories test facility in Hamilton, Ontario. As a part of the Stern testing for the GE14 fuel, critical power data was collected with zero-power rods and [[ ]] Four different rod-to-rod power distributions were tested for a wide range of inlet flow and inlet subcooling conditions at pressure of 1000 psia. The rod-to-rod power distributions or local peaking patterns tested with zero-power rods at Stern Laboratories are presented in Figure 3-5, where target rod(s), the highest R-factor rod(s), of each pattern were identified with a green background color. The peaking patterns J1/J2/J3 have [[ ]] zero-power rods and pattern D0xx has [[ ]] zero-power rods. Mass flux and inlet subcooling conditions are plotted in Figure 3-6. Typical bundle axial power shape is presented in Figure 3-7. The Stern Laboratories test assembly characteristics are provided in Reference 6.

A statistical analysis was performed for the GE14 database with zero-power rods consisting of [[ ]] data points obtained from the Stern test assembly. To facilitate the statistical evaluation of the predictive capability of the GEXL14 correlation, the concept of an experimental critical power ratio (ECPR) is used.

The ECPR is determined from the following relationship:

ECPR = (Predicted Critical Power)/(Measured Critical Power)

A summary of the ECPR statistics is provided in Table 3-5 and the predicted critical powers are compared to the measured critical power in Figure 3-8. It is shown from the mean ECPR that the GEXL14 correlation conservatively predicts the critical power data with zero-power rods. [[

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Figure 3-4 Power Spike in Fuel Rods Adjacent to Cobalt Rod Connectors at 00% In-Channel Void Fraction

all GE14 fuel. The current heat load calculated for refueling conditions from CPS calculation 01FC25 is 41.2 MBTU/hr, representing a margin of approximately 3% under the worst case FPCC system heat removal capacity of 42.54 MBTU/hr. Adding [[
]] The small amount of extra heat added by the cobalt isotope rods poses no additional risk of spent fuel pool local boiling over that previously analyzed.

The gamma radiation effect on the spent fuel pool walls was evaluated for the case that the GE14i bundle is placed 1, 4, and 6 feet from the pool wall. In the GE14i analysis, no credit was taken for shielding provided by the spent fuel and racks in the outer rows, however, water and self-shielding were credited.

Significant concrete heating due to gamma radiation begins at 1E+10 MeV/cm^2/sec. The maximum energy deposition rate due to a GE14i bundle placed one foot from the spent fuel pool walls is approximately 7.2E+10 MeV/cm^2/sec, so concrete heating due to gamma would be significant. At 4 feet, the energy deposition rate is 1.4E+8 MeV/cm^2/sec, well below that required to cause significant concrete heating.

Long-term concrete degradation begins with a total integrated gamma dose of approximately 1E+10 R. The total integrated dose from a GE14i assembly left in the spent fuel pool, one foot from the side, after 3 years is less than 3.65E+9 R, without taking into account any decay of the Co-60 or fission products. Therefore, there is no restriction on the amount of time a GE14i bundle can be stored in the Spent Fuel Pool (SFP), provided the bundle is stored at least one foot from the pool wall to avoid integrated dose effects. Note that the four foot limit for gamma heating will be more limiting for storage locations.

Per CPS Reactor Engineering, procedures exist to guide placement of irradiated fuel bundles in the SFP to avoid gamma heating of the wall concrete. These procedures should be modified to specify that the GE14i bundles be stored at least 4 feet from the pool walls. With the 4 foot distance requirement in effect, there is no limitation on the amount of time a GE14i bundle may remain in the pool.

The GE14i rods are clad with the same material as the GE14 rods so that there will be no appreciable difference in the corrosion products from GE14i versus GE14. Therefore, there will be no adverse effect on the cleanup portion of the FPCC system.

4.7.2 Post-Irradiation Handling

4.7.2.1 Post Irradiation Bundle Disassembly Timing

To reduce impact on plant outage planning and operations, normal cobalt isotope rod extraction will occur as post-outage activities after a fuel assembly's end of life (EOL). The cobalt isotope rods will be removed from the discharged GE14i fuel assembly and replaced