AREVA

March 1, 2013
NRC:13:010

Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Response to U.S. EPR Design Certification Application RAI 513, Supplement 11

In Reference 1, the NRC provided a request for additional information (RAI) regarding the U.S. EPR design certification application. To address NRC Staff supplemental comments concerning the Response to Question 09.01.01-53, and to fulfill a commitment made in Supplement 9 of this response, a schedule for a revised final Response to Question 09.01.01-59, and a history of the prior supplemental responses was provided in Supplement 10 (Reference 2) on February 1, 2013.

The enclosure to this letter provides a revised final Response to Question 09.01.01-59. The enclosure also includes a red line-strikeout format of the affected pages of AREVA Technical Report TN-Rack.0101 (submitted in Reference 3), which support the Response to Question 09.01.01-59.

AREVA Transnuclear, Inc. has determined that some of the material contained in the enclosed response is proprietary. As required by 10 CFR 2.390(b), an affidavit is enclosed to support the withholding of the information from public disclosure. Proprietary and non-proprietary versions of the enclosure to this letter are provided.

The following table indicates the respective pages in the enclosure that contain the response provided by AREVA NP Inc. to the subject questions.

Question #	Start Page	End Page
RAI 513 — 09.01.01-59	2	3

The schedule for a final response to the remaining four questions is unchanged, as shown in the following table.

Question #	Response Date
RAI 513 — 09.01.01-58	June 28, 2013
RAI 513 — 09.01.01-61	June 28, 2013
RAI 513 — 09.01.01-62	June 28, 2013
RAI 513 — 09.01.04-20	July 30, 2013

AREVA NP INC.

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Tel.: 434 832-3000 - www.areva.com

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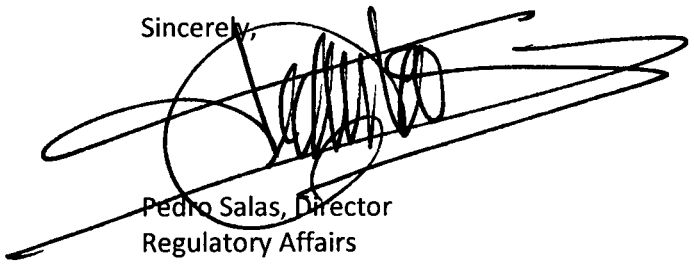
NRO

If you have any questions related to this information, please contact Len Gucwa by telephone at (434) 832-3466, or by e-mail at Len.Gucwa.ext@areva.com.

Sincerely,



Pedro Salas, Director
Regulatory Affairs
AREVA NP Inc.

Enclosures:

1. Proprietary Response to U.S. EPR Design Certification Application RAI 513, Supplement 11
2. Non-Proprietary Response to U.S. EPR Design Certification Application RAI 513, Supplement 11
3. Notarized Affidavit

cc: A. M. Snyder
Docket 52-020

References

Ref. 1: E-mail, Getachew Tesfaye (NRC) to Dennis Williford, et al (AREVA NP Inc.), "U.S. EPR Design Certification Application RAI No. 513 (5971,5040), FSAR Ch. 9," September 30, 2011.

Ref. 2: E-mail, Dennis Williford (AREVA NP Inc.) to Amy Snyder (NRC), "Response to U.S. EPR Design Certification Application RAI No. 513 (5971,5040), FSAR Ch. 9, Supplement 10," February 1, 2013.

Ref. 3: Letter, Sandra M. Sloan (AREVA NP Inc.) to Document Control Desk (NRC), "Submittal of AREVA Transnuclear Inc. Report TN-Rack.0101, 'U.S. EPR New and Spent Fuel Storage Rack Technical Report'," NRC:09:117, December 8, 2009.

AFFIDAVIT PURSUANT
TO 10 CFR 2.390

Transnuclear, Inc.)
State of Maryland) SS.
County of Howard)

I, Jayant Bondre, depose and say that I am the Chief Operating Officer of Transnuclear, Inc., duly authorized to execute this affidavit, and have reviewed or caused to have reviewed the information which is identified as proprietary and referenced in the paragraph immediately below. I am submitting this affidavit in conformance with the provisions of 10 CFR 2.390 of the Commission's regulations for withholding this information.

The information for which proprietary treatment is sought is listed below:

Portions of Transnuclear, Inc. document TN-Rack.0101, "U.S. EPR New and Spent Fuel Storage Rack Technical Report," Revision 1.

This document has been appropriately designated as proprietary.

I have personal knowledge of the criteria and procedures utilized by Transnuclear, Inc. in designating information as a trade secret, privileged or as confidential commercial or financial information.

Pursuant to the provisions of paragraph (b) (4) of Section 2.390 of the Commission's regulations, the following is furnished for consideration by the Commission in determining whether the information sought to be withheld from public disclosure, included in the above referenced document, should be withheld.

1) The information sought to be withheld from public disclosure involves details and analyses related to Transnuclear, Inc.'s design for new and spent fuel storage racks, which are owned and have been held in confidence by Transnuclear, Inc.

2) The information is of a type customarily held in confidence by Transnuclear, Inc. and not customarily disclosed to the public. Transnuclear, Inc. has a rational basis for determining the types of information customarily held in confidence by it.

3) Public disclosure of the information is likely to cause substantial harm to the competitive position of Transnuclear, Inc. because the information consists of details and analyses related to Transnuclear, Inc.'s design for new and spent fuel storage racks, the application of which provide a competitive economic advantage. The availability of such information to competitors would enable them to modify their product to better compete with Transnuclear, Inc., take marketing or other actions to improve their product's position or impair the position of Transnuclear, Inc.'s product, and avoid developing similar data and analyses in support of their processes, methods or apparatus.

Further the deponent sayeth not.

Jayant Bondre
Chief Operating Officer, Transnuclear, Inc.

Subscribed and sworn to me before this 28 day of February, 2013.

Notary Public

ZORA M. DOUGHERTY
NOTARY PUBLIC
My Commission Expires 10-17-2015
HOWARD COUNTY, MD

My Commission Expires 10 / 17 / 2015

AFFIDAVIT PURSUANT
TO 10 CFR 2.390

Transnuclear, Inc.)
State of Maryland) SS.
County of Howard)

I, Jayant Bondre, depose and say that I am a Vice President of Transnuclear, Inc., duly authorized to execute this affidavit, and have reviewed or caused to have reviewed the information which is identified as proprietary and referenced in the paragraph immediately below. I am submitting this affidavit in conformance with the provisions of 10 CFR 2.390 of the Commission's regulations for withholding this information.

The information for which proprietary treatment is sought is listed below:

1) Portions of Transnuclear, Inc. document TN-Rack.0101, "U.S. EPR New and Spent Fuel Storage Rack Technical Report," Revision 0

This document has been appropriately designated as proprietary.

I have personal knowledge of the criteria and procedures utilized by Transnuclear, Inc. in designating information as a proprietary trade secret, privileged or as confidential commercial or financial information.

Pursuant to the provisions of paragraph (b) (4) of Section 2.390 of the Commission's regulations, the following is furnished for consideration by the Commission in determining whether the information sought to be withheld from public disclosure, included in the above referenced documents, should be withheld.

1) The information sought to be withheld from public disclosure involves details and analyses related to Transnuclear, Inc.'s design for new and spent fuel storage racks, which are owned by Transnuclear, Inc. and other owners and have been held in confidence by Transnuclear, Inc.

2) The information is of a type customarily held in confidence by Transnuclear, Inc. and not customarily disclosed to the public. Transnuclear, Inc. has a rational basis for determining the types of information customarily held in confidence by it.

3) The information is being transmitted to the Commission in confidence under the provisions of 10 CFR 2.390 with the understanding that it is to be received in confidence by the Commission.

4) The information, to the best of my knowledge and belief, is not available in public sources, and any disclosure to third parties has been made pursuant to regulatory provisions or proprietary agreements which provide for maintenance of the information in confidence.

5) Public disclosure of the information is likely to cause substantial harm to the competitive position of Transnuclear, Inc. and to other owners of the information because:

   a) A similar product is manufactured and sold by competitors of Transnuclear, Inc.

   b) Development of this information by Transnuclear, Inc. and other owners of the information required expenditure of considerable resources. To the best of my

knowledge and belief, a competitor would have to undergo similar expense in generating equivalent information.

c) In order to acquire such information, a competitor would also require considerable time and inconvenience related to the development of a design and analysis of new and spent fuel storage racks.

d) The information required significant effort and expense to prepare this technical report for submittal to obtain the licensing approvals necessary for application of the information. Avoidance of this expense would decrease a competitor's cost in applying the information and marketing the product to which the information is applicable.

e) The information consists of details and analyses related to Transnuclear, Inc.'s design for new and spent fuel storage racks, the application of which provides a competitive economic advantage. The availability of such information to competitors would enable them to modify their product to unfairly get a better competitive position with Transnuclear, Inc., take marketing or other actions to improve their product's position or impair the position of Transnuclear, Inc.'s product, while avoiding the expense of developing similar data and analyses in support of their processes, methods or apparatus.

f) In pricing Transnuclear, Inc.'s products and services, significant research, development, engineering, analytical, licensing, quality assurance and other costs and expenses must be included. The ability of Transnuclear, Inc.'s competitors to utilize such information without similar expenditure of resources may enable them to sell at prices reflecting significantly lower costs.

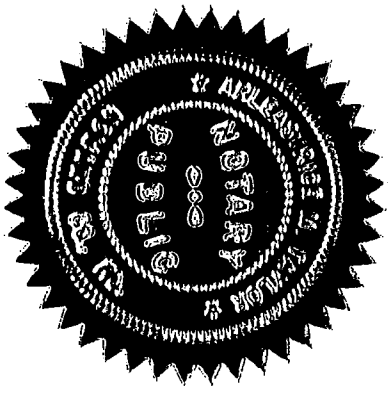
Further the deponent sayeth not.

Jayant Bondre
Vice President, Transnuclear, Inc.

Subscribed and sworn to me before this 16th day of November, 2009.

Notary Public

My Commission Expires 10/14/2012



Response to

Request for Additional Information No. 513(5971, 6040), Supplement 11

9/30/2011

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 09.01.01 - Criticality Safety of Fresh and Spent Fuel Storage and Handling
SRP Section: 09.01.04 - Light Load Handling System (Related to Refueling)

Application Section: 9.1 and Technical Report TN-Rack.0101, Rev 0

QUESTIONS for Reactor System, Nuclear Performance and Code Review (SRSB)
QUESTIONS for Balance of Plant Branch 1 (AP1000/EPR Projects) (SBPA)

Question 09.01.01-59:

OPEN ITEM

Follow-up to RAI 402, Question 09.01.01-44 (Issue #7)

In Issue #7 related to abnormal conditions; staff questioned the limiting abnormal condition identified by the applicant. The staff is concerned that it may be possible for an assembly to be in the new fuel elevator during the postulated scenario leading to the mislocation of an assembly outside of the storage racks in the limiting area. Verify that this scenario is not possible or provide an analysis that demonstrates that the minimum soluble boron requirement of 1100 ppm is unaffected by this scenario.

Response to Question 09.01.01-59:

This response supersedes the prior response provided in Supplement 7 in its entirety.

The new fuel elevator may contain a single fuel assembly during normal fuel handling operations. The accident analyses presented in AREVA Technical Report TN-Rack.0101, Section 5.4.4, will be revised to include the possibility of a fuel assembly located in the new fuel elevator as an initial condition of the postulated accidents. SCALE 4.4 is employed for criticality analyses. Evaluations include appropriate bias and uncertainty associated with manufacturing tolerances for the fuel handling accidents. AREVA Technical Report TN-Rack.0101, Table 5-28 (Part 3 of 3) will be revised to provide the results of analyses using SCALE 4.4. The worst-case scenario of a misloaded fresh fuel assembly (5 w/o U-235) outside the Region 2 racks, in combination with a fresh fuel assembly located in the new fuel elevator, is evaluated. The results demonstrate that 1100 ppm soluble boron is sufficient to maintain subcriticality for this postulated event. Table 5-33 and Figure 5-21 will be added to AREVA Technical Report TN-Rack.0101 to include the new scenario.

Outside the fuel storage racks, fuel assemblies may be located in the new fuel elevator, the fuel reconstitution facility, or the fuel transfer facility in the transfer pit. Each of these locations has the capacity to hold only one fuel assembly. Each location is sufficiently separated from the fuel storage racks to preclude neutronic coupling with fuel assemblies stored in the racks.

The additional postulated scenario includes a fuel assembly in the new fuel elevator and a second fuel assembly dropped against the new fuel elevator creating a two-assembly configuration outside the fuel storage racks. A criticality analysis has been performed to determine the reactivity effect of this configuration conservatively assuming that the fuel assemblies are spaced to maximize reactivity and ignoring any physical constraints due to the new fuel elevator design. Limiting fuel assembly parameters are employed for this purpose. The evaluation includes an uncertainty evaluation combining all fuel uncertainties (maximum fuel density, maximum pellet diameter, minimum outer clad, and maximum pitch). The results of this analysis demonstrates that the minimum soluble boron requirement of 1100 ppm is unaffected by this additional scenario. Table 5-34 and Figure 5-22 will be added to AREVA Technical Report TN-Rack.0101 to describe this additional scenario.

AREVA Technical Report TN-Rack.0101, Sections 5.5.2 and 5.6, will be revised to add a reference for the SCALE 5 computer code employed for benchmarking.

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

Technical Report Impact:

AREVA Technical Report TN-Rack.0101, Sections 5.4.4, 5.5.2, and 5.6 and Table 5-28 (Part 3 of 3) will be revised as described in the response and indicated on the enclosed markup. In addition, AREVA Technical Report TN-Rack.0101, Tables 5-33 and 5-34 and Figures 5-21 and 5-22 will be added as described in the response and indicated on the enclosed markup.

Technical Report
TN-Rack.0101
Markups

]

The various accident scenarios considered for Region 2 evaluations result in a significant change to the k_{eff} of the system and result in additional soluble boron requirements. The layout of the Region 2 modules in the spent fuel pool ensures that a fuel assembly cannot be accommodated in the space between the modules or the modules and the pool wall. This implies that *placement of fuel assemblies adjacent to the Region 2 racks is not credible, however, calculations are performed to determine the soluble boron concentration to mitigate the effect of* such accidental *configurations*. These scenarios are evaluated as follows:

- The case with the misloaded fuel considered the accidental misloading of a single fuel assembly with the highest allowable enrichment. An accidental misloading of a fresh fuel assembly with an enrichment of 5.00 wt. % U-235 is evaluated (Table 5-28 – Case ID # C16). Sensitivity calculations that determine the effect of the misloaded assembly position are also performed to determine the worst case k_{eff} (Table 5-28). *Additional sensitivity calculations are performed to determine the effect of the spacing between Region 2 racks and the misloaded fresh fuel assembly. The sensitivity study is shown on Table 5-28 (part 3/3).* Soluble boron requirements for the worst case are then determined.

- *The worst case scenario of a misload fuel assembly (fresh fuel 5.0 wt. % U-235 enrichment) outside Region 2 Racks is combined with a drop of a 5.0 wt. % enriched UO_2 fresh fuel assembly possibly present in the new fuel elevator. The dropped fuel assembly is placed diagonally next to the misload fuel assembly as shown in Figure 5-21. The results shown in Table 5-33 demonstrate that 1100 ppm pool boron water is required to ensure the subcriticality in the postulated event.*

- The worst case vertical accidental drop of the fuel assembly is modeled as a 5.00 wt. % fresh fuel assembly located at the inside corner of Region 2 racks located in the open space area where the fuel elevator is located, see Figure 5-5. [
  ] of the Region 2 rack modules at this location (Table 5-28 – Case # C17). *In addition, an evaluation was performed for accident drop of the fuel assembly outside of the Region 1 modules as shown in Figure 5-9. The results of these evaluations are shown as Case # C20 and #C21 (soluble boron requirements) and demonstrate that this configuration is bounded by that employed for Region 2 – Case # C16 and # C17.*

- *For completeness, the "Deep Drop in the Center" is also evaluated to determine the effect of the loss of fixed poison coverage of 3 inches at the bottom of the active fuel. The results are*

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also shown in Table 5-28 (Case # C22). Note that this configuration is bounded by the previous configuration evaluated in Case # C17 where the entire fuel assembly does not have fixed poison around it.

- The worst case horizontal accidental drop of the fuel assembly results in the fuel assembly being located at the top of the rack module supported by the top steel egg-crate section. This configuration results in the presence of at least [ ] inches of water between the fuel assemblies loaded in the cells and the "accidental" fuel assembly. [

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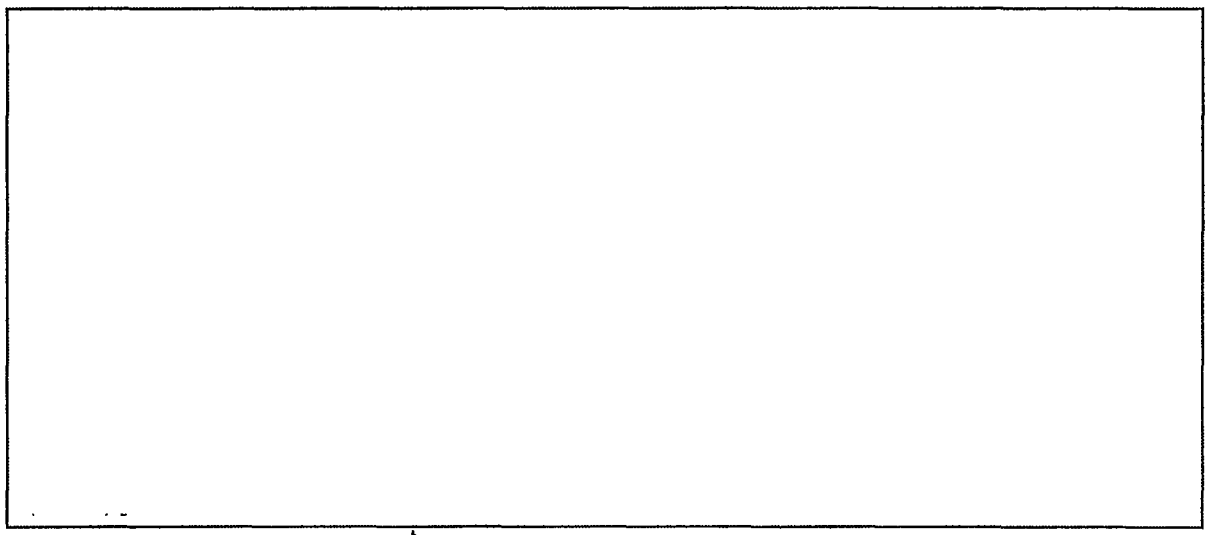
- 

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A sensitivity study is performed at the CRC statepoint #2, #3, #26 and #27 to determine the effect of employing 28 isotopes on the CRC system reactivity. Instead of utilizing all the isotopes included in the CRC calculations (more than 48 isotopes are employed), only the 28 isotopes utilized in the burnup credit calculations are employed. The results of this study are shown in Table 5-14G and indicate that the reduction in the number of isotopes leads to an increase in k_{eff} by greater than 0.02 Δk_{eff}. These results show that the use of 28 isotopes results in a statistically significant change in the CRC system reactivity. These results also indicate that crediting only 28 isotopes in design basis criticality calculations is conservative.

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All the design basis criticality calculations were performed using the CSAS25 module of the SCALE 4.4 computer code system using the 44 group ENDF/B-V cross section library. All the criticality benchmark calculations were also performed using the same module and cross section library except the CRC benchmarks which employed the SCALE 5.0 code system [17]. This difference was only to overcome the memory limitation of the SCALE 4.4 version since the same control module and cross section library were employed. The modeling of the unit cell for resonance treatment and the modeling of the "extra" cell (using MORE DATA card with DANCOFF input from single unit cell results) is identical for the design basis and the benchmark criticality calculations. Therefore, the computational method employed in both the design basis and the benchmark criticality calculations is similar.

The USL is calculated in accordance with NUREG/CR-6361 [7]. The computer program USLSTATS V1.4.2 (also described in [7]) was utilized to determine an upper subcritical limit (USL) on keff. The USL Method 1 (USL-1) applies a statistical calculation of the bias and its uncertainty plus an administrative margin to the linear fit of results of the experimental benchmark data developed herein. [

] The independent

13. *U.S. Nuclear Regulatory Commission, "Review and Prioritization of Technical Issues Related to Burnup Credit for LWR Fuel," NUREG/CR-6665, Published February 2000, ORNL/TM-1999/303.*

14. U.S. Nuclear Regulatory Commission, "Recommendations for Addressing Axial Burnup in PWR Burnup Credit Analyses," NUREG/CR-6801, Published March 2003, ORNL/TM-2001/273.

15. U.S. Nuclear Regulatory Commission, "Study of the Effect of Integral Burnable Absorbers for PWR Burnup Credit," NUREG/CR-6760, Published March 2002, ORNL/TM-2000-329.

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16. U.S. Nuclear Regulatory Commission, "Parametric Study of the Effect of Control Rods for PWR Burnup Credit," NUREG/CR-6759, Published February 2002, ORNL/TM-2001/69.

17. *Oak Ridge National Laboratory, RSIC Computer Code Collection, "SCALE 5: Modular Code System for Performing Standardized Computer Analyses for Licensing Evaluation for Workstations and Personal Computers, Oak Ridge National Laboratory, Radiation Shielding Information Center Code Package CCC-725, June 2004.*

18. "Validation of the SCALE System for PWR Spent Fuel Isotopic Composition Analyses," ORNL/TM-12667, OW Hermann, SM Bowman, MC Brady, CV Parks, March 1995.

19. "Isotopic Analysis of High-Burnup PWR Spent Fuel Samples From the Takahama-3 Reactor," ORNL/TM-2001/259 (NUREG/CR-6798), CE Sanders and IC Gauld, January 2003.

20. U. S. Nuclear Regulatory Commission, "Strategies for Application of Isotopic Uncertainties in Burnup-Credit," NUREG/CR-6811, Published June 2003, ORNL/TM-2001/257.

21. CAL-UDC-NU-000011 Rev A, "Three Mile Island Unit 1 Radiochemical Assay Comparisons to SAS2H Calculations," Office of Civilian Radioactive Waste Management, U.S. Department of Energy, April 2002.

22. M. D. DeHart "SCALE-4 Analysis of Pressurized Water Reactor Critical Configurations: Volume 1 – Summary," Oak Ridge National Laboratory, March 1995, ORNL/TM-12294/V1.

23. Radulescu G, Mueller D. E. and J. C. Wagner, "Sensitivity and Uncertainty Analysis of Commercial Reactor Criticals for Burnup Credit," Oak Ridge National Laboratory, January 2008, ORNL/TM-2006-87, NUREG/CR-6951.

24. S. M. Bowman, W.C. Jordan, J. F. Mincey, C.V. Parks, and L. M. Petrie, "Experience with the SCALE Criticality Safety Cross-Section Libraries," Oak Ridge National Laboratory, NUREG/CR-6686, Published October 2000, ORNL/TM-1999/322.

Table 5-28
Criticality Results for Region 2 – Mishandling Accident
(Part 3 of 3)

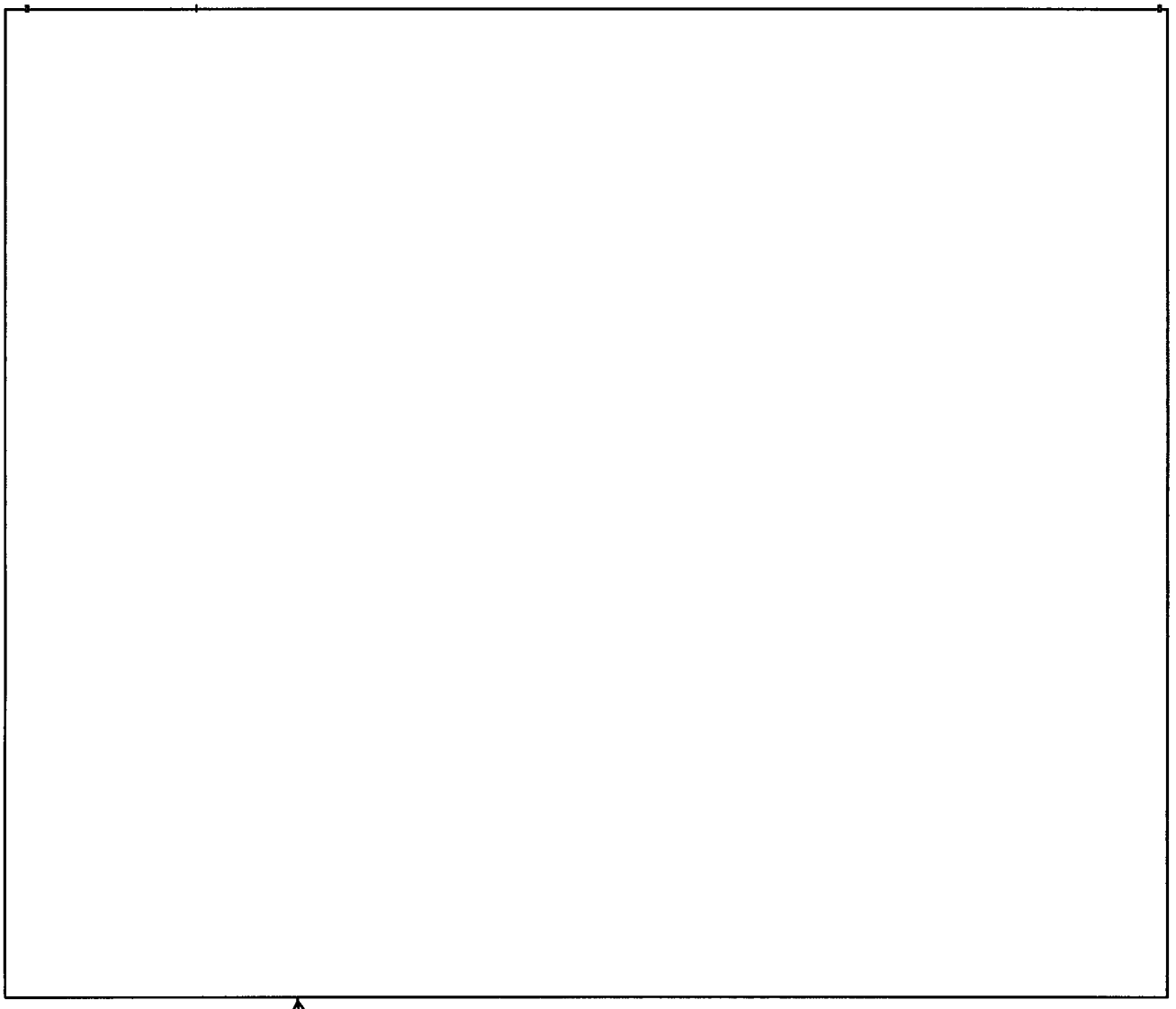

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Table 5-33
Criticality Results for Region 2 – Two Misload Fresh Fuel Assemblies Evaluation

Table 5-34
Criticality Results for The Evaluation of More Than One Misload Fuel Assembly (1)

Figure 5-21
KENO Model – Close-up of Two Misloaded Fuel Assembly Outside Region 2 Racks

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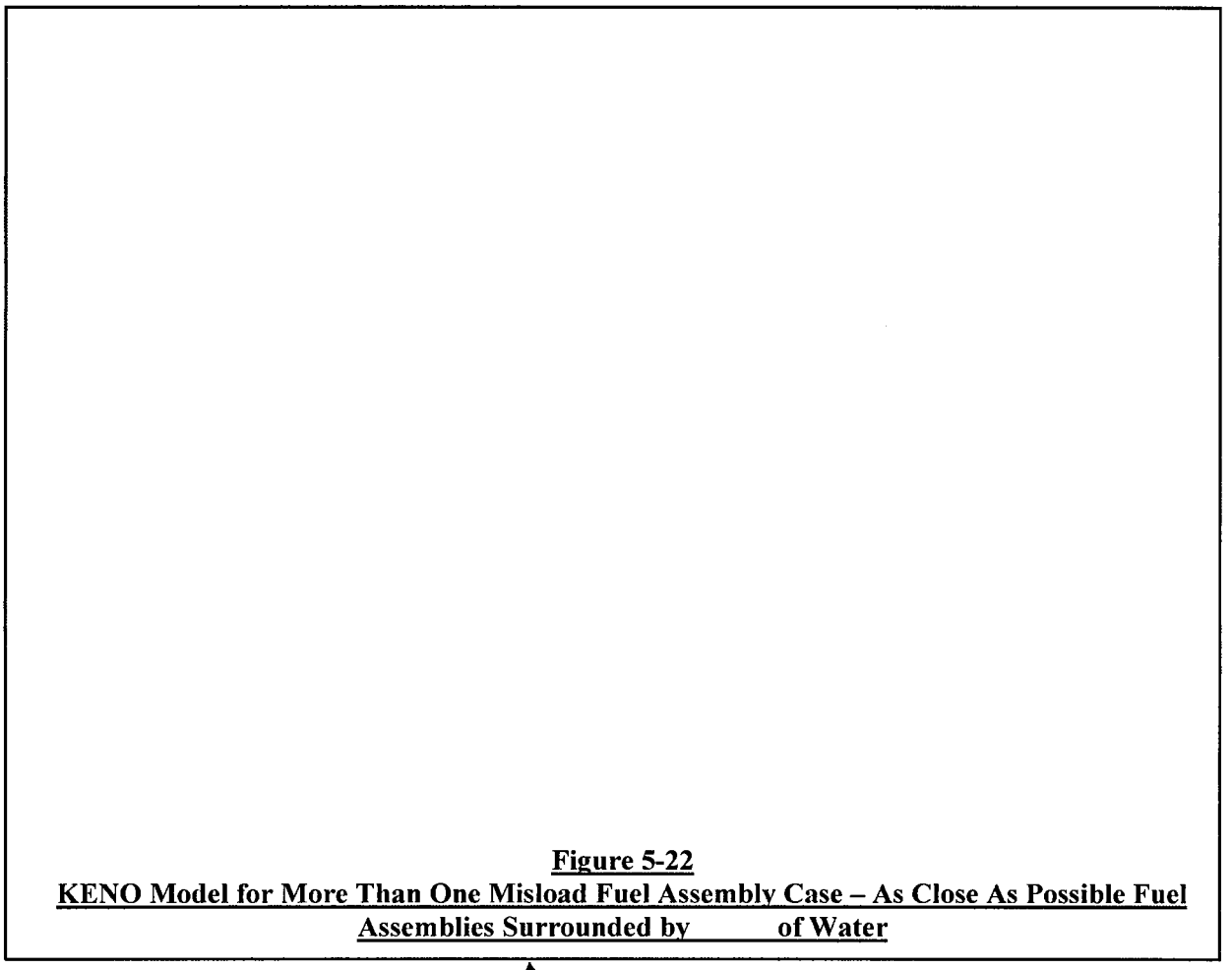

Figure 5-22
KENO Model for More Than One Misload Fuel Assembly Case – As Close As Possible Fuel Assemblies Surrounded by of Water

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