PROPRIETARY

Nuclear Innovation
North America LLC
4000 Avenue F, Suite A
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June 4, 2012
U7-C-NINA-NRC-120049
10 CFR 2.390

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
One White Flint North
11555 Rockville Pike
Rockville, MD 20852-2738

South Texas Project
Units 3 and 4
Docket No. PROJ0772
Response to Request for Additional Information

Reference: Letter from Michael Eudy to Mark McBurnett, "Request for Additional Information Re: South Texas Project Nuclear Operating Company Topical Report (TR) WCAP-17203-P, Fast Transient and ATWS Methodology (TAC No. ME4505)," April 2, 2012 (ML120830334)

Attached are the responses to the following NRC staff questions included the reference:

NRR RAI 8 S1	NRR RAI 23 S1
NRR RAI 16 S1	NRR RAI 25 S1
NRR RAI 20 S1	NRR RAI 27 S1

The responses to some of these RAI questions contain information proprietary to Westinghouse Electric Corporation. Since this letter contains information proprietary to Westinghouse Electric Company LLC, it is supported by an affidavit signed by Westinghouse, the owner of the information. The affidavit sets forth the basis on which the information may be withheld from public disclosure by the Commission and addresses with specificity the considerations listed in paragraph (b) (4) of Section 2.390 of the Commission's regulations.

Accordingly, it is respectfully requested that the information which is proprietary to Westinghouse be withheld from public disclosure in accordance with 10 CFR Section 2.390 of the Commission's regulations.

STI 33555710

T007
NRO

Attachments 1 through 6 contain the responses to the RAI questions. Attachments 7 through 11 contain the non-proprietary versions of the proprietary responses. Attachment 12 contains the request for withholding of proprietary information, the affidavit, the proprietary information notice, and the copyright notice.

Correspondence with respect to the copyright or proprietary aspects of this information or the supporting Westinghouse Affidavit should reference CAW-12-3493 and should be addressed to: J. A. Gresham, Manager, Regulatory Compliance and Plant Licensing, Westinghouse Electric Company LLC, Suite 428, 1000 Westinghouse Drive, Cranberry Township, Pennsylvania, 16066.

If this letter becomes separated from the proprietary material it is no longer proprietary.

There are no commitments in this letter.

If you have any questions, please contact me at (361) 972-7136, or Bill Mookhoek at (361) 972-7274.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on 6/4/12

Scott Head
Manager, Regulatory Affairs
Nuclear Innovation North America LLC

jet

Attachments:

1. NRR RAI 8 S1 (Proprietary)
2. NRR RAI 16 S1 (Proprietary)
3. NRR RAI 20 S1 (Proprietary)
4. NRR RAI 23 S1 (Proprietary)
5. NRR RAI 25 S1
6. NRR RAI 27 S1 (Proprietary)
7. NRR RAI 8 S1 (Non-Proprietary)
8. NRR RAI 16 S1 (Non-Proprietary)
9. NRR RAI 20 S1 (Non-Proprietary)
10. NRR RAI 23 S1 (Non-Proprietary)
11. NRR RAI 27 S1 (Non-Proprietary)
12. Request for Withholding Proprietary Information

cc: w/o attachment except*
(paper copy)

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NRR RAI-25.S1

The response to NRR RAI 25 clarified a number of inconsistencies in the topical report. Please clarify the following additional inconsistencies in WCAP-17203:

a) **The term "turbine safety valves" in Section 4.3.1, second bullet, should be replaced with "turbine stop valves."**

b) **The staff's understanding of recirculation flow increase transients for operating BWRs is that, if a scram occurs, it tends to occur on high neutron flux. While closure of the turbine control valves would ensue, closure would happen more gradually than a stop valve closure and would initiate several seconds after the initial scram signal. This does not appear consistent with the first two bullets of Section 4.2.1 of the topical report, which suggest that the power increase induced by increased recirculation flow would result in a pressure increase, a turbine trip, and an "eventual" reactor scram.**

Response to NRR RAI-25.S1

a) Westinghouse confirms that the term "turbine safety valves" was originally meant to be "turbine stop valves". The second bullet in Section 4.3.1 of the LTR will be updated with the correct term.

b) Westinghouse agrees with the NRC's understanding of recirculation flow increase events. If a scram occurs, it tends to occur on high neutron flux and the closure of the turbine control valves would initiate several seconds after the initial scram signal. However, depending on the initial conditions of the plant and recirculation flow increase rate, a maximum pump speed may be reached without initiating the scram signal. In this case, for reactors where the turbine inlet pressure is used for pressure control, the steam dome pressure may increase due to the increased steam flow causing the increase in a steamline pressure drop. To capture this scenario, Westinghouse would like to keep the first bullet of Section 4.2.1 in the LTR and remove only the last sentence of this bullet stating: "This event then becomes equivalent to a pressure increase scenario." The second bullet in Section 4.2.1 dealing with turbine trip will be removed in the approved version of the LTR based on the discussion above.

NRR RAI-8.S1

The response to NRR RAI 8 provided clear rationale for several items' PIRT rankings that the staff had identified as examples of where the original justifications were insufficient. Based on these explanations, a review of responses to Office of New Reactors (NRO) RAIs, and staff review of additional references, one further clarification is needed. Please provide adequate basis for the rankings assigned for [ ]^{a,c}.

Response to NRR RAI-8.S1

The total core pressure drop is given by the sum of three components: acceleration, friction effects, and gravity. The influence of the total pressure gradient along the channels is therefore treated by the phenomena [ ]^{a,c}. These two phenomena are the most important from the standpoint of model qualification for the calculation of core pressure drop during transient conditions. Both phenomena are [ ]^{a,c} and therefore the uncertainty in the determination of the core pressure drop is covered by the uncertainty in these two phenomena.

The phenomenon [

]^{a,c}

To provide a quantitative basis for the ranking, a sensitivity analysis was performed to assess the impact of phenomenon A13 on the transient figures-of-merit. The sensitivity study was performed for an ABWR reactor loaded with SVEA-96 Optima2 fuel and analyzed a "Generator load rejection without bypass" (LRNB) event and a "Three reactor internal pumps trip" (3RPT) event. The LRNB and the 3RPT belong to the Pressure increase/decrease (PI/PD) and the Recirculation flow increase/decrease (RI/RD) event categories, respectively. The AOO specific figures-of-merit (OLMCPR, Max RCPB pressure, max LHGR) were studied. The uncertainty in the pressure loss coefficients for the spacer grids is of the order [ ]^{a,c} based on full-scale pressure drop measurements. To conservatively cover all realistic conditions, an uncertainty range of [ ]^{a,c} is assumed in the analyses. The model uncertainty assessment for [

]^{a,c} is summarized in Table 1.

Table 1. Model uncertainty associated with the phenomenon [

]^{a,c}

a,c

[

]^{a,c} The result of the sensitivity study for the 3RPT event is shown in Table 3. The effect on the figures-of-merit is of the same order as for the LRNBP event.

Table 2. Results of sensitivity analysis of phenomenon A13 for LRNB event

a,c

Table 3. Results of sensitivity analysis of phenomenon A13 for 3RPT event

a,c

Limiting values by which Westinghouse judges whether uncertainties are so small or the effect on figures-of-merit is so minimal that they can be ignored were previously reported in the response to NRO RAI-23.S01. For example, the limiting value for the change in MCPR is [ ]^{a,c}, and for ΔLHGR and ΔRCPB pressure it is [ ]^{a,c}. Thus, by that account, the effect of the spacer pressure drop is minimal. [

]^{a,c}.

Consequently, the ranking of phenomenon [ ]^{a,c} is unchanged in the PIRT.

NRR RAI-16.S1

a) **The second paragraph of the response to NRR RAI 16 appears to credit Westinghouse's modeling practices for feedwater flow increase transients that [**

]^{a,c} . Please clarify whether these conservative modeling practices are considered by Westinghouse to be mandatory or optional. If they are considered mandatory, please modify WCAP-17203 to specify these modeling practices as procedural requirements.

b) **The staff understands that Westinghouse will evaluate off-rated conditions across the power-flow map to determine bounding initial conditions. However, having reviewed the response to NRO RAI 17 S01, the general approach (e.g., iterative calculations over a grid of statepoints, sensitivity studies, past experience, engineering judgment) used to ensure that limiting off-rated initial conditions for various transients (e.g., feedwater flow increase, recirculation flow increase) have been identified and adequately evaluated is not sufficiently clear. Specifically, the staff lacks confidence that experience and judgment alone would provide adequate basis for determination of limiting off-rated statepoints, without confirmatory calculations or analysis. Therefore, please describe further this aspect of the approach and provide justification that the process used to identify potentially limiting off-rated conditions is adequate.**

Response to NRR RAI-16.S1

a) The consideration of [

]^{a,c} Westinghouse will add the following two items to the list of bullets in Section 6.4.3.2.1 in the approved version of the LTR:

- [

]^{a,c}

b) Westinghouse does not intend to use engineering judgment alone as the primary means of determining the limiting off-rated statepoints. Westinghouse plans to use engineering judgment in determining the limiting off-rated statepoints as a complement to sensitivity studies and other objective means of evaluation. A more detailed description of Westinghouse's use of past experience and engineering judgment is as follows:

- For the case where previous calculations/analyses of a particular plant or a plant of a similar design are not available, sensitivity studies are conducted to determine the limiting off-rated statepoints.
- For the case where previous calculations/analyses of a particular plant or a plant of a similar design are available, engineering judgment is used to assess how the differences in the plant conditions between the current analysis and previously conducted analyses affect the selection of the limiting off-rated statepoints.

Westinghouse considers the use of engineering judgment in the context stated above to be credible, as it does not focus primarily on deduction of limiting conditions and instead focuses on judging the relevance of previous evaluations for use in a particular analysis.

The process outlined above is very similar to the process that Westinghouse plans to use to determine the limiting initial conditions for parameters such as feedwater temperature, steam dome pressure and core flow as stated in the response to NRR RAI-37.S1.

NRR RAI-20.S1

Please provide additional information to complete the response to NRR RAI 20. With respect to the plant condition at the initiation of the transient, what assumptions are made with respect to the modes or settings of plant control systems? For example, control systems associated with feedwater, recirculation, and steam/turbine systems have different control modes, including various automatic and manual control modes. Please clarify how the assumed control modes for plant control systems are determined and provide justification if the transient analysis approach takes credit for control systems being in modes that are not limiting.

Response to NRR RAI-20.S1

As described in response to RAI-20, the control systems required for a licensing analysis are [

]^{a,c}

NRR RAI-23.S1

a) The response to NRO RAI 19 states that linear heat generation rate (LHGR) and reactor pressure will be calculated using a deterministic methodology. Please clarify where the deterministic methodology for calculating these parameters is specified and justify any changes made from the current practice with respect to conservative inputs and assumptions. As necessary, please revise WCAP-17203 to ensure clarity.
b) Removal of conservatisms from the evaluation model and dissimilar sensitivities between MCPR and LHGR observed in a number of NRO RAI responses raise questions concerning the validity of equation (6) in the topical report in lieu of rigorous statistical treatment for LHGR. Please demonstrate the validity of this relation for a best-estimate evaluation model and contrast the approach with the existing method for ensuring compliance with LHGR limits.
c) Please provide additional clarification on when multi-parameter statistical evaluations are required and when single parameter evaluations may be performed. Based on the response to NRO RAI 19, the staff understands that Westinghouse proposes to subject only MCPR to statistical analysis for AOOs. For accidents, the staff presumes that only the metric for determining fuel failures is analyzed statistically (i.e., MCPR or peak cladding temperature). Please confirm whether these understandings are consistent with Westinghouse's intent, and further clarify the treatment of an anticipated transient without scram (A TWS), for which there are three figures of merit (peak cladding temperature, vessel pressure, and mass and energy release to containment).
d) Please clarify whether and how a normality test and normal distribution statistics (referred to in the topical report as "the analysis of variance method") would be used in the multi-parameter case to define 95/95 tolerance limits. Please clarify what statistical statement can be made about the joint distribution of multiple figures of merit based upon failing to reject the normality hypothesis for one or more of the individual distributions. Please revise topical report as necessary (e.g ., Section 7.4, Appendix B).

Response to NRR RAI-23.S1

a) For the reactor pressure, the overpressure protection event analysis described in Section 6.2.3 in the LTR bounds all fast transient events with regard to this acceptance limit. The same methodology is also described in Section 9.3.2 in Reference [1]. No changes from the current practice are made with respect to conservative inputs and assumptions for this acceptance limit. For the Linear Heat Generation Rate, the justification of changes from the current practice and methodology are discussed in part b) of this response.

b) In a traditional, conservative model, all relevant input and modeling parameters are biased towards the conservative direction producing a conservative estimate for both MCPR and LHGR simultaneously. This conservative evaluation model bounds all possible states and covers all uncertainty contributors for both the MCPR and LHGR.

[

]^{a,c}

[

]^{a,c}

This can be compared to the methodology described in the current LTR, [ ]^{a,c} As stated in Section 6.2.2 in the WCAP-17203-P, the LHGR change is determined by the same NRC-approved evaluation model used for determining the transient CPR. This means that the LHGR [ ]^{a,c} to confirm that the allowed transient TMOL overpower limit is not exceeded. If the value of LHGR is below the limit [ ]^{a,c}, the safety analysis of this event defines an OLMCPR that results in operating margin to the fuel TTMOL. If the value of LHGR exceeds the fuel TTMOL, either the [

]^{a,c} This methodology, consistent with the traditional conservative approach, assures that the uncertainties are accounted for in the evaluation model for both MCPR and LHGR.

c) Westinghouse confirms the NRCs understanding that for AOOs [ ]^{a,c} In addition, Westinghouse confirms that the metric for determining fuel failures is analyzed [ ]^{a,c}

For ATWS events, [ ]^{a,c} The analysis may be performed in the following two ways where both are considered equivalent:

- [

]^{a,c}

d) Due to the difficulties in performing normality test for multi-parameter cases, the Analysis of Variance method [ ]^{a,c}. For these cases, Westinghouse intends to use the [ ]^{a,c} . However, if several parameters are evaluated, such as ATWS, each parameter may be evaluated separately, the normality test may be performed and the [ ]^{a,c} may be used to analyze the results.

To reflect these considerations, the transient uncertainty evaluation methodology in Section 7.4 in the LTR will be updated as follows (changes are marked bold):

Original formulation:

Analyze results *– The results are tested for normality using normality tests as shown in Appendix B. If the data passes the normality test, then the 95th percentile, determined with 95% confidence is calculated according to the analysis of variance method captured by Equation 28 in Appendix B. In cases where computer results do not pass the normality test, the order statistics method is used instead to determine the 95th percentile, with 95% confidence. The results are tallied, ranking them from highest to lowest. Using the order statistics, the 95th percentile event acceptance criterion/criteria is/are determined with 95% confidence, by selecting the largest (in case of upper limit) or the lowest (in case of lower limit), from the obtained results. If the nth largest estimate is used instead, the number of code runs must be increased according to Equation 11 in Appendix B.*

Updated formulation:

Analyze results *– The results are tested for normality using normality tests as shown in Appendix B. If the data passes the normality test, then the 95th percentile, determined with 95% confidence is calculated according to the analysis of variance method captured by Equation 28 in Appendix B. In cases where computer results do not pass the normality test, the order statistics method is used instead to determine the 95th percentile, with 95% confidence. The results are tallied, ranking them from highest to lowest. Using the order statistics, the 95th percentile event acceptance criterion/criteria is/are determined with 95% confidence, by selecting the largest (in case of upper limit) or the lowest (in case of lower limit), from the obtained results. If the nth largest estimate is used instead, the number of code runs must be increased according to Equation 11 in Appendix B.*
[

]^{a,c}

References:

[1] CENPD-300-P-A, "Reference Safety Report for Boiling Water Reactor Reload Fuel", July 1996

NRR RAI-27.S1

a) **The response to NRR RAI 27 does not adequately clarify the meaning of the phrase "as low as possible recirculation flow increase rate" relative to the controller or operator errors that could lead to a recirculation flow increase. Further, while Westinghouse performed a useful sensitivity case for the advanced boiling water reactor (ABWR) with a faster-than-nominal increase rate, this does not demonstrate that the nominal case recirculation flow increase rate can be considered "as low as possible" - the limiting condition stated by Westinghouse - for either the ABWR or operating BWRs. Therefore, please provide additional discussion of what constitutes an "as low as possible recirculation flow increase rate" in practical terms, and confirm whether this phrase accurately describes [**

]^{a,c}. Also, presuming that [

]^{a,c} please clarify why it is acceptable to model the event as a fast transient, as opposed to the slow transient approach in topical report CENPD-300-P-A.

b) **Due to the importance of the scram in terminating recirculation flow increase transients, it is not clear that [**

]^{a,c} From the staff's experience, it is not clear that a generalization can be made for all reactor types and flow maps [

] ^{a,c}

Response to NRR RAI-27.S1

a) The term "as low as possible recirculation increase rate" practically corresponds to the conservatively low value of the rate limiter in the recirculation flow control system. [

.] ^{a,c}

The sensitivity study provided in the response to NRR RAI-27 was intended as an example with two different recirculation pump speeds and recirculation flow increase rates. It was not Westinghouse's intention to suggest that the nominal recirculation flow increase rate is the limiting condition for this event for all plant designs. [

]^{a,c} is determined by the process described above.

[

]^{a,c}

[

]^{a,c}

b) As stated in the original response to RAI-27 it is Westinghouse experience that the recirculation flow increase transients [ ]^{a,c}. However, Westinghouse does not assume a priori that the limiting statepoint is [ ]^{a,c} in the analyses of recirculation flow events. The selection of limiting off-rated statepoint is based on the evaluation across the whole power-flow map (consistent with the methodology in the LTR).

AFFIDAVIT

COMMONWEALTH OF PENNSYLVANIA:

ss

COUNTY OF BUTLER:

Before me, the undersigned authority, personally appeared B. F. Maurer, who, being by me duly sworn according to law, deposes and says that he is authorized to execute this Affidavit on behalf of Westinghouse Electric Company LLC (Westinghouse), and that the averments of fact set forth in this Affidavit are true and correct to the best of his knowledge, information, and belief:

B. F. Maurer, Manager
ABWR Licensing

Sworn to and subscribed before me
this 31st day of May 2012

Notary Public

COMMONWEALTH OF PENNSYLVANIA
NOTARIAL SEAL
Renee Giampole, Notary Public
Penn Township, Westmoreland County
My Commission Expires September 25, 2013

(1) I am Manager, ABWR Licensing, in Nuclear Services, Westinghouse Electric Company LLC (Westinghouse), and as such, I have been specifically delegated the function of reviewing the proprietary information sought to be withheld from public disclosure in connection with nuclear power plant licensing and rule making proceedings, and am authorized to apply for its withholding on behalf of Westinghouse.

(2) I am making this Affidavit in conformance with the provisions of 10 CFR Section 2.390 of the Commission's regulations and in conjunction with the Westinghouse Application for Withholding Proprietary Information from Public Disclosure accompanying this Affidavit.

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

(4) 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 should be withheld.

(i) The information sought to be withheld from public disclosure is owned and has been held in confidence by Westinghouse.

(ii) The information is of a type customarily held in confidence by Westinghouse and not customarily disclosed to the public. Westinghouse has a rational basis for determining the types of information customarily held in confidence by it and, in that connection, utilizes a system to determine when and whether to hold certain types of information in confidence. The application of that system and the substance of that system constitutes Westinghouse policy and provides the rational basis required.

Under that system, information is held in confidence if it falls in one or more of several types, the release of which might result in the loss of an existing or potential competitive advantage, as follows:

(a) The information reveals the distinguishing aspects of a process (or component, structure, tool, method, etc.) where prevention of its use by any of Westinghouse's

competitors without license from Westinghouse constitutes a competitive economic advantage over other companies.

(b) It consists of supporting data, including test data, relative to a process (or component, structure, tool, method, etc.), the application of which data secures a competitive economic advantage, e.g., by optimization or improved marketability.

(c) Its use 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 a similar product.

(d) It reveals cost or price information, production capacities, budget levels, or commercial strategies of Westinghouse, its customers or suppliers.

(e) It reveals aspects of past, present, or future Westinghouse or customer funded development plans and programs of potential commercial value to Westinghouse.

(f) It contains patentable ideas, for which patent protection may be desirable.

There are sound policy reasons behind the Westinghouse system which include the following:

(a) The use of such information by Westinghouse gives Westinghouse a competitive advantage over its competitors. It is, therefore, withheld from disclosure to protect the Westinghouse competitive position.

(b) It is information that is marketable in many ways. The extent to which such information is available to competitors diminishes the Westinghouse ability to sell products and services involving the use of the information.

(c) Use by our competitor would put Westinghouse at a competitive disadvantage by reducing his expenditure of resources at our expense.

(d) Each component of proprietary information pertinent to a particular competitive advantage is potentially as valuable as the total competitive advantage. If competitors acquire components of proprietary information, any one component may be the key to the entire puzzle, thereby depriving Westinghouse of a competitive advantage.

(e) Unrestricted disclosure would jeopardize the position of prominence of Westinghouse in the world market, and thereby give a market advantage to the competition of those countries.

(f) The Westinghouse capacity to invest corporate assets in research and development depends upon the success in obtaining and maintaining a competitive advantage.

(iii) The information is being transmitted to the Commission in confidence and, under the provisions of 10 CFR Section 2.390, it is to be received in confidence by the Commission.

(iv) The information sought to be protected is not available in public sources or available information has not been previously employed in the same original manner or method to the best of our knowledge and belief.

(v) The proprietary information sought to be withheld in this submittal is that which is appropriately marked in "Responses to NRR's Supplemental RAI 8.S1, 16.S1, 20.S1, 23.S1, 25.S1, and 27.S1 to WCAP-17203" (Proprietary), dated May 31, 2012, for submittal to the Commission, being transmitted by South Texas Project Nuclear Operating Company (STPNOC) letter and Application for Withholding Proprietary Information from Public Disclosure, to the Document Control Desk. The proprietary information as submitted by Westinghouse is in response to the NRC's Request for Additional Information on the AOO/ATWS topical report and may be used only for that purpose.

This information is part of that which will enable Westinghouse to:

(a) Assist the customer in obtaining NRC review and approval of the Westinghouse Fast Transient and ATWS Methodology topical as applied to current and ABWR plant designs.

Further this information has substantial commercial value as follows:

(a) Its use by a competitor would improve their competitive position in the design and licensing of a similar product for ABWR fast transient and ATWS analysis.

(b) The information requested to be withheld reveals the distinguishing aspects of a methodology which was developed by Westinghouse.

Public disclosure of this proprietary information is likely to cause substantial harm to the competitive position of Westinghouse because it would enhance the ability of competitors to provide similar fuel design and licensing defense services for commercial power reactors without commensurate expenses. Also, public disclosure of the information would enable others to use the information to meet NRC requirements for licensing documentation without purchasing the right to use the information.

The development of the technology described in part by the information is the result of applying the results of many years of experience in an intensive Westinghouse effort and the expenditure of a considerable sum of money.

In order for competitors of Westinghouse to duplicate this information, similar technical programs would have to be performed and a significant manpower effort, having the requisite talent and experience, would have to be expended.

Further the deponent sayeth not.

Proprietary Information Notice

Transmitted herewith are proprietary and/or non-proprietary versions of documents furnished to the NRC in connection with requests for generic and/or plant-specific review and approval.

In order to conform to the requirements of 10 CFR 2.390 of the Commission's regulations concerning the protection of proprietary information so submitted to the NRC, the information which is proprietary in the proprietary versions is contained within brackets, and where the proprietary information has been deleted in the non-proprietary versions, only the brackets remain (the information that was contained within the brackets in the proprietary versions having been deleted). The justification for claiming the information so designated as proprietary is indicated in both versions by means of lower case letters (a) through (f) located as a superscript immediately following the brackets enclosing each item of information being identified as proprietary or in the margin opposite such information. These lower case letters refer to the types of information Westinghouse customarily holds in confidence identified in Sections (4)(ii)(a) through (4)(ii)(f) of the affidavit accompanying this transmittal pursuant to 10 CFR 2.390(b)(1).

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