

PROPRIETARY



Nuclear Innovation
North America LLC
122 West Way, Suite 405
Lake Jackson, Texas 77566

979-316-3000

February 13, 2013
U7-C-NINA-NRC-130015
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 Nos. 52-012 and 52-013
Response to Request for Additional Information

Attached are responses to NRC Staff questions included in Request for Additional Information (RAI) letter number 420 related to Combined License Application (COLA) Part 2, Tier 2, Section 3.9.2.

Attachments 2 through 5 provide responses to the RAI questions listed below. Where there are COLA markups, they will be made at the first routine COLA update following NRC acceptance of the RAI response.

03.09.02-52

03.09.02-53

03.09.02-54

03.09.02-55

Please note that the information contained in Attachment 6 is considered proprietary to Westinghouse Electric Company, LLC and is supported by an affidavit signed by Westinghouse, the owner of the information. Attachment 5 contains the redacted (non-proprietary) version of this response. Attachment 1 provides the Westinghouse Application for Withholding Letter CAW-13-3616 and accompanying affidavit, Proprietary Information Notice, and Copyright Notice. 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 2.390 of the Commission's regulations. Correspondence with respect to the copyright or proprietary aspects of the items listed above or the supporting Westinghouse Affidavit should reference CAW-13-3616 and should be addressed to J.A. Gresham, Manager, Regulatory Compliance, Westinghouse Electric Company LLC, Suite 428, 1000 Westinghouse Drive, Cranberry Township, Pennsylvania 16066.

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When separated from the proprietary material (Attachment 6), this letter is not proprietary.

There are no commitments in this letter.

If you have any questions, please contact me at (979) 316-3011 or Bill Mookhoek at (979) 316-3014.

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

Executed on 2/13/13



Scott Head
Manager, Regulatory Affairs
NINA STP Units 3 & 4

jep

Attachments:

1. Westinghouse Application for Withholding letter CAW-13-3616 and Accompanying Affidavit, Proprietary Information Notice and Copyright Notice
2. RAI 03.09.02-52 (Non-Proprietary)
3. RAI 03.09.02-53 (Non-Proprietary)
4. RAI 03.09.02-54 (Non-Proprietary)
5. RAI 03.09.02-55 (Redacted Non-Proprietary)
6. RAI 03.09.02-55 (Proprietary)

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

Director, Office of New Reactors
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*George F. Wunder
*Tom Tai
Fred Brown
U. S. Nuclear Regulatory Commission

Jamey Seely
Nuclear Innovation North America

Peter G. Nemeth
Crain, Caton and James, P.C.

Richard Peña
Kevin Pollo
L. D. Blaylock
CPS Energy

Attachment 1

**Westinghouse Application for Withholding letter CAW-13-3616 and
Accompanying Affidavit, Proprietary Information Notice and
Copyright Notice**



Westinghouse Electric Company
Nuclear Services
1000 Westinghouse Drive
Cranberry Township, Pennsylvania 16066
USA

U.S. Nuclear Regulatory Commission
Document Control Desk
11555 Rockville Pike
Rockville, MD 20852

Direct tel: (412) 374-4419
Direct fax: (724) 720-0857
e-mail: maurerbf@westinghouse.com
Proj letter: WEC-NINA-2013-0008

CAW-13-3616

February 11, 2013

APPLICATION FOR WITHHOLDING PROPRIETARY
INFORMATION FROM PUBLIC DISCLOSURE

Subject: WEC-NINA-2013-0008 P-Enclosure "Response to RAI 03.09.02-55 for the Steam Dryer Flow-Induced Vibration Program – South Texas Project Units 3 & 4" (Proprietary)

The proprietary information for which withholding is being requested in the above-referenced report is further identified in Affidavit CAW-13-3616 signed by the owner of the proprietary information, Westinghouse Electric Company LLC. The affidavit, which accompanies this letter, 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 10 CFR Section 2.390 of the Commission's regulations.

Accordingly, this letter authorizes the utilization of the accompanying affidavit by Nuclear Innovation North America (NINA).

Correspondence with respect to the proprietary aspects of the application for withholding or the accompanying affidavit should reference CAW-13-3616 and should be addressed to James A. Gresham, Manager, Regulatory Compliance, Westinghouse Electric Company, Suite 428, 1000 Westinghouse Drive, Cranberry Township, Pennsylvania 16066.

Very truly yours,

A handwritten signature in black ink, appearing to read 'B. Maurer', written over a horizontal line.

Bradley F. Maurer, Manager
ABWR Licensing

Enclosures

cc: T. Tai (NRC TWFN 6 D38M)

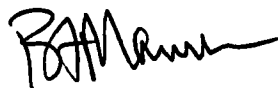
AFFIDAVIT

COMMONWEALTH OF PENNSYLVANIA:

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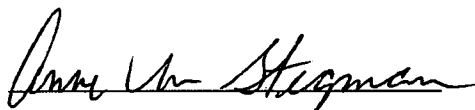
COUNTY OF BUTLER:

Before me, the undersigned authority, personally appeared Bradley 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:

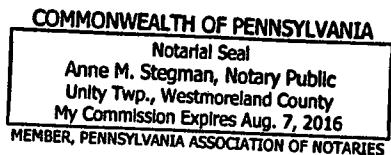


Bradley F. Maurer, Manager
ABWR Licensing

Sworn to and subscribed before me
this 11th day of February 2013



Notary Public



- (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 WEC-NINA-2013-0008 P-Enclosure "Response to RAI 03.09.02-55 for the Steam Dryer Flow-Induced Vibration Program – South Texas Project Units 3 & 4" (Proprietary), for submittal to the Commission, being transmitted by Nuclear Innovation North America (NINA) letter and Application for Withholding Proprietary Information from Public Disclosure, to the Document Control Desk. The proprietary information as submitted by Westinghouse is to assist the NRC in the review of the South Texas Project Units 3&4 flow induced vibration program 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 of the South Texas Project Units 3 and 4 COL Application.

Further this information has substantial commercial value as follows:

- (a) Westinghouse plans to sell the use of this information to its customers for purposes of plant specific ABWR flow induced vibration analyses for licensing basis applications.
- (b) Its use by a competitor would improve their competitive position in the design and licensing of a similar product for ABWR flow induced vibration analysis methodology.
- (c) 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 technical evaluation 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 request to assist the NRC in the review of the South Texas Project Units 3&4 flow induced vibration program.

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).

Copyright Notice

The reports transmitted herewith each bear a Westinghouse copyright notice. The NRC is permitted to make the number of copies of the information contained in these reports which are necessary for its internal use in connection with generic and plant-specific reviews and approvals as well as the issuance, denial, amendment, transfer, renewal, modification, suspension, revocation, or violation of a license, permit, order, or regulation subject to the requirements of 10 CFR 2.390 regarding restrictions on public disclosure to the extent such information has been identified as proprietary by Westinghouse, copyright protection notwithstanding. With respect to the non-proprietary versions of these reports, the NRC is permitted to make the number of copies beyond those necessary for its internal use which are necessary in order to have one copy available for public viewing in the appropriate docket files in the public document room in Washington, DC and in local public document rooms as may be required by NRC regulations if the number of copies submitted is insufficient for this purpose. Copies made by the NRC must include the copyright notice in all instances and the proprietary notice if the original was identified as proprietary.

RAI 03.09.02-52**QUESTION:**

NRC Regulatory Guide 1.20, Revision 3, Section 3.1.2 states:

“The vibration measurement program may be omitted if the inspection program is implemented. However the vibration measurement program related to the evaluation of the potential adverse flow effect from pressure fluctuations and vibrations in piping systems for both PWRs and BWRs, should not be omitted.”

There is no mention of main steam line (MSL) instrumentation to monitor the acoustic resonance and the dryer load during power ascension in WCAP-17257, “STP Unit 4 Reactor Internals Flow-Induced Vibration Assessment Program,” Revision 1. The staff requests the applicant to clarify whether instrumentation will be installed on the STP Unit 4 MSLs to ensure that acoustic resonances do not occur that could cause concern for the structural integrity of the steam dryer and other MSL components during the start-up tests up to full LTP power level. In the response to this RAI, the applicant is requested to:

- (a) Provide the number of strain gages to be installed on each MSL and the measures taken to ensure sufficient redundancy.
- (b) Explain and justify the method which will be used to calibrate the strain gages mounted on the MSLs.
- (c) Include the provided information in the application.

RESPONSE:

To address the concern identified in this RAI regarding monitoring the structural integrity of the STP Unit 4 steam dryer during power ascension, a vibration measurement program will be implemented for the Unit 4 steam dryer that is identical to the vibration measurement program for STP Unit 3 related to the steam dryer. The Unit 4 steam dryer instrumentation will be identical to that for Unit 3 as described in Section 6.4.2 of the STP Unit 3 Comprehensive Vibration Assessment Program (CVAP) report (WCAP-17256-P), and the power ascension will be performed as described in Section 6.6 of the Unit 3 CVAP report. The Unit 4 main steam lines (MSLs) will be instrumented with strain gages, consistent with the approach described in Section 6.4.2 of the Unit 3 CVAP report.

- (a) As discussed above, the instrumentation used to monitor the response of the STP Unit 4 steam dryer is the same as that summarized in the STP Unit 3 CVAP report. Details of the instrumentation locations, basis for the locations, and number of instruments to be installed described in the STP Unit 3 Measurement, Test and Inspection Plan report

(WCAP-17370-P) also apply to Unit 4. The discussion of the MSL instrumentation provided in Section 3.1.3 of that report for STP Unit 3 also applies to STP Unit 4.

- (b) Calibration of the MSL instrumentation will be performed in accordance with the instrument manufacturers' recommendations. Details of the installation and overall system testing and calibration will be included in the detailed power ascension test plan, which will be provided to NRC as discussed in the response to RAI 03.09.02-53.
- (c) WCAP-17257-P has been revised to reflect the inclusion of the measurement program for the STP Unit 4 steam dryer. Specifically, a new Section 3 has been added to the next revision of the WCAP, along with corresponding changes in the remainder of the report for improved clarity.

The STP 3&4 COLA Subsection 3.9.2.4 will be revised to reflect the inclusion of the vibration measurement program for the STP Unit 4 steam dryer. In addition, the COLA will be revised to reflect the revision changes to the reference reports in Subsection 3.9.8. The changes to Revision 8 of the COLA are shown in highlighted text below. These changes will be incorporated in the next revision of the STP 3&4 COLA.

3.9.2.4 Preoperational Flow-Induced Vibration Testing of Reactor Internals

For STP 4 reactor internals components, an inspection program will be implemented in lieu of a vibration measurement program as discussed in paragraph C.3.1.3 of Regulatory Guide 1.20. Subsection 3.9.2.3 identifies the assessment program for the STP 4 non-prototype. In addition, the vibration assessment program for STP Unit 4 will include a measurement program for the steam dryer.

3.9.8 References

- 3.9-13 "STP Unit 3 ABWR Prototype Reactor Internals Flow-Induced Vibration Assessment Program," WCAP-17256-P, Revision 34.
- 3.9-14 "STP Unit 4 Reactor Internals Flow-Induced Vibration Assessment Program," WCAP-17257-P, Revision 42.
- 3.9-25 "STP Unit 3 Steam Dryer Flow-Induced Vibration Assessment," WCAP-17385-P, Revision 34.
- 3.9-26 "South Texas Project Units 3 and 4 Reactor Internals Non-Dryer Component Flow-Induced Vibration Assessment," WCAP-17371-P, Revision 34.
- 3.9-27 "ABWR Dryer Operating Experience for STP Units 3 and 4," WCAP-17369-P, Revision 01.
- 3.9-28 "South Texas Project Unit 3 Comprehensive Vibration Assessment Program Measurement, Test, and Inspection Plan," WCAP-17370-P, Revision 34.

RAI 03.09.02-53**QUESTION:**

The applicant is requested to propose detailed license conditions for the flow-induced vibration start-up test program of Unit 3. The license conditions should address the following items:

- (a) Hold point at 60% at which full measurement program will be completed and the stress predictive analysis will be re-benchmarked to update the frequency dependent end-to end bias error and uncertainties (B&U). The end-to-end B&U, which will be used in load trending and projection for the next power hold point and full power conditions, should be based on comparison of the measured and the predicted stress/strain on the dryer.
- (b) Acceptance criteria (limit curves) based on the measurements at 60% power level.
- (c) Additional specific hold points beyond the first one at 60% power level. During these hold points, full measurement program will be completed and the B&U and acceptance criteria (limit curves) will be updated based on the measured data.
- (d) Data trending and projection of pressure, strain and acceleration levels to the next hold point and full power level.
- (e) Explain the method which will be used to calibrate the strain gages mounted on the dryer.
- (f) Actions to be taken during power ascension of Unit 3 if the measured dryer stresses or pressures challenge the limit curves developed from the previous hold point.
- (g) Reporting of results to NRC at 60%, 80%, 90% and 100% during power ascension. The plant will not proceed to the next power level for at least 72 hours after reporting measurements to the NRC.
- (h) Providing a full stress analysis report and evaluation at full power level within 90 days after reaching full power level. The report should include the final dryer load definition using steam dryer instrumentation and associated end-to-end B&U.

The applicant is requested to include the provided information in the application.

RESPONSE:

A proposed license condition for the flow-induced vibration power ascension test program for STP Unit 3 is provided. The license condition references a new Appendix 3N to the STP 3&4 COLA, and addresses the items requested in the RAI. Appendix 3N will be incorporated in Revision 9 to the STP 3&4 COLA. Also, as discussed in the response to 03.09.02-54, the proposed license condition and Appendix 3N are applicable to STP Unit 4 as well as to Unit 3.

PROPOSED LICENSE CONDITION

This license condition provides for monitoring and evaluating the response of the steam dryer in response to potential adverse flow effects as a result of power ascension from 60% power to the full power condition. Requirements placed on operation of the facility during power ascension to the full power condition are described in Appendix 3N.

Appendix 3N

Monitoring and Evaluation of the Steam Dryer During Power Ascension

1. A Power Ascension Test (PAT) Plan for the steam dryer testing will be provided to the NRC no later than 10 days before start-up. The PAT Plan will include the following:
 - Criteria for comparison and evaluation of projected strain levels with data obtained from the dryer instrumentation.
 - Methodology for developing Level 1 and Level 2 acceptance limits at selected dryer strain gage locations
 - Identification of steam dryer strain gage locations for which limit curves will be developed, and criteria for selection of those locations.
 - Methodology for developing projected strain levels for the next power level and for full power.
 - Specific hold points during power ascension.
 - Activities to be accomplished during hold points.
 - Details of the installation and calibration of the steam dryer instrumentation and MSL strain gages. Instrumentation will be mounted and calibrated in accordance with the manufacturers' instructions.
2. At an initial hold point of 60% of full power, pressures, strains, and accelerations will be recorded from the dryer mounted instrumentation. The minimum stress ratio and maximum stress will be computed from the predictive analysis using strain gage data from the dryer. Level 1 and Level 2 limit curves will be generated for comparison with data from strain gage locations on the steam dryer. Limit curves will be generated at the selected strain gage locations on the dryer. Bias error and uncertainties will be included. Data trending and a projection of strain levels will be generated for the next hold point and full power.

Level 1 limit curves (power spectral densities -- PSDs) are computed to show that the maximum dryer stress does not exceed the allowable stress of 9.95 ksi (68.6 MPa). Level 2 limit curves are obtained by multiplying the Level 1 curves by a factor of 0.80 (80%).
3. Power ascension will proceed to the next hold point where accelerations, strains, and pressures will be recorded. Using steam dryer strain gage data, a real-time analysis will determine the minimum stress ratio and maximum stress, including appropriate bias and uncertainties. Revised limit curves will be generated. Data trending and a projection of strain levels will be generated for the next hold point and full power.

If a Level 2 limit curve is exceeded, the power will be held at that power level to perform

a real-time stress analysis to develop new limit curves. If a Level 1 limit curve is exceeded, the power will be reduced to a previous power level where Level 1 was not exceeded and a real-time stress analysis will be performed to develop new limit curves.

4. Step 3 will be performed at 70%, 80%, 90% and full power levels. The limit curves, a summary of the measurement results, and projections of strain levels will be provided to the NRC at 60%, 80%, and 90% power. Power ascension will not proceed to the next power level for at least 72 hours after reporting to the NRC. The limit curves and a summary of the measurement results will be provided to the NRC at full power.
5. After full power has been achieved, a full stress analysis report and evaluation will be provided to the NRC within 90 days of reaching the full power level. The report will include the final dryer load definition using steam dryer instrumentation and associated end-to-end bias and uncertainties.

RAI 03.09.02-54

QUESTION:

The applicant is requested to propose detailed license conditions for the flow-induced vibration start-up test program of Unit 4. The license conditions should address the following items:

- (a) A requirement that strain gages be mounted on the MSLs to confirm the structural integrity of the steam dryer and MSL components up to and including full LTP power level.
- (b) Acceptance criteria to confirm the structural integrity of the steam dryer and MSL components during start-up and at full power.
- (c) Actions to be taken during the power ascension of Unit 4 if the acceptance criterion are not met.
- (d) Reporting to the NRC at 60%, 80%, 90% and 100% during power ascension the evaluation of the Unit 4 MSL data to demonstrate structural integrity of the Unit 4 steam dryer and MSL components. The plant will not proceed to the next power level for at least 72 hours after reporting measurements to the NRC.
- (e) Providing a report of the evaluation of the Unit 4 MSL data to demonstrate the structural integrity of the Unit 4 steam dryer and MSL component within 90 days after reaching full power level.

The applicant is also requested to include the provided information in the application.

RESPONSE:

As described in the response to RAI 03.09.02-52 regarding monitoring the structural integrity of the STP Unit 4 steam dryer during power ascension, a vibration measurement program will be implemented for the Unit 4 steam dryer that is identical to the vibration measurement program for STP Unit 3 related to the steam dryer. The Unit 4 steam dryer instrumentation will be identical to that for Unit 3, and the power ascension for Unit 4 will be performed the same as for Unit 3. As a result, the proposed license condition for Unit 4 is the same as the proposed license condition for Unit 3, as presented in the response to RAI 03.09.02-53.

RAI 03.09.02-55**QUESTION:**

In the audit from November 27 to 29, 2012, it was found that the thickness of the six cover-plate supporting ribs used in the dryer structural model is smaller than the actual thickness. The calculated natural frequencies of the cover-plate are thus lower than the actual natural frequencies of the cover-plate. The applicant is requested to provide a quantitative assessment to demonstrate that the dryer stress analysis based on the smaller thickness of the ribs is conservative.

RESPONSE:

To address the discrepancy related to the coverplate support rib thickness, the finite element model used in the original analysis was modified. The coverplate support rib thickness of []^{a,c} (used in the original analysis) was changed to []^{a,c} (actual dryer design). A modal analysis was then performed using the modified model and the results were compared to the original analysis.

The comparison of the calculated frequencies shows that those frequencies associated with the []^{a,c}

Frequencies associated with vibrations of all the other dryer components, including the []^{a,c}

In addition, []^{a,c} In
[]^{a,c} used in the dryer stress analysis.

In summary, the rib thickness change []^{a,c}

[]^{a,c} Similarly, because the []^{a,c}