HI-SPEED INDUSTRIAL SERVICE QualiTest® Diagnostics

7030 Ryburn Dr. Millington, TN Phone: (901) 873-5300 Fax: (901) 873-5301 www.gohispeed.com

December 16, 2019

Nucor Roll Mill
Jackson-Flowood, MS

Subject: December vibration survey

Most of the machines surveyed were found to be in good condition with the exception of the following:

QualiTest® uses a four step rating system for defects.

Class I: Defect is present, but effect on reliability is not clear; no immediate action is required. Continue to normally monitor.

Class II: Defect (s) present that may cause problem in long term (2-6 months). Repair during normal maintenance scheduling. Continue to monitor.

Class III; Defect (s) present that may cause failure in short term (less than 2 months). This should be addressed as soon as practical, with a high maintenance priority. Increase monitoring frequency.

Class IV; Defect (s) present that makes continued reliability unpredictable, and possibility of secondary damage is high. Repairs should be made ASAP. An unscheduled shutdown should be considered for repairs

Defects

Roll Stand 1A Planetary Gearbox
Overall vibration varies with each survey and may be influenced somewhat by speed and load. The vibrations in the planetary section still show signs of distress. We will continue to monitor this unit closely. Still rated as a **CLASS I** defect for now.

Roll Stand 2 MOTOR
Data of the motor indicates some signs of bearing issue possible in the motor. We will continue to monitor this closely. Rated as a **CLASS I** defect for now.

Roll Stand 2 Cooling Fan Motor
Data is starting to show an increase in 1 x rpm vibration. Fan wheel may be out of balance. Inspect, clean fan wheel as time allows. Rated as a **CLASS II** defect.

Roll Stand 4
Int. gearbox vibration has increased this survey. Data has been showing some signs of gear wear and or gear misalignment at the input to intermediate side. Speed and load may have some effect on the fluctuation of amplitude; however, signs of wear do exist. We will continue to monitor this issue closely. Rated as a **CLASS II** defect.

Roll Stand 5
Vibration was about the same in the gearbox outboard side this survey. A dominant gear mesh vibration is present towards the output of the gearbox. The up and down amplitude of this peak from month to month is likely due to change in tooth load and machine speed. We will continue to monitor this very closely. Rated as a **CLASS I** defect for now.

Roll Stand 5 Cooling Fan Motor
There still appears to be a vibration in this unit that may be due to imbalance of the fan wheel. Inspect, clean fan wheel as time allows. We will monitor this closely. Rated as a **CLASS II** defect.

Roll Stand 6
A dominant gear mesh vibration is present towards the output of the gearbox. Overall vibration increased slightly from last month. The up and down amplitude of this peak is likely due to change in tooth load and speed. This issue seems to have begun after gearbox was repaired. We will continue to monitor this very closely. Rated as a **CLASS I** defect.

Roll Stand 7
Output side of the gearbox vibration decreased substantially this survey. We still suspect this to be possibly due to a resonant gear mesh frequency vibration. The up and down amplitude of this peak from month to month is likely due to change in tooth load and machine speed. We will continue to monitor this very closely. Rated as a **CLASS II** defect.

Roll Stand 13 Cooling Fan Motor
Cooling fan motor data is showing vibrations associated with rotor issues such as loose or weak rotor bars. This could be influencing the higher than normal 1 x rpm vibration. Fan may also have some imbalance. We will monitor this closely. Rated as a **CLASS II**.

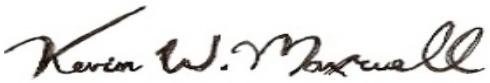
Ejector Fan
The motor appears to be thrusting slightly again. Overall vibration levels are within acceptable limits this survey. This issue will continue to be monitored closely. Rated as a **CLASS I** defect.

South Quincy Air Compressor

Equipment was not in service this survey; however, the following still applies: Motor 4 x rpm vibration has increased slightly this survey. This may be lobe pass frequency of the compressor or perhaps a coupling issue. It is recommended to inspect the coupling as time allows. Data has also shown (in the past) high frequency electrical type vibration such as 2 x line frequency, stator slot pass, and or rotor bar pass frequency vibrations. This usually indicates an electrical issue is present such as winding issue, rotor issue, etc. We will monitor this issue closely. Because of the increased 4 x rpm vibration in the motor, this is rated as a **CLASS II** defect.

As always, it has been a pleasure to NUCOR Steel Flowood, MS. If there are any comments or questions, do not hesitate to contact us.

Sincerely,



ISO Certified Vibration Analyst, Category III

HI-SPEED INDUSTRIAL SERVICE

QualiTest® Diagnostics

Cell: 901-486-4565

Email: kwilliam@gohispeed.com

Abbreviated Last Measurement Summary

****

Database: nucorja9.rbm
Station: Roll Mill Rolls

MEASUREMENT POINT	OVERALL LEVEL	HFD / VHFD
STD1A - Stand 1A	(10-Dec-19)	
	OVERALL LEVEL	1K-20KHz
MOH	.073 In/Sec	.023 G-s
MIH	.056 In/Sec	.022 G-s
MIA	.047 In/Sec	.033 G-s
COH	.171 In/Sec	.127 G-s
GIA	.020 In/Sec	.013 G-s
GIH	.038 In/Sec	.038 G-s
GI2	.038 In/Sec	.035 G-s
GI3	.028 In/Sec	.040 G-s
GI4	.025 In/Sec	.025 G-s
GI5	.021 In/Sec	.013 G-s
GI6	.023 In/Sec	.0090 G-s
GOH	.013 In/Sec	.058 G-s
STD2A - Stand 2A	(10-Dec-19)	
	OVERALL LEVEL	1K-20KHz
MOH	.070 In/Sec	.045 G-s
MIH	.060 In/Sec	.035 G-s
MIA	.140 In/Sec	.017 G-s
COH	.159 In/Sec	.015 G-s

STD2 - Stand 2 (10-Dec-19)

	OVERALL LEVEL	1K-20KHz
MOH	.104 In/Sec	.043 G-s
MIH	.126 In/Sec	.635 G-s
MIA	.143 In/Sec	.059 G-s
GIA	.072 In/Sec	.032 G-s
GIH	.059 In/Sec	.0089 G-s
COH	.451 In/Sec	.373 G-s

STD3 - Stand 3 (10-Dec-19)

	OVERALL LEVEL	1K-20KHz
MOH	.074 In/Sec	.155 G-s
MIH	.181 In/Sec	.019 G-s
MIA	.225 In/Sec	.099 G-s
GIA	.038 In/Sec	.025 G-s
GIH	.045 In/Sec	.022 G-s
COH	.164 In/Sec	.040 G-s

STD4 - Stand 4 (10-Dec-19)

	OVERALL LEVEL	1K-20KHz
MOH	.086 In/Sec	.164 G-s
MIH	.055 In/Sec	.030 G-s
MIA	.175 In/Sec	.151 G-s
GIA	.069 In/Sec	.107 G-s
GIH	.049 In/Sec	.152 G-s
COH	.107 In/Sec	.034 G-s

STD5 - Stand 5 (10-Dec-19)

	OVERALL LEVEL	1K-20KHz
MOH	.031 In/Sec	.027 G-s
MIH	.097 In/Sec	.039 G-s
MIA	.094 In/Sec	.079 G-s
GIA	.033 In/Sec	.0032 G-s
GIH	.039 In/Sec	.011 G-s
GOH	.060 In/Sec	.040 G-s
COH	.636 In/Sec	.046 G-s

STD6 - Stand 6 (10-Dec-19)

	OVERALL LEVEL	1K-20KHz
MOH	.033 In/Sec	.034 G-s
MIH	.034 In/Sec	.049 G-s
MIA	.080 In/Sec	.034 G-s
GIA	.037 In/Sec	.017 G-s
GIH	.033 In/Sec	.012 G-s
GOH	.132 In/Sec	.021 G-s
COH	.243 In/Sec	.096 G-s

STD7 - Stand 7 (10-Dec-19)

	OVERALL LEVEL	1K-20KHz
MOH	.038 In/Sec	.060 G-s
MIH	.092 In/Sec	.081 G-s
MIA	.042 In/Sec	.214 G-s
GIA	.022 In/Sec	.0056 G-s
GIH	.026 In/Sec	.019 G-s
GOH	.272 In/Sec	.191 G-s
COH	.291 In/Sec	.077 G-s

STD8 - Stand 8 (10-Dec-19)

	OVERALL LEVEL	1K-20KHz
MOH	.030 In/Sec	.012 G-s
MIH	.050 In/Sec	.026 G-s
MIA	.046 In/Sec	.021 G-s
GIA	.037 In/Sec	.016 G-s
GIH	.044 In/Sec	.055 G-s
COH	.121 In/Sec	.075 G-s

STD9 - Stand 9 (10-Dec-19)

	OVERALL LEVEL	1K-20KHz
MOH	.069 In/Sec	.082 G-s

MIH	.131 In/Sec	.055 G-s
MIA	.050 In/Sec	.159 G-s
GIA	.066 In/Sec	.0067 G-s
GIH	.071 In/Sec	.128 G-s
COH	.387 In/Sec	.115 G-s

STD10 - Stand 10 (10-Dec-19)

	OVERALL LEVEL	1K-20KHz
MOH	.029 In/Sec	.073 G-s
MIH	.032 In/Sec	.099 G-s
MIA	.031 In/Sec	.060 G-s
GIA	.055 In/Sec	.088 G-s
GIH	.033 In/Sec	.049 G-s
COH	.101 In/Sec	.079 G-s

STD11 - Stand 11 (10-Dec-19)

	OVERALL LEVEL	1K-20KHz
MOH	.019 In/Sec	.027 G-s
MIH	.026 In/Sec	.028 G-s
MIA	.050 In/Sec	.015 G-s
GIA	.042 In/Sec	.035 G-s
GIH	.050 In/Sec	.165 G-s
GOH	.038 In/Sec	.113 G-s
COH	.152 In/Sec	.039 G-s

STD12 - Stand 12 (10-Dec-19)

	OVERALL LEVEL	1K-20KHz
MOH	.024 In/Sec	.035 G-s
MIH	.052 In/Sec	.080 G-s
MIA	.041 In/Sec	.059 G-s
COH	.115 In/Sec	.047 G-s

STD13 - Stand 13 (10-Dec-19)

	OVERALL LEVEL	1K-20KHz
MOH	.082 In/Sec	.245 G-s
MIH	.085 In/Sec	.232 G-s
MIA	.127 In/Sec	.149 G-s
GIA	.055 In/Sec	.050 G-s
GIH	.061 In/Sec	.060 G-s
GOH	.058 In/Sec	.038 G-s
COH	.458 In/Sec	.676 G-s

NORTH AC - NORTH AIR COMPRESSOR QUINCY (10-Dec-19)

	OVERALL LEVEL	1 - 20 KHz
MOH	.132 In/Sec	.207 G-s
MIH	.129 In/Sec	.430 G-s
MIA	.213 In/Sec	.104 G-s
	OVERALL LEVEL	1K-20KHz
CIA	.233 In/Sec	.416 G-s
CIH	.197 In/Sec	.295 G-s
COH	.178 In/Sec	.276 G-s

WEST AC - WEST AIR COMPRESSOR QUINCY (10-Dec-19)

	OVERALL LEVEL	1 - 20 KHz
MOH	.281 In/Sec	.302 G-s
MIH	.252 In/Sec	.312 G-s
MIA	.225 In/Sec	.154 G-s
	OVERALL LEVEL	1K-20KHz
CIA	.350 In/Sec	.576 G-s
CIH	.410 In/Sec	.448 G-s
COH	.276 In/Sec	.457 G-s

Station: Roll Mill Utilities

MEASUREMENT POINT	OVERALL LEVEL	HFD / VHFD
HYDPMP1 - Hydraulic Pump East	(09-Dec-19)	
	OVERALL LEVEL	1K-20KHz
MOH	.223 In/Sec	.165 G-s
MIH	.461 In/Sec	.211 G-s
PIV	.310 In/Sec	1.102 G-s
HYDPMP3 - Hydraulic Pump West	(09-Dec-19)	
	OVERALL LEVEL	1K-20KHz
MOH	.158 In/Sec	.227 G-s
MIH	.386 In/Sec	.393 G-s
PIV	.293 In/Sec	1.501 G-s
DESFAN - Desolution Fan	(09-Dec-19)	
	OVERALL LEVEL	1K-20KHz
MOH	.042 In/Sec	.080 G-s
MIH	.036 In/Sec	.028 G-s
MIA	.057 In/Sec	.043 G-s
COMFAN - Combustion Air Fan	(09-Dec-19)	
	OVERALL LEVEL	1K-20KHz
MOH	.132 In/Sec	.149 G-s
MIH	.106 In/Sec	.216 G-s
MIA	.063 In/Sec	.198 G-s
FIH	.072 In/Sec	.109 G-s
FOH	.094 In/Sec	.503 G-s
EJCFAN - Ejector Air Fan	(09-Dec-19)	
	OVERALL LEVEL	1K-20KHz
MOH	.105 In/Sec	.296 G-s
MIH	.118 In/Sec	.350 G-s
MIA	.085 In/Sec	.256 G-s
FIH	.057 In/Sec	1.270 G-s
FOH	.141 In/Sec	.381 G-s
COLPMP1 - Furnace Cooling Pump East	(09-Dec-19)	
	OVERALL LEVEL	1K-20KHz
MOH	.101 In/Sec	.273 G-s
MIH	.046 In/Sec	.149 G-s
MIA	.085 In/Sec	.092 G-s
FCTSOUTH - Furnace CT Drive South	(09-Dec-19)	
	OVERALL LEVEL	1K-20KHz
MOH	.094 In/Sec	.070 G-s
MIH	.049 In/Sec	.143 G-s
MIA	.074 In/Sec	.098 G-s
FCTNORTH - Furnace CT Drive North	(09-Dec-19)	
	OVERALL LEVEL	1K-20KHz
MOH	.263 In/Sec	.061 G-s
MIH	.181 In/Sec	.135 G-s
MIA	.149 In/Sec	.114 G-s
SCLPMP2 - Scale Pit Pump North	(09-Dec-19)	
	OVERALL LEVEL	1K-20KHz
MOH	.267 In/Sec	.180 G-s
MIH	.150 In/Sec	.240 G-s
MIA	.133 In/Sec	.120 G-s
PIH	.154 In/Sec	.042 G-s
CTWTR2 - CT Pump West	(09-Dec-19)	
	OVERALL LEVEL	1K-20KHz
MOH	.067 In/Sec	.332 G-s
MIH	.071 In/Sec	.363 G-s
MIA	.127 In/Sec	.193 G-s

```
      MILWTR3    - Mill Water Pump West          (09-Dec-19)
                                  OVERALL LEVEL     1K-20KHz
            MOH                    .066 In/Sec       .321 G-s
            MIH                    .050 In/Sec       .197 G-s
            MIA                    .033 In/Sec       .204 G-s

      MILWTR2    - Mill Water Pump Center        (09-Dec-19)
                                  OVERALL LEVEL     1K-20KHz
            MOH                    .091 In/Sec       .517 G-s
            MIH                    .059 In/Sec       .722 G-s
            MIA                    .046 In/Sec       .394 G-s

      EASTBOOST  - East Booster Pump Small       (09-Dec-19)
                                  OVERALL LEVEL     1K-20KHz
            MOH                    .184 In/Sec       .326 G-s
            MIH                    .124 In/Sec       .120 G-s
            MIA                    .060 In/Sec       .060 G-s

--------------------------------------------------------------------------------
   Clarification Of Vibration Units:
      Acc      -->  G-s      RMS
      Vel      -->  In/Sec   PK
```