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

July 1, 2022

Nucor Roll Mill
Jackson-Flowood, MS

Subject: June vibration survey

Below is a summary report for the monthly Roll Mill vibration survey that was performed on June 28, 2022. Most of the machines surveyed were found to be in good condition except for 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

***Hi-Speed*** **Industrial Service** tests and inspects industrial machinery and equipment and makes recommendations concerning maintenance and repairs based on its experience in the field of industrial repair and maintenance. The information contained herein is provided as an opinion only, not as a guaranty or warranty of the matters discussed herein.

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**

Cell: 901-486-4565
Email: kwilliam@gohispeed.com

## Defects

**Roll Stand 1A Planetary Gearbox**
Gearbox data shows vibration levels to be lower this survey in the drive end. Input side still has some vibration around 1300 Hz. This is high frequency acceleration and may be gear or bearing related. Seems to be higher in vibration under heavy load. Roll stands were running slower and less loaded during this survey. We will monitor this closely. Rated as a **CLASS I** defect.

**Roll Stand 3**
Outboard motor bearing is starting to show some signs of bearing issue. Data is showing outer race defects harmonics on the ODE bearing. This will be monitored very closely in the coming surveys. Rated as a **CLASS II** defect for now.

**Roll Stand 5**
Gear mesh vibration decreased slightly this month. Last gear inspection of the gearbox does show some tooth wear in this 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. This is rated as a **CLASS II** defect.

**Roll Stand 6**
Gear mesh vibration decreased this month. A dominant gear mesh vibration is sometimes present towards the output of the gearbox. The up and down amplitude of this peak is likely due to change in tooth load and speed. We will continue to monitor this very closely. Because of the high amplitude this month, this issue is rated as a **CLASS II** defect.

**Roll Stand 7**
Gearbox vibration decreased some 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. Because of the high amplitudes in the gearbox and bearing defect related vibrations in the motor, this is rated as a **CLASS II** defect.

**Roll Stand 14**
The vibration that was seen in the input axial of the gearbox a couple of surveys ago was present again this survey. The change in vibration may be due to process load and speed. We will continue to monitor this closely and report any changes. Rated as a **CLASS I** defect.

**Roll Stand 16**
Drive motor has bearing issues. Vibration data indicates race defects in the motor bearings which likely caused by electrical fluting. Motor should be scheduled for replacement as scheduling allows. Ensure new motor has proper grounding/fluting protection. Rated as a **CLASS III** defect.

**North Quincy Compressor**
***Unit was down this survey. The following may still apply:*** Motor and compressor have increased vibration. Seems to be highest at 1 x rpm. Inspect coupling and ensure alignment is good ASAP. Rated as a **CLASS III** defect.

**South Quincy Compressor**
Inboard motor bearing vibration data shows some signs of defects in the motor bearings. Motor will likely need attention in the near future. Rated as a **CLASS II** defect.

**Ejector Fan**

Vibration is up some on the fan bearings. Data also shows some recent ½ harmonics of fan rpm. This typically is due to fit looseness. It is recommended to inspect fan wheel/ fan hub for looseness and perform lift check on fan shaft as time allows. Ensure there isn't any axial play of the fan shaft. Rated as a **CLASS II** defect.

**Furnace Cooling Tower Drives North and South**

Motors had higher vibrations this survey; however, the normally high vibration in the motor appears to be occurring at 1 x motor rpm and may indicate a structural issue such as loose fasteners, weak flexible motor base. This could also be caused by a resonance or air flow turbulence in this unit. We will continue to monitor this issue closely. Rated as a **CLASS II** defect.

**Mill Water West Pump**

Top thrust bearing is showing signs of bearing defects according to the spectral data of the Outboard end of the motor. This appears to be light defects at this time and will be monitored closely. Rated as a **CLASS I** defect.

Abbreviated Last Measurement Summary
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Database: nucorja9.rbm
Station: Roll Mill Rolls
Route No. 1: RM ROLL DRIVES

| MEASUREMENT POINT | OVERALL LEVEL | HFD / VHFD |
|---|---|---|
| STD1A - Stand 1A | (28-Jun-22) | |
| | OVERALL LEVEL | 1K-20KHz |
| MOH - Motor OB Horizontal | .065 In/Sec | .311 G-s |
| MIH - Motor IB Horizontal | .072 In/Sec | .140 G-s |
| MIA - Motor IB Axial | .103 In/Sec | .065 G-s |
| COH - COOLING FAN HORZ | .172 In/Sec | .091 G-s |
| GIA - Gearbox IB Axial | .075 In/Sec | .114 G-s |
| GIH - Gearbox IB Horizontal | .150 In/Sec | 1.051 G-s |
| GI2 - Gearbox 2 BEARING Horizontal | .121 In/Sec | .366 G-s |
| GI3 - Gearbox 3 BEARING Horizontal | .121 In/Sec | .611 G-s |
| GI4 - Gearbox 4 BEARING Horizontal | .101 In/Sec | .249 G-s |
| GI5 - Gearbox 5 BEARING Horizontal | .071 In/Sec | .451 G-s |
| GI6 - Gearbox 6 BEARING Horizontal | .049 In/Sec | .109 G-s |
| GOH - Gearbox OB Horizontal | .041 In/Sec | .022 G-s |
| STD2A - Stand 2A | (28-Jun-22) | |
| | OVERALL LEVEL | 1K-20KHz |
| MOH - Motor OB Horizontal | .049 In/Sec | .046 G-s |
| MIH - Motor IB Horizontal | .075 In/Sec | .046 G-s |
| MIA - Motor IB Axial | .076 In/Sec | .101 G-s |
| COH - COOLING FAN HORIZONTAL OUTBOARD | .224 In/Sec | .036 G-s |
| STD1 - Stand 1 | (28-Jun-22) | |
| | OVERALL LEVEL | 1K-20KHz |
| MOH - Motor OB Horizontal | .060 In/Sec | .088 G-s |
| MIH - Motor IB Horizontal | .101 In/Sec | .031 G-s |
| MIA - Motor IB Axial | .078 In/Sec | .157 G-s |
| GIA - Gearbox IB Axial | .488 In/Sec | .112 G-s |
| GIH - Gearbox IB Horizontal | .074 In/Sec | .021 G-s |
| COH - COOLING FAN HORZ | .068 In/Sec | .037 G-s |
| STD2 - Stand 2 | (28-Jun-22) | |
| | OVERALL LEVEL | 1K-20KHz |

| | | |
|---|---|---|
| MOH - Motor OB Horizontal | .051 In/Sec | .169 G-s |
| MIH - Motor IB Horizontal | .132 In/Sec | .032 G-s |
| MIA - Motor IB Axial | .327 In/Sec | .280 G-s |
| GIA - Gearbox IB Axial | .095 In/Sec | .082 G-s |
| GIH - Gearbox IB Horizontal | .145 In/Sec | .244 G-s |
| COH - Motor OB Horizontal | .216 In/Sec | .056 G-s |

STD3 - Stand 3 (28-Jun-22)

| | OVERALL LEVEL | 1K-20KHz |
|---|---|---|
| MOH - Motor OB Horizontal | .058 In/Sec | .205 G-s |
| MIH - Motor IB Horizontal | .089 In/Sec | .045 G-s |
| MIA - Motor IB Axial | .233 In/Sec | .262 G-s |
| GIA - Gearbox IB Axial | .036 In/Sec | .0095 G-s |
| GIH - Gearbox IB Horizontal | .049 In/Sec | .084 G-s |
| COH - COOLING FAN MOH | .199 In/Sec | .045 G-s |

STD4 - Stand 4 (28-Jun-22)

| | OVERALL LEVEL | 1K-20KHz |
|---|---|---|
| MOH - Motor OB Horizontal | .062 In/Sec | .028 G-s |
| MIH - Motor IB Horizontal | .044 In/Sec | .013 G-s |
| MIA - Motor IB Axial | .117 In/Sec | .096 G-s |
| GIA - Gearbox IB Axial | .074 In/Sec | .083 G-s |
| GIH - Gearbox IB Horizontal | .058 In/Sec | .043 G-s |
| COH - COOLING FAN MOH | .269 In/Sec | .028 G-s |

STD5 - Stand 5 (28-Jun-22)

| | OVERALL LEVEL | 1K-20KHz |
|---|---|---|
| MOH - Motor OB Horizontal | .041 In/Sec | .036 G-s |
| MIH - Motor IB Horizontal | .068 In/Sec | .102 G-s |
| MIA - Motor IB Axial | .095 In/Sec | .046 G-s |
| GIA - Gearbox IB Axial | .095 In/Sec | .0090 G-s |
| GIH - Gearbox IB Horizontal | .099 In/Sec | .031 G-s |
| GOH - Gearbox OB Horizontal | .362 In/Sec | .136 G-s |
| COH - COOLING FAN MOH | .413 In/Sec | .049 G-s |

STD6 - Stand 6 (28-Jun-22)

| | OVERALL LEVEL | 1K-20KHz |
|---|---|---|
| MOH - Motor OB Horizontal | .053 In/Sec | .021 G-s |
| MIH - Motor IB Horizontal | .048 In/Sec | .037 G-s |
| MIA - Motor IB Axial | .127 In/Sec | .034 G-s |
| GIA - Gearbox IB Axial | .065 In/Sec | .028 G-s |
| GIH - Gearbox IB Horizontal | .053 In/Sec | .067 G-s |
| GOH - Gearbox OB Horizontal | .217 In/Sec | .204 G-s |
| COH - COOLING FAN MOH | .367 In/Sec | .038 G-s |

STD7 - Stand 7 (28-Jun-22)

| | OVERALL LEVEL | 1K-20KHz |
|---|---|---|
| MOH - Motor OB Horizontal | .047 In/Sec | .109 G-s |
| MIH - Motor IB Horizontal | .035 In/Sec | .067 G-s |
| MIA - Motor IB Axial | .123 In/Sec | .257 G-s |
| GIA - Gearbox IB Axial | .050 In/Sec | .016 G-s |
| GIH - Gearbox IB Horizontal | .028 In/Sec | .027 G-s |
| GOH - Gearbox OB Horizontal | .193 In/Sec | .082 G-s |
| COH - COOLING FAN MOH | .375 In/Sec | .088 G-s |

STD8 - Stand 8 (28-Jun-22)

| | OVERALL LEVEL | 1K-20KHz |
|---|---|---|
| MOH - Motor OB Horizontal | .058 In/Sec | .068 G-s |
| MIH - Motor IB Horizontal | .062 In/Sec | .061 G-s |
| MIA - Motor IB Axial | .081 In/Sec | .189 G-s |
| GIA - Gearbox IB Axial | .041 In/Sec | .059 G-s |
| GIH - Gearbox IB Horizontal | .030 In/Sec | .067 G-s |
| COH - COOLING FAN MOH | .192 In/Sec | .067 G-s |

STD9 - Stand 9 (28-Jun-22)

| | OVERALL LEVEL | 1K-20KHz |
|---|---|---|
| MOH - Motor OB Horizontal | .036 In/Sec | .054 G-s |
| MIH - Motor IB Horizontal | .064 In/Sec | .076 G-s |
| MIA - Motor IB Axial | .114 In/Sec | .054 G-s |
| GIA - Gearbox IB Axial | .081 In/Sec | .040 G-s |

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|---|---|---|
| GIH - Gearbox IB Horizontal | .057 In/Sec | .199 G-s |
| COH - COOLING FAN MOH | .124 In/Sec | .077 G-s |

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|---|---|---|
| STD11 - Stand 11 | (28-Jun-22) | |
| | OVERALL LEVEL | 1K-20KHz |
| MOH - Motor OB Horizontal | .020 In/Sec | .023 G-s |
| MIH - Motor IB Horizontal | .031 In/Sec | .0094 G-s |
| MIA - Motor IB Axial | .025 In/Sec | .045 G-s |
| GIA - Gearbox IB Axial | .049 In/Sec | .0097 G-s |
| GIH - Gearbox IB Horizontal | .043 In/Sec | .053 G-s |
| GOH - Gearbox OB Horizontal | .018 In/Sec | .016 G-s |
| COH - COOLING FAN MOH | .168 In/Sec | .039 G-s |

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|---|---|---|
| STD13 - Stand 13 | (28-Jun-22) | |
| | OVERALL LEVEL | 1K-20KHz |
| MOH - Motor OB Horizontal | .044 In/Sec | .039 G-s |
| MIH - Motor IB Horizontal | .087 In/Sec | .129 G-s |
| MIA - Motor IB Axial | .129 In/Sec | .181 G-s |
| GIA - Gearbox IB Axial | .032 In/Sec | .055 G-s |
| GIH - Gearbox IB Horizontal | .030 In/Sec | .138 G-s |
| GOH - Gearbox OB Horizontal | .028 In/Sec | .024 G-s |
| COH - COOLING FAN MOH | .277 In/Sec | .164 G-s |

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|---|---|---|
| STD14 - Stand 14 | (28-Jun-22) | |
| | OVERALL LEVEL | 1K-20KHz |
| MOH - Motor OB Horizontal | .132 In/Sec | .063 G-s |
| MIH - Motor IB Horizontal | .133 In/Sec | .045 G-s |
| MIA - Motor IB Axial | .106 In/Sec | .040 G-s |
| COH - COOLING FAN MOH | .266 In/Sec | .158 G-s |
| GIA - Gearbox IB Axial | .219 In/Sec | .153 G-s |
| GIH - Gearbox IB Horizontal | .077 In/Sec | .018 G-s |
| GOH - Gearbox OB Horizontal | .055 In/Sec | .035 G-s |

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|---|---|---|
| STD16 - Stand 16 | (28-Jun-22) | |
| | OVERALL LEVEL | 1K-20KHz |
| MOH - Motor OB Horizontal | .072 In/Sec | .447 G-s |
| MIH - Motor IB Horizontal | .143 In/Sec | 1.174 G-s |
| MIA - Motor IB Axial | .106 In/Sec | .626 G-s |
| GIA - Gearbox IB Axial | .149 In/Sec | .100 G-s |
| GIH - Gearbox IB Horizontal | .068 In/Sec | .032 G-s |
| GOH - Gearbox OB Horizontal | .019 In/Sec | .024 G-s |
| COH - COOLING FAN MOH | .177 In/Sec | .043 G-s |

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|---|---|---|
| SOUTH AC - SOUTH AIR COMPRESSOR QUINCY | (28-Jun-22) | |
| | OVERALL LEVEL | 1 - 20 KHz |
| MOH - MOTOR OUTBOARD HORIZONTAL | .084 In/Sec | 1.089 G-s |
| MIH - MOTOR INBOARD HORIZONTAL | .224 In/Sec | 2.089 G-s |
| MIA - MOTOR INBOARD AXIAL | .091 In/Sec | 1.287 G-s |
| | OVERALL LEVEL | 1K-20KHz |
| CIA - COMPRESSOR INBOARD AXIAL | .319 In/Sec | .539 G-s |
| CIH - COMPRESSOR INBOARD HORIZONTAL | .241 In/Sec | .364 G-s |
| COH - COMPRESSOR OUTBOARD HORIZONTAL | .294 In/Sec | .325 G-s |

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|---|---|---|
| WEST AC - WEST AIR COMPRESSOR QUINCY | (28-Jun-22) | |
| | OVERALL LEVEL | 1 - 20 KHz |
| MOH - MOTOR OUTBOARD HORIZONTAL | .179 In/Sec | .368 G-s |
| MIH - MOTOR INBOARD HORIZONTAL | .174 In/Sec | .452 G-s |
| MIA - MOTOR INBOARD AXIAL | .416 In/Sec | .102 G-s |
| | OVERALL LEVEL | 1K-20KHz |
| CIA - COMPRESSOR INBOARD AXIAL | .168 In/Sec | .615 G-s |
| CIH - COMPRESSOR INBOARD HORIZONTAL | .222 In/Sec | .473 G-s |
| COH - COMPRESSOR OUTBOARD HORIZONTAL | .230 In/Sec | .341 G-s |

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Clarification Of Vibration Units:

| | | |
|---|---|---|
| Acc | --> G-s | RMS |
| Vel | --> In/Sec | PK |

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Database: nucorja9.rbm
Station: Roll Mill Utilities
Route No. 1: UTILITIES

| MEASUREMENT POINT | OVERALL LEVEL | HFD / VHFD |
|---|---|---|
| HYDPMP1 - Hydraulic Pump East | (28-Jun-22) | |
| | OVERALL LEVEL | 1K-20KHz |
| MOH - Motor OB Horizontal | .044 In/Sec | .282 G-s |
| MIH - Motor IB Horizontal | .157 In/Sec | .258 G-s |
| PIV - Pump IB Vertical | .288 In/Sec | 2.114 G-s |
| HYDPMP3 - Hydraulic Pump West | (28-Jun-22) | |
| | OVERALL LEVEL | 1K-20KHz |
| MOH - Motor OB Horizontal | .087 In/Sec | .311 G-s |
| MIH - Motor IB Horizontal | .294 In/Sec | .347 G-s |
| PIV - Pump IB Vertical | .285 In/Sec | 1.005 G-s |
| DESFAN - Desolution Fan | (28-Jun-22) | |
| | OVERALL LEVEL | 1K-20KHz |
| MOH - Motor OB Horizontal | .041 In/Sec | .073 G-s |
| MIH - Motor IB Horizontal | .049 In/Sec | .032 G-s |
| COMFAN - Combustion Air Fan | (28-Jun-22) | |
| | OVERALL LEVEL | 1K-20KHz |
| MOH - Motor OB Horizontal | .146 In/Sec | .134 G-s |
| MIH - Motor IB Horizontal | .129 In/Sec | .201 G-s |
| MIA - MOTOR IB Axial | .093 In/Sec | .106 G-s |
| FIH - Fan IB Horizontal | .077 In/Sec | .115 G-s |
| FOH - Fan OB Horizontal | .112 In/Sec | .957 G-s |
| EJCFAN - Ejector Air Fan | (28-Jun-22) | |
| | OVERALL LEVEL | 1K-20KHz |
| MOH - Motor OB Horizontal | .208 In/Sec | .281 G-s |
| MIH - Motor IB Horizontal | .175 In/Sec | .375 G-s |
| MIA - Motor IB AXIAL | .113 In/Sec | .190 G-s |
| FIH - Fan IB Horizontal | .108 In/Sec | .518 G-s |
| FOH - Fan OB Horizontal | .288 In/Sec | .804 G-s |
| COLPMP2 - Furnace Cooling Pump center | (28-Jun-22) | |
| | OVERALL LEVEL | 1K-20KHz |
| MOH - Motor OB Horizontal | .134 In/Sec | .131 G-s |
| MIH - Motor IB Horizontal | .140 In/Sec | .253 G-s |
| MIA - Motor IB Axial | .192 In/Sec | .191 G-s |
| FCTSOUTH - Furnace CT Drive South | (28-Jun-22) | |
| | OVERALL LEVEL | 1K-20KHz |
| MOH - Motor OB Horizontal | .421 In/Sec | .070 G-s |
| MIH - Motor IB Horizontal | .307 In/Sec | .081 G-s |
| MIA - Motor IB Axial | .544 In/Sec | .014 G-s |
| FCTNORTH - Furnace CT Drive North | (28-Jun-22) | |
| | OVERALL LEVEL | 1K-20KHz |
| MOH - Motor OB Horizontal | .543 In/Sec | .088 G-s |
| MIH - Motor IB Horizontal | .354 In/Sec | .115 G-s |
| MIA - Motor IB Axial | .171 In/Sec | .065 G-s |
| SCLPMP1 - Scale Pit Pump South | (28-Jun-22) | |
| | OVERALL LEVEL | 1K-20KHz |
| MOH - Motor OB Horizontal | .156 In/Sec | .438 G-s |
| MOV - Motor OB VERTICAL | .177 In/Sec | .503 G-s |
| MIV - Motor IB VERTICAL | .115 In/Sec | .182 G-s |
| MIH - Motor IB Horizontal | .222 In/Sec | .198 G-s |
| MIA - Motor IB Axial | .105 In/Sec | .153 G-s |
| CTWTR2 - CT Pump West | (28-Jun-22) | |
| | OVERALL LEVEL | 1K-20KHz |

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|---|---|---|
| MOH - Motor OB Horizontal | .052 In/Sec | .223 G-s |
| MIH - Motor IB Horizontal | .083 In/Sec | .237 G-s |
| MIA - Motor IB Axial | .084 In/Sec | .224 G-s |

MILWTR3 - Mill Water Pump West (28-Jun-22)

| | OVERALL LEVEL | 1K-20KHz |
|---|---|---|
| MOH - Motor OB Horizontal | .054 In/Sec | .354 G-s |
| MIH - Motor IB Horizontal | .048 In/Sec | .428 G-s |
| MIA - Motor IB Axial | .037 In/Sec | .268 G-s |

MILWTR1 - Mill Water Pump East (28-Jun-22)

| | OVERALL LEVEL | 1K-20KHz |
|---|---|---|
| MOH - Motor OB Horizontal | .053 In/Sec | .283 G-s |
| MIH - Motor IB Horizontal | .050 In/Sec | .542 G-s |
| MIA - Motor IB Axial | .032 In/Sec | .172 G-s |

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Clarification Of Vibration Units:

| | | | |
|---|---|---|---|
| Acc | --> | G-s | RMS |
| Vel | --> | In/Sec | PK |