HI-SPEED INDUSTRIAL SERVICE

MILLINGTON, TN

**November 19, 2020**

Arkema

Subject: November week 3 vibration service report

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.

This completes our assessment of your equipment for this survey. Thank you for your business and don't hesitate to call if you have any comments or questions.

Sincerely,

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**Weekly Route Critical Equipment Observations**

**C Concentrator Vacuum Pump 2130-1**
Vibrations appear to be slightly elevated this survey. Pump input is highest at 0.168"/sec velocity peak. No actions required just yet.

**Agitator, Hydrogenator C 7001-01**
The highest motor overall vibrations have leveled off at 0.108"/sec velocity peak for the inboard vertical. We will continue to monitor normally. Gearbox looks good.

**A/B Concentrator Vacuum Pump 57**
The outboard pump bearing overall is 0.269"/sec peak velocity, with a dominant vibration at 16 orders, which is most likely blade pass. We will continue to watch for changes. **Rated a Class I Defect.**

**Flash Vacuum Pump 2130-1**
Vibrations appear to be normal this survey. All velocity measurements are below 0.10"/sec peak. No actions required.

**Air Compressor C-201**
Rotor bar vibrations are normal for this motor's history. The trend clearly shows that the vibrations vary considerably over time but have risen considerably. We still believe these motors have possible weak rotor bar end connections that cause the vibrations to fluctuate higher due to loading. There are still blower case vibrations around 3 KHz. With a wide noise floor. We will continue to monitor this unit for changes. **Rated a Class I Defect**.

**Air Compressor C-202**
Rotor bar vibrations are normal for this motor's history. The trend clearly shows that the vibrations vary considerably over time. We are still watching acceleration near 5.44 g's RMS at 2500 Hz for the compressor section. **Rated a Class I Defect**. No immediate actions required at this time.

**Air Compressor C-203**
Rotor bar vibrations are still high for this motor's history. The waterfall spectra clearly show that the vibrations vary considerably over time. We still believe these motors have possible weak rotor bar end connections that cause the vibrations to fluctuate higher due to loading There is also acceleration in the blower case vibrations around 2.5 KHz at 6.3 g's. With a wide noise floor. We will continue to monitor this unit for changes. **Rated a Class II Defect**.

**Instrument Air Compressor**
The male and female shaft vibrations still seem to show gear mesh and harmonics as well as a beat vibration occasionally. The male and female shaft vibrations are up to 7.1 g's RMS. The dominant vibration appears to be the second gear mesh harmonic at near 2500 Hz. Two other harmonic vibrations at near 1500 and 1600 Hz are beating at near near 120 Hz. The beat is strong sometimes since the vibrations are close and of nearly equal amplitude. We are still watching this unit closely and will be going forward. **Rated a Class II Defect for now.**

**Air Compressor NASH A 201-08A**
Highest vibration is still in the pump itself at 0.265"/sec velocity peak for the outboard vertical. The vibration spectrum is still dominated by a 20-order vibration, which is thought to be vane pass. **Rated a Class I Defect.**

**D Hydrogenator Agitator 9002-10**
Vibration data shows a slight decrease in vibrations this survey. Highest overall vibration is 0.326"/sec velocity peak for the gearbox lower output bearing plate in the E/W direction. Rated a Class I Defect. No issues today.

**Abbreviated Last Measurement Summary**
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**Database: Arkema.rbm**
**Station: PEROXIDE**
**Route No. 5: ARK WK 3**
**Report Date: 19-Nov-20 14:33**

| MEASUREMENT POINT | OVERALL LEVEL | HFD / VHFD |
|---|---|---|
| 2130-1old - C Concentrator Vacuum Pump | (19-Nov-20) | |
| | OVERALL LEVEL | 1-20 KHz |
| 11 - Motor OB HOR | .060 In/Sec | .409 G-s |
| 21 - Motor IB HOR | .058 In/Sec | .485 G-s |
| 23 - Motor IB AXIAL | .135 In/Sec | .123 G-s |
| 71 - Compressor IB HOR | .134 In/Sec | .882 G-s |
| 81 - Compressor OB Horiz | .168 In/Sec | .747 G-s |
| 83 - Compressor OB Axial | .086 In/Sec | 1.352 G-s |
| 7000-01 - AGITATOR,HYDROGENATOR C | (19-Nov-20) | |
| | OVERALL LEVEL | 1-20 KHZ |
| 02 - DRIVESHAFT BRG-EAST-WEST | .039 In/Sec | .025 G-s |

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|---|---|---|---|
| 03 | - DRIVESHAFT BRG-VERTICAL | .046 In/Sec | .057 G-s |
| 11 | - C Hydro Agitator MOTOR OB HORIZ | .076 In/Sec | .786 G-s |
| 12 | - C Hydro Agitator MOTOR OB VERT | .057 In/Sec | .800 G-s |
| 13 | - C Hydro Agitator Motor OB Axial | .093 In/Sec | .045 G-s |
| 21 | - C Hydro Agitator MOTOR IB HORIZ | .085 In/Sec | .324 G-s |
| 22 | - C Hydro Agitator MOTOR IB VERT | .108 In/Sec | .455 G-s |
| 23 | - C Hydro Agitator Motor IB Axial | .077 In/Sec | .174 G-s |
| 31 | - C Hydro Agitator GrBx In Horizon | .102 In/Sec | .573 G-s |
| 32 | - C Hydro Agitator GrBx In VERT | .076 In/Sec | .847 G-s |
| 33 | - C Hydro Agitator GrBx In Axial | .050 In/Sec | .444 G-s |
| 41 | - C HY AG GBX INPUT OUTBOARD HZ | .094 In/Sec | 1.074 G-s |
| 42 | - C HY AG GBX INPUT OUTBOARD VERT | .085 In/Sec | 1.071 G-s |
| 51 | - C Hydro GrBx shaft 2 Top HZ E-W | .059 In/Sec | .650 G-s |
| 53 | - C Hydro GrBx shaft 2 Top AXIAL | .087 In/Sec | .371 G-s |
| 61 | - C Hydro GrBx shaft 2 BOT HZ E-W | .028 In/Sec | .406 G-s |
| 71 | - C Hydro GrBx OUTPUT TOP HZ E-W | .054 In/Sec | .572 G-s |
| 81 | - C Hydro GrBx OUTPUT BOT HZ E-W | .022 In/Sec | .335 G-s |
| 83 | - C Hydro GrBx OUTPUT Top Axial | .048 In/Sec | .410 G-s |

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| 57 | - A/B Concentr Vac Pmp-var RPM | (19-Nov-20) | |
| | | OVERALL LEVEL | 1-20 KHz |
| 11 | - Motor OB HOR | .044 In/Sec | .221 G-s |
| 12 | - Motor OB VERT | .049 In/Sec | .291 G-s |
| 21 | - Motor IB HOR | .058 In/Sec | .191 G-s |
| 23 | - Motor IB AXIAL | .057 In/Sec | .132 G-s |
| 71 | - Compressor IB HOR | .121 In/Sec | .323 G-s |
| 81 | - Compressor OB Horiz | .269 In/Sec | .680 G-s |
| 83 | - Compressor OB Axial | .071 In/Sec | .645 G-s |

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| 2130-1 | - FLASH VAP VAC PUMP-var speed | (19-Nov-20) | |
| | | OVERALL LEVEL | 1-20 KHz |
| 11 | - Motor OB HOR | .056 In/Sec | .127 G-s |
| 12 | - Motor OB VERT | .034 In/Sec | .268 G-s |
| 21 | - Motor IB HOR | .041 In/Sec | .472 G-s |
| 22 | - Motor IB VERT | .046 In/Sec | .520 G-s |
| 23 | - Motor IB AXIAL | .050 In/Sec | .709 G-s |
| 71 | - Compressor IB HOR | .060 In/Sec | .651 G-s |
| 72 | - Compressor IB VERT | .077 In/Sec | .891 G-s |
| 81 | - Compressor OB Horiz | .081 In/Sec | .373 G-s |
| 82 | - Compressor OB VERT | .087 In/Sec | .500 G-s |
| 83 | - Compressor OB Axial | .046 In/Sec | .561 G-s |

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| C-203 | - C-203 Comp | (19-Nov-20) | |
| | | OVERALL LEVEL | 1-20 KHz |
| 11 | - MOTOR OB HOR | .040 In/Sec | .750 G-s |
| 12 | - MOTOR OB VERT | .080 In/Sec | 2.970 G-s |
| 21 | - MOTOR IB HOR | .030 In/Sec | .895 G-s |
| 22 | - MOTOR IB VERT | .144 In/Sec | 7.535 G-s |
| 23 | - MOTOR IB AXIAL | .060 In/Sec | 2.017 G-s |
| | | OVERALL LEVEL | 1-20 KHZ |
| 71M | - COMP MALE SHAFT IB HOR | .056 In/Sec | 2.546 G-s |
| 72M | - COMP MALE SHAFT IB VERT | .046 In/Sec | 1.499 G-s |
| 73M | - COMP MALE SHAFT IB AXIAL | .076 In/Sec | 2.150 G-s |
| 81M | - COMP MALE SHAFT OB HOR | .082 In/Sec | 6.333 G-s |
| 82M | - COMP MALE SHAFT OB VERT | .067 In/Sec | 4.518 G-s |
| 71F | - COMP FEMALE SHAFT IB HOR | .064 In/Sec | 2.597 G-s |
| 72F | - COMP FEMALE SHAFT IB VERT | .046 In/Sec | 1.249 G-s |

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|---|---|---|---|
| 73F - COMP FEMALE SHAFT IB AXIAL | .113 In/Sec | 6.087 G-s |
| 81F - COMP FEMALE SHAFT OB HOR | .075 In/Sec | 3.243 G-s |
| 82F - COMP FEMALE SHAFT OB VERT | .065 In/Sec | 2.252 G-s |

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| C-202 - C-202 Comp | (19-Nov-20) | |
| | OVERALL LEVEL | 1-20 KHz |
| 11 - MOTOR OB HOR | .053 In/Sec | .405 G-s |
| 12 - MOTOR OB VERT | .109 In/Sec | .852 G-s |
| 21 - MOTOR IB HOR | .058 In/Sec | .415 G-s |
| 22 - MOTOR IB VERT | .110 In/Sec | 2.908 G-s |
| 23 - MOTOR IB AXIAL | .042 In/Sec | .440 G-s |
| | OVERALL LEVEL | 1-20 KHZ |
| 71M - COMP MALE SHAFT IB HOR | .045 In/Sec | 1.649 G-s |
| 72M - COMP MALE SHAFT IB VERT | .055 In/Sec | 2.026 G-s |
| 73M - COMP MALE SHAFT IB AXIAL | .073 In/Sec | 1.584 G-s |
| 81M - COMP MALE SHAFT OB HOR | .060 In/Sec | 3.061 G-s |
| 82M - COMP MALE SHAFT OB VERT | .068 In/Sec | 2.468 G-s |
| 71F - COMP FEMALE SHAFT IB HOR | .048 In/Sec | 2.228 G-s |
| 72F - COMP FEMALE SHAFT IB VERT | .053 In/Sec | .754 G-s |
| 73F - COMP FEMALE SHAFT IB AXIAL | .081 In/Sec | 5.440 G-s |
| 81F - COMP FEMALE SHAFT OB HOR | .055 In/Sec | 1.367 G-s |
| 82F - COMP FEMALE SHAFT OB VERT | .054 In/Sec | .990 G-s |

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|---|---|---|
| C-201 - C-201 Comp | (19-Nov-20) | |
| | OVERALL LEVEL | 1-20 KHz |
| 11 - MOTOR OB HOR | .114 In/Sec | 3.077 G-s |
| 12 - MOTOR OB VERT | .104 In/Sec | 3.426 G-s |
| 21 - MOTOR IB HOR | .095 In/Sec | .474 G-s |
| 22 - MOTOR IB VERT | .092 In/Sec | 3.309 G-s |
| 23 - MOTOR IB AXIAL | .057 In/Sec | .384 G-s |
| | OVERALL LEVEL | 1-20 KHZ |
| 71M - COMP MALE SHAFT IB HOR | .048 In/Sec | 2.119 G-s |
| 72M - COMP MALE SHAFT IB VERT | .054 In/Sec | 2.726 G-s |
| 73M - COMP MALE SHAFT IB AXIAL | .078 In/Sec | 2.117 G-s |
| 81M - COMP MALE SHAFT OB HOR | .059 In/Sec | 4.302 G-s |
| 82M - COMP MALE SHAFT OB VERT | .063 In/Sec | 1.826 G-s |
| 71F - COMP FEMALE SHAFT IB HOR | .047 In/Sec | 3.071 G-s |
| 72F - COMP FEMALE SHAFT IB VERT | .067 In/Sec | 2.203 G-s |
| 73F - COMP FEMALE SHAFT IB AXIAL | .049 In/Sec | 1.841 G-s |
| 81F - COMP FEMALE SHAFT OB HOR | .096 In/Sec | 3.576 G-s |
| 82F - COMP FEMALE SHAFT OB VERT | .048 In/Sec | 1.129 G-s |

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| new AC - INSTRUMENT AIR COMPRESSOR | (19-Nov-20) | |
| | OVERALL LEVEL | 1-20 KHz |
| 11 - MOTOR OB HOR | .165 In/Sec | 1.695 G-s |
| 12 - MOTOR OB VERT | .108 In/Sec | .643 G-s |
| 13 - MOTOR OB AXIAL | .078 In/Sec | .631 G-s |
| 21 - MOTOR IB HOR | .173 In/Sec | 1.230 G-s |
| 22 - MOTOR IB VERT | .101 In/Sec | .622 G-s |
| 23 - MOTOR IB AXIAL | .065 In/Sec | 1.361 G-s |
| | OVERALL LEVEL | 1-20 KHZ |
| 71F - COMP FEMALE SHAFT IB HOR | .169 In/Sec | 6.857 G-s |
| 72F - COMP FEMALE SHAFT IB VERT | .156 In/Sec | .862 G-s |
| 73F - COMP FEMALE SHAFT IB AXIAL | .195 In/Sec | 5.178 G-s |
| 81F - COMP FEMALE SHAFT OB HOR | .116 In/Sec | 2.394 G-s |
| 82F - COMP FEMALE SHAFT OB VERT | .265 In/Sec | 6.556 G-s |
| 83F - COMP FEMALE SHAFT OB AXIAL | .187 In/Sec | 3.967 G-s |

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|---|---|---|---|
| 71M - COMP MALE SHAFT IB HOR | | .100 In/Sec | 3.700 G-s |
| 72M - COMP MALE SHAFT IB VERT | | .137 In/Sec | 5.538 G-s |
| 73M - COMP MALE SHAFT IB AXIAL | | .135 In/Sec | 5.125 G-s |
| 81M - COMP MALE SHAFT OB HOR | | .142 In/Sec | 2.817 G-s |
| 82M - COMP MALE SHAFT OB VERT | | .247 In/Sec | 7.131 G-s |
| 83M - COMP MALE SHAFT OB AXIAL | | .208 In/Sec | 1.837 G-s |

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|---|---|---|---|
| 201-08A | - COMPRESSOR,NASH A 201-08A | (19-Nov-20) | |
| | | OVERALL LEVEL | 1-20 KHz |
| 11 | - Nash Compr A Motor OB Horiz | .061 In/Sec | .126 G-s |
| 12 | - Nash Compr A Motor OB Vertical | .077 In/Sec | .112 G-s |
| 13 | - Nash Compr A Motor OB Axial | .167 In/Sec | .085 G-s |
| 21 | - Nash Compr A Motor IB Horiz | .071 In/Sec | .096 G-s |
| 22 | - Nash Compr A Motor IB VERT | .103 In/Sec | .135 G-s |
| 23 | - Nash Compr A Motor IB AXIAL | .130 In/Sec | .129 G-s |
| 71 | - Nash Compr A COMP IB HORIZ | .152 In/Sec | .521 G-s |
| 72 | - Nash Compr A Compressor IB Verti | .226 In/Sec | .999 G-s |
| 73 | - Nash Compr A COMP IB AXIAL | .147 In/Sec | .598 G-s |
| 81 | - Nash Compr A COMP OB HORIZ | .177 In/Sec | .347 G-s |
| 82 | - Nash Compr A Compressor OB Verti | .265 In/Sec | .256 G-s |
| 83 | - Nash Compr A Compressor OB Axial | .130 In/Sec | .184 G-s |

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| 9002-10 | - D-HYDROGENATOR AGITATOR | (19-Nov-20) | |
| | | OVERALL LEVEL | 1-20 KHz |
| 11 | - MOTOR OUTBOARD HORIZONTAL | .093 In/Sec | .038 G-s |
| 21 | - MOTOR INBOARD HORIZONTAL | .078 In/Sec | .101 G-s |
| 23 | - MOTOR INBOARD AXIAL | .046 In/Sec | .069 G-s |
| 31 | - GEARBOX INPUT SHAFT -HORIZONTAL | .226 In/Sec | .605 G-s |
| 51 | - GEARBOX TOP PLATE- E-W | .226 In/Sec | .256 G-s |
| 52 | - GEARBOX TOP PLATE- N-S | .178 In/Sec | .242 G-s |
| 53 | - GEARBOX OUTPUT TOP -VERTICAL | .104 In/Sec | .585 G-s |
| 61 | - GEARBOX BOTTOM E-W-HORIZONTAL | .260 In/Sec | .114 G-s |
| 81 | - AGIT INTERMED BRG @ SEAL- N-S | .040 In/Sec | .023 G-s |
| 82 | - AGIT INTERMED BRG @ SEAL- E-W | .038 In/Sec | .023 G-s |
| 83 | - AGIT INTERMED BRG @ SEAL- VERT | .039 In/Sec | .165 G-s |

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|---|---|---|---|
| 530-02 | - PUMP,N.COOLING TWR,MIDDLE | (19-Nov-20) | |
| | | OVERALL LEVEL | 1-20 KHz |
| 11 | - MOT TOP N-S | .105 In/Sec | .857 G-s |
| 12 | - MOTOR TOP E-W | .194 In/Sec | .493 G-s |

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|---|---|---|---|
| 530-03 | - PUMP,N.COOLING TWR,SOUTH | (19-Nov-20) | |
| | | OVERALL LEVEL | 1-20 KHz |
| 11 | - MOT TOP N-S | .095 In/Sec | .556 G-s |
| 12 | - MOTOR TOP E-W | .186 In/Sec | .432 G-s |

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|---|---|---|---|
| 548-7 | - IRON-FREE H2O BOOSTER PUMP | (19-Nov-20) | |
| | | OVERALL LEVEL | 1-20 KHz |
| 11 | - MOTOR OUTBOARD HORIZONTAL | .018 In/Sec | .315 G-s |
| 21 | - MOTOR INBOARD HORIZONTAL | .021 In/Sec | .821 G-s |
| 23 | - MOTOR INBOARD AXIAL | .047 In/Sec | .371 G-s |
| 71 | - PUMP HORIZONTAL | .026 In/Sec | .106 G-s |
| 72 | - PUMP VERTICAL | .046 In/Sec | .119 G-s |

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|---|---|---|---|
| SCT-1 | - SOUTH CT PUMP - EAST | (19-Nov-20) | |
| | | OVERALL LEVEL | 1-20 KHz |
| 11 | - MOTOR OUTBOARD HORIZONTAL | .035 In/Sec | .493 G-s |

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|---|---|---|---|
| 21 | - MOTOR INBOARD HORIZONTAL | .048 In/Sec | 2.766 G-s |
| 23 | - MOTOR INBOARD AXIAL | .051 In/Sec | .163 G-s |
| 71 | - PUMP HORIZONTAL | .124 In/Sec | .844 G-s |
| 72 | - PUMP VERTICAL | .115 In/Sec | 1.220 G-s |

| SCT-2 | - SOUTH CT PUMP - MID | (19-Nov-20) | |
|---|---|---|---|
| | | OVERALL LEVEL | 1-20 KHz |
| 11 | - MOTOR OUTBOARD HORIZONTAL | .032 In/Sec | .245 G-s |
| 21 | - MOTOR INBOARD HORIZONTAL | .045 In/Sec | 1.666 G-s |
| 23 | - MOTOR INBOARD AXIAL | .080 In/Sec | .536 G-s |
| 71 | - PUMP HORIZONTAL | .145 In/Sec | .569 G-s |
| 72 | - PUMP VERTICAL | .152 In/Sec | .963 G-s |

| SCT-3 | - SOUTH CT PUMP - WEST | (19-Nov-20) | |
|---|---|---|---|
| | | OVERALL LEVEL | 1-20 KHz |
| 11 | - MOTOR OUTBOARD HORIZONTAL | .040 In/Sec | 1.180 G-s |
| 21 | - MOTOR INBOARD HORIZONTAL | .046 In/Sec | 1.189 G-s |
| 23 | - MOTOR INBOARD AXIAL | .075 In/Sec | .757 G-s |
| 71 | - PUMP HORIZONTAL | .154 In/Sec | .575 G-s |
| 72 | - PUMP VERTICAL | .178 In/Sec | .589 G-s |

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Clarification Of Vibration Units:

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