HI-SPEED INDUSTRIAL SERVICE

MILLINGTON, TN

**May 31, 2021**

Arkema

Subject: May week 3/4 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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**H2O2 Weekly Route Critical Equipment Observations**

**Agitator, Hydrogenator C 7001-01**
All vibrations are still under 0.12”/second velocity peak overall. We will continue to monitor normally. No immediate issue.

**A/B Concentrator Vacuum Pump 57**
The unit vibration overall is 0.29”/sec peak velocity for the outboard pump bearing and is dominated by a 16 order vibration which we believe to be vane pass. We will continue to watch for changes. **Rated a Class I Defect.**

**Flash Vacuum Pump 2130-1**
All vibrations are below 0.11”/second velocity peak overall. No reportable issues.

**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. 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 2.5-3 KHz with a wide noise floor. We will continue to monitor this unit closely for changes. **Rated a Class I Defect**.

**Air Compressor C-202**
Rotor bar vibrations are low for this motor’s history. The trend clearly shows 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 are still blower case vibrations around 2.5-3 KHz with a wide noise floor. We will continue to monitor this unit for changes. **Rated a Class I Defect.**

**Air Compressor C-203**
Rotor bar vibrations are slightly above normal for this motor’s history. The trend clearly shows 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 are still blower case vibrations around 2.5-3 KHz with a wide noise floor. **Rated a Class I 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. They continue to vary over time. Both shafts have between 6 and 10 g’s RMS overall in the data. The dominant vibration appears to be the second gear mesh harmonic at near 2500 Hz. We are still watching this unit closely and will be going forward. **Rated a Class I Defect for now.**

**Air Compressor NASH A 201-08A**
Highest vibration is still in the pump itself at 0.3"/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 II Defect.**

**D Hydrogenator Agitator 9002**
Highest overall vibration is at 0.24"/sec velocity peak for the gearbox top output horizontal. Vibrations are mostly sub-synchronous to motor speed and consist of multiple peaks near to 11 Hz. It appears to be a resonance, and the amplitude changes over time, but does not seem to be periodic. This is near the maximum amplitude we have seen for this measurement. Ensure all fasteners are at proper torque values and inspect support structures for any signs of stress cracks, broken welds, or metal fatigue. **Rated a Class I Defect now.**

**H2O2 Weekly Route Critical Equipment that was not surveyed due to crane work in proximity**

**C Concentrator Vacuum Pump 2130-1 (as last reported)**
The motor has the highest vibration amplitude of about 0.179"/second velocity peak overall in the axial measurement. Vibration consists mostly of a 4x RPM component. We suspect either a 4 finger coupling, or process issue associated with impeller pass. **Rated a Class I Defect.**

**H2O2 Monthly Route Equipment**

**North Cooling Tower North Fan; South Cooling Tower North and South Fans.**
These units have vibrations between 0.3 and 0.4"/second velocity peak. Inspect as time allows. **Rated a Class I Defect.**

**H2 Monthly Route Equipment**

**P1A Boiler Feed Water Pump**
Motor axial is up near 0.25"/second velocity peak at shaft speed. Inspect the coupling, fasteners and alignment as time allows. **Rated a Class I Defect.**

**FD Blower C1**
Motor data shows a vibration increase over time at shaft speed at near 0.36"/second velocity peak. Inspect the coupling, fasteners and alignment as time allows. **Rated a Class I Defect.**

East Cooling Tower Pump
Dominant vibration is at shaft speed. Inspect the coupling, fasteners and alignment as time allows.
**Rated a Class I Defect.**

**Abbreviated Last Measurement Summary**
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**Database: Arkema.rbm**
**Station: PEROXIDE**
**Route No. 5: ARK WK 3**
**Report Date: 01-Jun-21 07:54**

| MEASUREMENT POINT | OVERALL LEVEL | HFD / VHFD | MACHINE SPEED |
|---|---|---|---|
| 7000-01 - AGITATOR,HYDROGENATOR C | (28-May-21) | | |
| | OVERALL LEVEL | 1-20 KHZ | |
| 02 | .042 In/Sec | .053 G-s | 45.00 RPM |
| 03 | .050 In/Sec | .050 G-s | |
| 11 | .067 In/Sec | .754 G-s | 1400.0 RPM |
| 12 | .072 In/Sec | .610 G-s | |
| 13 | .110 In/Sec | .215 G-s | |
| 21 | .082 In/Sec | .477 G-s | |
| 22 | .124 In/Sec | .123 G-s | |
| 23 | .113 In/Sec | .980 G-s | |
| 31 | .077 In/Sec | .416 G-s | |
| 32 | .075 In/Sec | .504 G-s | |
| 33 | .064 In/Sec | .246 G-s | |
| 41 | .071 In/Sec | .439 G-s | |
| 42 | .085 In/Sec | .522 G-s | |
| 51 | .068 In/Sec | .356 G-s | 375.0 RPM |
| 53 | .085 In/Sec | .221 G-s | |
| 61 | .100 In/Sec | .221 G-s | |
| 71 | .043 In/Sec | .263 G-s | 45.00 RPM |
| 81 | .022 In/Sec | .161 G-s | |
| 83 | .061 In/Sec | .251 G-s | |
| 57 - A/B Concentr Vac Pmp-var RPM | (28-May-21) | | |
| | OVERALL LEVEL | 1-20 KHz | |
| 11 | .066 In/Sec | .190 G-s | 900.0 RPM |
| 12 | .063 In/Sec | .272 G-s | |
| 21 | .071 In/Sec | .168 G-s | |
| 23 | .070 In/Sec | .069 G-s | |
| 71 | .156 In/Sec | .378 G-s | |
| 81 | .283 In/Sec | .775 G-s | |
| 83 | .097 In/Sec | .333 G-s | |
| 2130-1 - FLASH VAP VAC PUMP-var speed | (28-May-21) | | |
| | OVERALL LEVEL | 1-20 KHz | |
| 11 | .040 In/Sec | .068 G-s | 1200.0 RPM |
| 12 | .033 In/Sec | .309 G-s | |
| 21 | .037 In/Sec | .658 G-s | |
| 22 | .043 In/Sec | .525 G-s | |

| | | | |
|---|---|---|---|
| 23 | .048 In/Sec | .190 G-s | |
| 71 | .067 In/Sec | .399 G-s | |
| 72 | .072 In/Sec | .620 G-s | |
| 81 | .109 In/Sec | .016 G-s | |
| 82 | .072 In/Sec | .645 G-s | |
| 83 | .038 In/Sec | .704 G-s | |

C-203 - C-203 Comp (28-May-21)

| | | | |
|---|---|---|---|
| | OVERALL LEVEL | 1-20 KHz | |
| 11 | .029 In/Sec | .731 G-s | 3588.0 RPM |
| 12 | .150 In/Sec | 6.298 G-s | |
| 21 | .020 In/Sec | .414 G-s | |
| 22 | .094 In/Sec | 3.283 G-s | |
| 23 | .060 In/Sec | 1.883 G-s | |
| | OVERALL LEVEL | 1-20 KHZ | |
| 71M | .039 In/Sec | 1.429 G-s | |
| 72M | .047 In/Sec | 2.553 G-s | |
| 73M | .066 In/Sec | 1.538 G-s | |
| 81M | .047 In/Sec | 1.946 G-s | |
| 82M | .054 In/Sec | 3.039 G-s | |
| 71F | .054 In/Sec | 1.896 G-s | |
| 72F | .054 In/Sec | 2.228 G-s | |
| 73F | .066 In/Sec | 2.612 G-s | |
| 81F | .034 In/Sec | 6.655 G-s | |
| 82F | .061 In/Sec | 1.989 G-s | |

C-202 - C-202 Comp (28-May-21)

| | | | |
|---|---|---|---|
| | OVERALL LEVEL | 1-20 KHz | |
| 11 | .049 In/Sec | .538 G-s | 3588.0 RPM |
| 12 | .108 In/Sec | .151 G-s | |
| 21 | .063 In/Sec | .388 G-s | |
| 22 | .086 In/Sec | .846 G-s | |
| 23 | .060 In/Sec | 1.534 G-s | |
| | OVERALL LEVEL | 1-20 KHZ | |
| 71M | .035 In/Sec | 1.457 G-s | |
| 72M | .041 In/Sec | .623 G-s | |
| 73M | .063 In/Sec | 1.109 G-s | |
| 81M | .032 In/Sec | 3.474 G-s | |
| 82M | .056 In/Sec | 2.478 G-s | |
| 71F | .033 In/Sec | 2.460 G-s | |
| 72F | .054 In/Sec | 1.284 G-s | |
| 73F | .042 In/Sec | 1.927 G-s | |
| 81F | .035 In/Sec | 2.046 G-s | |
| 82F | .048 In/Sec | 1.331 G-s | |

C-201 - C-201 Comp (28-May-21)

| | | | |
|---|---|---|---|
| | OVERALL LEVEL | 1-20 KHz | |
| 11 | .101 In/Sec | 1.099 G-s | 3588.0 RPM |
| 12 | .083 In/Sec | .947 G-s | |
| 21 | .091 In/Sec | .346 G-s | |
| 22 | .083 In/Sec | 3.157 G-s | |
| 23 | .102 In/Sec | 2.939 G-s | |
| | OVERALL LEVEL | 1-20 KHZ | |
| 71M | .041 In/Sec | 1.321 G-s | |
| 72M | .049 In/Sec | 2.154 G-s | |
| 73M | .070 In/Sec | 1.343 G-s | |
| 81M | .087 In/Sec | 6.572 G-s | |

| | | | | |
|---|---|---|---|---|
| | 82M | .056 In/Sec | 2.666 G-s | |
| | 71F | .053 In/Sec | 2.061 G-s | |
| | 72F | .069 In/Sec | 2.566 G-s | |
| | 73F | .032 In/Sec | .895 G-s | |
| | 81F | .040 In/Sec | 3.597 G-s | |
| | 82F | .060 In/Sec | 2.563 G-s | |

new AC - INSTRUMENT AIR COMPRESSOR (28-May-21)

| | OVERALL LEVEL | 1-20 KHz | |
|---|---|---|---|
| 11 | .151 In/Sec | 1.068 G-s | 1780.0 RPM |
| 12 | .104 In/Sec | .552 G-s | |
| 13 | .064 In/Sec | .525 G-s | |
| 21 | .118 In/Sec | 1.866 G-s | |
| 22 | .077 In/Sec | 1.042 G-s | |
| 23 | .076 In/Sec | .293 G-s | |
| | OVERALL LEVEL | 1-20 KHZ | |
| 71F | .168 In/Sec | 4.849 G-s | |
| 72F | .167 In/Sec | 5.231 G-s | |
| 73F | .153 In/Sec | 3.974 G-s | |
| 81F | .152 In/Sec | 2.975 G-s | |
| 82F | .180 In/Sec | 3.636 G-s | |
| 83F | .162 In/Sec | 3.743 G-s | |
| 71M | .111 In/Sec | 5.338 G-s | |
| 72M | .214 In/Sec | 9.830 G-s | |
| 73M | .104 In/Sec | 4.871 G-s | |
| 81M | .190 In/Sec | 3.608 G-s | |
| 82M | .271 In/Sec | 8.907 G-s | |
| 83M | .180 In/Sec | 6.241 G-s | |

201-08A - COMPRESSOR,NASH A 201-08A (28-May-21)

| | OVERALL LEVEL | 1-20 KHz | |
|---|---|---|---|
| 11 | .076 In/Sec | .103 G-s | 506.3 RPM |
| 12 | .083 In/Sec | .170 G-s | |
| 13 | .157 In/Sec | .109 G-s | |
| 21 | .089 In/Sec | .063 G-s | |
| 22 | .103 In/Sec | .091 G-s | |
| 23 | .145 In/Sec | .095 G-s | |
| 71 | .182 In/Sec | 1.276 G-s | |
| 72 | .245 In/Sec | 1.240 G-s | |
| 73 | .144 In/Sec | .321 G-s | |
| 81 | .165 In/Sec | .219 G-s | |
| 82 | .300 In/Sec | .396 G-s | |
| 83 | .154 In/Sec | .332 G-s | |

9002-10 - D-HYDROGENATOR AGITATOR (28-May-21)

| | OVERALL LEVEL | 1-20 KHz | |
|---|---|---|---|
| 11 | .071 In/Sec | .076 G-s | 1185.0 RPM |
| 21 | .066 In/Sec | .255 G-s | |
| 23 | .045 In/Sec | .081 G-s | |
| | OVERALL LEVEL | 1-20 KHZ | |
| 31 | .220 In/Sec | .727 G-s | |
| 31L | .149 In/Sec | .663 G-s | |
| | OVERALL LEVEL | 1-20 KHz | |
| 51 | .241 In/Sec | .200 G-s | |
| 51L | .207 In/Sec | .198 G-s | 100.0 RPM |
| 52 | .241 In/Sec | .245 G-s | |
| 52L | .241 In/Sec | .212 G-s | |

| | | | |
|---|---|---|---|
| 53 | .088 In/Sec | .456 G-s | |
| 53L | .026 In/Sec | .436 G-s | |
| 61 | .210 In/Sec | .103 G-s | |
| 61L | .156 In/Sec | .112 G-s | |
| 81 | .038 In/Sec | .035 G-s | |
| 82 | .033 In/Sec | .028 G-s | |
| 83 | .030 In/Sec | .221 G-s | |

NTC-SF - N CT-SOUTH FAN, N TWR (28-May-21)

| | OVERALL LEVEL | 1-20 KHz | |
|---|---|---|---|
| 1 | .370 In/Sec | .539 G-s | 1780.0 RPM |
| 2 | .174 In/Sec | .432 G-s | |
| 3 | .185 In/Sec | .472 G-s | |
| | OVERALL LEVEL | 1-20 KHZ | |
| 4 | .236 In/Sec | .444 G-s | |
| 5 | .0041 In/Sec | .0012 G-s | |
| 6 | .253 In/Sec | .408 G-s | |
| 6L | .225 In/Sec | .378 G-s | |

NCT - NF - N CT -NORTH FAN, N TWR (28-May-21)

| | OVERALL LEVEL | 1-20 KHz | |
|---|---|---|---|
| 7 | .219 In/Sec | .395 G-s | 1780.0 RPM |
| 8 | .162 In/Sec | .380 G-s | |
| 9 | .139 In/Sec | .310 G-s | |
| | OVERALL LEVEL | 1-20 KHZ | |
| 10 | .126 In/Sec | .335 G-s | |
| 11 | .175 In/Sec | .296 G-s | |
| 12 | .137 In/Sec | .380 G-s | |

530-02 - PUMP,N.COOLING TWR,MIDDLE (28-May-21)

| | OVERALL LEVEL | 1-20 KHz | |
|---|---|---|---|
| 11 | .077 In/Sec | .463 G-s | 1780.0 RPM |
| 12 | .098 In/Sec | .689 G-s | |

530-03 - PUMP,N.COOLING TWR,SOUTH (28-May-21)

| | OVERALL LEVEL | 1-20 KHz | |
|---|---|---|---|
| 11 | .085 In/Sec | .725 G-s | 1780.0 RPM |
| 12 | .110 In/Sec | .457 G-s | |

548-7 - IRON-FREE H2O BOOSTER PUMP (28-May-21)

| | OVERALL LEVEL | 1-20 KHz | |
|---|---|---|---|
| 11 | .015 In/Sec | .287 G-s | 1800.0 RPM |
| 21 | .020 In/Sec | .334 G-s | |
| 23 | .056 In/Sec | .423 G-s | |
| 71 | .035 In/Sec | .075 G-s | |
| 72 | .024 In/Sec | .121 G-s | |

STC-NF - S CT - NORTH FAN, S TWR (28-May-21)

| | OVERALL LEVEL | 1-20 KHz | |
|---|---|---|---|
| 1 | .325 In/Sec | .530 G-s | 1780.0 RPM |
| 2 | .287 In/Sec | .395 G-s | |
| 3 | .233 In/Sec | .112 G-s | |
| | OVERALL LEVEL | 1-20 KHZ | |
| 4 | .133 In/Sec | .377 G-s | |
| 5 | .164 In/Sec | .468 G-s | |

STC-MF - S CT - MID FAN, S TWR (28-May-21)

| | | | |
|---|---|---|---|
| | OVERALL LEVEL | 1-20 KHz | |
| 1 | .274 In/Sec | .365 G-s | 1780.0 RPM |
| 2 | .234 In/Sec | .075 G-s | |
| 3 | .129 In/Sec | .143 G-s | |
| | OVERALL LEVEL | 1-20 KHZ | |
| 4 | .112 In/Sec | .289 G-s | |
| 5 | .115 In/Sec | .466 G-s | |
| 6 | .090 In/Sec | .571 G-s | |

STC-SF - S CT - SOUTH FAN, S TWR (28-May-21)

| | | | |
|---|---|---|---|
| | OVERALL LEVEL | 1-20 KHz | |
| 1 | .212 In/Sec | .336 G-s | 1780.0 RPM |
| 2 | .251 In/Sec | .207 G-s | |
| 3 | .319 In/Sec | .098 G-s | |
| | OVERALL LEVEL | 1-20 KHZ | |
| 4 | .168 In/Sec | .537 G-s | |
| 5 | .107 In/Sec | .560 G-s | |
| 6 | .220 In/Sec | .683 G-s | |

SCT-1 - SOUTH CT PUMP - EAST (28-May-21)

| | | | |
|---|---|---|---|
| | OVERALL LEVEL | 1-20 KHz | |
| 11 | .039 In/Sec | .968 G-s | 1800.0 RPM |
| 21 | .046 In/Sec | 1.128 G-s | |
| 23 | .082 In/Sec | .259 G-s | |
| 71 | .159 In/Sec | .990 G-s | |
| 72 | .157 In/Sec | 1.371 G-s | |

SCT-2 - SOUTH CT PUMP - MID (28-May-21)

| | | | |
|---|---|---|---|
| | OVERALL LEVEL | 1-20 KHz | |
| 11 | .030 In/Sec | .128 G-s | 1800.0 RPM |
| 21 | .037 In/Sec | 1.385 G-s | |
| 23 | .089 In/Sec | .329 G-s | |
| 71 | .187 In/Sec | 1.040 G-s | |
| 72 | .148 In/Sec | .757 G-s | |

SCT-3 - SOUTH CT PUMP - WEST (28-May-21)

| | | | |
|---|---|---|---|
| | OVERALL LEVEL | 1-20 KHz | |
| 11 | .037 In/Sec | .710 G-s | 1800.0 RPM |
| 21 | .047 In/Sec | .638 G-s | |
| 23 | .090 In/Sec | .230 G-s | |
| 71 | .193 In/Sec | .517 G-s | |
| 72 | .187 In/Sec | .741 G-s | |

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

Abbreviated Last Measurement Summary

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Database: Arkema.rbm
Station: HYDROGEN
Route No. 1: H2 MONTHLY
Report Date: 01-Jun-21 07:54

| MEASUREMENT POINT | OVERALL LEVEL | HFD / VHFD | MACHINE SPEED |
|---|---|---|---|

P2A - PUMP MEA CIRC WEST P2A (28-May-21)

| | OVERALL LEVEL | 1-20 KHz | |
|---|---|---|---|
| 11 | .069 In/Sec | .235 G-s | 3585.0 RPM |
| 21 | .048 In/Sec | .169 G-s | |
| 23 | .063 In/Sec | .155 G-s | |
| 71 | .203 In/Sec | .801 G-s | |
| 72 | .176 In/Sec | .350 G-s | |

P1A - PUMP BFW WEST P1A (28-May-21)

| | OVERALL LEVEL | 1-20 KHz | |
|---|---|---|---|
| 11 | .081 In/Sec | .369 G-s | 3600.0 RPM |
| 21 | .122 In/Sec | .955 G-s | |
| 23 | .249 In/Sec | .385 G-s | |
| 71 | .039 In/Sec | .351 G-s | |
| 72 | .036 In/Sec | .451 G-s | |
| 81 | .176 In/Sec | .341 G-s | |
| 82 | .149 In/Sec | .604 G-s | |
| 83 | .061 In/Sec | .632 G-s | |

C2 - FD BLOWER C2 (28-May-21)

| | OVERALL LEVEL | 1-20 KHz | |
|---|---|---|---|
| 11 | .356 In/Sec | .232 G-s | 3600.0 RPM |
| 21 | .346 In/Sec | .277 G-s | |
| 23 | .264 In/Sec | .094 G-s | |
| 71 | .228 In/Sec | 2.199 G-s | |
| 81 | .308 In/Sec | 1.436 G-s | |

C1 - ID -BLOWER C1 (28-May-21)

| | OVERALL LEVEL | 1-20 KHz | |
|---|---|---|---|
| 11 | .108 In/Sec | .222 G-s | 1800.0 RPM |
| 21 | .118 In/Sec | .244 G-s | |
| 23 | .146 In/Sec | .352 G-s | |
| 71 | .100 In/Sec | 1.399 G-s | |
| 72 | .074 In/Sec | 1.251 G-s | |
| 81 | .199 In/Sec | .853 G-s | |
| 82 | .207 In/Sec | .973 G-s | |

CTPE - EAST COOLING TOWER PUMP (28-May-21)

| | OVERALL LEVEL | 1-20 KHz | |
|---|---|---|---|
| 11 | .167 In/Sec | .689 G-s | 1750.0 RPM |
| 21 | .064 In/Sec | .553 G-s | |
| 23 | .186 In/Sec | 1.038 G-s | |
| 71 | .169 In/Sec | .696 G-s | |
| 72 | .320 In/Sec | .657 G-s | |

CTPW - WEST COOLING TOWER PUMP (28-May-21)

| | OVERALL LEVEL | 1-20 KHz | |
|---|---|---|---|
| 11 | .056 In/Sec | .495 G-s | 1750.0 RPM |
| 21 | .072 In/Sec | .554 G-s | |
| 23 | .102 In/Sec | .697 G-s | |
| 71 | .261 In/Sec | 1.056 G-s | |
| 72 | .143 In/Sec | .989 G-s | |

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Clarification Of Vibration Units:
Acc --> G-s PK

**Vel --> In/Sec PK**