HI-SPEED INDUSTRIAL SERVICE

MILLINGTON, TN

November 30, 2020

Arkema

Subject: November week 4 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 output is highest vibration at 0.163”/sec velocity peak. No actions required just yet.

Agitator, Hydrogenator C 7001-01
The highest motor overall vibration has increased to 0.150”/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 0.271”/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 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 normal 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 6.99 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 female shaft axial vibration is up to 13 g's RMS. 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 II Defect for now.**

Air Compressor NASH A 201-08A
Highest vibration is still in the pump itself at 0.288"/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 change in vibrations this survey. Highest overall vibration is 0.281"/sec velocity peak for the gearbox upper output bearing plate in the N/S direction. **Rated a Class I Defect.** No immediate issue.

North Cooling Tower, South Fan
Motor overall outboard vibration is at 0.372"/sec velocity peak. The vibration is a beat between 30 and 27 Hz peaks. Inspect for possible causes such as loose or misaligned belts or worn drive shaft components. **Rated a Class I Defect.**

South Cooling Tower, North Fan
The overall vibration is highest in the motor and is at 0.335"/sec velocity peak. Multiple vibration peaks under 100 Hz combine to elevate the overall. Inspect for possible causes such as loose or misaligned belts or worn drive shaft components. **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: 30-Nov-20 08:23

MEASUREMENT POINT	OVERALL LEVEL	HFD / VHFD
2130-1old - C Concentrator Vacuum Pump	(25-Nov-20)	
	OVERALL LEVEL	1-20 KHz
11 - Motor OB HOR	.063 In/Sec	.403 G-s
21 - Motor IB HOR	.058 In/Sec	.434 G-s
23 - Motor IB AXIAL	.114 In/Sec	.135 G-s
71 - Compressor IB HOR	.128 In/Sec	.831 G-s
81 - Compressor OB Horiz	.163 In/Sec	.687 G-s
83 - Compressor OB Axial	.082 In/Sec	1.988 G-s

7000-01	- AGITATOR,HYDROGENATOR C	(25-Nov-20)	
		OVERALL LEVEL	1-20 KHZ
02	- DRIVESHAFT BRG-EAST-WEST	.044 In/Sec	.024 G-s
03	- DRIVESHAFT BRG-VERTICAL	.043 In/Sec	.042 G-s
11	- C Hydro Agitator MOTOR OB HORIZ	.068 In/Sec	.838 G-s
12	- C Hydro Agitator MOTOR OB VERT	.070 In/Sec	.749 G-s
13	- C Hydro Agitator Motor OB Axial	.108 In/Sec	.231 G-s
21	- C Hydro Agitator MOTOR IB HORIZ	.079 In/Sec	.253 G-s
22	- C Hydro Agitator MOTOR IB VERT	.150 In/Sec	.065 G-s
23	- C Hydro Agitator Motor IB Axial	.132 In/Sec	.564 G-s
31	- C Hydro Agitator GrBx In Horizon	.101 In/Sec	1.072 G-s
32	- C Hydro Agitator GrBx In VERT	.080 In/Sec	.683 G-s
33	- C Hydro Agitator GrBx In Axial	.041 In/Sec	.297 G-s
41	- C HY AG GBX INPUT OUTBOARD HZ	.095 In/Sec	1.267 G-s
42	- C HY AG GBX INPUT OUTBOARD VERT	.098 In/Sec	1.308 G-s
51	- C Hydro GrBx shaft 2 Top HZ E-W	.061 In/Sec	.976 G-s
53	- C Hydro GrBx shaft 2 Top AXIAL	.092 In/Sec	.299 G-s
61	- C Hydro GrBx shaft 2 BOT HZ E-W	.023 In/Sec	.581 G-s
71	- C Hydro GrBx OUTPUT TOP HZ E-W	.061 In/Sec	.566 G-s
81	- C Hydro GrBx OUTPUT BOT HZ E-W	.021 In/Sec	.330 G-s
83	- C Hydro GrBx OUTPUT Top Axial	.044 In/Sec	.473 G-s

57	- A/B Concentr Vac Pmp-var RPM	(25-Nov-20)	
		OVERALL LEVEL	1-20 KHz
11	- Motor OB HOR	.046 In/Sec	.182 G-s
12	- Motor OB VERT	.058 In/Sec	.140 G-s
21	- Motor IB HOR	.082 In/Sec	.264 G-s
23	- Motor IB AXIAL	.051 In/Sec	.131 G-s
71	- Compressor IB HOR	.125 In/Sec	.450 G-s
81	- Compressor OB Horiz	.271 In/Sec	.909 G-s
83	- Compressor OB Axial	.078 In/Sec	1.195 G-s

2130-1	- FLASH VAP VAC PUMP-var speed	(25-Nov-20)	
		OVERALL LEVEL	1-20 KHz
11	- Motor OB HOR	.044 In/Sec	.173 G-s
12	- Motor OB VERT	.035 In/Sec	.320 G-s
21	- Motor IB HOR	.044 In/Sec	.300 G-s
22	- Motor IB VERT	.045 In/Sec	.288 G-s
23	- Motor IB AXIAL	.056 In/Sec	.146 G-s
71	- Compressor IB HOR	.062 In/Sec	.714 G-s
72	- Compressor IB VERT	.071 In/Sec	.513 G-s
81	- Compressor OB Horiz	.079 In/Sec	.254 G-s
82	- Compressor OB VERT	.083 In/Sec	.377 G-s
83	- Compressor OB Axial	.054 In/Sec	.537 G-s

C-203	- C-203 Comp	(25-Nov-20)	
		OVERALL LEVEL	1-20 KHz
11	- MOTOR OB HOR	.084 In/Sec	3.126 G-s
12	- MOTOR OB VERT	.029 In/Sec	.921 G-s
21	- MOTOR IB HOR	.037 In/Sec	1.212 G-s
22	- MOTOR IB VERT	.111 In/Sec	4.282 G-s
23	- MOTOR IB AXIAL	.028 In/Sec	1.092 G-s
		OVERALL LEVEL	1-20 KHZ
71M	- COMP MALE SHAFT IB HOR	.047 In/Sec	1.617 G-s
72M	- COMP MALE SHAFT IB VERT	.045 In/Sec	1.479 G-s
73M	- COMP MALE SHAFT IB AXIAL	.076 In/Sec	1.802 G-s

81M - COMP MALE SHAFT OB HOR		.050 In/Sec	1.703 G-s
82M - COMP MALE SHAFT OB VERT		.063 In/Sec	6.990 G-s
71F - COMP FEMALE SHAFT IB HOR		.058 In/Sec	2.019 G-s
72F - COMP FEMALE SHAFT IB VERT		.046 In/Sec	1.181 G-s
73F - COMP FEMALE SHAFT IB AXIAL		.117 In/Sec	5.687 G-s
81F - COMP FEMALE SHAFT OB HOR		.056 In/Sec	3.019 G-s
82F - COMP FEMALE SHAFT OB VERT		.061 In/Sec	2.439 G-s

C-202	- C-202 Comp	(25-Nov-20)	
		OVERALL LEVEL	1-20 KHz
11 - MOTOR OB HOR		.039 In/Sec	.974 G-s
12 - MOTOR OB VERT		.112 In/Sec	.256 G-s
21 - MOTOR IB HOR		.064 In/Sec	.499 G-s
22 - MOTOR IB VERT		.138 In/Sec	4.964 G-s
23 - MOTOR IB AXIAL		.065 In/Sec	1.722 G-s
		OVERALL LEVEL	1-20 KHZ
71M - COMP MALE SHAFT IB HOR		.031 In/Sec	1.193 G-s
72M - COMP MALE SHAFT IB VERT		.046 In/Sec	1.463 G-s
73M - COMP MALE SHAFT IB AXIAL		.071 In/Sec	1.482 G-s
81M - COMP MALE SHAFT OB HOR		.036 In/Sec	4.153 G-s
82M - COMP MALE SHAFT OB VERT		.064 In/Sec	3.714 G-s
71F - COMP FEMALE SHAFT IB HOR		.044 In/Sec	1.809 G-s
72F - COMP FEMALE SHAFT IB VERT		.062 In/Sec	.976 G-s
73F - COMP FEMALE SHAFT IB AXIAL		.085 In/Sec	3.679 G-s
81F - COMP FEMALE SHAFT OB HOR		.049 In/Sec	2.933 G-s
82F - COMP FEMALE SHAFT OB VERT		.057 In/Sec	1.558 G-s

C-201	- C-201 Comp	(25-Nov-20)	
		OVERALL LEVEL	1-20 KHz
11 - MOTOR OB HOR		.075 In/Sec	.422 G-s
12 - MOTOR OB VERT		.064 In/Sec	1.198 G-s
21 - MOTOR IB HOR		.093 In/Sec	.807 G-s
22 - MOTOR IB VERT		.111 In/Sec	4.369 G-s
23 - MOTOR IB AXIAL		.122 In/Sec	4.814 G-s
		OVERALL LEVEL	1-20 KHZ
71M - COMP MALE SHAFT IB HOR		.028 In/Sec	.465 G-s
72M - COMP MALE SHAFT IB VERT		.044 In/Sec	1.803 G-s
73M - COMP MALE SHAFT IB AXIAL		.072 In/Sec	1.955 G-s
81M - COMP MALE SHAFT OB HOR		.077 In/Sec	4.219 G-s
82M - COMP MALE SHAFT OB VERT		.055 In/Sec	2.143 G-s
71F - COMP FEMALE SHAFT IB HOR		.051 In/Sec	2.542 G-s
72F - COMP FEMALE SHAFT IB VERT		.047 In/Sec	1.221 G-s
73F - COMP FEMALE SHAFT IB AXIAL		.092 In/Sec	4.544 G-s
81F - COMP FEMALE SHAFT OB HOR		.082 In/Sec	3.817 G-s
82F - COMP FEMALE SHAFT OB VERT		.061 In/Sec	1.725 G-s

new AC	- INSTRUMENT AIR COMPRESSOR	(25-Nov-20)	
		OVERALL LEVEL	1-20 KHz
11 - MOTOR OB HOR		.141 In/Sec	1.761 G-s
12 - MOTOR OB VERT		.106 In/Sec	.953 G-s
13 - MOTOR OB AXIAL		.082 In/Sec	.551 G-s
21 - MOTOR IB HOR		.171 In/Sec	1.345 G-s
22 - MOTOR IB VERT		.084 In/Sec	1.004 G-s
23 - MOTOR IB AXIAL		.060 In/Sec	.749 G-s
		OVERALL LEVEL	1-20 KHZ
71F - COMP FEMALE SHAFT IB HOR		.131 In/Sec	5.889 G-s
72F - COMP FEMALE SHAFT IB VERT		.235 In/Sec	8.573 G-s

73F - COMP FEMALE SHAFT IB AXIAL	.139 In/Sec	4.089 G-s
81F - COMP FEMALE SHAFT OB HOR	.166 In/Sec	4.798 G-s
82F - COMP FEMALE SHAFT OB VERT	.368 In/Sec	12.84 G-s
83F - COMP FEMALE SHAFT OB AXIAL	.370 In/Sec	13.70 G-s
71M - COMP MALE SHAFT IB HOR	.264 In/Sec	10.34 G-s
72M - COMP MALE SHAFT IB VERT	.154 In/Sec	3.792 G-s
73M - COMP MALE SHAFT IB AXIAL	.182 In/Sec	4.282 G-s
81M - COMP MALE SHAFT OB HOR	.152 In/Sec	3.782 G-s
82M - COMP MALE SHAFT OB VERT	.430 In/Sec	11.26 G-s
83M - COMP MALE SHAFT OB AXIAL	.189 In/Sec	4.010 G-s

201-08A - COMPRESSOR,NASH A 201-08A	(25-Nov-20)	
	OVERALL LEVEL	1-20 KHz
11 - Nash Compr A Motor OB Horiz	.080 In/Sec	.235 G-s
12 - Nash Compr A Motor OB Vertical	.086 In/Sec	.136 G-s
13 - Nash Compr A Motor OB Axial	.156 In/Sec	.086 G-s
21 - Nash Compr A Motor IB Horiz	.079 In/Sec	.118 G-s
22 - Nash Compr A Motor IB VERT	.105 In/Sec	.115 G-s
23 - Nash Compr A Motor IB AXIAL	.167 In/Sec	.111 G-s
71 - Nash Compr A COMP IB HORIZ	.164 In/Sec	1.000 G-s
72 - Nash Compr A Compressor IB Verti	.239 In/Sec	1.203 G-s
73 - Nash Compr A COMP IB AXIAL	.171 In/Sec	.440 G-s
81 - Nash Compr A COMP OB HORIZ	.191 In/Sec	.222 G-s
82 - Nash Compr A Compressor OB Verti	.288 In/Sec	.354 G-s
83 - Nash Compr A Compressor OB Axial	.156 In/Sec	.284 G-s

9002-10 - D-HYDROGENATOR AGITATOR	(25-Nov-20)	
	OVERALL LEVEL	1-20 KHz
11 - MOTOR OUTBOARD HORIZONTAL	.082 In/Sec	.090 G-s
21 - MOTOR INBOARD HORIZONTAL	.136 In/Sec	.223 G-s
23 - MOTOR INBOARD AXIAL	.045 In/Sec	.084 G-s
31 - GEARBOX INPUT SHAFT -HORIZONTAL	.165 In/Sec	.639 G-s
51 - GEARBOX TOP PLATE- E-W	.230 In/Sec	.229 G-s
52 - GEARBOX TOP PLATE- N-S	.281 In/Sec	.244 G-s
53 - GEARBOX OUTPUT TOP -VERTICAL	.108 In/Sec	.680 G-s
61 - GEARBOX BOTTOM E-W-HORIZONTAL	.195 In/Sec	.138 G-s
81 - AGIT INTERMED BRG @ SEAL- N-S	.041 In/Sec	.025 G-s
82 - AGIT INTERMED BRG @ SEAL- E-W	.033 In/Sec	.022 G-s
83 - AGIT INTERMED BRG @ SEAL- VERT	.038 In/Sec	.160 G-s

NTC-SF - N CT-SOUTH FAN, N TWR	(25-Nov-20)	
	OVERALL LEVEL	1-20 KHz
1 - MOTOR OB HORIZ	.372 In/Sec	.537 G-s
2 - MOTOR IB HORIZ	.179 In/Sec	.448 G-s
3 - MOTOR IB AXIAL	.196 In/Sec	.472 G-s
	OVERALL LEVEL	1-20 KHZ
4 - GEARBOX INPUT HORIZONTAL	.221 In/Sec	.420 G-s
5 - GEARBOX VERTICAL	.0035 In/Sec	.0012 G-s
6 - GEARBOX AXIAL	.289 In/Sec	.389 G-s
* 6L - GEARBOX AXIAL LOW FREQ	.137 In/Sec	.219 G-s

NCT - NF - N CT -NORTH FAN, N TWR	(25-Nov-20)	
	OVERALL LEVEL	1-20 KHz
7 - MOTOR OB HORIZ	.233 In/Sec	.348 G-s
8 - MOTOR IB HORIZ	.229 In/Sec	.363 G-s
9 - MOTOR IB AXIAL	.125 In/Sec	.295 G-s
	OVERALL LEVEL	1-20 KHZ

10	- GEARBOX INPUT HORIZONTAL	.139 In/Sec	.336 G-s
11	- GEARBOX VERTICAL	.164 In/Sec	.292 G-s
12	- GEARBOX AXIAL	.118 In/Sec	.366 G-s
530-01	- PUMP,N.COOLING TWR,NORTH	(20-Jan-20)	
		OVERALL LEVEL	1-20 KHz
11	- MOT TOP N-S	.155 In/Sec	.366 G-s
12	- MOTOR TOP E-W	.306 In/Sec	.366 G-s
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
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
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
STC-NF	- S CT - NORTH FAN, S TWR	(25-Nov-20)	
		OVERALL LEVEL	1-20 KHz
1	- MOTOR OB HORIZ	.335 In/Sec	.356 G-s
2	- MOTOR IB HORIZ	.287 In/Sec	.292 G-s
3	- MOTOR IB AXIAL	.256 In/Sec	.102 G-s
		OVERALL LEVEL	1-20 KHZ
6	- GEARBOX AXIAL	.196 In/Sec	.371 G-s
4	- GEARBOX INPUT HORIZONTAL	.151 In/Sec	.465 G-s
* 5	- GEARBOX VERTICAL	.175 In/Sec	.465 G-s
STC-MF	- S CT - MID FAN, S TWR	(25-Nov-20)	
		OVERALL LEVEL	1-20 KHz
1	- MOTOR OB HORIZ	.271 In/Sec	.354 G-s
2	- MOTOR IB HORIZ	.233 In/Sec	.097 G-s
3	- MOTOR IB AXIAL	.119 In/Sec	.161 G-s
		OVERALL LEVEL	1-20 KHZ
6	- GEARBOX AXIAL	.096 In/Sec	.315 G-s
4	- GEARBOX INPUT HORIZONTAL	.134 In/Sec	.411 G-s
5	- GEARBOX VERTICAL	.079 In/Sec	.561 G-s
STC-SF	- S CT - SOUTH FAN, S TWR	(25-Nov-20)	
		OVERALL LEVEL	1-20 KHz
1	- MOTOR OB HORIZ	.198 In/Sec	.338 G-s
2	- MOTOR IB HORIZ	.236 In/Sec	.199 G-s
3	- MOTOR IB AXIAL	.230 In/Sec	.091 G-s
		OVERALL LEVEL	1-20 KHZ
6	- GEARBOX AXIAL	.165 In/Sec	.519 G-s
4	- GEARBOX INPUT HORIZONTAL	.098 In/Sec	.556 G-s
5	- GEARBOX VERTICAL	.200 In/Sec	.720 G-s

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

Clarification Of Vibration Units:

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

* - Indicates Data Has Date/Time Different From Machine Date/Time