HI-SPEED INDUSTRIAL SERVICE

MILLINGTON, TN

October 12, 2020

Arkema

Subject: October week 1 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 Peroxide Route Critical Equipment Observations

C Concentrator Vacuum Pump 2130-1
Vibrations appear to be normal this survey. No vibration is above 0.157"/sec velocity peak. No actions required.

Agitator, Hydrogenator C 7001-01
The highest motor overall vibrations are 0.185"/sec velocity peak for the inboard vertical. Data shows multiple lower frequency harmonics of shaft speed as well as non-synchronous peaks in the upper frequencies. The bearings and fits in the replacement motor could be in some distress. A vibration at near 3x RPM is dominant and could possibly indicate a coupling or alignment issue.
Motor is rated a Class I Defect.

A/B Concentrator Vacuum Pump 57
This unit's motor vibration is still below 0.10"/sec velocity peak. The outboard pump bearing overall is 0.241"/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. We still believe these motors have possible weak rotor bar end connections that cause the vibrations to fluctuate higher due to loading. We will continue to monitor this unit for changes. **Rated a Class I Defect**. No actions required.

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 an increase in acceleration 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. **Rated a Class I Defect**. No actions required.

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 6 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 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 I Defect for now.**

Air Compressor NASH A 201-08A
Highest vibration is still in the pump itself at just under 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 I Defect.**

D Hydrogenator Agitator 9002-10
Vibration data shows a decrease in vibrations this survey. Highest overall vibration is 0.280"/sec velocity peak for the gearbox top output bearing plate in the N/S direction. No issues today.

Monthly Service Units

ABC Sec Filter Feed Pump North 2130-6 and East Oxidizer Feed Pump 9001-1
Both units are showing slightly elevated pump vibrations at near 2.0"/sec velocity peak.
Inspect for coupling and or alignment issues.

Abbreviated Last Measurement Summary

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Database: Arkema.rbm
Station: PEROXIDE
Report Date: 12-Oct-20 07:53

	MEASUREMENT POINT	OVERALL LEVEL	HFD / VHFD
7000-01	- AGITATOR,HYDROGENATOR C	(06-Oct-20)	
		OVERALL LEVEL	1-20 KHZ
02	- DRIVESHAFT BRG-EAST-WEST	.042 In/Sec	.088 G-s
03	- DRIVESHAFT BRG-VERTICAL	.046 In/Sec	.068 G-s
11	- C Hydro Agitator MOTOR OB HORIZ	.094 In/Sec	.690 G-s
12	- C Hydro Agitator MOTOR OB VERT	.113 In/Sec	.778 G-s
13	- C Hydro Agitator Motor OB Axial	.148 In/Sec	.584 G-s
21	- C Hydro Agitator MOTOR IB HORIZ	.119 In/Sec	.383 G-s
22	- C Hydro Agitator MOTOR IB VERT	.185 In/Sec	.411 G-s
23	- C Hydro Agitator Motor IB Axial	.177 In/Sec	1.088 G-s
31	- C Hydro Agitator GrBx In Horizon	.095 In/Sec	.636 G-s
32	- C Hydro Agitator GrBx In VERT	.095 In/Sec	1.026 G-s
33	- C Hydro Agitator GrBx In Axial	.055 In/Sec	.581 G-s
41	- C Hydro GrBx shaft 2 Top HZ E-W	.047 In/Sec	.752 G-s
42	- C Hydro GrBx shaft 2 BOT HZ E-W	.020 In/Sec	.480 G-s
51	- C Hydro GrBx OUTPUT TOP HZ E-W	.042 In/Sec	.491 G-s
52	- C Hydro GrBx OUTPUT BOT HZ E-W	.020 In/Sec	.324 G-s
53	- C Hydro GrBx OUTPUT Top Axial	.045 In/Sec	.523 G-s
* 53L	- C Hydro GrBx OUTPUT Top Axial	.043 In/Sec	.607 G-s
57	- A/B Concentr Vac Pmp-var RPM	(06-Oct-20)	
		OVERALL LEVEL	1-20 KHz
11	- Motor OB HOR	.068 In/Sec	.396 G-s
12	- Motor OB VERT	.051 In/Sec	.276 G-s
21	- Motor IB HOR	.064 In/Sec	.121 G-s
23	- Motor IB AXIAL	.063 In/Sec	.228 G-s
71	- Compressor IB HOR	.134 In/Sec	.551 G-s
81	- Compressor OB Horiz	.241 In/Sec	.759 G-s
83	- Compressor OB Axial	.090 In/Sec	1.411 G-s
2130-1	- FLASH VAP VAC PUMP-var speed	(06-Oct-20)	
		OVERALL LEVEL	1-20 KHz
11	- Motor OB HOR	.044 In/Sec	.089 G-s
12	- Motor OB VERT	.033 In/Sec	.359 G-s
21	- Motor IB HOR	.041 In/Sec	.587 G-s
22	- Motor IB VERT	.041 In/Sec	.473 G-s
23	- Motor IB AXIAL	.041 In/Sec	.151 G-s
71	- Compressor IB HOR	.058 In/Sec	.310 G-s
72	- Compressor IB VERT	.071 In/Sec	.339 G-s
81	- Compressor OB Horiz	.075 In/Sec	.250 G-s
82	- Compressor OB VERT	.083 In/Sec	.351 G-s
83	- Compressor OB Axial	.069 In/Sec	.227 G-s
236-06	- HYDRO FD PUMP N 236-06 -2FLR	(06-Oct-20)	

		OVERALL LEVEL	1-20 KHz
11	- Hydro Fd Pmp B No. Motor Top	.098 In/Sec	.254 G-s
21	- Hydro Fd Pmp B No. Motor Bottom	.070 In/Sec	.171 G-s

2130-6	- ABC SEC FILT FEED PUMP-NORTH	(06-Oct-20)	
		OVERALL LEVEL	1-20 KHz
11	- MOTOR OUTBOARD HORIZONTAL	.063 In/Sec	.260 G-s
21	- MOTOR INBOARD HORIZONTAL	.073 In/Sec	.092 G-s
23	- MOTOR INBOARD AXIAL	.085 In/Sec	.260 G-s
71	- PUMP HORIZONTAL	.178 In/Sec	.804 G-s
72	- PUMP VERTICAL	.105 In/Sec	1.009 G-s

9001-1	- EAST OXIDIZER FEED PUMP	(06-Oct-20)	
		OVERALL LEVEL	1-20 KHz
11	- MOTOR OUTBOARD HORIZONTAL	.036 In/Sec	.307 G-s
21	- MOTOR INBOARD HORIZONTAL	.057 In/Sec	.466 G-s
23	- MOTOR INBOARD AXIAL	.063 In/Sec	.083 G-s
71	- PUMP HORIZONTAL	.191 In/Sec	.627 G-s
72	- PUMP VERTICAL	.158 In/Sec	.280 G-s

9001-2	- MIDDLE OXIDIZER FEED PUMP	(06-Oct-20)	
		OVERALL LEVEL	1-20 KHz
11	- MOTOR OUTBOARD HORIZONTAL	.029 In/Sec	.454 G-s
21	- MOTOR INBOARD HORIZONTAL	.033 In/Sec	.727 G-s
23	- MOTOR INBOARD AXIAL	.044 In/Sec	.195 G-s
71	- PUMP HORIZONTAL	.084 In/Sec	.232 G-s
72	- PUMP VERTICAL	.077 In/Sec	.233 G-s

7016-11	- WEST OXIDIZER FEED PUMP	(06-Oct-20)	
		OVERALL LEVEL	1-20 KHz
11	- MOTOR OUTBOARD HORIZONTAL	.024 In/Sec	.192 G-s
21	- MOTOR INBOARD HORIZONTAL	.021 In/Sec	.454 G-s
23	- MOTOR INBOARD AXIAL	.016 In/Sec	.221 G-s
71	- PUMP HORIZONTAL	.090 In/Sec	1.226 G-s
72	- PUMP VERTICAL	.123 In/Sec	.976 G-s

234-01	- CHILL WATER PUMP 234-01	(06-Oct-20)	
		OVERALL LEVEL	1-20 KHz
11	- Chilled H2O Pump Motor OB Horizo	.039 In/Sec	.822 G-s
		OVERALL LEVEL	1-20 KHZ
11L	- MOTOR HORZ OUTBOARD - L-FREQ	.040 In/Sec	.900 G-s
		OVERALL LEVEL	1-20 KHz
21	- Chilled H2O Pump Motor IB Horizo	.039 In/Sec	1.052 G-s
23	- MOTOR INBOARD	.034 In/Sec	
		OVERALL LEVEL	1-20 KHZ
23L	- MOTOR AXIAL INBOARD - L-FREQ	.037 In/Sec	.766 G-s
		OVERALL LEVEL	1-20 KHz
71	- Chilled H2O Pump IB Horizontal	.075 In/Sec	.172 G-s
72	- PUMP VERTICAL	.071 In/Sec	.246 G-s

C-203	- C-203 Comp	(06-Oct-20)	
		OVERALL LEVEL	1-20 KHz
11	- MOTOR OB HOR	.136 In/Sec	5.045 G-s
12	- MOTOR OB VERT	.104 In/Sec	3.934 G-s
21	- MOTOR IB HOR	.039 In/Sec	1.369 G-s
22	- MOTOR IB VERT	.058 In/Sec	1.636 G-s
23	- MOTOR IB AXIAL	.019 In/Sec	.415 G-s

		OVERALL LEVEL	1-20 KHZ
71M - COMP MALE SHAFT IB HOR		.036 In/Sec	1.356 G-s
72M - COMP MALE SHAFT IB VERT		.048 In/Sec	1.736 G-s
73M - COMP MALE SHAFT IB AXIAL		.051 In/Sec	2.159 G-s
81M - COMP MALE SHAFT OB HOR		.075 In/Sec	2.672 G-s
82M - COMP MALE SHAFT OB VERT		.078 In/Sec	2.809 G-s
71F - COMP FEMALE SHAFT IB HOR		.055 In/Sec	2.382 G-s
72F - COMP FEMALE SHAFT IB VERT		.035 In/Sec	.571 G-s
73F - COMP FEMALE SHAFT IB AXIAL		.062 In/Sec	2.086 G-s
81F - COMP FEMALE SHAFT OB HOR		.053 In/Sec	1.304 G-s
82F - COMP FEMALE SHAFT OB VERT		.054 In/Sec	1.358 G-s

9000-01	- D HYDROGENATOR FD PUMP- WEST	(06-Oct-20)	
		OVERALL LEVEL	1-20 KHz
11	- MOTOR OUTBOARD HORIZONTAL	.030 In/Sec	.159 G-s
21	- MOTOR INBOARD HORIZONTAL	.030 In/Sec	.273 G-s
23	- MOTOR INBOARD AXIAL	.031 In/Sec	.436 G-s
71	- PUMP HORIZONTAL	.072 In/Sec	.791 G-s
72	- PUMP VERTICAL	.050 In/Sec	.536 G-s

236-04A	- HYDROGNTOR PRECOOLER FD PUMP	(06-Oct-20)	
		OVERALL LEVEL	1-20 KHz
11	- MOTOR OUTBOARD HORIZ	.052 In/Sec	.336 G-s
21	- MOTOR INBOARD HORIZ	.068 In/Sec	.606 G-s
23	- MOTOR INBOARD AXIAL	.032 In/Sec	.315 G-s
71	- PUMP HORIXONTAL	.123 In/Sec	.273 G-s
72	- PUMP VERTICAL	.067 In/Sec	.219 G-s

C-201	- C-201 Comp	(06-Oct-20)	
		OVERALL LEVEL	1-20 KHz
11	- MOTOR OB HOR	.129 In/Sec	3.904 G-s
12	- MOTOR OB VERT	.098 In/Sec	1.553 G-s
21	- MOTOR IB HOR	.099 In/Sec	1.843 G-s
22	- MOTOR IB VERT	.032 In/Sec	.383 G-s
23	- MOTOR IB AXIAL	.053 In/Sec	.513 G-s
		OVERALL LEVEL	1-20 KHZ
71M - COMP MALE SHAFT IB HOR		.039 In/Sec	1.092 G-s
72M - COMP MALE SHAFT IB VERT		.062 In/Sec	2.350 G-s
73M - COMP MALE SHAFT IB AXIAL		.072 In/Sec	3.038 G-s
81M - COMP MALE SHAFT OB HOR		.066 In/Sec	3.786 G-s
82M - COMP MALE SHAFT OB VERT		.066 In/Sec	2.538 G-s
71F - COMP FEMALE SHAFT IB HOR		.056 In/Sec	2.801 G-s
72F - COMP FEMALE SHAFT IB VERT		.062 In/Sec	1.983 G-s
73F - COMP FEMALE SHAFT IB AXIAL		.077 In/Sec	3.999 G-s
81F - COMP FEMALE SHAFT OB HOR		.074 In/Sec	2.774 G-s
82F - COMP FEMALE SHAFT OB VERT		.066 In/Sec	2.392 G-s

C-202	- C-202 Comp	(06-Oct-20)	
		OVERALL LEVEL	1-20 KHz
11	- MOTOR OB HOR	.033 In/Sec	.554 G-s
12	- MOTOR OB VERT	.134 In/Sec	1.311 G-s
21	- MOTOR IB HOR	.140 In/Sec	5.496 G-s
22	- MOTOR IB VERT	.195 In/Sec	6.739 G-s
23	- MOTOR IB AXIAL	.059 In/Sec	1.655 G-s
		OVERALL LEVEL	1-20 KHZ
71M - COMP MALE SHAFT IB HOR		.034 In/Sec	1.251 G-s
72M - COMP MALE SHAFT IB VERT		.050 In/Sec	1.482 G-s

73M - COMP MALE SHAFT IB AXIAL	.081 In/Sec	2.206 G-s
81M - COMP MALE SHAFT OB HOR	.063 In/Sec	3.995 G-s
82M - COMP MALE SHAFT OB VERT	.050 In/Sec	1.564 G-s
71F - COMP FEMALE SHAFT IB HOR	.036 In/Sec	2.281 G-s
72F - COMP FEMALE SHAFT IB VERT	.058 In/Sec	1.238 G-s
73F - COMP FEMALE SHAFT IB AXIAL	.097 In/Sec	4.424 G-s
81F - COMP FEMALE SHAFT OB HOR	.053 In/Sec	5.853 G-s
82F - COMP FEMALE SHAFT OB VERT	.054 In/Sec	1.807 G-s

201-08A - COMPRESSOR,NASH A 201-08A	(06-Oct-20)	
	OVERALL LEVEL	1-20 KHz
11 - Nash Compr A Motor OB Horiz	.069 In/Sec	.144 G-s
12 - Nash Compr A Motor OB Vertical	.070 In/Sec	.136 G-s
13 - Nash Compr A Motor OB Axial	.153 In/Sec	.095 G-s
21 - Nash Compr A Motor IB Horiz	.073 In/Sec	.107 G-s
22 - Nash Compr A Motor IB VERT	.108 In/Sec	.116 G-s
23 - Nash Compr A Motor IB AXIAL	.158 In/Sec	.131 G-s
71 - Nash Compr A COMP IB HORIZ	.154 In/Sec	.847 G-s
72 - Nash Compr A Compressor IB Verti	.236 In/Sec	1.133 G-s
73 - Nash Compr A COMP IB AXIAL	.146 In/Sec	.340 G-s
81 - Nash Compr A COMP OB HORIZ	.162 In/Sec	.568 G-s
82 - Nash Compr A Compressor OB Verti	.269 In/Sec	.551 G-s
83 - Nash Compr A Compressor OB Axial	.156 In/Sec	.325 G-s

9002-10 - D-HYDROGENATOR AGITATOR	(06-Oct-20)	
	OVERALL LEVEL	1-20 KHz
11 - MOTOR OUTBOARD HORIZONTAL	.084 In/Sec	.111 G-s
21 - MOTOR INBOARD HORIZONTAL	.075 In/Sec	.091 G-s
23 - MOTOR INBOARD AXIAL	.046 In/Sec	.058 G-s
31 - GEARBOX INPUT SHAFT -HORIZONTAL	.189 In/Sec	.580 G-s
	OVERALL LEVEL	1-20 KHZ
* 31L - GEARBOX INPUT SHAFT-N-S-LOW FRQ	.197 In/Sec	.645 G-s
	OVERALL LEVEL	1-20 KHz
51 - GEARBOX TOP PLATE- E-W	.252 In/Sec	.233 G-s
	OVERALL LEVEL	1-20 KHZ
* 51L - GEARBOX TOP PLATE E-W-LOW FRQ	.197 In/Sec	.141 G-s
	OVERALL LEVEL	1-20 KHz
52 - GEARBOX TOP PLATE- N-S	.280 In/Sec	.433 G-s
	OVERALL LEVEL	1-20 KHZ
* 52L - GEARBOX TOP PLATE N-S-LOW FRQ	.246 In/Sec	.262 G-s
	OVERALL LEVEL	1-20 KHz
53 - GEARBOX OUTPUT TOP -VERTICAL	.162 In/Sec	.559 G-s
61 - GEARBOX BOTTOM E-W-HORIZONTAL	.107 In/Sec	.151 G-s
	OVERALL LEVEL	1-20 KHZ
* 61L - GEARBOX BOTTOM-E-W-LOW FRQ	.322 In/Sec	.120 G-s
	OVERALL LEVEL	1-20 KHz
81 - AGIT INTERMED BRG @ SEAL- N-S	.037 In/Sec	.024 G-s
82 - AGIT INTERMED BRG @ SEAL- E-W	.045 In/Sec	.024 G-s
83 - AGIT INTERMED BRG @ SEAL- VERT	.044 In/Sec	.149 G-s

new AC - INSTRUMENT AIR COMPRESSOR	(06-Oct-20)	
	OVERALL LEVEL	1-20 KHz
11 - MOTOR OB HOR	.159 In/Sec	1.381 G-s
12 - MOTOR OB VERT	.107 In/Sec	.594 G-s
13 - MOTOR OB AXIAL	.066 In/Sec	.475 G-s
21 - MOTOR IB HOR	.152 In/Sec	1.351 G-s
22 - MOTOR IB VERT	.090 In/Sec	.443 G-s

23 - MOTOR IB AXIAL	.057 In/Sec	.669 G-s
	OVERALL LEVEL	1-20 KHZ
71M - COMP MALE SHAFT IB HOR	.106 In/Sec	4.810 G-s
72M - COMP MALE SHAFT IB VERT	.173 In/Sec	6.473 G-s
73M - COMP MALE SHAFT IB AXIAL	.148 In/Sec	3.763 G-s
81M - COMP MALE SHAFT OB HOR	.199 In/Sec	3.307 G-s
82M - COMP MALE SHAFT OB VERT	.259 In/Sec	6.506 G-s
83M - COMP MALE SHAFT OB AXIAL	.273 In/Sec	4.311 G-s
71F - COMP FEMALE SHAFT IB HOR	.162 In/Sec	6.366 G-s
72F - COMP FEMALE SHAFT IB VERT	.149 In/Sec	2.790 G-s
73F - COMP FEMALE SHAFT IB AXIAL	.167 In/Sec	3.675 G-s
81F - COMP FEMALE SHAFT OB HOR	.131 In/Sec	2.189 G-s
82F - COMP FEMALE SHAFT OB VERT	.235 In/Sec	5.105 G-s
83F - COMP FEMALE SHAFT OB AXIAL	.164 In/Sec	3.658 G-s

2130-1old - C Concentrator Vacuum Pump (06-Oct-20)

	OVERALL LEVEL	1-20 KHz
11 - Motor OB HOR	.061 In/Sec	.485 G-s
21 - Motor IB HOR	.063 In/Sec	.435 G-s
23 - Motor IB AXIAL	.112 In/Sec	.214 G-s
71 - Compressor IB HOR	.100 In/Sec	1.187 G-s
81 - Compressor OB Horiz	.157 In/Sec	.661 G-s
83 - Compressor OB Axial	.077 In/Sec	1.393 G-s

Clarification Of Vibration Units:

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

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