HI-SPEED INDUSTRIAL SERVICE

MILLINGTON, TN

December 4, 2020

Arkema

Subject: December 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 Route Critical Equipment Observations

C Concentrator Vacuum Pump 2130-1
Vibrations appear to be slightly elevated this survey. Pump vibration id virtually unchanged at 0.162”/sec velocity peak. No actions required just yet.

Agitator, Hydrogenator C 7001-01
The highest motor overall vibration has decreased to 0.119”/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 0.241”/sec peak velocity, with a dominant vibration at 16 orders, which is most likely vane 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 7.95 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 over 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 0.319"/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 0.271"/sec velocity peak for the gearbox upper output bearing plate in the N/S direction. **Rated a Class I Defect.** No immediate issue.

Abbreviated Last Measurement Summary
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Database: Arkema.rbm
Station: PEROXIDE
Route No. 3: ARK WK 1
Report Date: 04-Dec-20 12:42

MEASUREMENT POINT	OVERALL LEVEL	HFD / VHFD
2130-1old - C Concentrator Vacuum Pump	(04-Dec-20)	
	OVERALL LEVEL	1-20 KHz
11 - Motor OB HOR	.060 In/Sec	.462 G-s
21 - Motor IB HOR	.069 In/Sec	.510 G-s
23 - Motor IB AXIAL	.119 In/Sec	.194 G-s
71 - Compressor IB HOR	.126 In/Sec	.854 G-s
81 - Compressor OB Horiz	.162 In/Sec	.784 G-s
83 - Compressor OB Axial	.087 In/Sec	1.715 G-s
7000-01 - AGITATOR,HYDROGENATOR C	(04-Dec-20)	
	OVERALL LEVEL	1-20 KHZ
02 - DRIVESHAFT BRG-EAST-WEST	.053 In/Sec	.017 G-s
03 - DRIVESHAFT BRG-VERTICAL	.047 In/Sec	.036 G-s
11 - C Hydro Agitator MOTOR OB HORIZ	.071 In/Sec	.744 G-s
12 - C Hydro Agitator MOTOR OB VERT	.068 In/Sec	.716 G-s
13 - C Hydro Agitator Motor OB Axial	.089 In/Sec	.108 G-s
21 - C Hydro Agitator MOTOR IB HORIZ	.073 In/Sec	.444 G-s
22 - C Hydro Agitator MOTOR IB VERT	.119 In/Sec	.089 G-s
23 - C Hydro Agitator Motor IB Axial	.092 In/Sec	.371 G-s
31 - C Hydro Agitator GrBx In Horizon	.103 In/Sec	1.103 G-s
32 - C Hydro Agitator GrBx In VERT	.080 In/Sec	.742 G-s
33 - C Hydro Agitator GrBx In Axial	.061 In/Sec	.369 G-s
41 - C HY AG GBX INPUT OUTBOARD HZ	.091 In/Sec	1.008 G-s

42	- C HY AG GBX INPUT OUTBOARD VERT	.082 In/Sec	1.043 G-s
51	- C Hydro GrBx shaft 2 Top HZ E-W	.055 In/Sec	1.115 G-s
53	- C Hydro GrBx shaft 2 Top AXIAL	.098 In/Sec	.590 G-s
61	- C Hydro GrBx shaft 2 BOT HZ E-W	.023 In/Sec	.504 G-s
71	- C Hydro GrBx OUTPUT TOP HZ E-W	.052 In/Sec	1.169 G-s
81	- C Hydro GrBx OUTPUT BOT HZ E-W	.019 In/Sec	.284 G-s
83	- C Hydro GrBx OUTPUT Top Axial	.042 In/Sec	.452 G-s

57	- A/B Concentr Vac Pmp-var RPM	(04-Dec-20)	
		OVERALL LEVEL	1-20 KHz
11	- Motor OB HOR	.051 In/Sec	.183 G-s
12	- Motor OB VERT	.051 In/Sec	.256 G-s
21	- Motor IB HOR	.080 In/Sec	.169 G-s
23	- Motor IB AXIAL	.049 In/Sec	.116 G-s
71	- Compressor IB HOR	.120 In/Sec	.713 G-s
81	- Compressor OB Horiz	.241 In/Sec	.712 G-s
83	- Compressor OB Axial	.045 In/Sec	.888 G-s

2130-1	- FLASH VAP VAC PUMP-var speed	(04-Dec-20)	
		OVERALL LEVEL	1-20 KHz
11	- Motor OB HOR	.042 In/Sec	.258 G-s
12	- Motor OB VERT	.041 In/Sec	.245 G-s
21	- Motor IB HOR	.043 In/Sec	.730 G-s
22	- Motor IB VERT	.046 In/Sec	.858 G-s
23	- Motor IB AXIAL	.038 In/Sec	.028 G-s
71	- Compressor IB HOR	.056 In/Sec	.577 G-s
72	- Compressor IB VERT	.071 In/Sec	.601 G-s
81	- Compressor OB Horiz	.075 In/Sec	.309 G-s
82	- Compressor OB VERT	.081 In/Sec	.400 G-s
83	- Compressor OB Axial	.040 In/Sec	.455 G-s

236-06	- HYDRO FD PUMP N 236-06 -2FLR	(04-Dec-20)	
		OVERALL LEVEL	1-20 KHz
11	- Hydro Fd Pmp B No. Motor Top	.111 In/Sec	.127 G-s
21	- Hydro Fd Pmp B No. Motor Bottom	.073 In/Sec	.077 G-s

2130-6	- ABC SEC FILT FEED PUMP-NORTH	(04-Dec-20)	
		OVERALL LEVEL	1-20 KHz
11	- MOTOR OUTBOARD HORIZONTAL	.072 In/Sec	.204 G-s
21	- MOTOR INBOARD HORIZONTAL	.060 In/Sec	.289 G-s
23	- MOTOR INBOARD AXIAL	.026 In/Sec	.058 G-s
71	- PUMP HORIZONTAL	.184 In/Sec	1.113 G-s
72	- PUMP VERTICAL	.128 In/Sec	1.185 G-s

9001-1	- EAST OXIDIZER FEED PUMP	(04-Dec-20)	
		OVERALL LEVEL	1-20 KHz
11	- MOTOR OUTBOARD HORIZONTAL	.036 In/Sec	.288 G-s
21	- MOTOR INBOARD HORIZONTAL	.067 In/Sec	.598 G-s
23	- MOTOR INBOARD AXIAL	.041 In/Sec	.109 G-s
71	- PUMP HORIZONTAL	.167 In/Sec	.584 G-s
72	- PUMP VERTICAL	.137 In/Sec	.326 G-s

9001-2	- MIDDLE OXIDIZER FEED PUMP	(04-Dec-20)	
		OVERALL LEVEL	1-20 KHz
11	- MOTOR OUTBOARD HORIZONTAL	.032 In/Sec	.131 G-s
21	- MOTOR INBOARD HORIZONTAL	.037 In/Sec	.326 G-s
23	- MOTOR INBOARD AXIAL	.051 In/Sec	.312 G-s

71	- PUMP HORIZONTAL	.059 In/Sec	.136 G-s
72	- PUMP VERTICAL	.075 In/Sec	.260 G-s
7016-11	- WEST OXIDIZER FEED PUMP	(04-Dec-20)	
		OVERALL LEVEL	1-20 KHz
11	- MOTOR OUTBOARD HORIZONTAL	.024 In/Sec	.422 G-s
21	- MOTOR INBOARD HORIZONTAL	.018 In/Sec	.478 G-s
23	- MOTOR INBOARD AXIAL	.021 In/Sec	.168 G-s
71	- PUMP HORIZONTAL	.089 In/Sec	.543 G-s
72	- PUMP VERTICAL	.102 In/Sec	.645 G-s
234-01	- CHILL WATER PUMP 234-01	(04-Dec-20)	
		OVERALL LEVEL	1-20 KHz
11	- Chilled H2O Pump Motor OB Horizo	.050 In/Sec	.932 G-s
		OVERALL LEVEL	1-20 KHZ
11L	- MOTOR HORZ OUTBOARD - L-FREQ	.041 In/Sec	1.038 G-s
		OVERALL LEVEL	1-20 KHz
21	- Chilled H2O Pump Motor IB Horizo	.053 In/Sec	1.330 G-s
23	- MOTOR INBOARD	.065 In/Sec	
		OVERALL LEVEL	1-20 KHZ
23L	- MOTOR AXIAL INBOARD - L-FREQ	.062 In/Sec	.809 G-s
		OVERALL LEVEL	1-20 KHz
71	- Chilled H2O Pump IB Horizontal	.083 In/Sec	.261 G-s
72	- PUMP VERTICAL	.065 In/Sec	.193 G-s
C-203	- C-203 Comp	(04-Dec-20)	
		OVERALL LEVEL	1-20 KHz
11	- MOTOR OB HOR	.020 In/Sec	.328 G-s
12	- MOTOR OB VERT	.029 In/Sec	.518 G-s
21	- MOTOR IB HOR	.080 In/Sec	3.479 G-s
22	- MOTOR IB VERT	.097 In/Sec	3.689 G-s
23	- MOTOR IB AXIAL	.027 In/Sec	.831 G-s
		OVERALL LEVEL	1-20 KHZ
71M	- COMP MALE SHAFT IB HOR	.047 In/Sec	2.247 G-s
72M	- COMP MALE SHAFT IB VERT	.048 In/Sec	1.283 G-s
73M	- COMP MALE SHAFT IB AXIAL	.061 In/Sec	3.869 G-s
81M	- COMP MALE SHAFT OB HOR	.062 In/Sec	7.949 G-s
82M	- COMP MALE SHAFT OB VERT	.068 In/Sec	6.622 G-s
71F	- COMP FEMALE SHAFT IB HOR	.064 In/Sec	3.257 G-s
72F	- COMP FEMALE SHAFT IB VERT	.077 In/Sec	2.542 G-s
73F	- COMP FEMALE SHAFT IB AXIAL	.105 In/Sec	4.683 G-s
81F	- COMP FEMALE SHAFT OB HOR	.045 In/Sec	1.956 G-s
82F	- COMP FEMALE SHAFT OB VERT	.061 In/Sec	2.074 G-s
9000-01	- D HYDROGENATOR FD PUMP- WEST	(04-Dec-20)	
		OVERALL LEVEL	1-20 KHz
11	- MOTOR OUTBOARD HORIZONTAL	.028 In/Sec	.082 G-s
21	- MOTOR INBOARD HORIZONTAL	.029 In/Sec	.394 G-s
23	- MOTOR INBOARD AXIAL	.024 In/Sec	.276 G-s
71	- PUMP HORIZONTAL	.086 In/Sec	1.001 G-s
72	- PUMP VERTICAL	.055 In/Sec	.670 G-s
236-04A	- HYDROGNTOR PRECOOLER FD PUMP	(04-Dec-20)	
		OVERALL LEVEL	1-20 KHz
11	- MOTOR OUTBOARD HORIZ	.045 In/Sec	.320 G-s
21	- MOTOR INBOARD HORIZ	.070 In/Sec	.964 G-s
23	- MOTOR INBOARD AXIAL	.089 In/Sec	.183 G-s

71	- PUMP HORIXONTAL	.133 In/Sec	.208 G-s
72	- PUMP VERTICAL	.061 In/Sec	.313 G-s
C-202	- C-202 Comp	(04-Dec-20)	
		OVERALL LEVEL	1-20 KHz
11	- MOTOR OB HOR	.054 In/Sec	.736 G-s
12	- MOTOR OB VERT	.118 In/Sec	.626 G-s
21	- MOTOR IB HOR	.092 In/Sec	2.243 G-s
22	- MOTOR IB VERT	.174 In/Sec	6.772 G-s
23	- MOTOR IB AXIAL	.052 In/Sec	1.444 G-s
		OVERALL LEVEL	1-20 KHZ
71M	- COMP MALE SHAFT IB HOR	.049 In/Sec	2.491 G-s
72M	- COMP MALE SHAFT IB VERT	.048 In/Sec	1.748 G-s
73M	- COMP MALE SHAFT IB AXIAL	.081 In/Sec	2.325 G-s
81M	- COMP MALE SHAFT OB HOR	.083 In/Sec	3.556 G-s
82M	- COMP MALE SHAFT OB VERT	.067 In/Sec	2.026 G-s
71F	- COMP FEMALE SHAFT IB HOR	.052 In/Sec	2.057 G-s
72F	- COMP FEMALE SHAFT IB VERT	.064 In/Sec	1.852 G-s
73F	- COMP FEMALE SHAFT IB AXIAL	.079 In/Sec	3.537 G-s
81F	- COMP FEMALE SHAFT OB HOR	.068 In/Sec	2.247 G-s
82F	- COMP FEMALE SHAFT OB VERT	.069 In/Sec	1.930 G-s
C-201	- C-201 Comp	(04-Dec-20)	
		OVERALL LEVEL	1-20 KHz
11	- MOTOR OB HOR	.102 In/Sec	2.048 G-s
12	- MOTOR OB VERT	.168 In/Sec	6.831 G-s
21	- MOTOR IB HOR	.087 In/Sec	1.197 G-s
22	- MOTOR IB VERT	.049 In/Sec	.950 G-s
23	- MOTOR IB AXIAL	.056 In/Sec	.759 G-s
		OVERALL LEVEL	1-20 KHZ
71M	- COMP MALE SHAFT IB HOR	.050 In/Sec	1.868 G-s
72M	- COMP MALE SHAFT IB VERT	.055 In/Sec	2.675 G-s
73M	- COMP MALE SHAFT IB AXIAL	.072 In/Sec	6.275 G-s
81M	- COMP MALE SHAFT OB HOR	.061 In/Sec	2.859 G-s
82M	- COMP MALE SHAFT OB VERT	.077 In/Sec	2.769 G-s
71F	- COMP FEMALE SHAFT IB HOR	.053 In/Sec	1.911 G-s
72F	- COMP FEMALE SHAFT IB VERT	.047 In/Sec	1.219 G-s
73F	- COMP FEMALE SHAFT IB AXIAL	.092 In/Sec	4.023 G-s
81F	- COMP FEMALE SHAFT OB HOR	.086 In/Sec	3.449 G-s
82F	- COMP FEMALE SHAFT OB VERT	.053 In/Sec	1.126 G-s
new AC	- INSTRUMENT AIR COMPRESSOR	(04-Dec-20)	
		OVERALL LEVEL	1-20 KHz
11	- MOTOR OB HOR	.135 In/Sec	1.364 G-s
12	- MOTOR OB VERT	.111 In/Sec	1.021 G-s
13	- MOTOR OB AXIAL	.068 In/Sec	.924 G-s
21	- MOTOR IB HOR	.154 In/Sec	1.053 G-s
22	- MOTOR IB VERT	.082 In/Sec	1.168 G-s
23	- MOTOR IB AXIAL	.073 In/Sec	.686 G-s
		OVERALL LEVEL	1-20 KHZ
71F	- COMP FEMALE SHAFT IB HOR	.284 In/Sec	10.12 G-s
72F	- COMP FEMALE SHAFT IB VERT	.178 In/Sec	3.948 G-s
73F	- COMP FEMALE SHAFT IB AXIAL	.239 In/Sec	6.937 G-s
81F	- COMP FEMALE SHAFT OB HOR	.220 In/Sec	4.958 G-s
82F	- COMP FEMALE SHAFT OB VERT	.386 In/Sec	13.62 G-s
83F	- COMP FEMALE SHAFT OB AXIAL	.219 In/Sec	4.797 G-s
71M	- COMP MALE SHAFT IB HOR	.152 In/Sec	6.683 G-s

72M - COMP MALE SHAFT IB VERT		.242 In/Sec	9.399 G-s
73M - COMP MALE SHAFT IB AXIAL		.156 In/Sec	5.958 G-s
81M - COMP MALE SHAFT OB HOR		.179 In/Sec	5.294 G-s
82M - COMP MALE SHAFT OB VERT		.215 In/Sec	2.063 G-s
83M - COMP MALE SHAFT OB AXIAL		.240 In/Sec	2.523 G-s

201-08A	- COMPRESSOR,NASH A 201-08A	(04-Dec-20)	
		OVERALL LEVEL	1-20 KHz
11	- Nash Compr A Motor OB Horiz	.077 In/Sec	.130 G-s
12	- Nash Compr A Motor OB Vertical	.083 In/Sec	.133 G-s
13	- Nash Compr A Motor OB Axial	.173 In/Sec	.127 G-s
21	- Nash Compr A Motor IB Horiz	.084 In/Sec	.118 G-s
22	- Nash Compr A Motor IB VERT	.110 In/Sec	.106 G-s
23	- Nash Compr A Motor IB AXIAL	.161 In/Sec	.180 G-s
71	- Nash Compr A COMP IB HORIZ	.169 In/Sec	.499 G-s
72	- Nash Compr A Compressor IB Verti	.263 In/Sec	.961 G-s
73	- Nash Compr A COMP IB AXIAL	.197 In/Sec	.288 G-s
81	- Nash Compr A COMP OB HORIZ	.182 In/Sec	.285 G-s
82	- Nash Compr A Compressor OB Verti	.319 In/Sec	.341 G-s
83	- Nash Compr A Compressor OB Axial	.161 In/Sec	.425 G-s

9002-10	- D-HYDROGENATOR AGITATOR	(04-Dec-20)	
		OVERALL LEVEL	1-20 KHz
11	- MOTOR OUTBOARD HORIZONTAL	.097 In/Sec	.071 G-s
21	- MOTOR INBOARD HORIZONTAL	.070 In/Sec	.241 G-s
23	- MOTOR INBOARD AXIAL	.047 In/Sec	.095 G-s
31	- GEARBOX INPUT SHAFT -HORIZONTAL	.204 In/Sec	.588 G-s
51	- GEARBOX TOP PLATE- E-W	.191 In/Sec	.195 G-s
52	- GEARBOX TOP PLATE- N-S	.271 In/Sec	.266 G-s
53	- GEARBOX OUTPUT TOP -VERTICAL	.112 In/Sec	.605 G-s
61	- GEARBOX BOTTOM E-W-HORIZONTAL	.076 In/Sec	.114 G-s
81	- AGIT INTERMED BRG @ SEAL- N-S	.039 In/Sec	.027 G-s
82	- AGIT INTERMED BRG @ SEAL- E-W	.051 In/Sec	.019 G-s
83	- AGIT INTERMED BRG @ SEAL- VERT	.032 In/Sec	.202 G-s

Clarification Of Vibration Units:

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