HI-SPEED INDUSTRIAL SERVICE

MILLINGTON, TN

January 6, 2021

Arkema

Subject: January 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 is virtually unchanged at 0.149”/sec velocity peak for the outboard pump bearing. No actions required just yet.

Agitator, Hydrogenator C 7001-01
The highest motor overall vibration is at 0.113”/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 0.243”/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. We are still watching acceleration near 2500 Hz for the compressor section that appears to be harmonic. 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. They continue to vary over time. Both shafts have over 10 g's RMS overall in the outboard verticals. 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 0.293"/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 0.522"/sec velocity peak at around 11 Hz for the gearbox upper output bearing plate in the N/S direction. This is a large jump and could indicate a change in the unit or just a process anomaly. We will watch carefully during the next few surveys. **Rated a Class II 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: 06-Jan-21 07:24

MEASUREMENT POINT	OVERALL LEVEL	HFD / VHFD
2130-1old - C Concentrator Vacuum Pump	(04-Jan-21)	
	OVERALL LEVEL	1-20 KHz
11 - Motor OB HOR	.060 In/Sec	.516 G-s
21 - Motor IB HOR	.065 In/Sec	.478 G-s
23 - Motor IB AXIAL	.121 In/Sec	.214 G-s
71 - Compressor IB HOR	.125 In/Sec	.751 G-s
81 - Compressor OB Horiz	.149 In/Sec	.587 G-s
83 - Compressor OB Axial	.075 In/Sec	1.498 G-s
7000-01 - AGITATOR,HYDROGENATOR C	(04-Jan-21)	
	OVERALL LEVEL	1-20 KHZ
02 - DRIVESHAFT BRG-EAST-WEST	.036 In/Sec	.033 G-s
03 - DRIVESHAFT BRG-VERTICAL	.048 In/Sec	.033 G-s
11 - C Hydro Agitator MOTOR OB HORIZ	.065 In/Sec	.626 G-s
12 - C Hydro Agitator MOTOR OB VERT	.069 In/Sec	.716 G-s
13 - C Hydro Agitator Motor OB Axial	.091 In/Sec	.206 G-s
21 - C Hydro Agitator MOTOR IB HORIZ	.073 In/Sec	.353 G-s
22 - C Hydro Agitator MOTOR IB VERT	.113 In/Sec	.153 G-s
23 - C Hydro Agitator Motor IB Axial	.048 In/Sec	.177 G-s

31	- C Hydro Agitator GrBx In Horizon	.099 In/Sec	.886 G-s
32	- C Hydro Agitator GrBx In VERT	.077 In/Sec	.834 G-s
33	- C Hydro Agitator GrBx In Axial	.050 In/Sec	.347 G-s
41	- C HY AG GBX INPUT OUTBOARD HZ	.095 In/Sec	1.174 G-s
42	- C HY AG GBX INPUT OUTBOARD VERT	.094 In/Sec	1.037 G-s
51	- C Hydro GrBx shaft 2 Top HZ E-W	.103 In/Sec	1.100 G-s
53	- C Hydro GrBx shaft 2 Top AXIAL	.076 In/Sec	.357 G-s
61	- C Hydro GrBx shaft 2 BOT HZ E-W	.034 In/Sec	.391 G-s
71	- C Hydro GrBx OUTPUT TOP HZ E-W	.053 In/Sec	.628 G-s
81	- C Hydro GrBx OUTPUT BOT HZ E-W	.023 In/Sec	.340 G-s
83	- C Hydro GrBx OUTPUT Top Axial	.049 In/Sec	.463 G-s

57	- A/B Concentr Vac Pmp-var RPM	(04-Jan-21)	
		OVERALL LEVEL	1-20 KHz
11	- Motor OB HOR	.045 In/Sec	.241 G-s
12	- Motor OB VERT	.054 In/Sec	.210 G-s
21	- Motor IB HOR	.063 In/Sec	.264 G-s
23	- Motor IB AXIAL	.049 In/Sec	.188 G-s
71	- Compressor IB HOR	.117 In/Sec	.484 G-s
81	- Compressor OB Horiz	.245 In/Sec	.619 G-s
83	- Compressor OB Axial	.043 In/Sec	.810 G-s

2130-1	- FLASH VAP VAC PUMP-var speed	(04-Jan-21)	
		OVERALL LEVEL	1-20 KHz
11	- Motor OB HOR	.038 In/Sec	.161 G-s
12	- Motor OB VERT	.077 In/Sec	.108 G-s
21	- Motor IB HOR	.040 In/Sec	.354 G-s
22	- Motor IB VERT	.044 In/Sec	.383 G-s
23	- Motor IB AXIAL	.059 In/Sec	.367 G-s
71	- Compressor IB HOR	.067 In/Sec	.453 G-s
72	- Compressor IB VERT	.077 In/Sec	.816 G-s
81	- Compressor OB Horiz	.083 In/Sec	.221 G-s
82	- Compressor OB VERT	.082 In/Sec	.440 G-s
83	- Compressor OB Axial	.041 In/Sec	.425 G-s

236-06	- HYDRO FD PUMP N 236-06 -2FLR	(04-Jan-21)	
		OVERALL LEVEL	1-20 KHz
11	- Hydro Fd Pmp B No. Motor Top	.107 In/Sec	.177 G-s
21	- Hydro Fd Pmp B No. Motor Bottom	.086 In/Sec	.341 G-s

2130-6	- ABC SEC FILT FEED PUMP-NORTH	(04-Jan-21)	
		OVERALL LEVEL	1-20 KHz
11	- MOTOR OUTBOARD HORIZONTAL	.062 In/Sec	.149 G-s
21	- MOTOR INBOARD HORIZONTAL	.060 In/Sec	.486 G-s
23	- MOTOR INBOARD AXIAL	.028 In/Sec	.045 G-s
71	- PUMP HORIZONTAL	.162 In/Sec	.759 G-s
72	- PUMP VERTICAL	.109 In/Sec	1.083 G-s

9001-1	- EAST OXIDIZER FEED PUMP	(04-Jan-21)	
		OVERALL LEVEL	1-20 KHz
11	- MOTOR OUTBOARD HORIZONTAL	.031 In/Sec	.348 G-s
21	- MOTOR INBOARD HORIZONTAL	.074 In/Sec	.188 G-s
23	- MOTOR INBOARD AXIAL	.057 In/Sec	.085 G-s
71	- PUMP HORIZONTAL	.109 In/Sec	.648 G-s
72	- PUMP VERTICAL	.147 In/Sec	.273 G-s

9001-2	- MIDDLE OXIDIZER FEED PUMP	(04-Jan-21)

		OVERALL LEVEL	1-20 KHz
11	- MOTOR OUTBOARD HORIZONTAL	.021 In/Sec	.207 G-s
21	- MOTOR INBOARD HORIZONTAL	.028 In/Sec	.714 G-s
23	- MOTOR INBOARD AXIAL	.040 In/Sec	.228 G-s
71	- PUMP HORIZONTAL	.070 In/Sec	.275 G-s
72	- PUMP VERTICAL	.105 In/Sec	.258 G-s

7016-11 - WEST OXIDIZER FEED PUMP (04-Jan-21)

		OVERALL LEVEL	1-20 KHz
11	- MOTOR OUTBOARD HORIZONTAL	.020 In/Sec	.456 G-s
21	- MOTOR INBOARD HORIZONTAL	.022 In/Sec	.490 G-s
23	- MOTOR INBOARD AXIAL	.031 In/Sec	.175 G-s
71	- PUMP HORIZONTAL	.087 In/Sec	.380 G-s
72	- PUMP VERTICAL	.063 In/Sec	.520 G-s

234-01 - CHILL WATER PUMP 234-01 (04-Jan-21)

		OVERALL LEVEL	1-20 KHz
11	- Chilled H2O Pump Motor OB Horizo	.097 In/Sec	.772 G-s
21	- Chilled H2O Pump Motor IB Horizo	.081 In/Sec	1.091 G-s
23	- MOTOR INBOARD AXIAL	.112 In/Sec	
71	- Chilled H2O Pump IB Horizontal	.079 In/Sec	.281 G-s
72	- PUMP VERTICAL	.073 In/Sec	.231 G-s

C-203 - C-203 Comp (04-Jan-21)

		OVERALL LEVEL	1-20 KHz
11	- MOTOR OB HOR	.067 In/Sec	2.553 G-s
12	- MOTOR OB VERT	.060 In/Sec	2.051 G-s
21	- MOTOR IB HOR	.098 In/Sec	4.054 G-s
22	- MOTOR IB VERT	.101 In/Sec	4.054 G-s
23	- MOTOR IB AXIAL	.045 In/Sec	1.682 G-s
		OVERALL LEVEL	1-20 KHZ
71M	- COMP MALE SHAFT IB HOR	.060 In/Sec	3.588 G-s
72M	- COMP MALE SHAFT IB VERT	.058 In/Sec	3.931 G-s
73M	- COMP MALE SHAFT IB AXIAL	.065 In/Sec	4.358 G-s
81M	- COMP MALE SHAFT OB HOR	.071 In/Sec	5.717 G-s
82M	- COMP MALE SHAFT OB VERT	.073 In/Sec	4.294 G-s
71F	- COMP FEMALE SHAFT IB HOR	.052 In/Sec	2.231 G-s
72F	- COMP FEMALE SHAFT IB VERT	.072 In/Sec	1.922 G-s
73F	- COMP FEMALE SHAFT IB AXIAL	.080 In/Sec	2.993 G-s
81F	- COMP FEMALE SHAFT OB HOR	.081 In/Sec	3.530 G-s
82F	- COMP FEMALE SHAFT OB VERT	.062 In/Sec	1.865 G-s

9000-01 - D HYDROGENATOR FD PUMP- WEST (04-Jan-21)

		OVERALL LEVEL	1-20 KHz
11	- MOTOR OUTBOARD HORIZONTAL	.025 In/Sec	.264 G-s
21	- MOTOR INBOARD HORIZONTAL	.037 In/Sec	.400 G-s
23	- MOTOR INBOARD AXIAL	.023 In/Sec	.345 G-s
71	- PUMP HORIZONTAL	.084 In/Sec	.783 G-s
72	- PUMP VERTICAL	.058 In/Sec	.769 G-s

236-04A - HYDROGNTOR PRECOOLER FD PUMP (04-Jan-21)

		OVERALL LEVEL	1-20 KHz
11	- MOTOR OUTBOARD HORIZ	.051 In/Sec	.296 G-s
21	- MOTOR INBOARD HORIZ	.092 In/Sec	.140 G-s
23	- MOTOR INBOARD AXIAL	.027 In/Sec	.165 G-s
71	- PUMP HORIXONTAL	.136 In/Sec	.285 G-s
72	- PUMP VERTICAL	.059 In/Sec	.345 G-s

C-202 - C-202 Comp	(04-Jan-21)	
	OVERALL LEVEL	1-20 KHz
11 - MOTOR OB HOR	.058 In/Sec	.705 G-s
12 - MOTOR OB VERT	.124 In/Sec	1.058 G-s
21 - MOTOR IB HOR	.073 In/Sec	1.216 G-s
22 - MOTOR IB VERT	.157 In/Sec	5.338 G-s
23 - MOTOR IB AXIAL	.070 In/Sec	2.052 G-s
	OVERALL LEVEL	1-20 KHZ
71M - COMP MALE SHAFT IB HOR	.038 In/Sec	1.512 G-s
72M - COMP MALE SHAFT IB VERT	.045 In/Sec	1.078 G-s
73M - COMP MALE SHAFT IB AXIAL	.082 In/Sec	2.098 G-s
81M - COMP MALE SHAFT OB HOR	.056 In/Sec	2.106 G-s
82M - COMP MALE SHAFT OB VERT	.073 In/Sec	2.656 G-s
71F - COMP FEMALE SHAFT IB HOR	.062 In/Sec	2.311 G-s
72F - COMP FEMALE SHAFT IB VERT	.091 In/Sec	2.702 G-s
73F - COMP FEMALE SHAFT IB AXIAL	.080 In/Sec	3.960 G-s
81F - COMP FEMALE SHAFT OB HOR	.070 In/Sec	3.022 G-s
82F - COMP FEMALE SHAFT OB VERT	.069 In/Sec	1.776 G-s

C-201 - C-201 Comp	(04-Jan-21)	
	OVERALL LEVEL	1-20 KHz
11 - MOTOR OB HOR	.098 In/Sec	.820 G-s
12 - MOTOR OB VERT	.098 In/Sec	2.236 G-s
21 - MOTOR IB HOR	.102 In/Sec	2.245 G-s
22 - MOTOR IB VERT	.101 In/Sec	3.111 G-s
23 - MOTOR IB AXIAL	.065 In/Sec	.636 G-s
	OVERALL LEVEL	1-20 KHZ
71M - COMP MALE SHAFT IB HOR	.049 In/Sec	2.140 G-s
72M - COMP MALE SHAFT IB VERT	.064 In/Sec	2.211 G-s
73M - COMP MALE SHAFT IB AXIAL	.077 In/Sec	1.915 G-s
81M - COMP MALE SHAFT OB HOR	.100 In/Sec	5.139 G-s
82M - COMP MALE SHAFT OB VERT	.065 In/Sec	2.548 G-s
71F - COMP FEMALE SHAFT IB HOR	.057 In/Sec	3.082 G-s
72F - COMP FEMALE SHAFT IB VERT	.071 In/Sec	2.373 G-s
73F - COMP FEMALE SHAFT IB AXIAL	.057 In/Sec	2.228 G-s
81F - COMP FEMALE SHAFT OB HOR	.090 In/Sec	3.264 G-s
82F - COMP FEMALE SHAFT OB VERT	.073 In/Sec	2.522 G-s

new AC - INSTRUMENT AIR COMPRESSOR	(04-Jan-21)	
	OVERALL LEVEL	1-20 KHz
11 - MOTOR OB HOR	.158 In/Sec	1.313 G-s
12 - MOTOR OB VERT	.111 In/Sec	.957 G-s
13 - MOTOR OB AXIAL	.065 In/Sec	.479 G-s
21 - MOTOR IB HOR	.157 In/Sec	1.425 G-s
22 - MOTOR IB VERT	.083 In/Sec	.448 G-s
23 - MOTOR IB AXIAL	.046 In/Sec	.552 G-s
	OVERALL LEVEL	1-20 KHZ
71F - COMP FEMALE SHAFT IB HOR	.241 In/Sec	9.172 G-s
72F - COMP FEMALE SHAFT IB VERT	.147 In/Sec	2.503 G-s
73F - COMP FEMALE SHAFT IB AXIAL	.205 In/Sec	5.562 G-s
81F - COMP FEMALE SHAFT OB HOR	.143 In/Sec	3.172 G-s
82F - COMP FEMALE SHAFT OB VERT	.366 In/Sec	10.89 G-s
83F - COMP FEMALE SHAFT OB AXIAL	.201 In/Sec	4.774 G-s
71M - COMP MALE SHAFT IB HOR	.106 In/Sec	4.544 G-s
72M - COMP MALE SHAFT IB VERT	.191 In/Sec	6.608 G-s
73M - COMP MALE SHAFT IB AXIAL	.118 In/Sec	6.185 G-s

81M - COMP MALE SHAFT OB HOR		.186 In/Sec	5.844 G-s
82M - COMP MALE SHAFT OB VERT		.397 In/Sec	13.74 G-s
83M - COMP MALE SHAFT OB AXIAL		.265 In/Sec	4.935 G-s

201-08A	- COMPRESSOR,NASH A 201-08A	(04-Jan-21)	
		OVERALL LEVEL	1-20 KHz
11	- Nash Compr A Motor OB Horiz	.069 In/Sec	.098 G-s
12	- Nash Compr A Motor OB Vertical	.079 In/Sec	.124 G-s
13	- Nash Compr A Motor OB Axial	.159 In/Sec	.273 G-s
21	- Nash Compr A Motor IB Horiz	.073 In/Sec	.139 G-s
22	- Nash Compr A Motor IB VERT	.099 In/Sec	.150 G-s
23	- Nash Compr A Motor IB AXIAL	.160 In/Sec	.105 G-s
71	- Nash Compr A COMP IB HORIZ	.150 In/Sec	1.420 G-s
72	- Nash Compr A Compressor IB Verti	.246 In/Sec	1.283 G-s
73	- Nash Compr A COMP IB AXIAL	.164 In/Sec	.236 G-s
81	- Nash Compr A COMP OB HORIZ	.177 In/Sec	.455 G-s
82	- Nash Compr A Compressor OB Verti	.296 In/Sec	.276 G-s
83	- Nash Compr A Compressor OB Axial	.165 In/Sec	.407 G-s

9002-10	- D-HYDROGENATOR AGITATOR	(04-Jan-21)	
		OVERALL LEVEL	1-20 KHz
11	- MOTOR OUTBOARD HORIZONTAL	.085 In/Sec	.075 G-s
21	- MOTOR INBOARD HORIZONTAL	.077 In/Sec	.229 G-s
23	- MOTOR INBOARD AXIAL	.054 In/Sec	.068 G-s
		OVERALL LEVEL	1-20 KHZ
31	- GEARBOX INPUT SHAFT -HORIZONTAL	.189 In/Sec	.602 G-s
31L	- GEARBOX INPUT SHAFT-N-S-LOW FRQ	.201 In/Sec	.593 G-s
		OVERALL LEVEL	1-20 KHz
51	- GEARBOX OUTPUT TOP E-W	.274 In/Sec	.189 G-s
51L	- GEARBOX OUTPUT TOP E-W- 100RPM	.222 In/Sec	.142 G-s
52	- GEARBOX TOP PLATE- N-S	.522 In/Sec	.274 G-s
52L	- GEARBOX OUTPUT TOP N-S 100RPM	.232 In/Sec	.262 G-s
53	- GEARBOX OUTPUT TOP -AXIAL	.140 In/Sec	.635 G-s
61	- GEARBOX OUTPUT BOTTOM E-W-HZ	.168 In/Sec	.134 G-s
81	- AGIT INTERMED BRG @ SEAL- N-S	.037 In/Sec	.025 G-s
82	- AGIT INTERMED BRG @ SEAL- E-W	.037 In/Sec	.024 G-s
83	- AGIT INTERMED BRG @ SEAL- VERT	.043 In/Sec	.172 G-s

Clarification Of Vibration Units:

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