HI-SPEED INDUSTRIAL SERVICE

MILLINGTON, TN

July 13, 2020

ARKEMA
Subject: July week 2 vibration service report

Weekly Peroxide Route Critical Equipment Observations

C Concentrator Vacuum Pump 2130-1
The pump was not running this survey.

A/B Concentrator Vacuum Pump 57
Exterior water is still on the pump unit this month. The outboard bearing horizontal vibration has climbed again to 0.331"/sec velocity peak overall. The vibration is dominated by a 16-order peak, which is most likely vane pass. The vibration will shorten the life of the unit. **Rated a Class I Defect**.

Agitator, Hydrogenator C 7001-01
The highest motor overall is 0.162"/sec velocity peak again for the inboard axial vibration. 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 3x RPM vibration is dominant and could indicate a coupling or alignment issue. **Motor is rated a Class I Defect now.**

Flash Vacuum Pump 2130-1
Vibrations appear to be normal this survey. 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 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 watching an increase in acceleration for the compressor section. Rated a Class I Defect this survey. No immediate actions required at this time.

Air Compressor C-203
Rotor bar vibrations are elevated 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. **Rated a Class I Defect this survey**. No actions required.

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Instrument Air Compressor new
The male and female shaft vibrations seem to show gear mesh and harmonics as well as a beat vibration occasionally. The female shaft outboard vertical vibration is at 0.4"/sec velocity peak and 9 g's RMS. Two vibrations at near 1500 and 1600 Hz are beating at just over 110 Hz. The beat is very strong since the vibrations are close and of nearly equal amplitude. We will keep a close eye on this unit going forward. **Rated a Class II Defect for now.**

Air Compressor NASH A 201-08A
Highest vibration is still in the pump itself at just over 0.265"/sec velocity peak for the outboard vertical. **Rated a Class I Defect.**

D Hydrogenator Agitator 9002-10
Vibration data shows a large increase in vibrations this survey. Highest amplitude is 0.398"/sec velocity peak for the top bearing plate. **Still rated a Class I Defect.**

Monthly Route Equipment with issues

Hydrogen East Cooling Tower Pump
The unit suffers from a 1xRPM vibration which is dominant in the pump vertical at almost 0.5"/sec velocity peak. Inspect the unit coupling, fasteners, and alignment; for associated defects such as looseness, eccentricity, wear, damage, misalignment, base defects, and soft foot. Inspect at the next opportunity. **Rated a Class II Defect.**

Middle Mix Bed Water Pump 191-07
The unit still suffers from a 5x RPM vibration. We suspect a vane pass process issue or wear in the pump. Inspect and adjust or replace in the future. **Rated a Class I Defect.**

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 do not hesitate to call if you have any comments or questions.

Sincerely,

David W. Shook
Senior Reliability Specialist
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Hi-Speed **Industrial Service**

Abbreviated Last Measurement Summary

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Database: Arkema.rbm
Station: PEROXIDE
Route No. 4: ARK WK 2
Report Date: 13-Jul-20 14:05

MEASUREMENT POINT	OVERALL LEVEL	HFD / VHFD
7000-01 - AGITATOR,HYDROGENATOR C	(13-Jul-20)	
	OVERALL LEVEL	1-20 KHZ
01 - DRIVESHAFT BRG-NORTH-SOUTH	.041 In/Sec	.038 G-s
02 - DRIVESHAFT BRG-EAST-WEST	.038 In/Sec	.032 G-s
03 - DRIVESHAFT BRG-VERTICAL	.043 In/Sec	.040 G-s
11 - C Hydro Agitator MOTOR OB HORIZ	.098 In/Sec	.926 G-s
12 - C Hydro Agitator MOTOR OB VERT	.114 In/Sec	.838 G-s
13 - C Hydro Agitator Motor OB Axial	.158 In/Sec	.379 G-s
21 - C Hydro Agitator MOTOR IB HORIZ	.118 In/Sec	.227 G-s
22 - C Hydro Agitator MOTOR IB VERT	.156 In/Sec	.478 G-s
23 - C Hydro Agitator Motor IB Axial	.165 In/Sec	.455 G-s
31 - C Hydro Agitator GrBx In Horizon	.095 In/Sec	.626 G-s
32 - C Hydro Agitator GrBx In VERT	.087 In/Sec	.897 G-s
33 - C Hydro Agitator GrBx In Axial	.067 In/Sec	.484 G-s
41 - C Hydro Agitator GrBx Top HZ E-W	.056 In/Sec	.670 G-s
42 - C Hydro Agitator GrBx TOP HZ N-S	.032 In/Sec	.583 G-s
51 - C Hydro Agitator GrBx BOT HZ E-W	.021 In/Sec	.476 G-s
52 - C Hydro Agitator GrBx BOT HZ N-S	.021 In/Sec	.565 G-s
53 - C Hydro Agitator GrBx Top Axial	.047 In/Sec	.517 G-s
57 - A/B Concentr Vac Pmp-var RPM	(13-Jul-20)	
	OVERALL LEVEL	1-20 KHz
11 - Motor OB HOR	.058 In/Sec	.505 G-s
12 - Motor OB VERT	.065 In/Sec	.449 G-s
21 - Motor IB HOR	.065 In/Sec	.209 G-s
23 - Motor IB AXIAL	.070 In/Sec	.220 G-s
71 - Compressor IB HOR	.117 In/Sec	.613 G-s
81 - Compressor OB Horiz	.331 In/Sec	.618 G-s
83 - Compressor OB Axial	.045 In/Sec	.902 G-s
2130-1 - FLASH VAP VAC PUMP-var speed	(13-Jul-20)	
	OVERALL LEVEL	1-20 KHz
11 - Motor OB HOR	.051 In/Sec	.182 G-s
12 - Motor OB VERT	.039 In/Sec	.275 G-s
21 - Motor IB HOR	.039 In/Sec	.481 G-s
22 - Motor IB VERT	.044 In/Sec	.669 G-s
23 - Motor IB AXIAL	.058 In/Sec	.591 G-s
71 - Compressor IB HOR	.063 In/Sec	.568 G-s
72 - Compressor IB VERT	.076 In/Sec	.473 G-s
81 - Compressor OB Horiz	.077 In/Sec	.269 G-s
82 - Compressor OB VERT	.091 In/Sec	.320 G-s
83 - Compressor OB Axial	.048 In/Sec	.481 G-s
C-203 - C-203 Comp	(13-Jul-20)	
	OVERALL LEVEL	1-20 KHz
11 - MOTOR OB HOR	.077 In/Sec	2.645 G-s

12	- MOTOR OB VERT	.038 In/Sec	.686 G-s
21	- MOTOR IB HOR	.065 In/Sec	2.290 G-s
22	- MOTOR IB VERT	.191 In/Sec	9.045 G-s
23	- MOTOR IB AXIAL	.025 In/Sec	.804 G-s
		OVERALL LEVEL	1-20 KHZ
71M	- COMP MALE SHAFT IB HOR	.038 In/Sec	1.852 G-s
72M	- COMP MALE SHAFT IB VERT	.047 In/Sec	2.547 G-s
73M	- COMP MALE SHAFT IB AXIAL	.064 In/Sec	1.890 G-s
81M	- COMP MALE SHAFT OB HOR	.074 In/Sec	5.027 G-s
82M	- COMP MALE SHAFT OB VERT	.057 In/Sec	2.101 G-s
71F	- COMP FEMALE SHAFT IB HOR	.041 In/Sec	2.953 G-s
72F	- COMP FEMALE SHAFT IB VERT	.045 In/Sec	1.248 G-s
73F	- COMP FEMALE SHAFT IB AXIAL	.065 In/Sec	1.381 G-s
81F	- COMP FEMALE SHAFT OB HOR	.042 In/Sec	3.229 G-s
82F	- COMP FEMALE SHAFT OB VERT	.051 In/Sec	1.341 G-s

C-202	- C-202 Comp	(13-Jul-20)	
		OVERALL LEVEL	1-20 KHz
11	- MOTOR OB HOR	.053 In/Sec	.388 G-s
12	- MOTOR OB VERT	.116 In/Sec	.642 G-s
21	- MOTOR IB HOR	.055 In/Sec	.617 G-s
22	- MOTOR IB VERT	.088 In/Sec	.496 G-s
23	- MOTOR IB AXIAL	.038 In/Sec	.305 G-s
		OVERALL LEVEL	1-20 KHZ
71M	- COMP MALE SHAFT IB HOR	.050 In/Sec	3.254 G-s
72M	- COMP MALE SHAFT IB VERT	.043 In/Sec	.794 G-s
73M	- COMP MALE SHAFT IB AXIAL	.074 In/Sec	1.812 G-s
81M	- COMP MALE SHAFT OB HOR	.047 In/Sec	2.411 G-s
82M	- COMP MALE SHAFT OB VERT	.055 In/Sec	1.585 G-s
71F	- COMP FEMALE SHAFT IB HOR	.043 In/Sec	1.924 G-s
72F	- COMP FEMALE SHAFT IB VERT	.063 In/Sec	1.212 G-s
73F	- COMP FEMALE SHAFT IB AXIAL	.081 In/Sec	9.939 G-s
81F	- COMP FEMALE SHAFT OB HOR	.048 In/Sec	2.278 G-s
82F	- COMP FEMALE SHAFT OB VERT	.053 In/Sec	1.368 G-s

C-201	- C-201 Comp	(13-Jul-20)	
		OVERALL LEVEL	1-20 KHz
11	- MOTOR OB HOR	.084 In/Sec	.331 G-s
12	- MOTOR OB VERT	.082 In/Sec	.793 G-s
21	- MOTOR IB HOR	.094 In/Sec	.523 G-s
22	- MOTOR IB VERT	.040 In/Sec	.125 G-s
23	- MOTOR IB AXIAL	.081 In/Sec	1.888 G-s
		OVERALL LEVEL	1-20 KHZ
71M	- COMP MALE SHAFT IB HOR	.047 In/Sec	2.441 G-s
72M	- COMP MALE SHAFT IB VERT	.042 In/Sec	3.220 G-s
73M	- COMP MALE SHAFT IB AXIAL	.081 In/Sec	1.919 G-s
81M	- COMP MALE SHAFT OB HOR	.066 In/Sec	5.815 G-s
82M	- COMP MALE SHAFT OB VERT	.043 In/Sec	2.174 G-s
71F	- COMP FEMALE SHAFT IB HOR	.055 In/Sec	1.984 G-s
72F	- COMP FEMALE SHAFT IB VERT	.040 In/Sec	.642 G-s
73F	- COMP FEMALE SHAFT IB AXIAL	.055 In/Sec	2.563 G-s
81F	- COMP FEMALE SHAFT OB HOR	.058 In/Sec	2.586 G-s
82F	- COMP FEMALE SHAFT OB VERT	.055 In/Sec	1.197 G-s

new AC	- INSTRUMENT AIR COMPRESSOR	(13-Jul-20)	
		OVERALL LEVEL	1-20 KHz
11	- MOTOR OB HOR	.150 In/Sec	1.047 G-s

12	- MOTOR OB VERT	.097 In/Sec	.739 G-s
13	- MOTOR OB AXIAL	.066 In/Sec	.413 G-s
21	- MOTOR IB HOR	.159 In/Sec	1.183 G-s
22	- MOTOR IB VERT	.075 In/Sec	.857 G-s
23	- MOTOR IB AXIAL	.057 In/Sec	.898 G-s
		OVERALL LEVEL	1-20 KHZ
71F	- COMP FEMALE SHAFT IB HOR	.158 In/Sec	5.450 G-s
72F	- COMP FEMALE SHAFT IB VERT	.142 In/Sec	3.259 G-s
73F	- COMP FEMALE SHAFT IB AXIAL	.181 In/Sec	3.580 G-s
81F	- COMP FEMALE SHAFT OB HOR	.136 In/Sec	2.896 G-s
82F	- COMP FEMALE SHAFT OB VERT	.399 In/Sec	9.641 G-s
83F	- COMP FEMALE SHAFT OB AXIAL	.157 In/Sec	3.112 G-s
71M	- COMP MALE SHAFT IB HOR	.101 In/Sec	3.437 G-s
72M	- COMP MALE SHAFT IB VERT	.182 In/Sec	5.427 G-s
73M	- COMP MALE SHAFT IB AXIAL	.142 In/Sec	4.496 G-s
81M	- COMP MALE SHAFT OB HOR	.188 In/Sec	4.930 G-s
82M	- COMP MALE SHAFT OB VERT	.222 In/Sec	4.736 G-s
83M	- COMP MALE SHAFT OB AXIAL	.210 In/Sec	1.911 G-s

201-08A	- COMPRESSOR,NASH A 201-08A	(13-Jul-20)	
		OVERALL LEVEL	1-20 KHz
11	- Nash Compr A Motor OB Horiz	.072 In/Sec	.096 G-s
12	- Nash Compr A Motor OB Vertical	.072 In/Sec	.110 G-s
13	- Nash Compr A Motor OB Axial	.133 In/Sec	.097 G-s
21	- Nash Compr A Motor IB Horiz	.074 In/Sec	.092 G-s
22	- Nash Compr A Motor IB VERT	.096 In/Sec	.078 G-s
23	- Nash Compr A Motor IB AXIAL	.138 In/Sec	.095 G-s
71	- Nash Compr A COMP IB HORIZ	.142 In/Sec	1.014 G-s
72	- Nash Compr A Compressor IB Verti	.221 In/Sec	1.070 G-s
73	- Nash Compr A COMP IB AXIAL	.152 In/Sec	.302 G-s
81	- Nash Compr A COMP OB HORIZ	.167 In/Sec	.619 G-s
82	- Nash Compr A Compressor OB Verti	.265 In/Sec	.620 G-s
83	- Nash Compr A Compressor OB Axial	.156 In/Sec	.605 G-s

202-05	- NASH SEAL LIQUID PUMP-A	(13-Jul-20)	
		OVERALL LEVEL	1-20 KHz
11	- MOTOR OUTBOARD HORIZ	.057 In/Sec	.067 G-s
21	- MOTOR INBOARD HORIZ	.018 In/Sec	.164 G-s
23	- MOTOR INBOARD AXIAL	.014 In/Sec	.085 G-s
71	- PUMP HORIZ	.037 In/Sec	.057 G-s
72	- PUMP VERT	.023 In/Sec	.053 G-s

9002-10	- D-HYDROGENATOR AGITATOR	(13-Jul-20)	
		OVERALL LEVEL	1-20 KHz
11	- MOTOR OUTBOARD HORIZONTAL	.080 In/Sec	.129 G-s
21	- MOTOR INBOARD HORIZONTAL	.091 In/Sec	.093 G-s
23	- MOTOR INBOARD AXIAL	.057 In/Sec	.114 G-s
31	- GEARBOX INPUT SHAFT -HORIZONTAL	.182 In/Sec	.615 G-s
51	- GEARBOX TOP PLATE- E-W	.204 In/Sec	.251 G-s
52	- GEARBOX TOP PLATE- N-S	.398 In/Sec	.425 G-s
53	- GEARBOX OUTPUT TOP -VERTICAL	.134 In/Sec	.670 G-s
61	- GEARBOX BOTTOM E-W-HORIZONTAL	.177 In/Sec	.158 G-s
81	- AGIT INTERMED BRG @ SEAL- N-S	.042 In/Sec	.020 G-s
82	- AGIT INTERMED BRG @ SEAL- E-W	.042 In/Sec	.024 G-s
83	- AGIT INTERMED BRG @ SEAL- VERT	.041 In/Sec	.141 G-s

9003-01	- D-HYDRO PRIMARY FILT FD PUMP	(13-Jul-20)

		OVERALL LEVEL	1-20 KHz
11	- MOTOR OUTBOARD HORIZONTAL	.038 In/Sec	.297 G-s
21	- MOTOR INBOARD HORIZONTAL	.040 In/Sec	.348 G-s
23	- MOTOR INBOARD AXIAL	.044 In/Sec	.195 G-s
71	- PUMP HORIZONTAL	.092 In/Sec	.188 G-s
72	- PUMP VERTICAL	.078 In/Sec	.197 G-s

9001-01 - D-HYDRO SECOND. FILT FD PUMP (13-Jul-20)

		OVERALL LEVEL	1-20 KHz
11	- MOTOR OUTBOARD HORIZONTAL	.056 In/Sec	.626 G-s
21	- MOTOR INBOARD HORIZONTAL	.050 In/Sec	.500 G-s

Abbreviated Last Measurement Summary

Database: Arkema.rbm
Station: HYDROGEN
Route No. 1: H2 MONTHLY
Report Date: 13-Jul-20 14:07

MEASUREMENT POINT		OVERALL LEVEL	HFD / VHFD

CTPE - EAST COOLING TOWER PUMP (13-Jul-20)

		OVERALL LEVEL	1-20 KHz
11	- MOTOR OUTBOARD HORIZONTAL	.353 In/Sec	1.659 G-s
21	- MOTOR INBOARD HORIZONTAL	.272 In/Sec	2.361 G-s
23	- MOTOR INBOARD AXIAL	.184 In/Sec	.578 G-s
71	- PUMP HORIZONTAL	.216 In/Sec	.556 G-s
72	- PUMP VERTICAL	.445 In/Sec	.680 G-s

CTPW - WEST COOLING TOWER PUMP (13-Jul-20)

		OVERALL LEVEL	1-20 KHz
11	- MOTOR OUTBOARD HORIZONTAL	.098 In/Sec	1.255 G-s
21	- MOTOR INBOARD HORIZONTAL	.073 In/Sec	.637 G-s
23	- MOTOR INBOARD AXIAL	.108 In/Sec	1.094 G-s
71	- PUMP HORIZONTAL	.222 In/Sec	.931 G-s
72	- PUMP VERTICAL	.176 In/Sec	1.358 G-s

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

71	- PUMP HORIZONTAL	.072 In/Sec	.360 G-s
72	- PUMP VERTICAL	.076 In/Sec	.377 G-s

192-03 - Two Stage Water Pump A-WEST (13-Jul-20)

		OVERALL LEVEL	1-20 KHz
11	- MOTOR OUTBOARD HORIZONTAL	.068 In/Sec	.300 G-s
21	- MOTOR IB HORIZ	.074 In/Sec	.322 G-s
23	- motor inboard axial	.056 In/Sec	.143 G-s
71	- PUMP HORIZONTAL	.141 In/Sec	.677 G-s
72	- PUMP VERTICAL	.121 In/Sec	.763 G-s

191-07 - M MIX BED WATER PUMP 191-07 (13-Jul-20)

		OVERALL LEVEL	1-20 KHz
11	- Chilled H2O Pump Motor OB Horizo	.159 In/Sec	.483 G-s
21	- Chilled H2O Pump Motor IB Horizo	.135 In/Sec	.761 G-s

23	- MOTOR INBOARD	.064 In/Sec	.306 G-s
71	- Chilled H2O Pump IB Horizontal	.341 In/Sec	.252 G-s
72	- PUMP VERTICAL	.282 In/Sec	.239 G-s

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

Abbreviated Last Measurement Summary

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Database: Arkema.rbm
Station: HYDROGEN
Route No. 1: H2 MONTHLY
Report Date: 13-Jul-20 14:07

MEASUREMENT POINT		OVERALL LEVEL	HFD / VHFD
CTPE	- EAST COOLING TOWER PUMP	(13-Jul-20)	
		OVERALL LEVEL	1-20 KHz
11	- MOTOR OUTBOARD HORIZONTAL	.353 In/Sec	1.659 G-s
21	- MOTOR INBOARD HORIZONTAL	.272 In/Sec	2.361 G-s
23	- MOTOR INBOARD AXIAL	.184 In/Sec	.578 G-s
71	- PUMP HORIZONTAL	.216 In/Sec	.556 G-s
72	- PUMP VERTICAL	.445 In/Sec	.680 G-s
CTPW	- WEST COOLING TOWER PUMP	(13-Jul-20)	
		OVERALL LEVEL	1-20 KHz
11	- MOTOR OUTBOARD HORIZONTAL	.098 In/Sec	1.255 G-s
21	- MOTOR INBOARD HORIZONTAL	.073 In/Sec	.637 G-s
23	- MOTOR INBOARD AXIAL	.108 In/Sec	1.094 G-s
71	- PUMP HORIZONTAL	.222 In/Sec	.931 G-s
72	- PUMP VERTICAL	.176 In/Sec	1.358 G-s

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