HI-SPEED INDUSTRIAL SERVICE QualiTest® Diagnostics

7030 Ryburn Dr. Millington, TN Phone: (901) 873-5300 Fax: (901) 873-5301 www.gohispeed.com

June 26th, 2023

Shawna Guffey
Arkema
Memphis, TN

The following is a summary of findings from the June 2023 WEEK 3 vibration survey at the H2O2 Plant and the monthly H2 plant survey that was performed on June 23rd, 2023.

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.

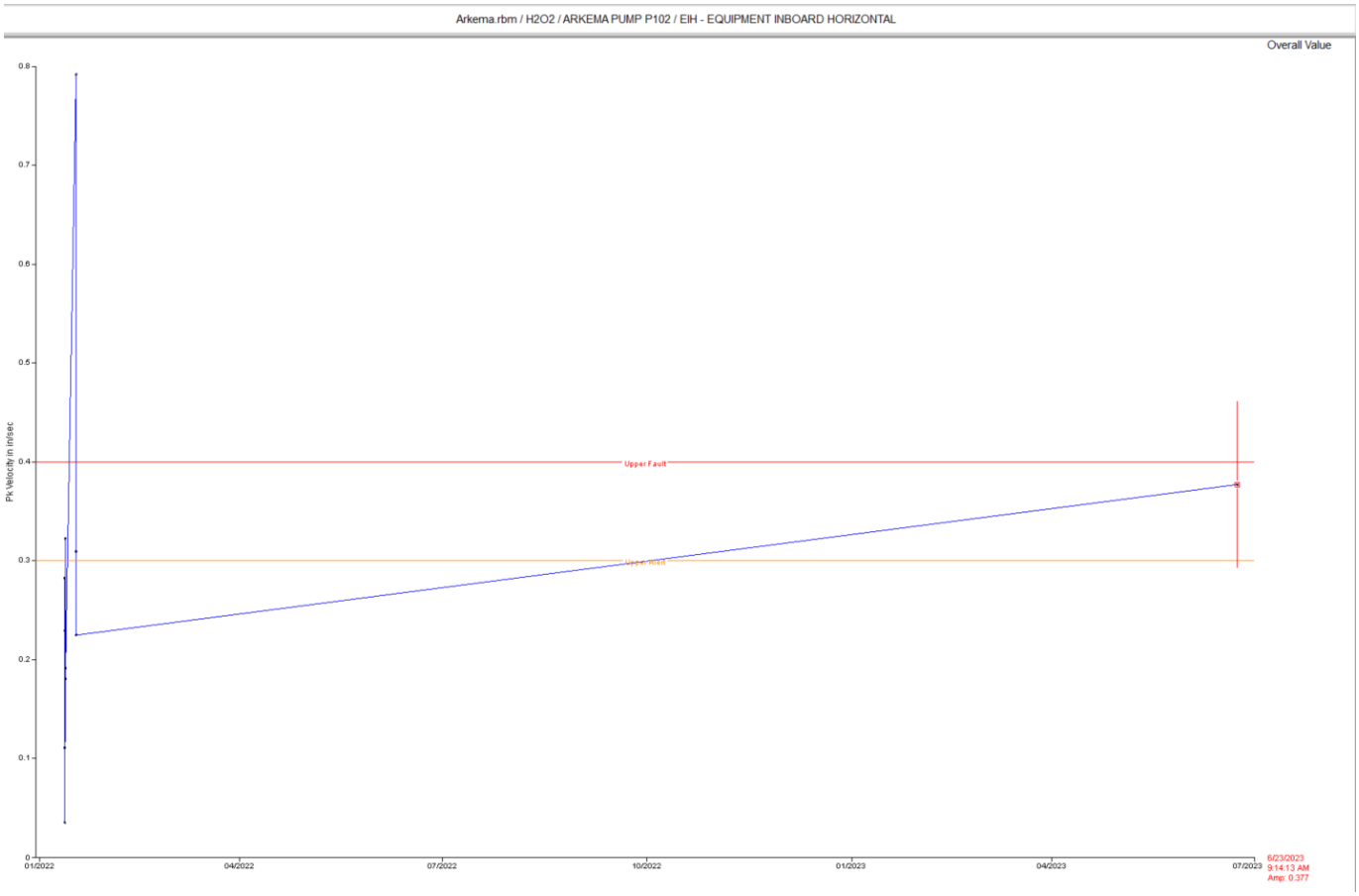
CLASS III; Defect (s) present that may cause failure in short term (less than 2 months). This should be addressed as soon as practical, with a high maintenance priority. Increase monitoring frequency.

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

Defect Summary

WEEK 3 H2O2 Plant

P102 Pump CLASS I



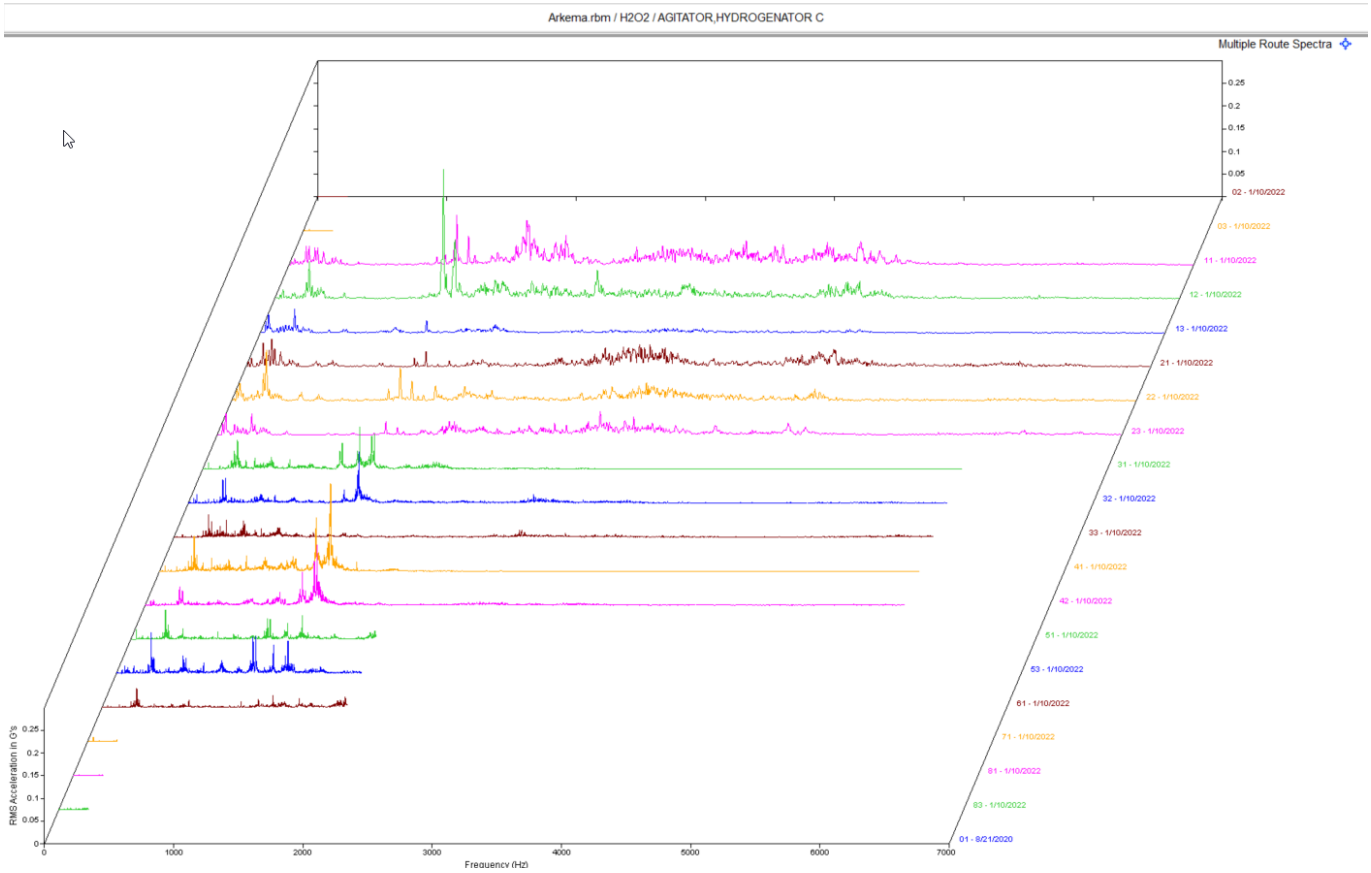
Observation:

Data above is a trend of the inboard pump horizontal. Data shows the overall amplitude to be lower compared to previous data taken back from 1/12 to 1/7/22.

Recommendation:

Overall amplitude is just above low alarm limit at .3 ips-pk. This pump is now on our weekly route, so we need to establish a more reliable trend to help determine severity.

Agitator, Hydrogenator C CLASS I



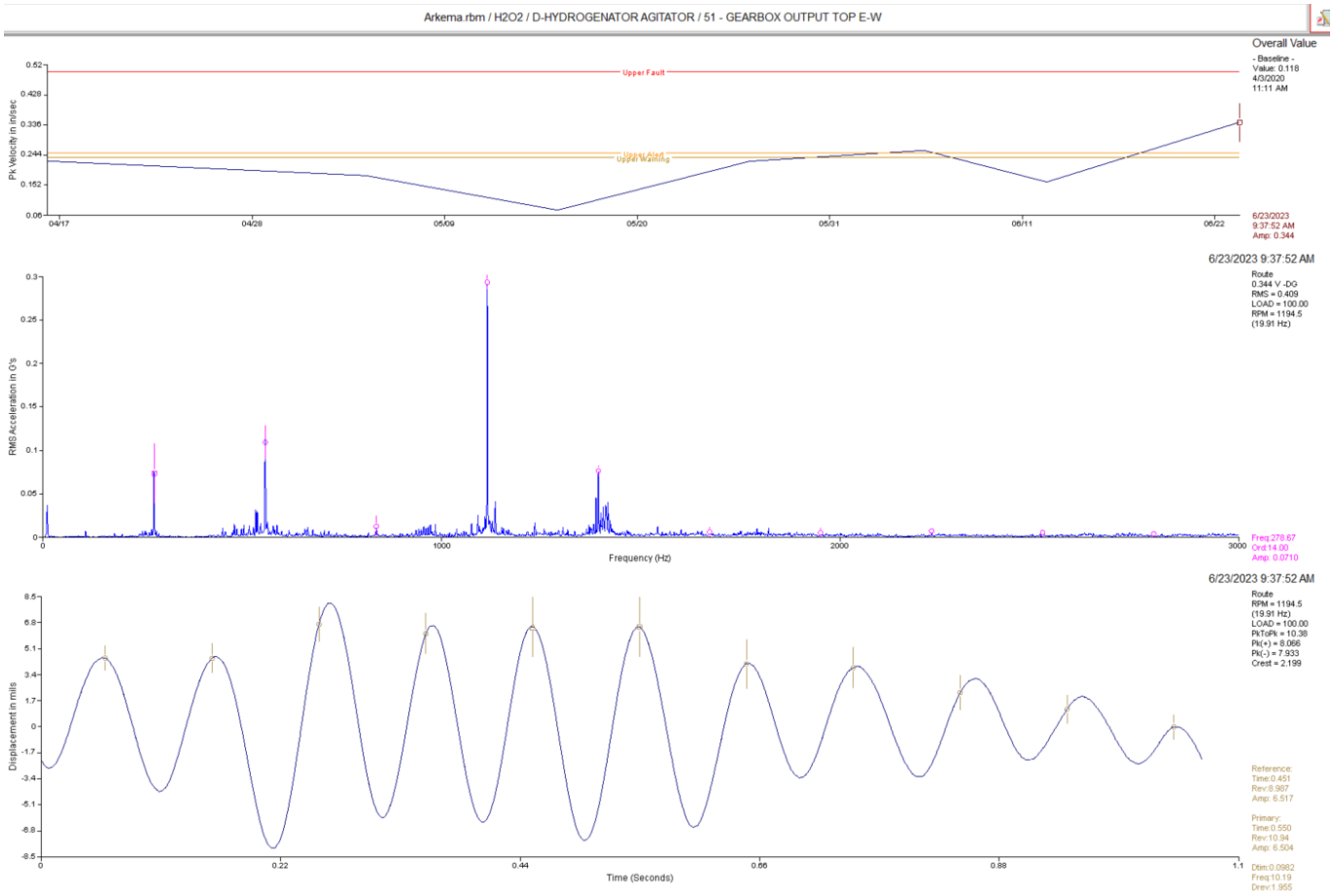
Observation:

Data above is a multipoint spectral waterfall. Data does show a decrease in noise floor in the motor data. Data points labeled 11-23.

Recommendation:

Motor data still suggests a possible issue in the motor. May be rolling element defects in bearings. Looks like motor bearings were likely greased recently which has apparently helped lower the noise floor a bit. We are monitoring this closely.

D Hydrogenator Agitator CLASS II



Observation:

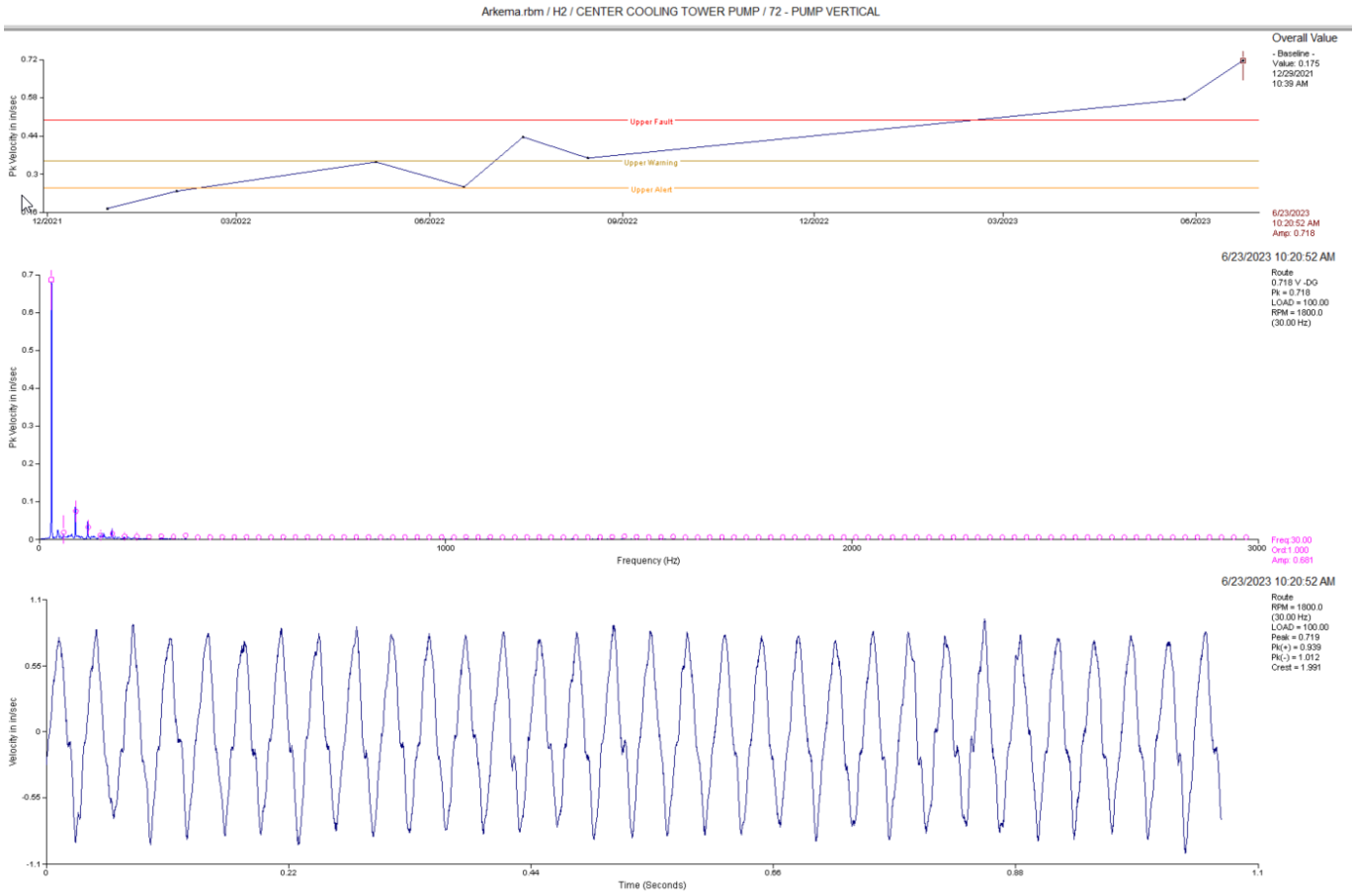
Data above is output top radial direction (East-West). Peaks in the spectrum appear to be related to a gear mesh frequency fundamental with harmonics thereof. This may be due to heavy tooth load or internal gear issue such as wear and/or internal misalignment. Waveform data shows a dominant low frequency vibration that is likely a harmonic of output speed of the agitator. Gearbox does have a torsional vibration that may be due to issues with output shaft of the gear drive.

Recommendation:

Ensure gear drive is not heavily loaded due to process issues. Ensure output shaft does not excessive shaft defection. Will continue to monitor closely.

H2O2 Plant MONTHLY

Center Cooling Tower Pump CLASS III



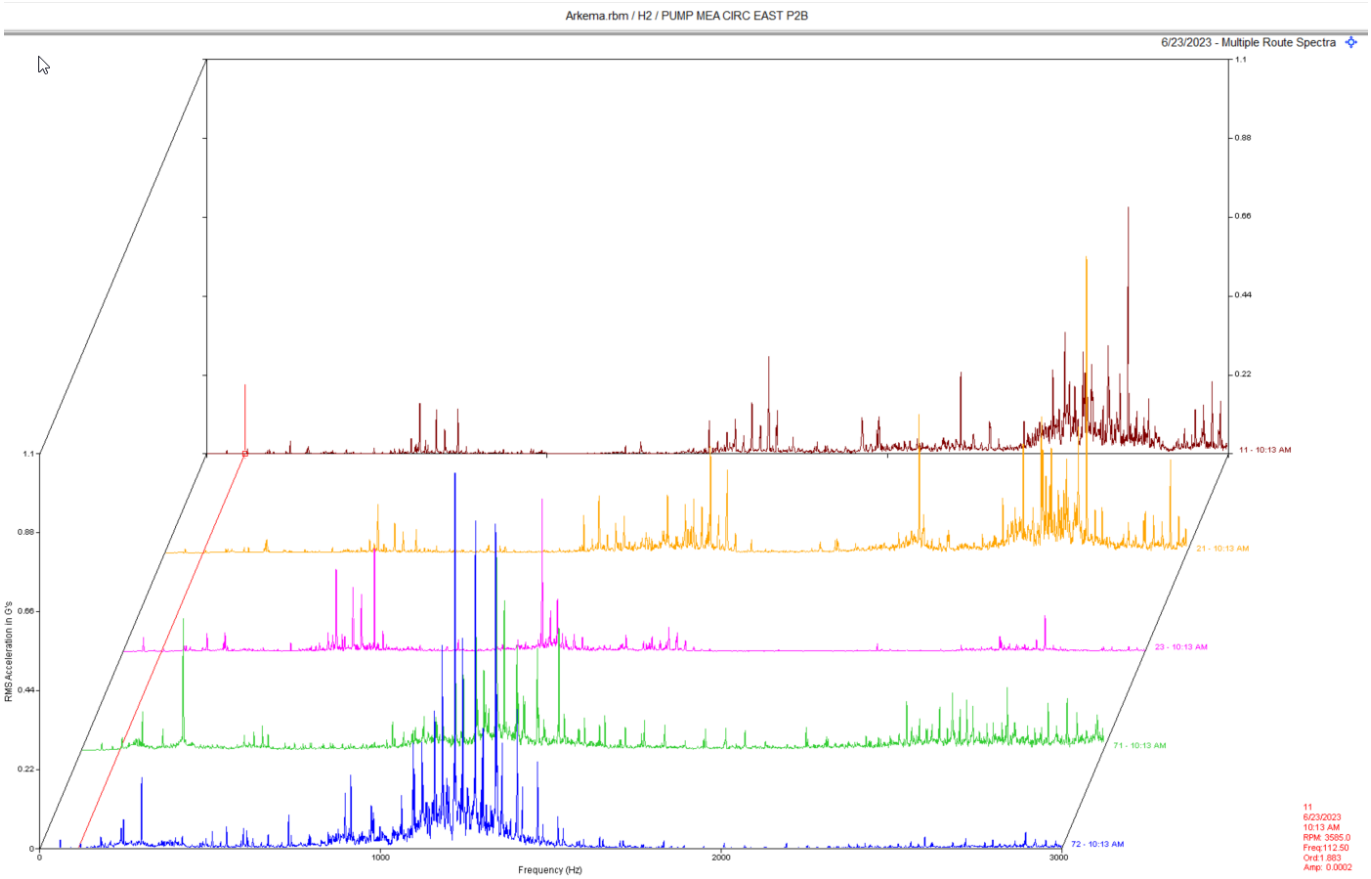
Observation:

Data above is the Pump Vertical. Data shows a high vibration at 1 x rpm with some harmonics.

Recommendation:

Cooling tower motors/pumps have base issues. They were not installed correctly. Bases need to be leveled and fastened properly to the concrete. There should not be gaps between the base frame and the concrete pad. The bases also need to epoxy grouted. Because the bases are not installed correctly, there is excessive vibration, especially in the motor/pump verticals. Ensure bases are leveled, fastened properly, and grouted in as soon as time allows.

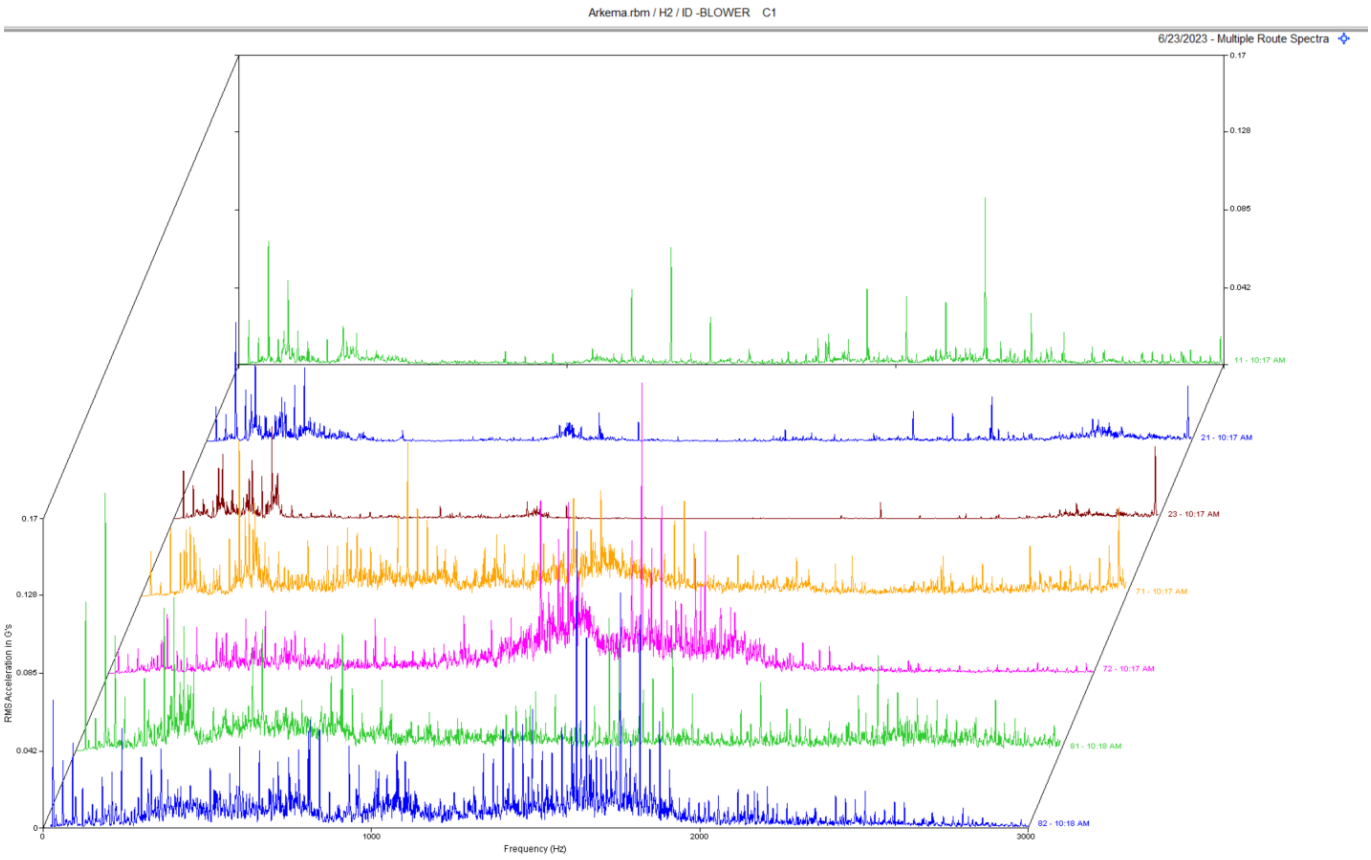
MEA Circ Pump East P2B CLASS III



Observation:
Data above is a multi-point spectrum of the motor and the pump. Spectral data indicates bearing defects in the motor and pump.

Recommendation:
Replace motor and pump as time allows.

ID Blower CLASS II



Observation:

Data above is a multi-point spectrum of the motor and the fan Spectral data indicates bearing defects are present in the fan bearings.

Recommendation:

Fan bearings may need to be replaced in the next few months. Monitoring this issue closely.

Abbreviated Last Measurement Summary

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Database: Arkema.rbm
Station: PEROXIDE
Route No. 3: ARK WK 3

MEASUREMENT POINT	OVERALL LEVEL	HFD / VHFD
P102 - ARKEMA PUMP P102	(23-Jun-23)	
	OVERALL LEVEL	1K-20KHz
MOH	.130 In/Sec	.219 G-s
MOV	.147 In/Sec	.277 G-s
MIH	.142 In/Sec	.479 G-s
MIV	.232 In/Sec	.440 G-s
MIA	.107 In/Sec	.375 G-s
EIA	.319 In/Sec	2.083 G-s
EIH	.377 In/Sec	1.340 G-s
EIV	.363 In/Sec	1.375 G-s
EOH	.222 In/Sec	1.673 G-s
EOV	.192 In/Sec	1.683 G-s
2130-1old - C Concentrator Vacuum Pump	(23-Jun-23)	
	OVERALL LEVEL	1-20 KHz
11	.085 In/Sec	.351 G-s
21	.086 In/Sec	.605 G-s
23	.152 In/Sec	.589 G-s
71	.138 In/Sec	1.655 G-s
81	.197 In/Sec	.475 G-s
83	.152 In/Sec	.922 G-s
7000-01 - AGITATOR,HYDROGENATOR C	(23-Jun-23)	
	OVERALL LEVEL	1-20 KHZ
02	.045 In/Sec	.0060 G-s
03	.047 In/Sec	.0089 G-s
11	.081 In/Sec	2.510 G-s
12	.112 In/Sec	.795 G-s
13	.124 In/Sec	.615 G-s
21	.097 In/Sec	1.349 G-s
22	.197 In/Sec	.522 G-s
23	.117 In/Sec	.340 G-s
31	.071 In/Sec	.438 G-s
32	.099 In/Sec	.677 G-s
33	.035 In/Sec	.159 G-s
41	.076 In/Sec	.204 G-s
42	.118 In/Sec	.348 G-s
51	.063 In/Sec	.237 G-s
53	.062 In/Sec	.124 G-s
61	.024 In/Sec	.243 G-s
71	.054 In/Sec	.243 G-s
81	.019 In/Sec	.329 G-s
83	.046 In/Sec	.135 G-s
57 - A/B Concentr Vac Pmp-var RPM	(23-Jun-23)	
	OVERALL LEVEL	1-20 KHz
11	.057 In/Sec	.310 G-s
12	.064 In/Sec	.239 G-s
21	.063 In/Sec	.298 G-s
23	.090 In/Sec	.235 G-s
71	.132 In/Sec	.478 G-s
81	.365 In/Sec	.846 G-s
83	.135 In/Sec	1.321 G-s

2130-1 - FLASH VAP VAC PUMP-var speed (23-Jun-23)

	OVERALL LEVEL	1-20 KHz
11	.053 In/Sec	.205 G-s
12	.076 In/Sec	.283 G-s
21	.040 In/Sec	.269 G-s
22	.052 In/Sec	.231 G-s
23	.085 In/Sec	.197 G-s
71	.069 In/Sec	.908 G-s
72	.094 In/Sec	.864 G-s
81	.069 In/Sec	1.206 G-s
82	.087 In/Sec	.577 G-s
83	.063 In/Sec	.341 G-s

C-203 - C-203 Comp (12-Jun-23)

	OVERALL LEVEL	1-20 KHz
11	.054 In/Sec	2.255 G-s
12	.055 In/Sec	1.980 G-s
21	.064 In/Sec	2.547 G-s
22	.029 In/Sec	.848 G-s
23	.020 In/Sec	.323 G-s
	OVERALL LEVEL	1-20 KHZ
71M	.050 In/Sec	2.737 G-s
72M	.045 In/Sec	.964 G-s
73M	.069 In/Sec	1.056 G-s
81M	.052 In/Sec	14.36 G-s
82M	.060 In/Sec	1.664 G-s
71F	.054 In/Sec	13.95 G-s
72F	.060 In/Sec	1.384 G-s
73F	.046 In/Sec	1.015 G-s
81F	.064 In/Sec	11.23 G-s
82F	.042 In/Sec	1.620 G-s

C-202 - C-202 Comp (23-Jun-23)

	OVERALL LEVEL	1-20 KHz
11	.055 In/Sec	1.969 G-s
12	.153 In/Sec	.831 G-s
21	.069 In/Sec	.615 G-s
22	.059 In/Sec	.121 G-s
23	.041 In/Sec	.221 G-s
	OVERALL LEVEL	1-20 KHZ
71M	.040 In/Sec	3.736 G-s
72M	.045 In/Sec	.832 G-s
73M	.070 In/Sec	1.156 G-s
81M	.045 In/Sec	13.44 G-s
82M	.050 In/Sec	1.344 G-s
71F	.037 In/Sec	5.710 G-s
72F	.060 In/Sec	.606 G-s
73F	.044 In/Sec	1.143 G-s
81F	.058 In/Sec	25.26 G-s
82F	.052 In/Sec	1.874 G-s

C-201 - C-201 Comp (23-Jun-23)

	OVERALL LEVEL	1-20 KHz
11	.100 In/Sec	1.310 G-s
12	.052 In/Sec	1.427 G-s
21	.118 In/Sec	1.489 G-s
22	.042 In/Sec	.249 G-s
23	.067 In/Sec	.384 G-s
	OVERALL LEVEL	1-20 KHZ
71M	.064 In/Sec	3.462 G-s
72M	.051 In/Sec	1.319 G-s
73M	.083 In/Sec	1.850 G-s
81M	.046 In/Sec	8.680 G-s
82M	.037 In/Sec	.712 G-s
71F	.044 In/Sec	2.507 G-s
72F	.060 In/Sec	1.023 G-s
73F	.038 In/Sec	.989 G-s
81F	.046 In/Sec	4.881 G-s
82F	.069 In/Sec	1.392 G-s

new AC - INSTRUMENT AIR COMPRESSOR (23-Jun-23)

	OVERALL LEVEL	1-20 KHz
11	.095 In/Sec	1.038 G-s
12	.091 In/Sec	.886 G-s
13	.060 In/Sec	.516 G-s
21	.074 In/Sec	1.435 G-s
22	.069 In/Sec	1.610 G-s
23	.042 In/Sec	.779 G-s
	OVERALL LEVEL	1-20 KHZ
71F	.088 In/Sec	14.73 G-s
72F	.110 In/Sec	4.280 G-s
73F	.145 In/Sec	7.434 G-s
81F	.224 In/Sec	4.175 G-s
82F	.380 In/Sec	7.759 G-s
83F	.268 In/Sec	8.578 G-s
71M	.089 In/Sec	11.22 G-s
72M	.153 In/Sec	15.06 G-s
73M	.139 In/Sec	9.156 G-s
81M	.192 In/Sec	7.264 G-s
82M	.231 In/Sec	12.58 G-s
83M	.175 In/Sec	9.216 G-s

201-08A - COMPRESSOR,NASH A 201-08A (23-Jun-23)

	OVERALL LEVEL	1-20 KHz
11	.057 In/Sec	.155 G-s
12	.076 In/Sec	.291 G-s
13	.114 In/Sec	.128 G-s
21	.047 In/Sec	.081 G-s
22	.079 In/Sec	.090 G-s
23	.130 In/Sec	.121 G-s
71	.154 In/Sec	.595 G-s
72	.174 In/Sec	.185 G-s
73	.118 In/Sec	.224 G-s
81	.158 In/Sec	.195 G-s
82	.201 In/Sec	.149 G-s
83	.136 In/Sec	.129 G-s

9002-10 - D-HYDROGENATOR AGITATOR (23-Jun-23)

	OVERALL LEVEL	1-20 KHz
11	.073 In/Sec	.463 G-s
21	.066 In/Sec	1.091 G-s
23	.076 In/Sec	.154 G-s
	OVERALL LEVEL	1-20 KHZ
31	.152 In/Sec	.802 G-s
31L	.134 In/Sec	.750 G-s
	OVERALL LEVEL	1-20 KHz
51	.344 In/Sec	.498 G-s
51L	.344 In/Sec	.498 G-s
52	.066 In/Sec	.434 G-s
52L	.209 In/Sec	.208 G-s
53	.208 In/Sec	.241 G-s
53L	.059 In/Sec	.250 G-s
61	.151 In/Sec	.273 G-s
61L	.151 In/Sec	.273 G-s
81	.038 In/Sec	.025 G-s
82	.032 In/Sec	.111 G-s
83	.050 In/Sec	.017 G-s

NTC-SF - N CT-SOUTH FAN, N TWR (23-Jun-23)

	OVERALL LEVEL	1-20 KHz
1	.366 In/Sec	.586 G-s
2	.204 In/Sec	.494 G-s
3	.206 In/Sec	.511 G-s
	OVERALL LEVEL	1-20 KHZ
4	.239 In/Sec	.345 G-s
5	.110 In/Sec	.0011 G-s
6	.338 In/Sec	.463 G-s

NCT - NF	- N CT -NORTH FAN, N TWR	(23-Jun-23)	
		OVERALL LEVEL	1-20 KHz
7		.319 In/Sec	.750 G-s
8		.213 In/Sec	.487 G-s
9		.190 In/Sec	.361 G-s
		OVERALL LEVEL	1-20 KHZ
10		.146 In/Sec	.317 G-s
11		.181 In/Sec	.303 G-s
12		.141 In/Sec	.356 G-s
530-01	- PUMP,N.COOLING TWR,NORTH	(23-Jun-23)	
		OVERALL LEVEL	1-20 KHz
11		.141 In/Sec	.540 G-s
12		.208 In/Sec	2.644 G-s
530-02	- PUMP,N.COOLING TWR,MIDDLE	(23-Jun-23)	
		OVERALL LEVEL	1-20 KHz
11		.154 In/Sec	1.515 G-s
12		.105 In/Sec	.524 G-s
530-03	- PUMP,N.COOLING TWR,SOUTH	(23-Jun-23)	
		OVERALL LEVEL	1-20 KHz
11		.256 In/Sec	.228 G-s
12		.183 In/Sec	.330 G-s
548-7	- IRON-FREE H2O BOOSTER PUMP	(23-Jun-23)	
		OVERALL LEVEL	1-20 KHz
11		.041 In/Sec	.509 G-s
21		.047 In/Sec	1.313 G-s
23		.035 In/Sec	.634 G-s
71		.052 In/Sec	.186 G-s
72		.059 In/Sec	.168 G-s
STC-NF	- S CT - NORTH FAN, S TWR	(23-Jun-23)	
		OVERALL LEVEL	1-20 KHz
1		.314 In/Sec	.498 G-s
2		.252 In/Sec	.324 G-s
3		.198 In/Sec	.189 G-s
		OVERALL LEVEL	1-20 KHZ
4		.147 In/Sec	.358 G-s
5		.133 In/Sec	.451 G-s
STC-MF	- S CT - MID FAN, S TWR	(23-Jun-23)	
		OVERALL LEVEL	1-20 KHz
1		.264 In/Sec	.509 G-s
2		.201 In/Sec	.084 G-s
3		.161 In/Sec	.096 G-s
		OVERALL LEVEL	1-20 KHZ
4		.085 In/Sec	.272 G-s
5		.118 In/Sec	.482 G-s
6		.098 In/Sec	.487 G-s
STC-SF	- S CT - SOUTH FAN, S TWR	(23-Jun-23)	
		OVERALL LEVEL	1-20 KHz
1		.117 In/Sec	.343 G-s
2		.235 In/Sec	.236 G-s
3		.197 In/Sec	.099 G-s
		OVERALL LEVEL	1-20 KHZ
4		.125 In/Sec	.519 G-s
5		.076 In/Sec	.460 G-s
6		.352 In/Sec	.691 G-s
SCT-1	- SOUTH CT PUMP - EAST	(23-Jun-23)	
		OVERALL LEVEL	1-20 KHz
11		.066 In/Sec	1.576 G-s
21		.060 In/Sec	1.046 G-s
23		.062 In/Sec	.562 G-s
71		.144 In/Sec	1.520 G-s
72		.153 In/Sec	1.713 G-s

		OVERALL LEVEL	1-20 KHz
SCT-2	- SOUTH CT PUMP - MID	(23-Jun-23)	
11		.098 In/Sec	2.644 G-s
21		.049 In/Sec	1.131 G-s
23		.066 In/Sec	1.452 G-s
71		.138 In/Sec	.959 G-s
72		.092 In/Sec	1.149 G-s
SCT-3	- SOUTH CT PUMP - WEST	(23-Jun-23)	
11		.034 In/Sec	.891 G-s
21		.048 In/Sec	.692 G-s
23		.080 In/Sec	.694 G-s
71		.126 In/Sec	1.296 G-s
72		.169 In/Sec	1.256 G-s

Database: Arkema.rbm
Station: HYDROGEN
Route No. 1: H2 MONTHLY

MEASUREMENT POINT		OVERALL LEVEL	HFD / VHFD
P2B	- PUMP MEA CIRC EAST P2B	(23-Jun-23)	
11		.080 In/Sec	6.206 G-s
21		.085 In/Sec	4.703 G-s
23		.104 In/Sec	1.082 G-s
71		.189 In/Sec	3.910 G-s
72		.216 In/Sec	3.563 G-s
P1A	- PUMP BFW WEST P1A	(23-Jun-23)	
11		.083 In/Sec	.938 G-s
21		.081 In/Sec	1.461 G-s
23		.166 In/Sec	2.208 G-s
71		.123 In/Sec	.959 G-s
72		.108 In/Sec	.973 G-s
81		.083 In/Sec	.776 G-s
82		.105 In/Sec	.585 G-s
83		.094 In/Sec	.501 G-s
C2	- FD BLOWER C2	(23-Jun-23)	
11		.125 In/Sec	.381 G-s
21		.124 In/Sec	.344 G-s
23		.056 In/Sec	.309 G-s
71		.075 In/Sec	1.997 G-s
81		.111 In/Sec	1.366 G-s
C1	- ID -BLOWER C1	(23-Jun-23)	
11		.114 In/Sec	.441 G-s
21		.108 In/Sec	.969 G-s
23		.100 In/Sec	.223 G-s
71		.118 In/Sec	1.088 G-s
72		.071 In/Sec	.938 G-s
81		.298 In/Sec	2.604 G-s
82		.231 In/Sec	1.010 G-s
CTPC	- CENTER COOLING TOWER PUMP	(23-Jun-23)	
11		.312 In/Sec	.912 G-s
21		.121 In/Sec	1.057 G-s
23		.288 In/Sec	.560 G-s
71		.148 In/Sec	1.113 G-s
72		.718 In/Sec	.295 G-s

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      CTPW       - WEST COOLING TOWER PUMP       (23-Jun-23)
                                    OVERALL LEVEL     1-20 KHz
            11                       .145 In/Sec       .853 G-s
            21                       .133 In/Sec      3.776 G-s
            23                       .239 In/Sec      1.366 G-s
            71                       .318 In/Sec      1.138 G-s
            72                       .130 In/Sec       .491 G-s

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   Clarification Of Vibration Units:
      Acc       -->  G-s      PK
      Vel       -->  In/Sec   PK
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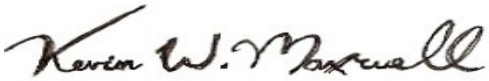
As always, it has been a pleasure to serve Arkema. If there are any comments or questions, do not hesitate to contact us.

Sincerely,



ISO Certified Vibration Analyst, Category III

HI-SPEED INDUSTRIAL SERVICE

QualiTest® Diagnostics

Cell: 901-486-4565
Email: kwilliam@gohispeed.com