

7030 Ryburn Dr. Millington, TN

Phone: (901) 873-5300

Fax: (901) 873-5301

www.gohispeed.com

August 16th, 2023

Shawna Guffey Arkema Memphis, TN

The following is a summary of findings from the August 2023 WEEK 2 vibration survey at the H2O2 Plant and the MONTHLY H2 vibration survey that was performed on August 15th, 2023.

QualiTest® uses a four step rating system for defects.

<u>CLASS I</u>: Defect is present, but effect on reliability is not clear; no immediate action is required. Continue to normally monitor.

<u>CLASS II</u>: Defect (s) present that may cause problem in long term (2-6 months). Repair during normal maintenance scheduling. Continue to monitor.

<u>CLASS III</u>; 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.

<u>CLASS IV</u>; 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.

Agitator, Hydrogenator C CLASS I



Observation:

Data above is a multipoint spectral waterfall. Data still shows some 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. This issue appears to be minor at this time and we are monitoring this closely.

D Hydrogenator Agitator CLASS II



Observation:

Data above is output top radial direction (East-West). Displacement amplitudes are quite high. Waveform shows an amplitude of 10 mil peak-peak. There is quite a bit of low frequency vibration in the gear drive. Spectral and waveform data shows a dominant low frequency vibration that is likely a harmonic of output speed of the gearbox. Gearbox does appear to have visible torsional movement. The gear mesh vibration previously seen in the data appears to be lower this survey.

Recommendation:

Ensure output shaft does not excessive shaft defection. Check coupling hubs and shaft for run out using a dial indicator. 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 P2A CLASS II



Observation:

Data above is waterfall spectra of the pump vertical. Trend is also pump vertical overall velocity amplitude. Spectral data shows an increase in 5 x rpm vibration. This likely vane pass if impeller has 5 vanes.

Recommendation:

For now, ensure pump flow is normal. Pump impeller may have issue causing a high vane pass vibration. This will be watched closely.

FD Blower CLASS IV



Observation:

Data above is the motor inboard axial. Data shows a high 1 x rpm with a smaller 2, 3, and 4 x rpm vibration. Vibration has increased significantly since replacing fan shaft and fan bearings. The shaft that in place right now has excessive run-out (.003 to .005" in various spots on shaft).

Recommendation:

Fan shaft and or the fan wheel is likely the issue here. We recommend replacing the fan shaft with a TGP 4140 (steel type) shaft. Replace bearings also. Ensure fan wheel is not warped or cracked. Fan wheel needs to be dynamically balanced with new shaft and coupling. **Replace ASAP due to high vibration.**

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:

Not a lot of change since last survey. Fan bearings may need to be replaced in the next few months. Monitoring this issue closely.

Database:	Arkema.rbm						
Station:	PER	OXIDE					
Route No.	2:	ARK WK	2				

MEASUREMENT	F POINT	OVERALL LEVEL	HFD / VHFD
P102	- ARKEMA DIIMD D1(12 (15	-Aug-23)
1102		OVERALL LEVEL	1K-20KHz
MOH		072 In/Sec	325 G-s
MOV		.058 In/Sec	.345 G-s
мтн		.071 In/Sec	.428 G-s
MTV		077 In/Sec	264 G-s
МТА		058 Tn/Sec	318 6-5
ETA		147 In/Sec	2 161 G-s
ETH		177 In/Sec	582 G-s
ETV		149 Tn/Sec	1 216 G-s
ET V EOH		.149 IN/Sec	1.210 G S
EOV		.096 In/Sec	.517 G-s
2130-1old	- C Concentrator	Vacuum Pump (15	-Aug-23)
		OVERALL LEVEL	1-20 KHz
11		.073 In/Sec	.412 G-s
21		.082 In/Sec	.705 G-s
23		.141 In/Sec	.182 G-s
71		.145 In/Sec	2.527 G-s
81		.189 In/Sec	.676 G-s
83		.153 In/Sec	.384 G-s
7000-01	- AGITATOR, HYDROG	GENATOR C (15	-Aug-23)
		OVERALL LEVEL	1-20 KHZ
02		.047 In/Sec	.019 G-s
03		.048 In/Sec	.0091 G-s
11		.078 In/Sec	1.009 G-s
12		.125 In/Sec	.322 G-s
13		.121 In/Sec	.402 G-s
21		.104 In/Sec	.930 G-s
22		.171 In/Sec	.445 G-s
23		.136 In/Sec	.283 G-s
31		.072 In/Sec	.327 G-s
32		.086 In/Sec	.125 G-s
33		.044 In/Sec	.091 G-s
41		.060 In/Sec	.204 G-s
42		.088 In/Sec	.213 G-s
51		.067 In/Sec	.216 G-s
53		.071 In/Sec	.076 G-s
61		.025 In/Sec	.190 G-s
71		.061 In/Sec	.281 G-s
81		.023 In/Sec	.248 G-s
83		.053 In/Sec	.100 G-s
57	- A/B Concentr Va	ac Pmp-var RPM (15	-Aug-23)
		OVERALL LEVEL	1-20 KHz
11		.036 In/Sec	.318 G-s
12		.035 In/Sec	.096 G-s
21		.039 In/Sec	.240 G-s
23		.063 In/Sec	.103 G-s
71		.051 In/Sec	.445 G-s
81		.060 In/Sec	.459 G-s
83		.037 In/Sec	.140 G-s
2130-1	- FLASH VAP VAC	PUMP-var speed (15	-Aug-23)
		OVERALL LEVEL	1-20 KHz

	11		.049 In/Sec	.175 G-s
	12		.045 In/Sec	.080 G-s
	21		.046 In/Sec	.311 G-s
	22		.053 In/Sec	.122 G-s
	23		.075 In/Sec	.109 G-s
	71		.078 In/Sec	.659 G-s
	/2 01		.070 In/Sec	.164 G-S
	82		071 Tr/Sec	1.023 G-S 447 G-s
	83		.047 In/Sec	.232 G-s
			• • • • •	
C-202		- C-202 Comp	(1	L5-Aug-23)
			OVERALL LEVEL	1-20 KHz
	11		.080 In/Sec	3.563 G-s
	12		.154 In/Sec	2.421 G-s
	21		.071 In/Sec	1.103 G-s
	22		.059 In/Sec	.405 G-s
	23		.USI IN/SEC	.9/1 G-S
	71M		062 In/Sec	3 282 G-s
	72M		.035 In/Sec	.835 G-s
	73M		.071 In/Sec	.655 G-s
	81M		.047 In/Sec	8.159 G-s
	82M		.040 In/Sec	.679 G-s
	71F		.026 In/Sec	4.917 G-s
	72F		.067 In/Sec	2.157 G-s
	73F		.030 In/Sec	1.548 G-s
	81F		.035 In/Sec	5.838 G-s
	82F		.043 In/Sec	1.009 G-s
C-201		- C-201 Comp	11	5-3110-23)
C-201			OVERALL LEVEL	1-20 KHz
	11		.120 In/Sec	3.314 G-s
	12		.079 In/Sec	2.668 G-s
	21		.103 In/Sec	.926 G-s
	22		.035 In/Sec	.137 G-s
	23		.059 In/Sec	.241 G-s
			OVERALL LEVEL	1-20 KHZ
	71M		.067 In/Sec	4.223 G-s
	72M		.043 In/Sec	.496 G-s
	7 JM 9 1 M		.008 IN/Sec	.792 G-S
	82M		025 In/Sec	4.033 G-s 721 G-s
	71F		.053 In/Sec	3.203 G-s
	72F		.057 In/Sec	.495 G-s
	73F		.027 In/Sec	.821 G-s
	81F		.040 In/Sec	4.247 G-s
	82F		.061 In/Sec	1.140 G-s
new AC		- INSTRUMENT	AIR COMPRESSOR (1	1 20 WH-
	11		OVERALL LEVEL	1 107 C-2
	12		103 Tn/Sec	545 C-e
	13		.048 In/Sec	.142 G-s
	21		.074 In/Sec	1.533 G-s
	22		.077 In/Sec	.586 G-s
	23		.034 In/Sec	.352 G-s
			OVERALL LEVEL	1-20 KHZ
	71F		.100 In/Sec	6.822 G-s
	72F		.102 In/Sec	2.356 G-s
	/3F		.067 In/Sec	2.441 G-s
	82F.		.115 IN/Sec	4.124 G-S
	83F		166 Tn/Sec	1 425 G-e
	71M		.110 In/Sec	8.796 G-s
	72M		.085 In/Sec	2.515 G-s
	73M		.108 In/Sec	1.282 G-s
	81M		.124 In/Sec	5.902 G-s
	82M		.248 In/Sec	1.614 G-s
	83M		.197 In/Sec	1.587 G-s

201-08A		-	COMPRESSOR, NASH	A 201-08A	(15-Aug-23)
				OVERALL LEVE	1-20 KHz
	11			.049 In/Sec	.178 G-s
	12			.046 In/Sec	.093 G-s
	13			.104 In/Sec	.105 G-s
	21			.042 In/Sec	.170 G-s
	22			.052 In/Sec	.075 G-s
	23			.131 In/Sec	.123 G-s
	71			.157 In/Sec	.741 G-s
	72			.151 In/Sec	.103 G-s
	73			.118 In/Sec	.195 G-s
	81			.161 In/Sec	.215 G-s
	82			.166 In/Sec	.116 G-s
	83			.119 In/Sec	.075 G-s
202-05		_	NASH SEAL LTOUT		(15-300-23)
202 05			NASH SEAH HIQUI	OVERALL LEVEL	(15 Aug 25)
	11				
	11 01			.020 IN/Sec	.009 G-S
	21			.021 IN/Sec	.351 G-8
	23			.024 IN/Sec	.041 G-S
	71			.026 IN/Sec	.070 G-s
	12			.031 In/Sec	.018 G-S
9002-10		_	D-HYDROGENATOR A	GITATOR	(15-Aug-23)
				OVERALL LEVE	1-20 KHz
	11			.067 In/Sec	.213 G-s
	21			.076 In/Sec	.254 G-s
	23			.066 In/Sec	.076 G-s
				OVERALL LEVEL	1-20 KHZ
	31			.175 In/Sec	.772 G-s
	з1т.			111 In/Sec	698 G-s
	011			OVERALL LEVEL	. 1-20 KHz
	51			218 Tn/Sec	240 G-s
	51T			210 IN/Sec	.240 G S
	571			.218 IN/Sec	.240 G-S
	52			.057 IN/Sec	.240 G-S
	521			.152 In/Sec	.452 G-S
	53			.196 In/Sec	.320 G-S
	231			.211 In/Sec	.2/4 G-S
	61 C1T			.148 In/Sec	.188 G-S
	01L			.118 In/Sec	.188 G-S
	81			.044 In/Sec	.034 G-s
	82			.032 In/Sec	.023 G-s
	83			.041 In/Sec	.011 G-s
9003-01		_	D-HYDRO PRIMARY	FILT FD PUMP	(15-Aug-23)
				OVERALL LEVEL	1-20 KHz
	11			.031 In/Sec	.487 G-s
	21			.039 In/Sec	1.261 G-s
	23			041 Tn/Sec	402 G-s
	71			084 Tn/Sec	286 G-s
	72			.004 In/Sec	183 G-s
	-				.200 0 0
9001-01		-	D-HYDRO SECOND.	FILT FD PUMP	(15-Aug-23)
				OVERALL LEVE	L 1-20 KHz
	11			.046 In/Sec	.681 G-s
	21			.047 In/Sec	.337 G-s
	23			.047 In/Sec	.112 G-s
	71			.076 In/Sec	.434 G-s
	72			.093 In/Sec	.140 G-s
100 00			-		
192-03		-	Two Stage Water	Pump A-WEST	(15-Aug-23)
				OVERALL LEVEL	1-20 KHz
	11			.067 In/Sec	.796 G-s
	21			.084 In/Sec	.932 G-s
	23			.079 In/Sec	.355 G-s
	71			.222 In/Sec	1.385 G-s
	72			.111 In/Sec	.351 G-s
191-07		_	M MIX BED WATER	PUMP 191-07	(15-Aug-23)

	OVERALL LEVEL	1-20 KHz
11	.075 In/Sec	.475 G-s
21	.047 In/Sec	.567 G-s
23	.076 In/Sec	.112 G-s
71	.132 In/Sec	.402 G-s
72	.206 In/Sec	.144 G-s

Station: HYDROGEN Route No. 1: H2 MONTHLY

MEASUR	EMENT	PC	DINT			OVERAL	L LEVEL	HFD ,	/ VHF
P2A		- F	UMP	MEA	CIRC	WEST P2A		(10-Aug-23))
		_				OVERAL	LL LEVEI	1-20	, KHz
	11					.078	In/Sec	.310	G-s
	21					.083	In/Sec	.559	G-s
	23					.086	In/Sec	.277	G-s
	71					.499	In/Sec	.831	G-s
	72					.451	In/Sec	.458	G-s
P1A		- F	PUMP	BFW	WEST	P1A		(10-Aug-23))
						OVERA	LL LEVEI	1-20 1	KHz
	11					.139	In/Sec	.945	G-s
	21					.119	In/Sec	. 980	G-s
	23					.131	In/Sec	.868	G-s
	71					.159	In/Sec	1.715	G-s
	72					.097	In/Sec	. 932	G-s
	81					.089	In/Sec	1.446	G-s
	82					.091	In/Sec	.354	G-s
	83					.078	In/Sec	. 627	G-s
C2		- F	D BL	OWEI	ર (22		(14-Aug-23)	
						OVERAI	LL LEVEL	. 1-20 1	KHz
	MOH					. 635	In/Sec	1.040	G-s
	MOV					. 997	In/Sec	. 527	G-s
	MIH					.454	In/Sec	1.628	G-s
	MIV					.813	In/Sec	.456	G-s
	MIA					2.207	In/Sec	.376	G-s
	FIA					2.285	In/Sec	1.119	G-s
	FIH					.875	In/Sec	2.838	G-s
	FIV					1.258	In/Sec	1.682	G-s
	FOH					.855	In/Sec	3.271	G-s
	101					2.137	111/000	1.001	
C1		- I	:D -B	LOWE	ER	C1		(10-Aug-23))
						OVERA	гт телет	1-20 I	KHZ
	TT					002	Tr /Coo	202	~ ~
	01					.093	In/Sec	. 382	G-s
	21					.093	In/Sec In/Sec	.382	G-s G-s
	21 23 71					.093 .092 .089	In/Sec In/Sec In/Sec	.382 .321 .164	G-s G-s G-s
	21 23 71 72					.093 .092 .089 .128	In/Sec In/Sec In/Sec	.382 .321 .164 .438	G-s G-s G-s G-s
	21 23 71 72					.093 .092 .089 .128 .088	In/Sec In/Sec In/Sec In/Sec In/Sec	.382 .321 .164 .438 .378	G-s G-s G-s G-s G-s
	21 23 71 72 81 82					.093 .092 .089 .128 .088 .283 .215	In/Sec In/Sec In/Sec In/Sec In/Sec In/Sec	.382 .321 .164 .438 .378 3.957 .815	G-s G-s G-s G-s G-s G-s G-s
CERC	21 23 71 72 81 82	- 0	ידיאותר			.093 .092 .089 .128 .088 .283 .215	In/Sec In/Sec In/Sec In/Sec In/Sec	.382 .321 .164 .438 .378 3.957 .815	G-s G-s G-s G-s G-s G-s G-s
CTPC	21 23 71 72 81 82	- c	ENTE	R CC	DOLING	.093 .092 .089 .128 .088 .283 .215 G TOWER PI	In/Sec In/Sec In/Sec In/Sec In/Sec In/Sec	.382 .321 .164 .438 .378 3.957 .815 (10-Aug-23)	G-s G-s G-s G-s G-s G-s G-s
CTPC	21 23 71 72 81 82	- c	ENTE	R CC	OOLING	.093 .092 .089 .128 .088 .283 .215 G TOWER PT OVERAI	In/Sec In/Sec In/Sec In/Sec In/Sec In/Sec JMP LL LEVEI In/Sec	.382 .321 .164 .438 .378 3.957 .815 (10-Aug-23) .1-20 1	G-s G-s G-s G-s G-s G-s G-s KHz
CTPC	21 23 71 72 81 82 11	- c	ENTE	R CC	OOLING	.093 .092 .089 .128 .088 .283 .215 G TOWER PU OVERAJ .187 .112	In/Sec In/Sec In/Sec In/Sec In/Sec In/Sec In/Sec In/Sec In/Sec	.382 .321 .164 .438 .378 3.957 .815 (10-Aug-23) .862 .862 .2271	G-s G-s G-s G-s G-s G-s G-s KHz G-s
CTPC	21 23 71 72 81 82 11 21 23	- c	ENTE	R CC	DOLING	.093 .092 .089 .128 .088 .283 .215 G TOWER PU OVERAJ .187 .113	In/Sec In/Sec In/Sec In/Sec In/Sec In/Sec In/Sec In/Sec In/Sec	.382 .321 .164 .438 .378 3.957 .815 (10-Aug-23) .862 2.271 .862	G-s G-s G-s G-s G-s G-s (G-s) (Hz G-s (G-s)
СТРС	21 23 71 72 81 82 11 21 23 71	- c	ENTE	R CC	DOLING	.093 .092 .089 .128 .088 .283 .215 G TOWER PU OVERAJ .187 .113 .131 .131	In/Sec In/Sec In/Sec In/Sec In/Sec In/Sec In/Sec In/Sec In/Sec	.382 .321 .164 .438 .378 3.957 .815 (10-Aug-23) .862 2.271 .862 2.271 .911	G-s G-s G-s G-s G-s G-s G-s (KHz G-s G-s G-s
CTPC	21 23 71 72 81 82 11 21 23 71 72	- c	ENTE	R CC	DOLING	.093 .092 .089 .128 .088 .283 .215 G TOWER PO OVERAN .187 .113 .131 .185 .465	In/Sec In/Sec In/Sec In/Sec In/Sec In/Sec In/Sec In/Sec In/Sec In/Sec	.382 .321 .164 .438 .378 3.957 .815 (10-Aug-23) .862 2.271 .862 2.271 .911 .792 .312	G-s G-s G-s G-s G-s G-s G-s C-s G-s G-s G-s G-s G-s
CTPC	21 23 71 72 81 82 11 21 23 71 72	- C	ENTE		DOLING	.093 .092 .089 .128 .088 .283 .215 G TOWER PU OVERAJ .187 .113 .131 .185 .465	In/Sec In/Sec In/Sec In/Sec In/Sec In/Sec In/Sec In/Sec In/Sec	.382 .321 .164 .438 .378 3.957 .815 (10-Aug-23) .862 2.271 .911 .792 .312	G-s G-s G-s G-s G-s G-s G-s G-s G-s G-s
CTPC CTPW	21 23 71 72 81 82 11 21 23 71 72	- C	CENTE TEST	R C0	DOLING	.093 .092 .089 .128 .088 .283 .215 G TOWER PU OVERAJ .187 .113 .131 .185 .465	In/Sec In/Sec In/Sec In/Sec In/Sec In/Sec In/Sec In/Sec In/Sec In/Sec	.382 .321 .164 .438 .378 3.957 .815 (10-Aug-23) .862 2.271 .911 .792 .312 (10-Aug-23)	G-s G-s G-s G-s G-s G-s G-s (G-s G-s G-s G-s (Hz S-s G-s (G-s)
CTPC CTPW	21 23 71 72 81 82 11 21 23 71 72	- C	CENTE TEST	R CC	DOLING	.093 .092 .089 .128 .088 .283 .215 G TOWER PI OVERAJ .187 .113 .131 .185 .465 FOWER PUMI OVERAJ OVERAJ	In/Sec In/Sec In/Sec In/Sec In/Sec In/Sec In/Sec In/Sec In/Sec In/Sec In/Sec In/Sec	.382 .321 .164 .438 .378 3.957 .815 (10-Aug-23) .862 2.271 .911 .792 .312 (10-Aug-23) .1-20 1 .862 2.271 .911 .792 .312	G-s G-s G-s G-s G-s G-s G-s C-s G-s G-s C-s C-s C-s C-s C-s C-s C-s C-s C-s C

2	23			.084	In/Sec	. 935	G-s		
7	71			.254	In/Sec	1.141	G-s		
7	12			.107	In/Sec	. 393	G-s		
Clarificati	lon Of	Vibratic	on Units:						
Acc	>	G-s	PK						
Vel	>	In/Sec	PK						

As always, it has been a pleasure to serve Arkema. If there are any comments or questions, do not hesitate to contact us.

Sincerely,

Keven W. Maxwell 1

ISO Certified Vibration Analyst, Category III



QualiTest Diagnostics Cell: 901-486-4565 Email: <u>kwilliam@gohispeed.com</u>