HI-SPEED INDUSTRIAL SERVICE QualiTest® Diagnostics

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October 19th, 2023

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Arkema
Memphis, TN

The following is a summary of findings from the October 2023 WEEK 1 and 2 vibration survey at the H2O2 Plant that was performed on October 13, 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.

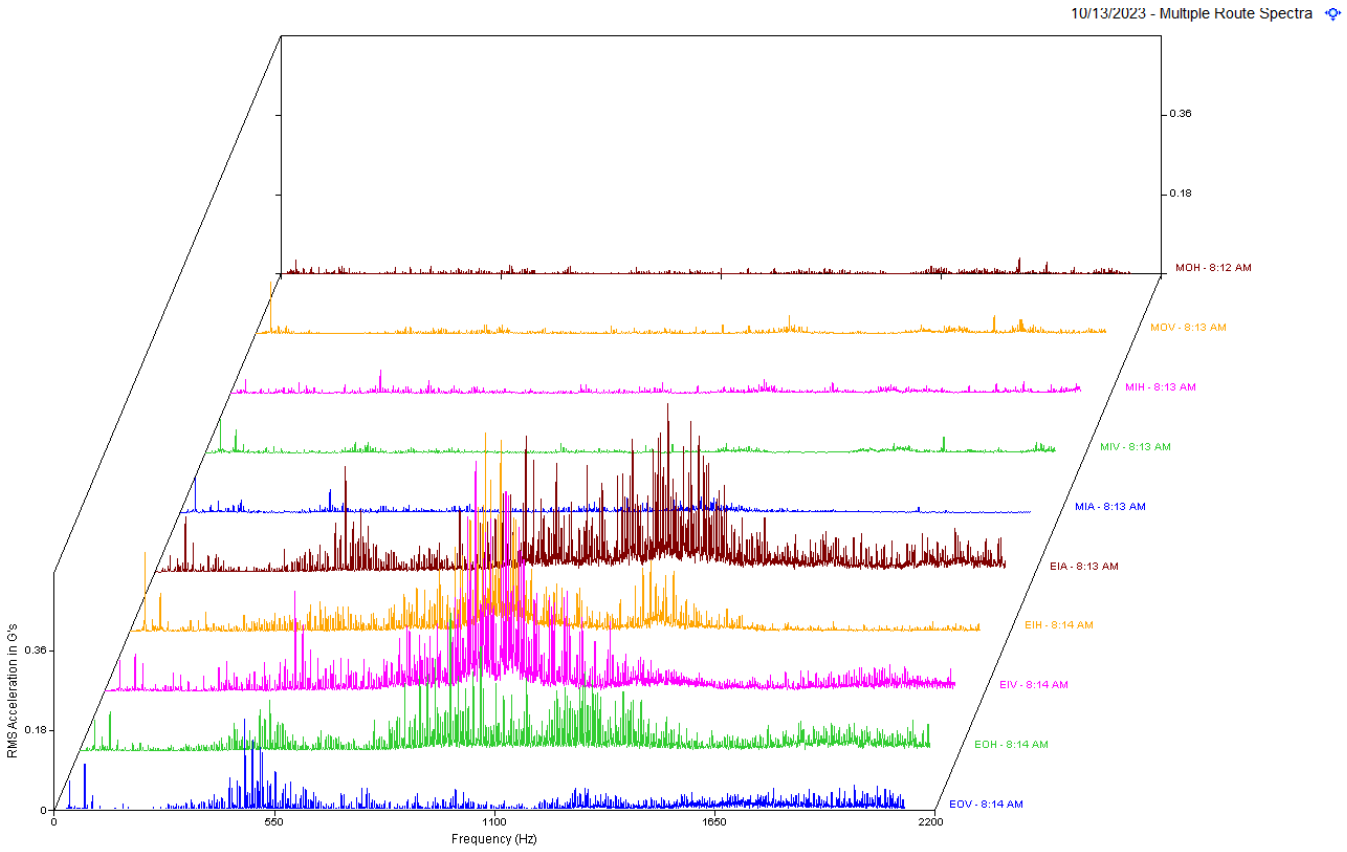
CLASS III; Defect (s) present that may cause failure in short term (less than 2 months). This should be addressed as soon as practical, with a high maintenance priority. Increase monitoring frequency.

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 2 H2O2 Plant

Pump 102 P102 CLASS I



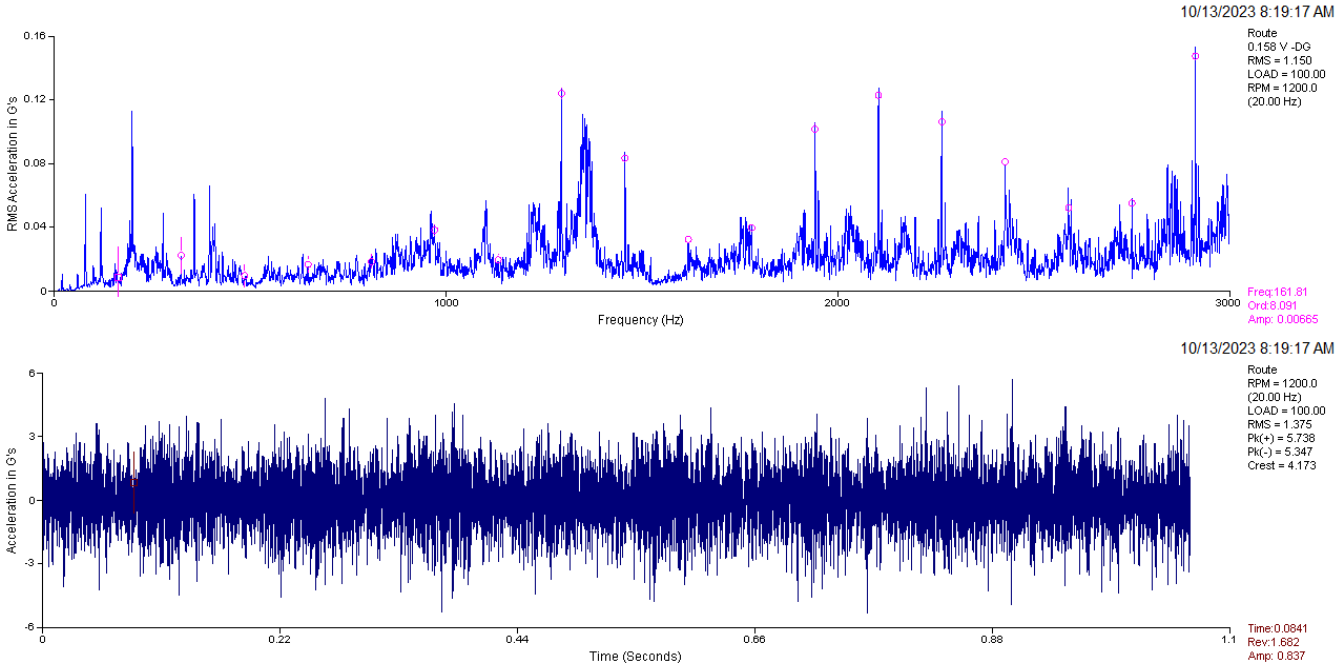
Observation:

Data above is a multipoint spectral waterfall. Pump data (EIA-EOV) shows axial vibration with multiple rpm harmonics throughout the pump spectra.

Recommendation:

The pump appears to have possible internal wear beginning to occur. The higher vibration in the axial direction may indicate excessive axial clearances. We are monitoring this very closely.

C Concentrator Vacuum Pump CLASS I



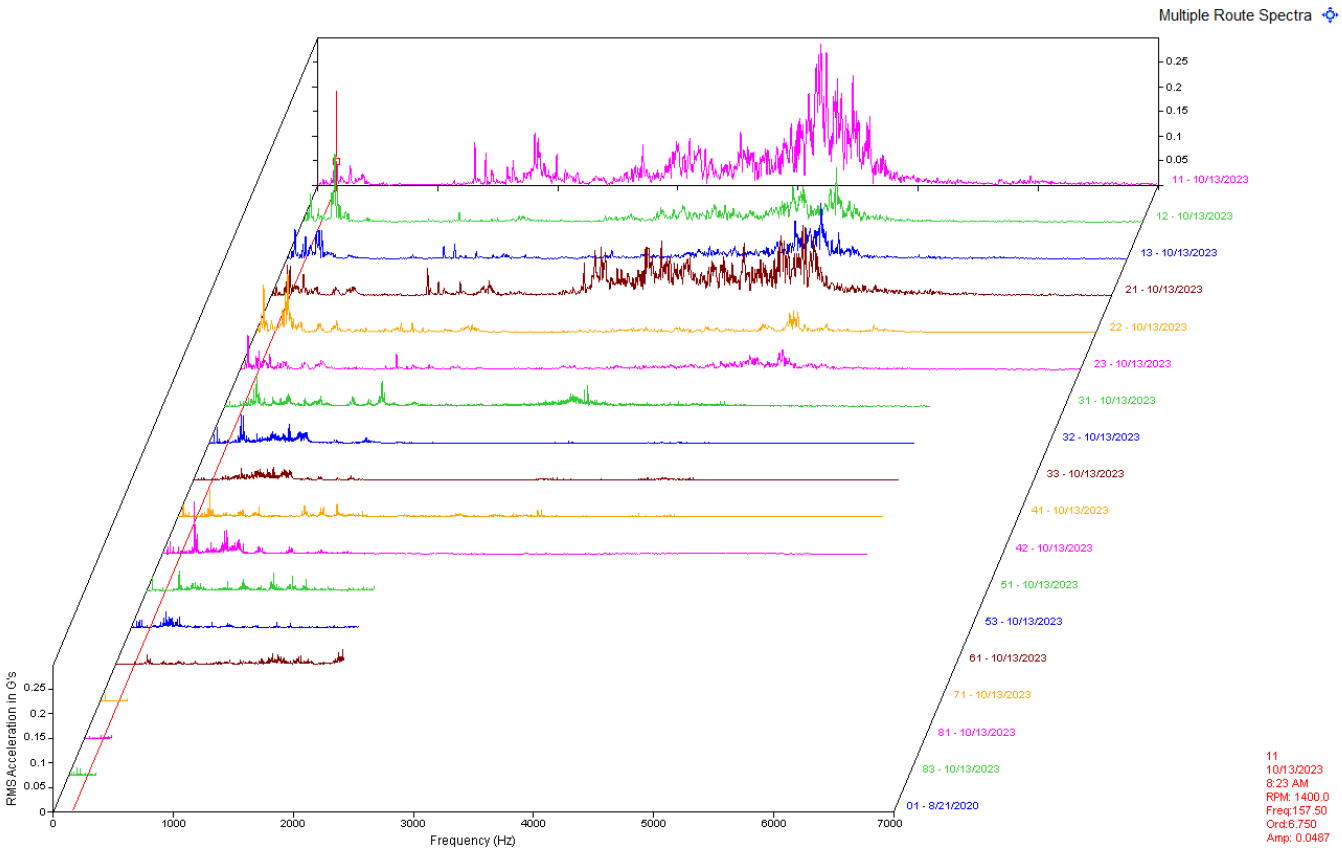
Observation:

Data above is the pump drive end horizontal. The small peaks in mid to high range of the spectrum are non-synchronous peaks and are very likely bearing defect frequencies but may be impeller related if pump has 8 vanes.

Recommendation:

The pump appears to have early to mid-stage bearing defects/wear and or impeller issues. We need to confirm the number of vanes on impeller. We are monitoring this issue closely.

Agitator, Hydrogenator C CLASS I



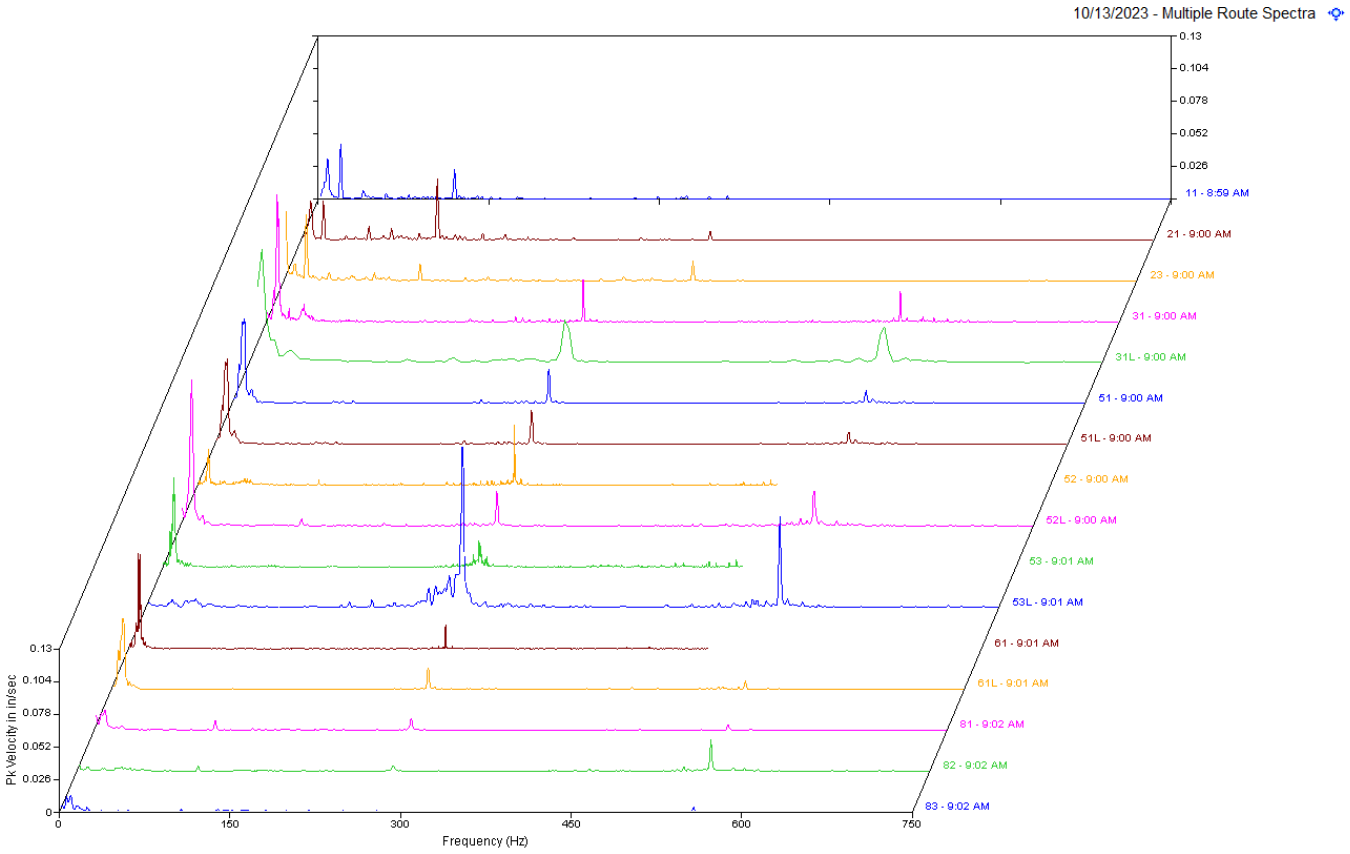
Observation:

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



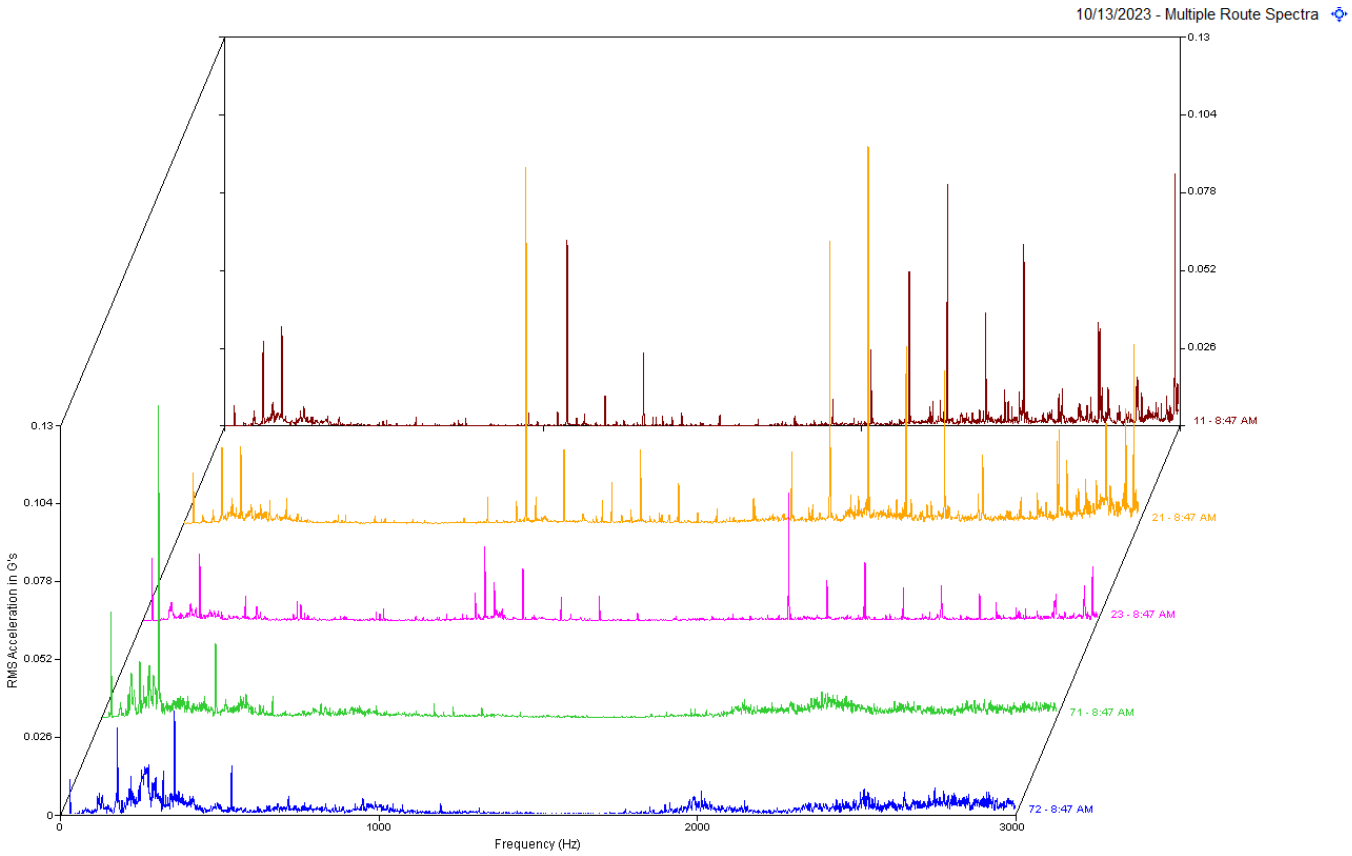
Observation:

Data above is a multi-point spectra of the motor and gear drive. 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. There is also some gear mesh harmonics on the output axial that have increased in amplitude.

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.

236-04A Hydrogenator Precooler Feed Pump CLASS II



Observation:
Motor data shows both electrical and mechanical defects according to the multi point spectra above.

Recommendation:
Data suggests issues with this motor. Motor should be replaced as time allows.

Abbreviated Last Measurement Summary

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Database: Arkema.rbm
Station: PEROXIDE
Route No. 1: ARK WK 1

MEASUREMENT POINT		OVERALL LEVEL	HFD / VHFD
P102	- ARKEMA PUMP P102	(13-Oct-23)	
		OVERALL LEVEL	1K-20KHz
	MOH	.114 In/Sec	.357 G-s
	MOV	.303 In/Sec	.470 G-s
	MIH	.109 In/Sec	.560 G-s
	MIV	.212 In/Sec	.481 G-s
	MIA	.205 In/Sec	.293 G-s
	EIA	.282 In/Sec	1.503 G-s
	EIH	.498 In/Sec	1.077 G-s
	EIV	.306 In/Sec	1.001 G-s
	EOH	.256 In/Sec	1.131 G-s
	EOV	.234 In/Sec	.785 G-s
236-06	- HYDRO FD PUMP N 236-06 -2FLR	(13-Oct-23)	
		OVERALL LEVEL	1-20 KHz
	11	.111 In/Sec	.333 G-s
	21	.079 In/Sec	.263 G-s
2130-6	- ABC SEC FILT FEED PUMP-NORTH	(13-Oct-23)	
		OVERALL LEVEL	1-20 KHz
	11	.037 In/Sec	1.033 G-s
	21	.033 In/Sec	1.060 G-s
	23	.068 In/Sec	.929 G-s
	71	.199 In/Sec	1.102 G-s
	72	.130 In/Sec	1.206 G-s
9001-1	- EAST OXIDIZER FEED PUMP	(13-Oct-23)	
		OVERALL LEVEL	1-20 KHz
	11	.031 In/Sec	.321 G-s
	21	.045 In/Sec	.498 G-s
	23	.063 In/Sec	.934 G-s
	71	.101 In/Sec	.882 G-s
	72	.104 In/Sec	.851 G-s
9001-2	- MIDDLE OXIDIZER FEED PUMP	(13-Oct-23)	
		OVERALL LEVEL	1-20 KHz
	11	.043 In/Sec	1.096 G-s
	21	.049 In/Sec	.657 G-s
	23	.058 In/Sec	.765 G-s
	71	.088 In/Sec	.412 G-s
	72	.095 In/Sec	.586 G-s
7016-11	- WEST OXIDIZER FEED PUMP	(13-Oct-23)	
		OVERALL LEVEL	1-20 KHz
	11	.033 In/Sec	.721 G-s
	21	.022 In/Sec	.931 G-s
	23	.028 In/Sec	1.070 G-s
	71	.089 In/Sec	.554 G-s
	72	.078 In/Sec	.945 G-s
234-01	- CHILL WATER PUMP 234-01	(13-Oct-23)	
		OVERALL LEVEL	1-20 KHz
	11	.070 In/Sec	1.484 G-s
	21	.033 In/Sec	.465 G-s
	23	.049 In/Sec	
	71	.190 In/Sec	.553 G-s
	72	.030 In/Sec	.574 G-s

C-203 - C-203 Comp (13-Oct-23)

	OVERALL LEVEL	1-20 KHz
11	.069 In/Sec	2.960 G-s
12	.037 In/Sec	1.107 G-s
21	.123 In/Sec	5.226 G-s
22	.023 In/Sec	.473 G-s
23	.027 In/Sec	.811 G-s
	OVERALL LEVEL	1-20 KHZ
71M	.065 In/Sec	4.030 G-s
72M	.044 In/Sec	.739 G-s
73M	.113 In/Sec	.886 G-s
81M	.046 In/Sec	7.922 G-s
82M	.037 In/Sec	1.578 G-s
71F	.064 In/Sec	2.489 G-s
72F	.052 In/Sec	1.019 G-s
73F	.074 In/Sec	.554 G-s
81F	.039 In/Sec	5.169 G-s
82F	.034 In/Sec	1.832 G-s

9000-02 - D HYDROGENATOR FD PUMP- EAST (13-Oct-23)

	OVERALL LEVEL	1-20 KHz
11	.037 In/Sec	.543 G-s
21	.050 In/Sec	.899 G-s
23	.060 In/Sec	.868 G-s
71	.102 In/Sec	.688 G-s
72	.079 In/Sec	.665 G-s

236-04A - HYDROGNTOR PRECOOLER FD PUMP (13-Oct-23)

	OVERALL LEVEL	1-20 KHz
11	.040 In/Sec	.603 G-s
21	.065 In/Sec	1.159 G-s
23	.066 In/Sec	2.552 G-s
71	.128 In/Sec	.391 G-s
72	.053 In/Sec	.339 G-s

C-202 - C-202 Comp (13-Oct-23)

	OVERALL LEVEL	1-20 KHz
11	.121 In/Sec	4.205 G-s
12	.156 In/Sec	1.291 G-s
21	.073 In/Sec	1.163 G-s
22	.063 In/Sec	.290 G-s
23	.048 In/Sec	.372 G-s
	OVERALL LEVEL	1-20 KHZ
71M	.054 In/Sec	3.475 G-s
72M	.040 In/Sec	.938 G-s
73M	.094 In/Sec	1.434 G-s
81M	.047 In/Sec	9.524 G-s
82M	.038 In/Sec	.840 G-s
71F	.029 In/Sec	6.929 G-s
72F	.065 In/Sec	1.793 G-s
73F	.042 In/Sec	1.074 G-s
81F	.042 In/Sec	8.913 G-s
82F	.046 In/Sec	1.056 G-s

C-201 - C-201 Comp (13-Oct-23)

	OVERALL LEVEL	1-20 KHz
11	.178 In/Sec	6.473 G-s
12	.056 In/Sec	1.564 G-s
21	.117 In/Sec	1.283 G-s
22	.037 In/Sec	.274 G-s
23	.058 In/Sec	.228 G-s
	OVERALL LEVEL	1-20 KHZ
71M	.071 In/Sec	3.733 G-s
72M	.043 In/Sec	1.349 G-s
73M	.068 In/Sec	1.095 G-s
81M	.039 In/Sec	7.296 G-s
82M	.030 In/Sec	.842 G-s
71F	.041 In/Sec	2.449 G-s
72F	.047 In/Sec	.590 G-s

	73F	.037 In/Sec	.493 G-s
	81F	.035 In/Sec	8.693 G-s
	82F	.065 In/Sec	2.506 G-s

201-08A - COMPRESSOR,NASH A 201-08A (13-Oct-23)

	OVERALL LEVEL	1-20 KHz
11	.054 In/Sec	.115 G-s
12	.050 In/Sec	.149 G-s
13	.112 In/Sec	.130 G-s
21	.045 In/Sec	.123 G-s
22	.056 In/Sec	.045 G-s
23	.145 In/Sec	.059 G-s
71	.150 In/Sec	.539 G-s
72	.168 In/Sec	.063 G-s
73	.112 In/Sec	.127 G-s
81	.156 In/Sec	.280 G-s
82	.170 In/Sec	.156 G-s
83	.155 In/Sec	.241 G-s

9002-10 - D-HYDROGENATOR AGITATOR (13-Oct-23)

	OVERALL LEVEL	1-20 KHz
11	.070 In/Sec	.297 G-s
21	.077 In/Sec	.229 G-s
23	.086 In/Sec	.070 G-s
	OVERALL LEVEL	1-20 KHZ
31	.170 In/Sec	.627 G-s
31L	.115 In/Sec	.671 G-s
	OVERALL LEVEL	1-20 KHz
51	.120 In/Sec	.360 G-s
51L	.120 In/Sec	.360 G-s
52	.080 In/Sec	.209 G-s
52L	.163 In/Sec	.539 G-s
53	.143 In/Sec	.234 G-s
53L	.200 In/Sec	.260 G-s
61	.134 In/Sec	.224 G-s
61L	.095 In/Sec	.224 G-s
81	.038 In/Sec	.031 G-s
82	.033 In/Sec	.021 G-s
83	.029 In/Sec	.0088 G-s

Station: PEROXIDE
Route No. 2: ARK WK 2

MEASUREMENT POINT	OVERALL LEVEL	HFD / VHFD

P102 - ARKEMA PUMP P102 (13-Oct-23)

	OVERALL LEVEL	1K-20KHz
MOH	.114 In/Sec	.357 G-s
MOV	.303 In/Sec	.470 G-s
MIH	.109 In/Sec	.560 G-s
MIV	.212 In/Sec	.481 G-s
MIA	.205 In/Sec	.293 G-s
EIA	.282 In/Sec	1.503 G-s
EIH	.498 In/Sec	1.077 G-s
EIV	.306 In/Sec	1.001 G-s
EOH	.256 In/Sec	1.131 G-s
EOV	.234 In/Sec	.785 G-s

C-203 - C-203 Comp (13-Oct-23)

	OVERALL LEVEL	1-20 KHz
11	.069 In/Sec	2.960 G-s
12	.037 In/Sec	1.107 G-s
21	.123 In/Sec	5.226 G-s
22	.023 In/Sec	.473 G-s
23	.027 In/Sec	.811 G-s
	OVERALL LEVEL	1-20 KHZ
71M	.065 In/Sec	4.030 G-s

	72M	.044 In/Sec	.739 G-s
	73M	.113 In/Sec	.886 G-s
	81M	.046 In/Sec	7.922 G-s
	82M	.037 In/Sec	1.578 G-s
	71F	.064 In/Sec	2.489 G-s
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	73F	.074 In/Sec	.554 G-s
	81F	.039 In/Sec	5.169 G-s
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C-202 - C-202 Comp (13-Oct-23)

	OVERALL LEVEL	1-20 KHz
11	.121 In/Sec	4.205 G-s
12	.156 In/Sec	1.291 G-s
21	.073 In/Sec	1.163 G-s
22	.063 In/Sec	.290 G-s
23	.048 In/Sec	.372 G-s
	OVERALL LEVEL	1-20 KHZ
71M	.054 In/Sec	3.475 G-s
72M	.040 In/Sec	.938 G-s
73M	.094 In/Sec	1.434 G-s
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71F	.029 In/Sec	6.929 G-s
72F	.065 In/Sec	1.793 G-s
73F	.042 In/Sec	1.074 G-s
81F	.042 In/Sec	8.913 G-s
82F	.046 In/Sec	1.056 G-s

C-201 - C-201 Comp (13-Oct-23)

	OVERALL LEVEL	1-20 KHz
11	.178 In/Sec	6.473 G-s
12	.056 In/Sec	1.564 G-s
21	.117 In/Sec	1.283 G-s
22	.037 In/Sec	.274 G-s
23	.058 In/Sec	.228 G-s
	OVERALL LEVEL	1-20 KHZ
71M	.071 In/Sec	3.733 G-s
72M	.043 In/Sec	1.349 G-s
73M	.068 In/Sec	1.095 G-s
81M	.039 In/Sec	7.296 G-s
82M	.030 In/Sec	.842 G-s
71F	.041 In/Sec	2.449 G-s
72F	.047 In/Sec	.590 G-s
73F	.037 In/Sec	.493 G-s
81F	.035 In/Sec	8.693 G-s
82F	.065 In/Sec	2.506 G-s

201-08A - COMPRESSOR,NASH A 201-08A (13-Oct-23)

	OVERALL LEVEL	1-20 KHz
11	.054 In/Sec	.115 G-s
12	.050 In/Sec	.149 G-s
13	.112 In/Sec	.130 G-s
21	.045 In/Sec	.123 G-s
22	.056 In/Sec	.045 G-s
23	.145 In/Sec	.059 G-s
71	.150 In/Sec	.539 G-s
72	.168 In/Sec	.063 G-s
73	.112 In/Sec	.127 G-s
81	.156 In/Sec	.280 G-s
82	.170 In/Sec	.156 G-s
83	.155 In/Sec	.241 G-s

202-05 - NASH SEAL LIQUID PUMP-A (13-Oct-23)

	OVERALL LEVEL	1-20 KHz
11	.019 In/Sec	.109 G-s
21	.021 In/Sec	.155 G-s
23	.019 In/Sec	.059 G-s
71	.030 In/Sec	.064 G-s
72	.017 In/Sec	.042 G-s

9002-10 - D-HYDROGENATOR AGITATOR (13-Oct-23)

	OVERALL LEVEL	1-20 KHz
11	.070 In/Sec	.297 G-s
21	.077 In/Sec	.229 G-s
23	.086 In/Sec	.070 G-s
	OVERALL LEVEL	1-20 KHZ
31	.170 In/Sec	.627 G-s
31L	.115 In/Sec	.671 G-s
	OVERALL LEVEL	1-20 KHz
51	.120 In/Sec	.360 G-s
51L	.120 In/Sec	.360 G-s
52	.080 In/Sec	.209 G-s
52L	.163 In/Sec	.539 G-s
53	.143 In/Sec	.234 G-s
53L	.200 In/Sec	.260 G-s
61	.134 In/Sec	.224 G-s
61L	.095 In/Sec	.224 G-s
81	.038 In/Sec	.031 G-s
82	.033 In/Sec	.021 G-s
83	.029 In/Sec	.0088 G-s

9003-01 - D-HYDRO PRIMARY FILT FD PUMP (13-Oct-23)

	OVERALL LEVEL	1-20 KHz
11	.021 In/Sec	.578 G-s
21	.030 In/Sec	.711 G-s
23	.026 In/Sec	.103 G-s
71	.094 In/Sec	.246 G-s
72	.100 In/Sec	.073 G-s

9001-01 - D-HYDRO SECOND. FILT FD PUMP (13-Oct-23)

	OVERALL LEVEL	1-20 KHz
11	.042 In/Sec	.843 G-s
21	.048 In/Sec	.630 G-s
23	.039 In/Sec	.146 G-s
71	.084 In/Sec	.706 G-s
72	.099 In/Sec	.200 G-s

192-03 - Two Stage Water Pump A-WEST (13-Oct-23)

	OVERALL LEVEL	1-20 KHz
11	.063 In/Sec	.719 G-s
21	.073 In/Sec	.900 G-s
23	.079 In/Sec	.296 G-s
71	.213 In/Sec	1.600 G-s
72	.105 In/Sec	.413 G-s

191-07 - M MIX BED WATER PUMP 191-07 (13-Oct-23)

	OVERALL LEVEL	1-20 KHz
11	.078 In/Sec	.717 G-s
21	.061 In/Sec	.503 G-s
23	.079 In/Sec	.133 G-s
71	.229 In/Sec	.331 G-s
72	.266 In/Sec	.107 G-s

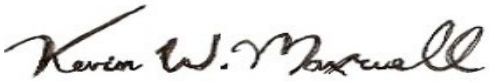
Clarification Of Vibration Units:

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,



ISO Certified Vibration Analyst, Category III

HI-SPEED INDUSTRIAL SERVICE

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