

October 31, 2022  
Project No. 221528

Jim Cornell  
Wastewater Division Manager  
City of Kalamazoo  
1415 Harrison Street  
Kalamazoo, Michigan 49007

### **City of Kalamazoo – Wastewater Treatment Plant Industrial Hygiene Evaluation - Formaldehyde**

Dear Jim:

On October 5, 2022, Fishbeck conducted an Industrial Hygiene Evaluation to determine and/or monitor employee exposures to formaldehyde at the City of Kalamazoo Wastewater Treatment Plant located at 1415 Harrison Street, Kalamazoo, Michigan. This evaluation was performed at your request and with the assistance of Steven Helmer, Senior Operations Supervisor.

### **Exposure Monitoring and General Area Monitoring**

Exposure monitoring was conducted in accordance with accepted Industrial Hygiene methods recognized by the National Institute for Occupational Safety and Health (NIOSH) and the Occupational Safety and Health Administration (OSHA). Results of the monitoring are an indication of conditions at this location on the date and time/shift of monitoring only. Should conditions change, Fishbeck makes no predictions as to the resulting air contaminants (formaldehyde).

General or fixed area sampling was used to measure emissions from process equipment (e.g., sterilizing) and task simulations. It is important to note that the intent of the regulations is that samples taken for the purpose of measuring employee exposures be taken only by the personal method. If samples taken by the general area method were to be used to determine employee exposures, it would be necessary to demonstrate that they accurately measure employee exposures. Therefore, fixed area or general area air sampling represents conditions that existed at a specific point during the period in which the sample was collected. The measured air contaminant represents only potential exposure for an employee positioned at the same location, for the same period of time. In this case, the result would indicate “worst case,” as the sampler (not the employee) remained in one fixed area.

### **Formaldehyde**

Full-task exposure monitoring was performed for formaldehyde in the approximate breathing zone (BZ) of six (6) representative employees resulting in nine (9) samples. General area sampling was also performed in three (3) locations resulting in six (6) samples.

## Industrial Hygiene Method

Exposure monitoring and general area sampling was performed in accordance with OSHA Method 1007 method using the Assay Technology 571 Formaldehyde Gas Monitor Badge. Fifteen samples and a field blank were sent under chain-of-custody procedures to Assay Technology, an AIHA accredited laboratory located in Livermore, California for analysis.

## Exposure Limits

The MIOSHA PEL for airborne concentrations of formaldehyde is 0.75 ppm and the MIOSHA action level is 0.5 ppm TWA. The ACGIH TLV-TWA is 0.1 ppm. The MIOSHA STEL for airborne concentrations of formaldehyde is 2 ppm and the recommended ACGIH TLV-STEL is 0.3 ppm.

## Sample Results

Exposure monitoring results are summarized in Table 1. The results indicate that airborne concentrations of formaldehyde were not detected above analytical limit of detection in any of the personal samples collected.

General area monitoring results are summarized in Table 2. All sample results indicated that airborne concentrations of formaldehyde gas were not detected except the sample collected by the Cake Conveyor Belt. At this location, very low concentrations (e.g., 0.005 ppm) of formaldehyde gas were measured over a 24-hour period.

Because the sampling period was greater than 480-minutes and the sample was collected in a fixed location, MIOSHA exposure limits cannot be used as exposure limits. Therefore, the National Library of Medicine, (NIH) Critical Reviews of Toxicology, "Identifying an airborne limit for formaldehyde considering both irritation and cancer hazards" was used. This publication states "Although individuals can differ in their sensitivity to odor and eye irritation, the majority of authoritative reviews of the formaldehyde literature have concluded that an air concentration of 0.3 ppm will provide protection from eye irritation for virtually everyone. A weight of evidence-based formaldehyde exposure limit of 0.1 ppm is recommended as an indoor air level for all individuals for odor detection and sensory irritation."<sup>1</sup>

Analytical results are attached.

## Summary and Recommendations

On October 5, 2022, Fishbeck conducted an Industrial Hygiene Evaluation to determine and/or monitor employee exposures to formaldehyde at the City of Kalamazoo Wastewater Treatment Plant located at 1415 Harrison Street, Kalamazoo, Michigan.

The results indicated that airborne concentrations of formaldehyde gas/vapor were not detected above the analytical limit of detection for any of the personal exposure monitoring samples. These results indicate that no job classifications were exposed to airborne concentrations at or above MIOSHA exposure limits. Only one area sample, Cake Conveyor Belt, measured airborne concentrations of formaldehyde gas over a 24-hour sample period. Based on the majority of authoritative reviews, 0.005 ppm is well below levels which would cause eye irritation for virtually everyone.

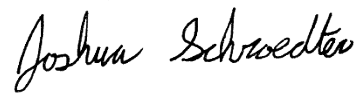
Fishbeck has no other recommendations other than continue industry best practices. If procedures or equipment change, Fishbeck recommends conducting an additional investigation to ensure exposures stay below their respective limits.

---

<sup>1</sup> NIH. Crit.Rev. Toxicol. 2011 Sept. 41 (8) 672-721.

If you have any questions or require additional information, please contact me at 616.464.3967 or [jj Schroedter@fishbeck.com](mailto:jj Schroedter@fishbeck.com).

Sincerely,

A handwritten signature in black ink that reads "Joshua J. Schroedter". The signature is written in a cursive, flowing style.

**Joshua J. Schroedter, CIH**  
Industrial Hygienist

**Table 1 – Summary of Exposure Monitoring Results – Formaldehyde**  
 City of Kalamazoo – Wastewater Treatment Plant  
 Sample Date: October 5, 2022

Sample Description	Sample Time	Sample Results (ppm)	MIOSHA Action Level/PEL (ppm)	MIOSHA STEL (ppm)
PZ21110 & PZ223513, BZ, Dan Bernard, Driver, Loading Cake	On: 1:48 a.m. Off: 2:37 a.m. (49 minutes)	<0.10	0.5/0.75	na
	On: 10:05 a.m. Off: 11:04 a.m. (59 minutes)	<0.085		
PZ21125, BZ, Bernie Kline, Driver, Loading Cake	On: 5:11 a.m. Off: 9:05 a.m. (234 minutes)	<0.021		
PZ21335, BZ, Brian Parker, Operator	On: 6:32 a.m. Off: 1:32 p.m. (420 minutes)	<0.012		
PZ21072, BZ, Mark Hetz, Operator	On: 6:37 a.m. Off: 1:32 p.m. (415 minutes)	<0.012		
PZ21115, BZ, Pete Bushouse, Maintenance	On: 7:00 a.m. Off: 2:30 p.m. (450 minutes)	<0.011		
PZ22175, BZ, Andy Doke, Maintenance	On: 7:04 a.m. Off: 1:28 p.m. (384 minutes)	<0.013		
PZ23993, BZ, Dan Bernard, Driver, Wash Off Load Area End of Day Clean	On: 10:46 a.m. Off: 11:01 a.m. (15 minutes)	<0.34		
PZ24189, BZ, Pete Bush, Maintenance, Grit Dip Task	On: 9:00 a.m. Off: 9:16 a.m. (16 minutes)	<0.31		

BZ breathing zone

**Table 2 – Summary of General Area Monitoring Results – Formaldehyde**  
 City of Kalamazoo – Wastewater Treatment Plant

Sample Description	Sample Date & Time	Sample Results (ppm)
PZ24036, GA, Centrifuge by Cake Conveyor Belt (12-hour Daytime)	10/5/2022 On: 8:00 a.m. Off: 8:16 p.m.	<0.0068
PZ24333, GA, Centrifuge by Cake Conveyor (12-hour Nighttime)	10/5/2022 – 10/6/2022 On: 8:17 p.m. Off: 8:12 a.m.	<0.0070
PZ22280, GA, Centrifuge by Cake Conveyor Belt (24-hour)	10/5/2022 – 10/6/2022 On: 8:00 a.m. Off: 8:12 a.m.	0.0050
PZ23906, GA, Divider Between Bunkers 1 & 2 (12-hour Daytime)	10/5/2022 On: 8:09 a.m. Off: 8:19 p.m.	<0.0069
PZ23551, GA, Divider Between Bunkers 1 & 2 (12-hour Nighttime)	10/5/2022 – 10/6/2022 On: 8:19 p.m. Off: 8:12 a.m.	<0.0070
PZ24246, GA, Divider Between Bunkers 2 & 3 (24-hour)	10/5/2022 – 10/6/2022 On: 8:09 a.m. Off: 8:14 a.m.	<0.0035

GA      general area

Customer: FISHBECK  
Attention: JOSH SCHROEDTER  
Address: 1515 ARBORETUM DRIVE SE  
GRAND RAPIDS, MI 49546  
USA

Lab Work Order: 2022100454

Customer No.: 62729  
Received Date: October 12, 2022  
Date Reported: October 20, 2022  
Date Report Revised: October 24, 2022

Project ID: 221528

Phone No.: (616) 575-3824

PO No.:

Fax No.:

Exposure results are the average concentration for the period of time monitored. '<' means the result is 'less than the RptLmt'. RptLmt = Reporting Limit. The results relate only to the items tested. Unless noted below, samples were received in acceptable condition, all applicable quality control were within method specifications, lab blanks were subtracted before a result was reported, and any customer supplied field blanks were not subtracted from sample results. The molar volume at 25 C (24.45 L/mole) was used to calculate parts per million, ppm. Air concentrations reported are based upon field sampling information provided by the customer. For assistance with the content of this report, please visit the Customer Support section of our web site at <http://www.assaytech.com> or contact Technical Support at 1-800-833-1258. For details of significant method modifications go to [www.assaytech.com/method](http://www.assaytech.com/method).

Additional Work Order Comments: This is a revised report.

Lab Sample ID	Lab Code	Date Sampled	Client Sample ID	Media	Media Lot / Serial #	Analytes Requested	Quantity Found			Sample		Concentration		
							Total	RptLmt	Units	Vol. (L)	Time (min)	Found	Units	
22041825	ATOH	10/05/2022	PETE BUSH / GRIT DIP TANK	571A	9G22 - PZ24189	FORMALDEHYDE	<	0.10	UG	0.259	16	<	0.31	PPM
Analyzed By: JZATCHOK			Analyzed On: 10/19/2022		Approved By: BEWING		Approved On: 10/20/2022							
22041828	ATOH	10/05/2022	PETE BUSH / MAINTENANCE	571A	9G22 - PZ21115	FORMALDEHYDE	<	0.10	UG	7.29	450	<	0.011	PPM
Analyzed By: JZATCHOK			Analyzed On: 10/19/2022		Approved By: BEWING		Approved On: 10/20/2022							
22041829	ATOH	10/05/2022	DAN / DRIVER LOADING MATERIAL	571A	9G22 - PZ23513	FORMALDEHYDE	<	0.10	UG	0.956	59	<	0.085	PPM
Analyzed By: JZATCHOK			Analyzed On: 10/19/2022		Approved By: BEWING		Approved On: 10/20/2022							
22041830	ATOH	10/05/2022	MARK / OPERATOR	571A	9G22 - PZ21072	FORMALDEHYDE	<	0.10	UG	6.72	415	<	0.012	PPM
Analyzed By: JZATCHOK			Analyzed On: 10/19/2022		Approved By: BEWING		Approved On: 10/20/2022							
22041832	ATOH	10/05/2022	BERNIE / DRIVER LOADING CAKE	571A	9G22 - PZ21125	FORMALDEHYDE	<	0.10	UG	3.79	234	<	0.021	PPM
Analyzed By: JZATCHOK			Analyzed On: 10/19/2022		Approved By: BEWING		Approved On: 10/20/2022							
22041833	ATOH	10/05/2022	DAN / DRIVER LOADING MATERIAL / CAKE	571A	9G22 - PZ21110	FORMALDEHYDE	<	0.10	UG	0.794	49	<	0.10	PPM

Customer: FISHBECK  
Attention: JOSH SCHROEDTER  
Address: 1515 ARBORETUM DRIVE SE  
GRAND RAPIDS, MI 49546  
USA

Lab Work Order: 2022100454

Customer No.: 62729  
Received Date: October 12, 2022  
Date Reported: October 20, 2022  
Date Report Revised: October 24, 2022

Project ID: 221528

Phone No.: (616) 575-3824  
Fax No.:

PO No.:

Lab Sample ID	Lab Code	Date Sampled	Client Sample ID	Media	Media Lot / Serial #	Analytes Requested	Quantity Found			Sample		Concentration		
							Total	RptLmt	Units	Vol. (L)	Time (min)	Found	Units	
Analyzed By: JZATCHOK						Analyzed On: 10/19/2022		Approved By: BEWING		Approved On: 10/20/2022				
22041834	ATOH	10/05/2022	CENTRIFUGE AT CAKE CONVEYOR BELT	571A	9G22 - PZ24333	FORMALDEHYDE	<	0.10	UG	11.6	715	<	0.0070	PPM
Analyzed By: JZATCHOK						Analyzed On: 10/19/2022		Approved By: BEWING		Approved On: 10/20/2022				
22041836	ATOH		BLANK	571A	9G22 - PZ20866	FORMALDEHYDE	<	0.10	UG					
Analyzed By: JZATCHOK						Analyzed On: 10/19/2022		Approved By: BEWING		Approved On: 10/20/2022				
Sample Comments: The date sampled was not provided on the lab request form.														
22041838	ATOH	10/05/2022	AT SOUTH DIVIDER BETWEEN BUNKER 1 AND 2	571A	9G22 - PZ23906	FORMALDEHYDE	<	0.10	UG	11.8	730	<	0.0069	PPM
Analyzed By: SGREEN						Analyzed On: 10/19/2022		Approved By: SGREEN		Approved On: 10/24/2022				
Sample Comments: The sampling time has been revised at the customer's request. Please note the concentration values have also changed due to the sampling time revision.														
22041839	ATOH	10/05/2022	SOUTH DIVIDER BETWEEN BUNKERS 1 AND 2	571A	9G22 - PZ23551	FORMALDEHYDE	<	0.10	UG	11.6	716	<	0.0070	PPM
Analyzed By: JZATCHOK						Analyzed On: 10/19/2022		Approved By: BEWING		Approved On: 10/20/2022				
22041840	ATOH	10/05/2022	AT NORTH DIVIDER BETWEEN BUNKERS 2 AND 3	571A	9G22 - PZ24246	FORMALDEHYDE	<	0.10	UG	23.4	1445	<	0.0035	PPM
Analyzed By: JZATCHOK						Analyzed On: 10/19/2022		Approved By: BEWING		Approved On: 10/20/2022				
22041841	ATOH	10/05/2022	DAN / LOAD AREA END OF DAY CLEAN	571A	9G22 - PZ23993	FORMALDEHYDE	<	0.10	UG	0.243	15	<	0.34	PPM
Analyzed By: JZATCHOK						Analyzed On: 10/19/2022		Approved By: BEWING		Approved On: 10/20/2022				

Customer: FISHBECK  
Attention: JOSH SCHROEDTER  
Address: 1515 ARBORETUM DRIVE SE  
GRAND RAPIDS, MI 49546  
USA

Lab Work Order: 2022100454

Customer No.: 62729  
Received Date: October 12, 2022  
Date Reported: October 20, 2022  
Date Report Revised: October 24, 2022

Project ID: 221528

Phone No.: (616) 575-3824

PO No.:

Fax No.:

Lab Sample ID	Lab Code	Date Sampled	Client Sample ID	Media	Media Lot / Serial #	Analytes Requested	Quantity Found			Sample		Concentration	
							Total	RptLmt	Units	Vol. (L)	Time (min)	Found	Units
22041842	ATOH	10/05/2022	BRIAN PARKER / OPERATOR	571A	9G22 - PZ21335	FORMALDEHYDE	<	0.10	UG	6.80	420	<	0.012 PPM
Analyzed By: JZATCHOK			Analyzed On: 10/19/2022			Approved By: BEWING			Approved On: 10/20/2022				
22041843	ATOH	10/05/2022	CENTRIFUGE AT CAKE CONVEYOR BELT	571A	9G22 - PZ22280	FORMALDEHYDE	0.14	0.10	UG	23.5	1452	0.0050	PPM
Analyzed By: JZATCHOK			Analyzed On: 10/19/2022			Approved By: BEWING			Approved On: 10/20/2022				
22041844	ATOH	10/05/2022	ANDY / MAINTENANCE	571A	9G22 - PZ22175	FORMALDEHYDE	<	0.10	UG	6.22	384	<	0.013 PPM
Analyzed By: JZATCHOK			Analyzed On: 10/19/2022			Approved By: BEWING			Approved On: 10/20/2022				
22041847	ATOH	10/05/2022	CENTRIFUGE AT CAKE CONVEYOR BELT	571A	9G22 - PZ24036	FORMALDEHYDE	<	0.10	UG	11.9	736	<	0.0068 PPM
Analyzed By: SGREEN			Analyzed On: 10/19/2022			Approved By: SGREEN			Approved On: 10/24/2022				

Sample Comments: The sampling time has been revised at the customer's request. Please note the concentration values have also changed due to the sampling time revision.

Method References:

TestCode	Analytes Requested	Method Reference	Regulatory Agency	TWA Limit	STEL Limit	Exposure Units
50000A	FORMALDEHYDE	MOD OSHA 1007	OSHA PEL / STEL	0.75	2	PPM

Applicable OSHA PELs or NIOSH RELS have been included in this lab report for guidance, but may not be sufficient for regulatory compliance. Clients should be aware that more stringent international, state, local, or organizational exposure limits may supersede the limits included with this report. Visit [www.OSHA.gov/dsg/annotated-pels](http://www.OSHA.gov/dsg/annotated-pels) for detailed information on exposure limits and OSHA policies.