

October 16, 2017

Mr. Michael Lane Office of Court Management/Facilities Management Environmental Coordinator Lowell District Court 41 Hurd Street Lowell, MA 01852

## RE: 50 State Street, Springfield, Massachusetts – Indoor Air Quality Services TRC Project 288235

Mr. Lane,

On September 29, 2017, TRC conducted an indoor air quality (IAQ) investigation of the Springfield Hall of Justice building located at 50 State Street in Springfield, Massachusetts. This IAQ investigation included: visual and olfactory observations; and direct-reading measurements of routine IAQ parameters including temperature (T), relative humidity (RH), carbon dioxide (CO<sub>2</sub>), carbon monoxide (CO), total volatile organic compounds (TVOC) and airborne particulate. This report presents TRC's observations, results of the IAQ measurements, conclusions and recommendations.

The purpose of the investigation was to perform IAQ screening measurements to determine whether the routine IAQ parameters are within acceptable guidelines for personnel occupancy.

# **OBSERVATIONS**

During the building walkthrough observations were made of readily accessible areas including interior building finish materials. Generally the office areas as well as the common spaces were observed to be in good condition.

It should be noted that some areas have both central heating, ventilating and air conditioning (HVAC) in addition to fan coil units, while other areas have HVAC only. Attachment A illustrates the approximate location (see purple dots) of areas where measurements were collected.

# SAMPLING AND ANALYTICAL METHODS

TRC utilized a visual/olfactory inspection of the space coupled with real time measurements to conduct the investigation.

## **Baseline Indoor Air Quality Parameter Monitoring**

Monitoring of baseline IAQ Parameters was conducted in the selected building areas. Real-time monitor readings for CO, CO<sub>2</sub>, T, and RH were collected using a TSI Q-Trak<sup>TM</sup> IAQ Monitor Model 7565. This instrument uses: an electrochemical cell to monitor CO; a nondispersive infrared sensor to monitor CO<sub>2</sub>; and thermistors and thin-film capacitor sensors to measure temperature and relative humidity, respectively. The instrument is calibrated prior to use in the field using standard CO and CO<sub>2</sub> calibration gas and is serviced annually.

## **Total Volatile Organic Compounds**

Direct-reading measurements for TVOCs were performed using a RAE Systems MultiRAE Five Gas Analyzer (Model PGM-50-5P). This instrument measures TVOCs based on the principle of ionization of the molecules by a sealed ultraviolet source (10.6 eV). Instrument response to any particular VOC depends upon the energy of the ultraviolet lamp and the ionization potential of the VOC. The instrument detector cannot distinguish among several VOCs that may be present in the sampled atmosphere, but instead provides a cumulative response. The instrument was calibrated prior to use in the field using standard isobutylene calibration gas.

### Airborne particulate

Direct-reading measurements of airborne particulate as PM<sub>10</sub> and PM<sub>2.5</sub> were conducted using two TSI Incorporated DustTrak Model 8520 Aerosol Monitors. The instruments measure PM<sub>10</sub> by drawing air through 10-micron size-selecting inlet, or PM<sub>2.5</sub> by drawing air through 2.5-micron size-selecting inlet and passing the sampled air through a light-scattering laser photometer. The instruments are calibrated annually by the manufacturer in accordance with International Organization for Standardization (ISO) standard 12103-2, and are zeroed in the field prior to use in accordance with manufacturer recommendations.

# **BACKGROUND INFORMATION**

CO<sub>2</sub>. Indoor CO<sub>2</sub> measurements provide a useful indicator of whether a space is provided with adequate make-up (outdoor) air for the number of occupants present, since CO<sub>2</sub> levels may build up when there is insufficient outdoor make-up air. The American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) Standard 62-2016, <u>Ventilation for Acceptable Indoor Air Quality</u>, recommends the difference between indoor and outdoor CO<sub>2</sub> concentrations be maintained at 700 parts per million (ppm) or less. Maintaining a difference of no more than 700 ppm equates to approximately 15 cubic feet per minute of outdoor supply air per occupant. Outdoor concentrations of CO<sub>2</sub> typically range from 350 - 450 ppm.

**CO.** CO is a combustion product, often present in buildings with boilers, fuel-burning engines, parking garages, or busy side streets near the outdoor air intakes. CO is a colorless, odorless gas



that can cause fatigue or drowsiness, nausea, headache, and difficulty breathing when present at elevated levels. The U.S. National Ambient Air Quality Standard (NAAQS) for CO is 9 ppm (8-hour average).

**Temperature and RH**. Occupants are generally tolerant of temperatures between 68° and 82 °F. ASHRAE Standard 55-2013 <u>Thermal Environmental Conditions for Human Occupancy</u> recommends temperatures be generally maintained between 75° F to 82 °F during warmer summer operative conditions and 68° F to 78° F in cooler winter operative conditions.

ASHRAE does not specify lower limits for relative humidity; however, ASHRAE does recognize that low relative humidity may cause discomfort. Relative humidity below 30% may cause specific physiological effects (such as dry and sore nose and throat, bleeding nose, sinus and tracheal irritation, dry scratchy eyes, inability to wear contact lenses, and dry flaking skin), that can lead to occupant discomfort and dissatisfaction with the indoor environment. The U.S. EPA recommends that RH be maintained below 60% to prevent mold growth on indoor surfaces and building materials.

**TVOC.** TVOC measurements were performed to determine if unusually high cumulative concentrations of this group of air contaminants existed in the building. TVOCs have many sources, including the evaporation of paint solvents, cleaning products and deodorizing products being used in the building, personal care products and off-gassing from building materials, furnishings and office equipment. Exposures to elevated concentrations of TVOCs may cause symptoms such as headaches, dizziness, and eye, nose and respiratory tract irritation.

Screening for the presence of TVOCs with direct-reading instrumentation is a convenient method for characterizing TVOCs in the building environment although it provides no information on the identities and relative amounts of the individual chemicals that constitute the TVOC mixture. If the indoor TVOC concentrations are significantly and consistently greater than the outdoor TVOC concentration, then the presence of one or more active TVOC sources within the building is likely. Subsequent air sampling and analysis by different methods which can provide the identification of individual TVOCs may be warranted depending upon the circumstances.

In general, indoor TVOC concentrations should be similar to outdoor concentrations, unless there is a substantial source of TVOCs in the building. In TRC's experience, outdoor TVOC concentrations are frequently less than 0.1 parts per million (ppm).

The U.S. Occupational Safety and Health Administration (OSHA) has established a full-shift average occupational exposure limit of 1 ppm for benzene, which is among the lowest of occupational exposure limits of any component of TVOCs that are likely to be encountered in the indoor environment.

Airborne particulate. Airborne particulate in indoor environments originates from various sources within the building including building materials and furnishings, occupant activities, and



construction and renovation activities, as well as from the outdoor air. High concentrations of airborne dust may cause irritation of the eyes, skin and respiratory tract.

The US EPA has established NAAQSs for  $PM_{10}$  and  $PM_{2.5}$  (particles with aerodynamic diameters less than or equal to 10 and 2.5 micrometers, respectively) of 0.150 and 0.035 milligrams per cubic meter of air (mg/m<sup>3</sup>) as maximum 24-hour time-weighted average concentrations. These primary standards apply to ambient air quality and are intended to protect the health of the general public, including sensitive populations such as asthmatics, children, elderly, and individuals with heart disease or chronic obstructive pulmonary disease. The NAAQS values of 0.150 mg/m<sup>3</sup> for PM<sub>10</sub> and 0.035 mg/m<sup>3</sup> for PM<sub>2.5</sub> may be used as guidelines for evaluating indoor air quality.

# SAMPLING RESULTS/INTERPRETATION

A summary of the sampling results is presented as ranges in the table below. The CO and CO<sub>2</sub> measurements are presented in ppm concentration units. Temperature and RH are presented in  $^{\circ}$ F and percent relative humidity (%), respectively. The TVOC measurements are presented in ppm concentration units. The PM<sub>10</sub> and PM<sub>2.5</sub> measurements are presented in mg/m<sup>3</sup> concentration units. Attachment B includes all direct measurements collected in various locations throughout the building during this assessment.

Measurement Location	Time	CO <sub>2</sub> (ppm)	CO (ppm)	Т ( <sup>0</sup> F)	RH (%)	PM <sub>10</sub> (mg/m <sup>3</sup> )	PM <sub>2.5</sub> (mg/m <sup>3</sup> )	TVOC (ppm)	
Ground Floor									
Multiple locations	08:31 to 08:52	441- 502	ND (< 3)	ND (< 3) 63.1 -70.3		0.003 -0.013	0.002 -0.004	ND (<0.1)	
1 <sup>st</sup> Floor									
Multiple locations	09:05 to 09:42	482 - 618	ND (< 3)	70.9 – 73.9	36.3 -41.1	0.005 -0.014	0.003-0.013	ND (<0.1)	

#### Summary of Basic IAQ Parameters throughout the Building Springfield Hall of Justice, 50 State St., Springfield, Massachusetts September 29, 2017



#### Summary of Basic IAQ Parameters throughout the Building

Springfield Hall of Justice, 50 State St., Springfield, Massachusetts

September 29, 2017

Measurement Location	Time	CO <sub>2</sub> (ppm)	CO (ppm)	Т ( <sup>0</sup> F)	RH (%)	PM <sub>10</sub> (mg/m <sup>3</sup> )	PM <sub>2.5</sub> (mg/m <sup>3</sup> )	TVOC (ppm)		
				2 <sup>nd</sup> Floor						
Multiple locations	09:49 to 13:33	434 - 569	ND (< 3)	$70.8 - 78.3^{1}$	30.3 -41.1	0.004 -0.014	0.001-0.003	ND (<0.1)- 0.6 <sup>2</sup>		
3 <sup>rd</sup> Floor										
Multiple locations	11:38 to 12:16	406-529	ND (< 3)	70.3-74.7	32.8-37.4	0.004-0.011	0.001-0.004	ND (<0.1)		
4 <sup>th</sup> Floor										
Multiple locations	$\begin{array}{c c} Multiple \\ locations \\ 13:20 \end{array} \begin{array}{c} 12:27 \\ to \\ 13:20 \end{array} \begin{array}{c} 395-546 \\ (<3) \end{array}$		ND (< 3)	69.8-73.3 34.4-41.5		0.004-0.012	0.001-0.002	ND (<0.1)		
			A	Ambient-Outdoor	°S					
Outdoors front of building	08:28	428	ND (< 3)	60.7	49.3	0.007	0.002	ND (<0.1)		
Outdoors front of building	11:30	392	ND (< 3)	65.4	35.2	0.006	0.005	ND (<0.1)		
Standards		ASHRAE <700 above ambient (< 1,092 to 1,128)	U.S. EPA NAAQS 9	ASHRAE Guideline Summer = 75-82° F Fall & Winter = 68-78° F	U.S. EPA < 60	<b>NAAQS</b> PM <sub>10</sub> =0.150 mg/m <sup>3</sup>	NAAQS PM <sub>2.5</sub> =0.035 mg/m <sup>3</sup>	Indoor and outdoor concen- trations should be similar		
(ppm = parts per million, °F = degrees Fahrenheit, % = percent, mg/m3 = milligrams per cubic meter of air, ND is non-detect)										

The baseline IAQ measurements collected indicate that the CO measurements were non-detect at all test locations.

The  $CO_2$  measurements were below the ASHRAE guideline of 1,092 to 1,128 ppm at all test locations.

The temperature readings were generally within the recommended comfort range for winter occupancy, with the exception of room 249 and 246B being just slightly over the high end of the comfort range. It should be noted that these two rooms are located on the sunny side of the

 $<sup>^{2}</sup>$  All locations with the exception of room 210A were ND (<0.1). There was no obvious or unusual source of TVOCs noted in this location at the time of the assessment.



<sup>&</sup>lt;sup>1</sup> Temperatures of 78.1 and 78.3 °F were recorded in room 249 and 246B respectively. All other rooms were within the recommended winter ranges.

building and have large glass windows; thus higher indoor temperatures in these rooms appear to result from the radiant heat load. The relative humidity readings were within acceptable ranges.

The airborne concentrations of  $PM_{10}$  measured at the indoor sampling locations ranged from 0.003 to 0.014 mg/m<sup>3</sup>. The airborne concentrations of  $PM_{2.5}$  at the indoor locations ranged from non-detect (< 0.001) to 0.013 mg/m<sup>3</sup>. The concurrent outdoor  $PM_{10}$  concentration ranged from 0.006 to 0.007 mg/m<sup>3</sup> and the concurrent  $PM_{2.5}$  concentration ranged from 0.002 to 0.005 mg/m<sup>3</sup>. Black particulate and accumulation could be observed on the internal blades of the air purifier and the fan coil unit in room 422.

The indoor  $PM_{10}$  concentrations were below the reference value of 0.150 mg/m<sup>3</sup> and the indoor  $PM_{2.5}$  concentrations were below the reference values of 0.035 mg/m<sup>3</sup>.

The TVOC concentrations were generally non-detect (< 0.1), with the exception of room 210A where it was 0.6 ppm, which is slightly above the outdoor concentrations of ND (<0.1) ppm. The TVOC concentration in room 210A is well below the OSHA limit of 1 ppm for benzene, which is among the lowest of occupational exposure limits of any component of TVOCs that are likely to be encountered in the indoor environment. TVOC in this room is probably associated with cleaning products and deodorizing products being used in the room, or personal care products.

# CONCLUSIONS AND RECOMMENDATIONS

During TRC's visit no evidence of water intrusion was noted.

The baseline IAQ measurements collected throughout the building indicated that CO<sub>2</sub> concentrations were within the recommended limit.

The CO and humidity measurements were within the recommended ranges. The temperature readings were generally within the recommended comfort range for winter occupancy, with temperatures just over the high end of the comfort range in rooms 249 and 246B. Elevated temperatures in these two rooms are likely the result of radiant heat through large windows.

TVOC concentration in room 210A is probably associated with cleaning products and deodorizing products being used in the room, or personal care products.

The indoor concentrations of  $PM_{10}$  and  $PM_{2.5}$  were below the reference values. Black accumulation could be observed on the air purifier and the fan coil unit inside room 422.

Based on these observations and measurements, TRC recommends the following:

- 1. Perform an evaluation of the HVAC system and fan coil units to ensure that uniform ventilation is provided within all spaces.
- 2. Identify that the fan coil units in rooms 249 and 246B operate as needed and determine whether additional cooling systems are necessary in rooms 249 and 246B.



3. Evaluation of the fan coil units should specifically include the unit in room 422 and the unit should be cleaned as needed.

TRC appreciates the opportunity to provide you with IAQ services. If you have any questions or comments, please call TRC at (781) 933-2555.

Very Truly Yours, **TRC** 

Reviewed by:

ann D. Eckmann

Simona Holacsek, CIH Senior Project Manager

Ann D. Eckmann, CIH Industrial Hygiene Group Leader



# ATTACHMENT A APROXIMATE LOCATION OF SAMPLING AREAS











NORTH





# ATTACHMENT B DIRECT READING MEASUREMENTS OF THE BASIC IAQ PARAMETERS

![](_page_13_Picture_1.jpeg)

Number of occupants	Time	Location	PM <sub>10</sub> mg/m <sup>3</sup>	PM <sub>2.5</sub> mg/m <sup>3</sup>	Temp(F)	RH	CO <sub>2</sub> ppm	CO ppm	TVOC ppm		
0	08:28	Outdoors	0.007	0.002	60.7	49.3	428	ND (<3)	ND (<0.1)		
0	11:30	Outdoors	0.006	0.005	65.4	35.2	392	ND (<3)	ND (<0.1)		
Ground Floor											
2	08:31	Garage SW	0.013	0.004	63.1	51	482	ND (<3)	ND (<0.1)		
1	08:34	Garage middle	0.008	0.003	65.1	49.4	465	ND (<3)	ND (<0.1)		
1	08:37	Shop G42	0.004	0.002	69.3	49.8	454	ND (<3)	ND (<0.1)		
0	08:40	Hallway G33	0.003	0.002	70.3	46.1	502	ND (<3)	ND (<0.1)		
1	08:43	Break Room G27C	0.004	0.003	70.2	48.2	461	ND (<3)	ND (<0.1)		
0	08:46	G48	0.004	0.003	69.7	46.9	441	ND (<3)	ND (<0.1)		
0	08:49	G02	0.004	0.003	69.6	45.8	457	ND (<3)	ND (<0.1)		
0	08:52	G54	0.003	0.003	70	41.9	464	ND (<3)	ND (<0.1)		
			1 <sup>st</sup> ]	Floor							
5	09:05	1st. Fl. District court probation	0.014	0.013	73.4	37.9	557	ND (<3)	ND (<0.1)		
1	09:08	1st. Fl. 149	0.007	0.007	73.9	37	602	ND (<3)	ND (<0.1)		
3	09.11	1st. Probation employees	0.007	0.006	73 /	36.8	/01	ND (<3)	ND (<0.1)		
2	09.11	1st Fl Rm 140	0.007	0.005	73.4	37.1	546	ND (<3)	ND (<0.1)		
25	09.20	1st fl District Court rm 1	0.007	0.003	73.3	36.3	535	ND (<3)	ND (<0.1)		
70	09:22	1st. Fl. District court room 2	0.01	0.004	72.7	37.8	585	ND (<3)	ND (<0.1)		
0	09:25	1st. Fl. 121 A	0.011	0.003	72.3	37.1	482	ND (<3)	ND (<0.1)		
6	09:29	1st. F. District criminal office	0.014	0.004	72.1	39.1	515	ND (<3)	ND (<0.1)		

## 50 State Street, Springfield, MA Indoor Air Quality Services

		1st. Fl. Criminal 101 clerk's						ND (<3)	ND (<0.1)	
1	09:32	office	0.008	0.004	70.9	41.1	568			
7	09:36	1st. Fl. Elevator lobby	0.007	0.004	71.3	37.7	618	ND (<3)	ND (<0.1)	
		1st. Fl. District attorney						ND (<3)	ND (<0.1)	
4	09:42	prosecutor office	0.005	0.003	72.6	37.3	570			
2 <sup>nd</sup> Floor										
2	09:49	2nd fl. Elevators lobby	0.005	0.002	72.1	35.5	489	ND (<3)	ND (<0.1)	
10	09:53	2nd fl. District civil	0.014	0.002	72.1	37.9	532	ND (<3)	ND (<0.1)	
		2nd fl. Employee break room						ND (<3)	ND (<0.1)	
1	09:55	Rm. 228	0.005	0.002	72.2	36.3	474			
2	09:59	2nd fl. Rm. 210 A	0.011	0.002	72.2	36.2	521	ND (<3)	0.6	
1	10:02	2nd fl. Rm. 209	0.008	0.003	71.6	34.9	513	ND (<3)	ND (<0.1)	
		2nd fl. Judge John Payne's						ND (<3)	ND (<0.1)	
1	10:11	office	0.004	0.002	71	41.1	532			
		2nd fl. Judge William Boyle						ND (<3)	ND (<0.1)	
0	10:16	office	0.004	0.002	71.2	40.1	500			
1	10:20	2nd fl. Judges lobby 206	0.005	0.001	70.8	38.4	491	ND (<3)	ND (<0.1)	
		2nd fl. Regional director of						ND (<3)	ND (<0.1)	
0	10:27	security	0.009	0.001	71.4	34.7	452			
0	10:30	2nd. Fl. Room 249	0.004	0.002	78.1	30.3	444	ND (<3)	ND (<0.1)	
0	10:37	2nd fl. Room 246B	0.006	0.002	78.3	31.2	569	ND (<3)	ND (<0.1)	
1	10:44	2nd fl. Superior room 241	0.01	0.001	74	3.3	462	ND (<3)	ND (<0.1)	
1	13:27	2nd fl. District court room 6	0.004	0.001	72.1	33.9	502	ND (<3)	ND (<0.1)	
0	13:29	2nd fl. District court room 3	0.004	0.001	71.3	34.3	447	ND (<3)	ND (<0.1)	
0	13:33	2nd fl. District courtroom 9	0.005	0.001	71.3	34.8	434	ND (<3)	ND (<0.1)	
-			3 <sup>rd</sup> F	loor				1		

## 50 State Street, Springfield, MA Indoor Air Quality Services

TRC Project 288235

-	T					Т	1		1
0	11:38	3rd fl. Room 320A	0.008	0.002	71	37.4	529	ND (<3)	ND (<0.1)
5	11:40	3rd fl. Superior court room 1	0.005	0.002	71.2	34.7	433	ND (<3)	ND (<0.1)
1	11:43	3rd fl. Superior court room 2	0.005	0.002	71.1	34	424	ND (<3)	ND (<0.1)
0	11:46	3rd fl. Judges lobby 347B	0.006	0.003	72.2	34.5	449	ND (<3)	ND (<0.1)
0	11.26	3rd fl. Superior court room	0.005	0 004	74 7	32.8	463	ND (<3)	ND (<0.1)
4	12:00	3rd fl. Room 350	0.005	0.002	73.9	32.9	459	ND (<3)	ND (<0.1)
2	12:02	3rd fl. Room 366	0.008	0.002	73.9	33.1	462	ND (<3)	ND (<0.1)
0	12:04	3rd fl. District attorney lounge	0.005	0.003	73.5	32.9	453	ND (<3)	ND (<0.1)
5	12:07	3rd fl. Superior court probation	0.011	0.003	72.7	33.8	513	ND (<3)	ND (<0.1)
2	12:09	3rd fl. Superior court clerks criminal	0.008	0.002	72.3	34.7	479	ND (<3)	ND (<0.1)
2	12:11	3rd fl. Law library	0.005	0.002	71.7	37.2	450	ND (<3)	ND (<0.1)
	12:12	3rd fl. Training room	0.009	0.003	71	33.5	453	ND (<3)	ND (<0.1)
0	12:16	3rd fl. Superior court room 3	0.004	0.001	70.3	35.4	406	ND (<3)	ND (<0.1)
			4 <sup>th</sup> F	loor					
8	12:27	4th fl. Registry of probate	0.005	0.001	69.8	37.4	516	ND (<3)	ND (<0.1)
2	12:37	4th fl. Room 431	0.006	0.002	70.9	37.4	463	ND (<3)	ND (<0.1)
2	12:42	4th fl. 434	0.005	0.001	71.4	36.2	469	ND (<3)	ND (<0.1)
1	12:48	4th fl. Probation vault 440	0.005	0.001	71.7	41.5	449	ND (<3)	ND (<0.1)
2	12:53	4th fl. Jury pool	0.012	0.001	70.4	35	477	ND (<3)	ND (<0.1)
7	12:58	4th fl. Registry of deeds	0.006	0.001	70.7	37.8	465	ND (<3)	ND (<0.1)
3	13:03	4th fl. Land registry	0.005	0.002	71.7	36.6	480	ND (<3)	ND (<0.1)

## 50 State Street, Springfield, MA Indoor Air Quality Services

TRC Project 288235

								ND (<3)	ND (<0.1)
0	13:06	4th fl. Probate courtroom 1	0.005	0.001	70.2	34.5	395		
								ND (<3)	ND (<0.1)
0	13:12	4th Probate court room 3	0.004	0.001	70.6	34.9	407		
								ND (<3)	ND (<0.1)
0	13:15	4th fl. Probate court room 2	0.005	0.001	71	34.4	408		
								ND (<3)	ND (<0.1)
0	13:20	4th fl. Room 422	0.006	0.002	73.3	35.5	546	` ´ ´	, , , , , , , , , , , , , , , , , , ,