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June 26, 2017

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

RE: 80 State Street, Springfield, Massachusetts – Indoor Air Quality Services
TRC Project 281272

Mr. Lane,

On June 15, 2017, TRC conducted a limited indoor air quality (IAQ) investigation at Springfield Juvenile Court located at 80 State Street in Springfield, Massachusetts. The investigation was performed in representative locations of the building. The IAQ investigation included visual and olfactory observations; and direct-reading measurements of routine IAQ parameters including temperature (T), relative humidity (RH), carbon dioxide (CO_2), 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

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. Efflorescence and peeling paint were observed in some areas of the 3rd floor and in the basement. Areas observed to have these signs of water intrusion are listed below:

- 3rd floor - Rm. 323, Housing Rm.307, Rm. 305, and
- Basement - Rm. B47, Rm. B58 and Rm. B14

It should be noted that some areas have both central heating and ventilating air conditioning system (HVAC) and fan coil units, while other areas have HVAC only. For a list of all locations observed during this assessment see Attachment A.

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_2, T, and RH were collected using a TSI Q-Trak™ IAQ Monitor Model 7565. This instrument uses: an electrochemical cell to monitor CO; a nondispersive infrared sensor to monitor CO_2; 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_2 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 VOCs 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_{10} and $PM_{2.5}$ were conducted using two TSI Incorporated DustTrak Model 8520 Aerosol Monitors. The instruments measure PM_{10} by drawing air through 10-micron size-selecting inlet, or $PM_{2.5}$ 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_2. Indoor CO_2 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_2 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, *Ventilation for Acceptable Indoor Air Quality*, recommends the difference between indoor and outdoor CO_2 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_2 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 *Thermal Environmental Conditions for Human Occupancy* 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 and cleaning products being used in the building, 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. In general, indoor TVOC concentrations are expected to be similar to outdoor concentrations, unless there is a substantial source of TVOCs in the building.

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^3) 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^3 for PM_{10} and 0.035 mg/m^3 for $PM_{2.5}$ may be used as guidelines for evaluating indoor air quality.

SAMPLING RESULTS/INTERPRETATION

The IAQ measurements in locations where CO_2 concentration was above the recommended limits are summarized in the table below. The CO and CO_2 measurements are presented in ppm concentration units. Temperature and RH are presented in °F and percent relative humidity (%), respectively. The TVOC measurements are presented in ppm concentration units. The PM_{10} and $PM_{2.5}$ measurements are presented in mg/m^3 concentration units. Attachment A includes all direct measurements collected in representative locations during this assessment.

Summary of Locations with Elevated CO_2 Measurements
Springfield Juvenile Courthouse, 80 State St., Springfield, Massachusetts
June 15, 2017

Measurement Location	Time	CO_2 (ppm)	CO (ppm)	T (^0F)	RH (%)	PM_{10} (mg/m^3)	$PM_{2.5}$ (mg/m^3)	VOC (ppm)
3rd Floor								
Housing, Kitchen rm. 307	13:32	1169	ND (< 3)	73.6	43	0.004	ND (< 0.001)	ND (<0.1)
Conference rm. 303	13:36	1114	ND (< 3)	74.1	39.3	0.002	ND (< 0.001)	ND (<0.1)
2nd Floor								
Housing, Court rm. 2	11:17	1340	ND (< 3)	73.4	48.1	0.002	0.001	0.1
Judges lobby, rm.2	11:21	1304	ND (< 3)	73.3	38.5	0.003	0.001	ND (<0.1)

Summary of Locations with Elevated CO_2 Measurements
Springfield Juvenile Courthouse, 80 State St., Springfield, Massachusetts
June 15, 2017

Measurement Location	Time	CO_2 (ppm)	CO (ppm)	T (^0F)	RH (%)	PM_{10} (mg/m^3)	$PM_{2.5}$ (mg/m^3)	VOC (ppm)
Information desk	11:24	1838	ND (< 3)	74.1	45.5	0.021	0.001	ND (<0.1)
Housing jury, rm.208	11:27	1897	ND (< 3)	74.9	42.5	0.021	0.001	ND (<0.1)
Conference, rm.220	11:30	1508	ND (< 3)	75.0	39.6	0.004	0.003	ND (<0.1)
Stairwell, outside rm. 222	11:32	1170	ND (< 3)	74.2	36.8	0.003	0.001	ND (<0.1)
Judicial dept., rm.240	11:41	1184	ND (< 3)	72.9	45.3	0.009	0.001	ND (<0.1)
1st Floor								
Juvenile main lobby	12:54	1159	ND (< 3)	76.3	33.8	0.004	0.002	ND (<0.1)
Main area, rm. 151	13:01	1110	ND (< 3)	74.6	33.9	0.025	0.002	ND (<0.1)
Main stairwell, rm.124	13:05	1120	ND (< 3)	74.5	34.7	0.004	0.002	ND (<0.1)
Juvenile clerks rm. 132	13:08	1300	ND (< 3)	74.4	34.2	0.008	0.002	ND (<0.1)
Rm. 138	13:16	1100	ND (< 3)	72.3	35.2	0.003	0.001	ND (<0.1)
Housing clerk	13:20	1165	ND (< 3)	72.7	35.2	0.005	0.001	ND (<0.1)
Rm.116	13:22	1145	ND (< 3)	72.0	35.9	0.003	0.001	ND (<0.1)
Basement								
Rm. B11	14:14	1256	ND (< 3)	72.3	43	0.004	0.002	0.1
Rm. B35	14:23	1106	ND (< 3)	72.5	41.6	0.004	0.001	ND (<0.1)

Summary of Locations with Elevated CO_2 Measurements
Springfield Juvenile Courthouse, 80 State St., Springfield, Massachusetts
June 15, 2017

Measurement Location	Time	CO_2 (ppm)	CO (ppm)	T (^{0}F)	RH (%)	PM_{10} (mg/m^3)	$PM_{2.5}$ (mg/m^3)	VOC (ppm)
Ambient-Outdoors								
Outdoors front of building	10:54	399	ND (< 3)	73.8	39.3	0.011	0.004	0.1
Standards		**ASHRAE <700 above ambient (< 1,099)**	**U.S. EPA NAAQS 9**	**ASHRAE Guideline Summer = 75-82^o F Fall & Winter = 68-78^o F**	**U.S. EPA < 60**	**NAAQS** PM_{10}=0.150 mg/m^3	**NAAQS** $PM_{2.5}$=0.035 mg/m^3	Indoor and outdoor concen-trations should be similar

(ppm = parts per million, ^{o}F = degrees Fahrenheit, % = percent, ND is non-detect)

The baseline IAQ measurements taken in representative areas indicate that the CO measurements were non-detect at all test locations.

The CO_2 measurements were above the ASHRAE guideline of 1,099 ppm in various locations throughout the building, as indicated in the table above. .

The temperature readings were within or only slightly below the recommended comfort range for summer occupancy. The relative humidity readings were within acceptable ranges.

The airborne concentrations of PM_{10} measured at the indoor sampling locations ranged from 0.002 to 0.025mg/m^3. The airborne concentrations of $PM_{2.5}$ at the indoor locations ranged from non-detect (< 0.001) to 0.003 mg/m^3. The concurrent outdoor PM_{10} concentration was 0.011 mg/m^3 and the concurrent $PM_{2.5}$ concentration was 0.004 mg/m^3.

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

The VOC concentrations ranged from non-detect (< 0.1) to 0.1 at all test locations. The concurrent outdoor VOC measurement was 0.1 ppm.

CONCLUSIONS AND RECOMMENDATIONS

During TRC's visit evidence of water intrusion was noted along the perimeter wall in some locations of the 3rd floor including Rm. 323, Housing Rm.307, Rm. 305, and the basement including Rm. B47, Rm. B58 and Rm. B14.

The baseline IAQ measurements taken in representative locations indicated that CO_2 concentrations were above the recommended limits in some areas. Some of these areas were

equipped with fan coil units, however a number of these units had been shut off during TRC's visit.

The CO, temperature and humidity measurements and VOC were within the recommended ranges.

The indoor concentrations for PM_{10} and $PM_{2.5}$ were below the reference values.

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

1. Perform an evaluation of the building envelope and perform repairs as needed to stop the water intrusion inside the 3rd floor and the basement space.

2. Remove water-damaged materials and perform necessary repairs.

3. Improve the quantity of outdoor air ventilation in areas where elevated CO_2 concentrations above recommended guidelines were noted.

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

Simona Holacsek, CIH
Senior Project Manager

Reviewed by:

Ann D. Eckmann

Ann D. Eckmann, CIH
Industrial Hygiene Group Leader

ATTACHMENT A
Direct Reading Measurements of the Basic IAQ Parameters

June 15, 2017 TRC Project 281272 Springfield Juvenile Court										
Location	**Time**	**Number of occupants**	**$PM_{2.5}$ mg/m3**	**PM_{10} mg/m^3**	**Temperature (f)**	**Rh**	**CO_2 ppm**	**CO ppm**	**TVOCs ppm**	**Comments**
Outdoors	*10:54*	*0*	*0.004*	*0.011*	*73.8*	*39.3*	*399*	*0.1*	*0.1*	
Third Floor										
3rd fl. Rm.323	12:30	0	0.001	0.008	74.1	39.9	938	0	0	Central HVAC & fan coil unit. Efflorescence at the top of the window, paint peeling
3rd fl. Rm. 324	12:36	0	0.001	0.002	73.6	42	976	0	0	Central HVAC only
3rd fl. Rm. 326	12:40	1	0.001	0.002	74.5	41.4	973	0	0	Central HVAC only. Slight perfume smell
3rd fl. Juvenile probation clerks cubicle area	12:42	7	0.002	0.004	75.6	39.1	1072	0	0	Central HVAC & fan coil units.
3rd fl. Rm. 347	12:46	1	0.001	0.006	75.5	39.2	979	0	0	Central HVAC & fan coil unit
3rd fl. Kitchen area	12:49	0	0.002	0.016	75.6	40.5	1055	0	0	Central HVAC only
3rd fl. Housing rm. 323	13:26	0	0.001	0.003	73.3	41.8	1037	0	0	Central HVAC & fan coil units
3rd fl. Chief housing, rm. 322	13:29	0	0.002	0.003	73.4	41.4	1085	0	0	Central HVAC and fan coil unit
3rd fl. Housing kitchen, rm. 307	13:32	4	0.001	0.004	73.6	43	1169	0	0	Central HVAC & a coil unit. Paint peeling on the wall
3rd fl. Conference rm. 303	13:36	0	0.001	0.002	74.1	39.3	1114	0	0	Fan coil unit only
3rd fl. Rm. 316	13:39	0	0.002	0.005	72.8	46.1	1029	0	0	Central HVAC only. Mostly file cabinets

June 15, 2017 TRC Project 281272 Springfield Juvenile Court										
Location	**Time**	**Number of occupants**	**$PM_{2.5}$ mg/m3**	**PM_{10} mg/m^3**	**Temperature (f)**	**Rh**	**CO_2 ppm**	**CO ppm**	**TVOCs ppm**	**Comments**
3rd fl. Rm. 305	13:43	1	0.001	0.003	74.3	45.1	1079	0	0	Central HVAC & fan coil units. Cracked & peeling paint along perimeter wall
3rd fl. Break rm. 319	13:46	0	0.001	0.003	75	44	1079	0	0	Central HVAC only
Second Floor										
2nd fl. Court rm.2	10:59	6	0.001	0.006	79.4	36.5	981	0.5	0	
2nd fl. Court rm.3	11:02	2	0.001	0.004	74.6	36.3	1025	0.1	0	
2nd fl. Juv. Court rm.1	11:08	2	0.001	0.024	73.7	41.3	779	0.1	0	
2nd fl. Housing court rm.1	11:12	18	0.001	0.008	74	45.2	831	0	0	
2nd fl. Housing court rm.2	11:17	4	0.001	0.002	73.4	48.1	1340	0.1	0.1	Heat pumps
202 Judges lobby	11:21	1	0.001	0.003	73.3	38.5	1304	0.1	0	Perfume odor
2nd fl. Information desk	11:24	10	0.001	0.021	74.1	45.5	1838	0.1	0	Steal smell, could detect difference in temp.
2nd fl. Housing jury rm. 208	11:27	11	0.001	0.021	74.9	42.5	1897	0.1	0	Carpet
2nd fl. Conference rm. 220	11:30	0	0.003	0.004	75	39.6	1508	0.1	0	
2nd fl. Stairwell outside rm.222	11:32	0	0.001	0.003	74.2	36.8	1170	0.3	0	
2nd fl. Judge rm.232	11:36	0	0.001	0.001	73.1	43.2	959	0	0	Fan coil unit & supply
2nd fl. Judicial dept. rm.240	11:41	2	0.001	0.009	72.9	45.3	1184	0	0	Door open
2nd fl. Jud. Dept. rm. 227	11:44	0	0.001	0.002	73.5	42	940	0	0	Central HVAC

June 15, 2017 TRC Project 281272 Springfield Juvenile Court										
Location	**Time**	**Number of occupants**	**$PM_{2.5}$ mg/m3**	**PM_{10} mg/m^3**	**Temperature (f)**	**Rh**	**CO_2 ppm**	**CO ppm**	**TVOCs ppm**	**Comments**
2nd fl. Judge's lobby 226	11:47	2	0.001	0.01	73.9	41.7	975	0	0	Central HVAC only
2nd fl. Judges lobby rm.223	11:50	0	0.001	0.003	74.2	40.8	952	0	0	Central HVAC & fan coil unit
2nd fl. Probation rm. 241	11:54	0	0.001	0.002	74.5	40	900	0	0	Slight paint smell
2nd fl. Copier area	11:56	0	0.001	0.002	74.3	40.2	929	0	0	Central HVAC only
2nd fl. Rm.250	11:58	1	0.003	0.01	74.4	36.4	973	0	0	HVAC & fain coils - folders stored on top of the grill
2nd fl. Rm. 249	12:02	0	0.001	0.003	74.7	40.9	990	0	0	Central HVAC & fan coil unit
2nd fl. Rm. 242	12:06	0	0.001	0.001	74.1	40.3	950	0	0	Central HVAC only
2nd fl. Room 251	12:08	0	0.001	0.004	74.3	41.7	1028	0	0	Central HVAC & fan. coils
2nd fl. Rm. 252	12:11	0	0.001	0.002	73.5	42.4	962	0	0	Central HVAC & fan coil
2nd fl. Rm. 245	12:12	0	0.001	0.002	73.3	41	957	0	0	Central HVAC only
2nd fl. Rm. 246	12:15	1	0.001	0.004	73.5	42.4	1074	0	0	Central HVAC only
2nd fl. Rm. 253	12:18	1	0.001	0.006	73.7	42.9	1049	0	0	Central HVAC & fan coil covered with folders. Plants in the room
2nd fl. 254	12:23	0	0.001	0.002	74.1	42	1002	0	0	Central HVAC & fan coil units
First Floor										
1st fl. Juv. Main lobby	12:54	2	0.002	0.004	76.3	33.8	1159	0	0	Central HVAC

June 15, 2017 TRC Project 281272 Springfield Juvenile Court										
Location	**Time**	**Number of occupants**	**$PM_{2.5}$ mg/m3**	**PM_{10} mg/m^3**	**Temperature (f)**	**Rh**	**CO_2 ppm**	**CO ppm**	**TVOCs ppm**	**Comments**
1st fl. Public waiting rm. 155	12:57	0	0.002	0.004	75.2	32.4	1040	0	0	Central HVAC & fan coil units
1st fl. Main area rm.151	13:01	2	0.002	0.025	74.6	33.9	1110	0	0	Central HVAC
1st fl. Main stairwell rm. 124	13:05	3	0.002	0.004	74.5	34.7	1120	0	0	No vents
1st fl. Juv. Clerks' rm. 132	13:08	6	0.002	0.008	74.4	34.2	1300	0	0	Central HVAC & fan coil units
1st fl. Rm. 144	13:13	0	0.001	0.002	72.3	34.4	1049	0	0	Central HVAC & fan coil units
1st fl. Rm. 138	13:16	0	0.001	0.003	72.3	35.2	1110	0	0	Central HVAC & fan coil units
1st fl. Housing clerk	13:20	7	0.001	0.005	72.7	35.2	1165	0	0	Central HVAC & fan coil units
1st fl. Rm.116	13:22	0	0.001	0.003	72	35.9	1145		0	Central HVAC & fan coil units
Basement										
Basement rm. B47	13:54	0	0.002	0.004	72.8	35	984	0	0	Central HVAC only. Efflorescence and paint peeling off the walls
Basement rm. B 58	13:58	0	0.001	0.005	71.4	42.6	1025	0	0	Central HVAC only. Paint peeling, file storage area
Basement, rm. B14	14:06	0	0.001	0.002	72.7	40.7	969	0	0	Central HVAC only. Paint peeling on walls
Basement rm. B11	14:14	4	0.002	0.004	72.3	43	1256	0	0.1	Central HVAC only
Basement probation rm. B21	14:21	1	0.001	0.003	71.9	41.1	1072	0	0	Central HVAC

June 15, 2017 TRC Project 281272 Springfield Juvenile Court										
Location	**Time**	**Number of occupants**	**$PM_{2.5}$ mg/m3**	**PM_{10} mg/m^3**	**Temperature (f)**	**Rh**	**CO_2 ppm**	**CO ppm**	**TVOCs ppm**	**Comments**
Basement, rm. B35	14:23	1	0.001	0.004	72.5	41.6	1106	0	0	Central HVAC & fan coil units
Basement, rm. B34	14:26	0	0.001	0.002	72.9	39.2	1038	0	0	Central HVAC & fan coil unit
Basement, rm. B27	14:28	0	0.001	0.003	72.9	40.1	1050	0	0	Central HVAC & fan coil
Basement holding cells desk area, outside B2	14:32	0	0.002	0.003	71.5	39	961	0	0	Central HVAC only
Basement holding cells desk area B61	14:35	2	0.001	0.002	70.3	36.4	978	0	0	Central HVAC only