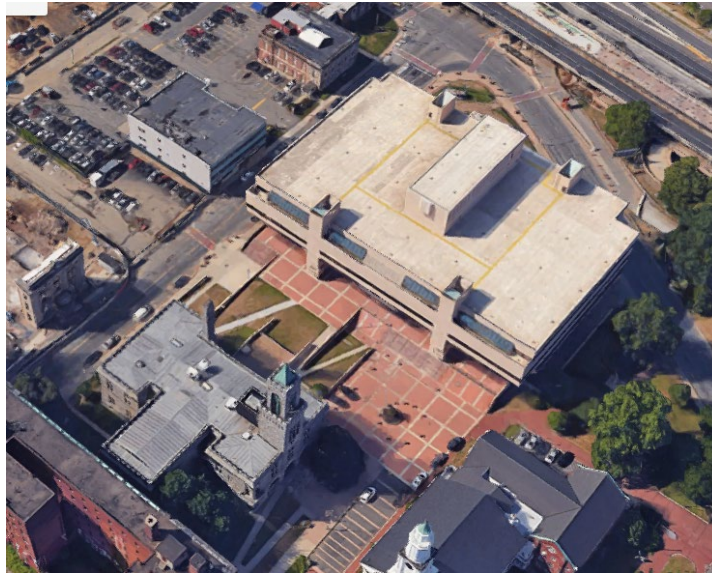


INDOOR AIR QUALITY ASSESSMENT

Springfield Court Complex

**Roderick Ireland Courthouse (50 State Street)
Section 1**

**Western Housing (37 Elm St) and Springfield Juvenile Courts (80 State St)
Section 2**



Prepared by:
Massachusetts Department of Public Health
Bureau of Environmental Health
Indoor Air Quality Program
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February 2019

Executive Summary

The MA Department of Public Health, Bureau of Environmental Health (BEH) was asked by the Administrative Office of the Trial Court (AOTC) to assess indoor environmental conditions at the Springfield Court Complex. The complex consists of the Roderick Ireland Courthouse and the building that contains the Western Housing Court and the Springfield Juvenile Court. The complex is located in downtown Springfield, MA. BEH conducted these building assessments on October 26, October 29, and November 2, 2018.

BEH followed its standard protocol for conducting indoor air quality assessments in public buildings and also conducted air sampling for mercury throughout both buildings. Mercury air sampling was added due to concerns expressed by some court staff regarding potential workplace exposure to mercury vapor and perceived links to amyotrophic lateral sclerosis (ALS). On October 26 and 29, IAQ staff took 228 measurements for mercury vapor at locations within the Roderick Ireland Courthouse. On October 29 and November 2, IAQ staff took 109 measurements at the Western Housing Court and Springfield Juvenile Court building.

BEH evaluated the mercury vapor measurements by comparing them to the federal Agency for Toxic Substances and Disease Registry's (ATSDR) health-based screening level for mercury for schools and commercial buildings. Mercury is not known to be associated with ALS. Although researchers continue to study environmental factors and genetic susceptibility, the causes of ALS remain largely unknown.

The assessment of indoor air quality in the **Roderick Ireland Courthouse** found the following:

- Measured mercury levels were consistent with outdoor background levels.
- No source of mercury was discovered within the building.
- The HVAC system components are beyond their expected service life. An inefficient HVAC system can contribute to respiratory irritation and symptoms in building occupants.
- Due to inadequate HVAC system filters, the building is likely impacted by vehicle exhaust pollutants from I-91 and other vehicle traffic.

The assessment of indoor air quality in the **Western Housing and Springfield Juvenile Court** building found the following:

- Mercury vapor measurements in the Western Housing and Springfield Juvenile Court were found to be higher than outdoor levels, indicating that a source existed in the building.
 - The highest concentration of mercury vapor was traced to a holding cell (Room B39 Cell B1) in the basement. The holding cell was padded with a rubberized material thought to be a likely mercury vapor source.
 - Mercury vapor from the rubberized padding appeared to be migrating to upper floors via both the nearby elevator shaft and the HVAC system.
 - With the exception of the padded holding cell area, the mercury levels measured in the air in the remainder of the building were all below the screening level.

- Levels measured in the padded holding cell exceeded the screening level for schools and commercial buildings, indicating the need for follow-up and remediation.
 - Note: The screening level for schools and commercial buildings incorporates conservative (that is, health protective) assumptions. Short-term exposure in the padded cell would not be expected to pose a health risk for transient occupants since the duration of exposure would be significantly less than in a school or commercial setting.
- Levels measured in other basement areas were below the screening level.
- On November 6, 2018, BEH recommended follow-up mercury sampling by the AOTC's environmental consultant, Environmental Health & Engineering (EH&E), to determine if the materials were a source of mercury vapor, and if so, to conduct proper remediation and follow-up testing.
 - EH&E confirmed that the rubberized padding and underlying plywood walls were sources of mercury vapor and began remediation. On November 9, 2018, AOTC staff and EH&E completed the remediation in Room B39 Cell B1.
 - After the materials were removed, EH&E reported that air sampling indicated that mercury vapor levels inside holding cell B1 and in areas directly outside EH&E's work area were below the screening level, demonstrating the rubberized material was the source of mercury vapor and its successful removal.
- With respect to general indoor air quality findings, BEH made a number of recommendations that will improve indoor air quality at the Western Housing and Springfield Juvenile Court. These range from repairs and maintenance of the heating, ventilation and air conditioning (HVAC) system to replacing worn-out carpeting and damaged ceiling tiles. Please see the full report for the list of short- and long-term recommendations.
- Based on joint federal guidance from the US EPA and the Agency for Toxic Substances and Disease Registry, the highest level of mercury vapor measured in the Western Housing and Springfield Juvenile Court would not be distinguishable from background mercury levels, even with sustained employee exposure. Therefore, the use of biomonitoring to evaluate employee exposure at the HJC will not be informative.

This document contains two sections that follow with full reports on BEH's indoor air quality assessments:

- Section 1: Indoor Air Quality Assessment of the Roderick Ireland Courthouse, including mercury vapor sampling results
- Section 2: Indoor Air Quality Assessment of the Western Housing Court/Springfield Juvenile Court, including mercury vapor sampling results

Section 1

Roderick Ireland Courthouse



Roderick Ireland Courthouse Summary

The MA Department of Public Health, Bureau of Environmental Health (BEH) Indoor Air Quality (IAQ) Program was asked by the Administrative Office of the Trial Court (AOTC) to assess indoor environmental conditions within the Roderick Ireland Courthouse (RIC) located in downtown Springfield, MA. BEH/IAQ staff visited the RIC on October 26 and 29, 2018. BEH/IAQ followed its standard protocol for assessing indoor air quality in public buildings and also conducted air sampling for mercury vapor in 228 locations in the RIC. Mercury sampling was done due to staff concerns regarding potential exposure to mercury vapor and perceived links with the development of Amyotrophic Lateral Sclerosis (ALS).

The assessment of indoor air quality in the Roderick Ireland Courthouse found the following:

- No levels of mercury vapor above outdoor ambient levels were measured in the building.
- No source of mercury was discovered within the building.
- The heating, ventilation and air conditioning (HVAC) system components are beyond their expected service life due to their age and apparent lack of routine maintenance prior to 1999 (when the building was managed by Hampden County).
- Due to inadequate HVAC system filters, the building is likely impacted by vehicle exhaust pollutants due to its close proximity to I-91 and to other vehicle traffic.

A number of short- and long-term recommendations are made that would improve general indoor air quality at the Roderick Ireland Courthouse.

Background

Building:	Roderick Ireland Courthouse (RIC)
Address:	50 State Street, Springfield, MA
Reason for Request:	Staff concerns related to possible mercury vapor exposure and perceived links to the development of amyotrophic lateral sclerosis (ALS), as well as general IAQ concerns
Date(s) of Assessment:	October 26 and 29, 2018
Massachusetts Department of Public Health/Bureau of Environmental Health (MDPH/BEH) Staff Conducting Assessment:	Michael Feeney, Director, IAQ Program; Cory Holmes and Jason Dustin, Environmental Analysts IAQ Program
Building Description:	The court complex is a four-story, tiered, cement and steel frame building constructed in 1973 as an energy efficient facility. It contains courtrooms, waiting rooms, offices and a lockup area.
Building Population:	Approximately 200 employees and several hundred visitors daily
Windows:	Openable in some areas

The RIC (formerly the Hall of Justice) is located at the corner formed by State, East Columbia, and Court Streets. Approximately 200 feet to the west of the RIC is an elevated portion of Interstate 91 (I-91), which is half the height of the building (Picture 1). The RIC shares an underground parking lot with the Western Housing Court/Springfield Juvenile Court [Housing and Juvenile Courts (HJC)] building (Picture 2) to form the Springfield Court Complex. On October 26 and October 29, 2018, IAQ staff conducted a general indoor air quality assessment of the RIC (and the HJC buildings) following its standard protocol for assessing indoor air quality in public buildings. In addition, IAQ staff conducted air sampling for mercury vapor due to staff concerns regarding potential exposure to mercury vapor and perceived links to ALS. The results for the RIC are the subject of this report. (Section 2 is a report on the HJC indoor air quality assessment.).

The IAQ Program has visited the building several times over the years, and conducted a full evaluation most recently in 2006. A summary of the recommendations in the 2006 report is

included as Appendix A and the full 2006 report can be found at <https://www.mass.gov/info-details/indoor-air-quality-reports-cities-and-towns-s#springfield->.

The configuration of the building structure, window systems, and heating, ventilating and air-conditioning (HVAC) equipment have not changed since the 2006 IAQ assessment. On June 16, 2017, IAQ staff also visited the RIC to examine the interior of HVAC equipment in Room 204. Photos taken during that visit are included as Pictures 6 through 10 to depict likely representative conditions of unrepaired fan coil units (FCUs) located throughout the RIC.

During this assessment, building occupants reported a number of symptoms to IAQ staff, including respiratory irritation, lethargy, tiredness, and eye irritation. As stated earlier, concerns were also raised regarding the possible presence of mercury in the RIC and exposure playing a role in the development of chronic diseases, including Amyotrophic Lateral Sclerosis (ALS).

Previous Relevant Environmental History

A search of the Massachusetts Department of Environmental Protection's (MassDEP) hazardous waste sites database did not show any open or closed waste sites on the subject property.

Methods

Please refer to the BEH IAQ Manual for methods, sampling procedures, and interpretation of results (<https://www.mass.gov/lists/indoor-air-quality-manual-and-appendices#indoor-air-quality-manual->). Air testing for mercury vapor was conducted using a Lumex Mercury analyzer RA-915+. Mercury vapor air samples were taken within the breathing zone (approximately 3' above the floor¹).

IAQ Testing Results

The following is a summary of indoor air testing results (see Table 1 for the 10/26/18 visit and Table 2 for the 10/29/18 visit):

- **Carbon dioxide** levels were below the MDPH guideline of 800 parts per million (ppm) in all areas surveyed, indicating adequate air exchange for the population in the building at the time of assessment.
- **Temperature** was within or close to the MDPH recommended range of 70°F to 78°F in all areas tested.
- **Relative humidity** was generally *below* the MDPH recommended range of 40 to 60% at the time of assessment.
- **Carbon monoxide** levels were non-detectable (ND) in all areas tested.

¹ This is the height where people would be sitting and likely spending more time than standing.

- *Fine particulate matter (PM2.5)* concentrations measured were below the National Ambient Air Quality Standard (NAAQS) limit of 35 µg/m³ in all areas tested.
- *Total Volatile Organic Compounds (TVOC)* were non-detect (ND) in areas tested.
- *Mercury Vapor* levels were below outdoor ambient levels in all areas tested (Table 3).

Ventilation

An HVAC system has several functions. First it provides heating and, if equipped, cooling. Second, it is a source of fresh air. Finally, an HVAC system will dilute and remove normally occurring indoor environmental pollutants by not only introducing fresh air, but by filtering the airstream and ejecting stale air to the outdoors via exhaust ventilation. Even if an HVAC system is operating as designed, point sources of respiratory irritation may exist and cause symptoms in sensitive individuals

Fresh air intakes are located in a variety of areas, including the rooftop penthouse and at ground level (Picture 3). Fresh air is supplied by ceiling- or wall-mounted fresh air supply vents (Picture 4). Each area adjacent to windows is equipped with fan coil units (FCUs) (Picture 5). The FCUs are used for recirculating as well as heating and cooling air and are not a source of fresh air.

The HVAC system in the RIC is approximately 45 years old. Efficient function of equipment of this age is difficult to maintain and/or balance because compatible replacement parts are often unavailable. According to the American Society of Heating, Refrigeration and Air-Conditioning Engineering (ASHRAE), the service life² for the various components of the HVAC system is between 20 to 30 years (Table 4), assuming routine maintenance of the equipment (ASHRAE, 1991). Despite attempts to maintain the equipment, the optimal operational lifespan of this equipment has been exceeded. Due to its age, rebalancing the HVAC system would prove to be difficult.

The Condition of the FCU System

As previously mentioned, during the June 16, 2017 visit, the FCU in Room 204 was opened and examined. Pictures 6 through 10 show the condition of the interior of the FCU in Room 204 and would be expected to be representative of conditions of other FCUs in the building that have not been repaired. Since the 2017 visit, court facilities staff have reportedly repaired the interior of 30% of the FCUs. Operation of FCUs during hot, humid weather creates a significant source of water that can cause damage to building components. FCUs with cooling capacity are equipped with drip pans that drain condensation. The pan is located beneath the cooling coils and empties

² The service life is the median time during which a particular system or component of ...[an HVAC]... system remains in its original service application and then is replaced. Replacement may occur for any reason, including, but not limited to, failure, general obsolescence, reduced reliability, excessive maintenance cost, and changed system requirements due to such influences as building characteristics or energy prices (ASHRAE, 1991).

into a condensation collector, which is connected to a plastic drainage hose within the pipe chase. The following FCU conditions were noted during the 2017 and 2018 visits:

- The FCU configuration makes accessing drip pans labor intensive. IAQ staff could not examine the drip pans of FCUs since it would necessitate disassembly of the FCU. Considering this difficulty, it is unlikely that the drip pan or coils of each FCU are cleaned routinely.
- The condensation collectors were uniformly coated with scale (Picture 6). Scale refers to metal corrosion and mineral deposits that can occur when standing water remains in drip pans or on coils. Standing water can cause metal corrosion. As water evaporates over time, mineral and debris can coat the drip pans, coils, and pipes. This can lead to odors, microbial growth, and inefficient operation.
- The FCU motor cover, flexible steel electric conduit, and the underside of the drip pan were corroded (Picture 7).
- Fiberglass insulation appears to have been moistened through contact with an uninsulated copper pipe (Picture 8). This pipe appears to be connected to the drip pan collector. Uninsulated pipes can generate condensation and cause water damage to adjacent materials that can support mold growth, such as the paper on insulation.
- The insulation on the FCU cover is damaged (Picture 9).

Water damage caused by the conditions described above has impacted materials on or adjacent to FCUs.

Due to design, likely lack of routine maintenance before 1999 (when the building was under previous management), and equipment deterioration, it is likely that the FCUs may be a source of microbial growth and airborne pollutants when operating. These conditions would be more prominent when the FCUs are in cooling mode.

The FCUs use a filter medium that is not cut to size (Picture 10), which makes it difficult to get a tight fit. This filter material also appears to provide minimal filtration. MDPH recommends filters of a Minimum Efficiency Reporting Value (MERV) of 8, which is adequate in filtering out pollen and mold spores (ASHRAE, 2012). Filters should fit flush in the cabinets without spaces for air to go around the filter. Court facilities staff reported that the use of cut-to-size filter media has been discontinued and replaced with a different type of filter media.

Dust and debris was noted on flat surfaces, particularly on ceiling tiles around fresh air supply vents (Pictures 4, 11 and 12; Table 1). The location of the RIC may entrain vehicle exhaust from I-91 and/or idling from State Street traffic under certain wind conditions, which would not be filtered by poorly fitted filters. The levels of vehicle-related pollutants in the RIC would be expected to vary depending on time of day, local meteorological conditions, and other variables. To reduce vehicle exhaust pollutant entrainment, a further upgrade of filters on fresh air supplies may be necessary. Lack of appropriate filtration would likely account for the dust and debris on

flat surfaces reported by building occupants. Vehicle exhaust from nearby highways may have a detrimental effect on building occupants:

...[W]orking near highways and major roads may have greater exposure to vehicle exhaust. According to the US EPA (2014), pollutants from vehicles are generally higher within 600 feet of the road. Pollutants emitted directly from vehicle tailpipes include particulate matter, carbon monoxide, nitrogen oxides, and ozone. At distances beyond 600 feet, pollutants decrease to background levels. Pollutant concentrations may be higher in the morning when lower wind conditions result in poorer dispersion of these pollutants. Wind speed and direction can also influence concentration of pollutants. Research shows that children, people with pre-existing cardiopulmonary disease, and older adults are often at higher risk for adverse health impacts, including asthma onset and aggravation, reduced lung function, cardiovascular disease, and pre-term and low-birthweight infants, and impaired lung development in children (US EPA, 2014).

As noted previously, the RIC is within 600 feet of I-91 and has a ground-level fresh air intake at the corner of East Columbia and State Streets. In addition, the newly opened MGM Casino located across from the RIC would be expected to increase traffic along State Street, increasing vehicle exhaust concentrations at ground level. Based on these observations, it is likely that vehicle exhaust from surrounding traffic is being entrained in the RIC HVAC system.

It is recommended that HVAC systems be re-balanced every five years to ensure adequate air systems function (SMACNA, 1994). It was unknown when the last time these systems had been balanced.

Relative Humidity

The relative humidity readings were below the MDPH recommended comfort range the first day of the assessment in all areas tested. The MDPH recommends a comfort range of 40 to 60 percent for indoor air relative humidity. Relative humidity in the building would be expected to drop during the winter months due to heating. The sensation of dryness and irritation is common in a low relative humidity environment. “Extremely low (below 20%) relative humidity may be associated with eye irritation [and]...may affect the mucous membranes of individuals with bronchial constriction, rhinitis, or cold and influenza related symptoms” (Arundel et al., 1986). Low relative humidity is a common problem during the heating season in the northeast part of the United States. According to the court facility management, the RIC HVAC system was originally equipped with a humidification system which is no longer in use. HVAC system humidification systems are not recommended for office buildings since these types of systems require consistent monitoring and can aerosolize minerals and water treatment chemicals into the HVAC system.

Microbial/Moisture Concerns

Water-damaged ceiling tiles were observed in a number of areas (Pictures 13 and 14; Table 1), which may be evidence of current/historic leaks of the roof or plumbing system. Ceiling tiles are porous and may be a source of microbial growth if they are exposed to chronic moisture. These ceiling tiles should be replaced once leaks are found and repaired.

Some water-damaged plaster walls and plaster ceilings were observed. Plaster ceilings and walls are generally not susceptible to mold growth. Some walls were noted to have efflorescence. Efflorescence is a characteristic sign of water damage, but it is not mold growth. As moisture penetrates and works its way through porous building materials (e.g., brick, plaster, and cement), water-soluble compounds in the material dissolve, creating a solution. As this solution moves to the surface of the material, the water evaporates, leaving behind white, powdery mineral deposits.

BEH/IAQ staff noted that several areas of carpeting in the RIC were soiled and or water-damaged. Chronic water damage of carpeting may result in microbial growth in the carpeting. Carpeting is generally not recommended in areas prone to chronic moisture and/or condensation (e.g., basement areas).

As noted above, some FCUs were reported to have chronic leaks or condensation issues. In addition, it was reported that the FCU cabinets and drip pans have not been cleaned regularly for some time and a buildup of dust/debris has occurred. Lack of FCU cabinet cleanliness and chronic moisture may result in microbial growth as well as water damage of surrounding porous building materials. It was reported that RIC facilities personnel have begun the process of cleaning and repairing these units and their drip pans.

Plants and flowers were observed in some areas (Picture 15; Tables 1 and 2). Plants/flowers can be a source of pollen and mold, which can be respiratory irritants to some individuals. Plants should be properly maintained and equipped with drip pans and should be located away from airflow to prevent the aerosolization of dirt, pollen, and mold. Water leaking from plant pots, as shown in Picture 15, can be a source of water damage to building materials.

BEH/IAQ staff noted a number of window gaskets that appeared to be in disrepair. This condition may allow water infiltration/damage to porous building materials or stored items in these areas.

Other Concerns

General Conditions

Exposure to low levels of total volatile organic compounds (TVOCs) may produce eye, nose, throat, and/or respiratory irritation in some sensitive individuals. In addition to testing for TVOCs, BEH/IAQ staff examined spaces for products containing VOCs. BEH/IAQ staff noted air fresheners, hand sanitizers, cleaning products, dry erase materials and a scent diffuser in the office space (Tables 1 and 2). At the time of the testing, TVOCs were not detected. All of these products have the potential to be irritants to the eyes, nose, throat, and respiratory system of sensitive individuals.

Food and food preparation equipment were observed in some offices and common areas. Food should be kept tightly sealed to prevent pest access and food preparation equipment should be kept clean to prevent smoke, odors and pests.

Items were observed on flat surfaces, such as windowsills, tabletops, counters, bookcases, and desks. Items, including boxes, were also stored on the floor. Items stored in offices provide a location for dusts to accumulate. These items also make it difficult for custodial staff to clean. Items should be relocated and/or be cleaned periodically to avoid excessive dust build-up.

In a few areas, ceiling tiles were missing or ajar/damaged (Table 1), which can allow dust and debris from above the ceiling tiles into occupied spaces. Ceiling tiles should be flush in the ceiling tile grid.

Carpeting

The offices were mostly carpeted. The usable life of carpeting is approximately 10-11 years (IICRC, 2002). Older carpeting cannot be adequately cleaned and may become a source of particulates and odors. Replacement of old carpeting should be considered. Carpets should be cleaned annually (or semi-annually in soiled/high traffic areas) in accordance with Institute of Inspection, Cleaning and Restoration Certification (IICRC) recommendations, (IICRC, 2012).

Lighting

IAQ staff noted that many work spaces appeared to be significantly darker than other work areas in the building. The American National Standard Institute (ANSI) recommends 30–100 foot-candles (300-1,000 lux). Increasing lighting would likely serve to alleviate/reduce symptoms reported in these work areas. Low-light conditions are associated with headaches, tired eyes, and/or irritation (NIOSH, 1998). Lack of light has also been associated with seasonal affective disorder, which among its symptoms is excessive tiredness (NMHA, 2006).

Mercury Vapor Sampling

Mercury occurs naturally in the environment and can be expected to be found at low levels in air. Mercury (Hg) is a naturally occurring metal that has several forms. Elemental mercury (also known as metallic mercury) is a shiny, silver-white, odorless liquid at room temperature. When heated, it forms a colorless, odorless vapor. When elemental mercury is spilled or a device containing mercury breaks, the spilled mercury can vaporize. Exposure to elemental mercury primarily occurs by inhaling mercury vapors that are released into air. Although elemental mercury is not readily absorbed by the skin or stomach, people can also be exposed to elemental mercury vapors when mercury is handled.

Sources of mercury in buildings can typically include exhaust from vehicles/furnaces and broken mercury-containing items such as fluorescent light bulbs, thermometers, thermostats, barometers and sphygmomanometers (blood pressure cuffs).

During the assessment, IAQ staff examined areas throughout the RIC and could not visually identify possible sources of mercury (e.g. broken mercury-containing fluorescent light bulbs) in areas sampled.

The background level of mercury outside the RIC was measured at 0.019 $\mu\text{g}/\text{m}^3$. **Indoor mercury levels were all below background and ranged from 0.002 to 0.016 $\mu\text{g}/\text{m}^3$.**

Concerns regarding ALS

Despite concerted scientific efforts and ongoing public interest, the causes of ALS remain largely unknown. Approximately 90% of ALS cases occur sporadically, while the rest are linked to heritable factors and family history of the disease. Researchers continue to study environmental factors, genetic susceptibility, and the interplay between the two in the hope of understanding why some people develop ALS but not others.

Over the past 20 years, discoveries of more than a dozen gene mutations have helped explain the genetic etiology of some ALS cases. Mutations in genes (such as SOD1 and C9ORF72) account for up to 60% of familial and 9% of sporadic cases. Scientists believe that advances in genome sequencing efforts and technology will lead to the discovery of even more ALS-linked genes, and consequently, a better understanding of the disease pathways that cause ALS.

Identifying environmental causes or risk factors has proven to be challenging due to a number of factors including the number of possible exposures and the unknown length of time from exposure to disease onset. A few studies have found that exposures to heavy metals and cyanobacteria-produced toxins are higher among ALS cases than controls, but more research is needed to yield conclusive findings. Occupational exposures, such as to pesticides and electromagnetic fields, and head injury or trauma sustained by sports players have also appeared to increase risk for ALS. However, no conclusive links have been established. Military service is one occupation with an association to ALS strongly supported by evidence – veterans are 1.5 to 2 times more likely to be diagnosed with ALS than non-veterans. Researchers suspect that the intense physical activity, lifestyle factors such as tobacco use, exposure to toxins, or a combination of these factors might help explain this increased risk.

Epidemiologic studies have consistently found that men, Caucasians, and individuals between the ages of 55 and 75 are more likely to develop ALS. In Massachusetts, the ALS Registry collects yearly reports of patients treated for or diagnosed with ALS in order to document and evaluate demographic and geographic patterns in the Commonwealth. To date, findings of the incidence of ALS in Massachusetts (estimated at 2.2 cases per 100,000 people) have been consistent with other estimates in the scientific literature and, while analyses are limited, no statistically significant geographic differences in ALS incidence have been observed. With additional years of ALS surveillance data, the Registry will be able to produce more robust analyses of disease patterns across the state. In the meantime, the latest Massachusetts ALS data brief, based on ALS reporting from 2007-2011, can be found on the Registry's website at <http://www.mass.gov/dph/als>.

Conclusions/Recommendations

Based on observations made at the time of assessment, no source of mercury vapor could be identified in the RIC.

The indoor air quality conditions at the RIC are complex and interconnected. The RIC has a number of conditions that can adversely affect IAQ, including: the location near I-91 and other vehicle exhaust sources; the age and function of the HVAC system; the location of HVAC fresh air intakes; lack of appropriate filtration for HVAC equipment; and other conditions noted in the assessment. The IAQ Program made a number of recommendations in the 2006 assessment related to improving IAQ, which included capital improvements to the RIC (Appendix A).

While some problems can be addressed as soon as practicable, others will require planning and resources. For this reason, a two-phase approach consisting of *short-term* measures to improve air quality and *long-term* measures to address overall IAQ concerns is proposed.

Short-Term Recommendations

1. Implement recommendations made in the 2006 IAQ assessment (Appendix A), if not already completed.
2. Have an IAQ consultant analyze accumulated dust on vents/ceiling tiles to determine the origin of the black dust/debris/soot.
3. Have an IAQ consultant replicate the mercury vapor analysis throughout the RIC to confirm the IAQ Program analysis using a device of similar sensitivity as a Lumex Mercury Vapor Analyzer.
4. Have an occupational health or lighting consultant conduct an adequacy of lighting study at each workstation throughout the RIC.
5. Have an environmental consultant further research the history of land use of the RIC parcel, given staff concerns and questions on historical use of the property.
6. Balance the HVAC system every 5 years in accordance with Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) recommendations (SMACNA, 1994).
7. Repair any leaks in FCUs and inspect plumbing for adequate insulation to avoid condensation issues.
8. Clean FCU cabinets and drip pans on a regular basis.
9. Clean supply/return and exhaust vents regularly. If vents cannot be adequately cleaned, replace vents.
10. Replace all soiled/stained ceiling tiles.
11. Repair leaks and replace water-damaged ceiling tiles.
12. Review the ceiling tile grid to ensure it is complete and that tiles are flush with the grid.
13. Replace worn-out carpeting in the building, prioritizing areas that have been water-damaged. When carpeting is replaced, carpet squares should be used to allow for easier replacement of small sections if they get damaged. Refrain from installing carpet below grade or in other areas prone to chronic moisture.
14. Clean carpeting annually or semi-annually in high-traffic areas, in accordance with IICRC recommendations (IICRC, 2012)
15. Repair window gaskets to prevent water infiltration during driving rain events.
16. Repair plaster walls/ceilings following the repair of associated leaks.
17. Maintain plants and flowers properly to prevent water damage and odors.
18. Minimize use of products containing VOCs.

19. Keep food in tightly-sealed containers and keep food preparation equipment clean to prevent odors and pests.
20. Store items neatly and move periodically to allow for cleaning/dust removal.
21. Refer to resource manual and other related IAQ documents located on the MDPH's website for advice on maintaining public buildings. These documents are available at: <http://mass.gov/dph/iaq>.

Long-Term Recommendations

1. Have a building/ventilation engineer assess the adequacy of HVAC system filters given the close proximity to I-91 and other roadways. Improve filtration if feasible given the age of the HVAC system.
2. Have a building/ventilation engineer examine each of the HVAC system components listed in Table 4. The engineer should make recommendations regarding condition, adequacy of HVAC system function and control, as well as feasibility of replacement or repair.
3. Consult with a building envelope specialist regarding repair/replacement of windows and roof components to prevent leaks and increase thermal comfort.

Section 2

Western Housing Court and Springfield Juvenile Court



Western Housing Court/Springfield Juvenile Court Summary

The MA Department of Public Health, Bureau of Environmental Health (BEH) Indoor Air Quality (IAQ) Program was asked to assess indoor environmental conditions within the Western Housing Court/Springfield Juvenile Court building (HJC) located in downtown Springfield, MA. BEH/IAQ staff visited the HJC on October 29 and November 2, 2018. In addition to following its standard protocol for assessing indoor air quality in public buildings, the BEH/IAQ Program conducted air sampling for mercury vapor. At HJC, IAQ staff took 109 measurements over the course of two days. Mercury sampling was done due to staff concerns regarding potential exposure to mercury vapor and perceived links with the development of Amyotrophic Lateral Sclerosis (ALS).

BEH evaluated the mercury vapor measurements by comparing them to the federal Agency for Toxic Substances and Disease Registry's (ATSDR) health-based screening level for mercury for schools and commercial buildings.

The assessment of indoor air quality in the HJC found the following:

- Mercury vapor sampling in the Western Housing and Springfield Juvenile Court was found to be higher than outdoor levels, indicating that a source existed in the building.
 - The highest concentration of mercury vapor was traced to a holding cell (Room B39 Cell B1) in the basement. The holding cell was padded with a rubberized material thought to be a likely mercury vapor source.
 - Mercury vapor from the rubberized padding appeared to be migrating to upper floors via both the nearby elevator shaft and the HVAC system.
 - With the exception of the padded holding cell area, the mercury levels measured in the air in the remainder of the building were all below the screening level.
 - Levels measured in the padded holding cell area exceeded the screening level, indicating the need for follow-up and remediation.
 - The screening level for schools and commercial buildings incorporates conservative (that is, health protective) assumptions. Short-term exposure in the padded cell would not be expected to pose a health risk for transient occupants since the duration of exposure would be significantly less than in a school or commercial setting.
 - For the other basement areas tested, the measured levels were below the screening level.
 - On November 6, 2018, BEH recommended follow-up mercury sampling by the AOTC's environmental consultant, Environmental Health & Engineering (EH&E), to determine if the materials were a source of mercury vapor, and if so, to conduct proper remediation and follow-up testing.
 - EH&E confirmed that the rubberized padding and underlying plywood walls were sources of mercury vapor. On November 9, 2018, AOTC staff and EH&E completed the remediation in Room B39 Cell B1.

- After the materials were removed, EH&E reported that air sampling found that mercury vapor levels inside holding cell B1 and in areas directly outside EH&E's work area were below the screening level, demonstrating that the rubberized material was the source of mercury vapor in the Western Housing and Springfield Juvenile Court building and that it was successfully removed.
- With respect to general indoor air quality findings, BEH made a number of recommendations that will improve general indoor air quality at the Western Housing and Springfield Juvenile Court. These range from repairs and maintenance of the heating, ventilation and air conditioning (HVAC) system to replacing worn-out carpeting and damaged ceiling tiles. Please see below for the list of short- and long-term recommendations.
- Based on joint federal guidance from the US EPA and the Agency for Toxic Substances and Disease Registry, the highest level of mercury vapor measured in the Western Housing and Springfield Juvenile Court would not be distinguishable from background mercury levels, even with sustained employee exposure. Therefore, the use of biomonitoring to evaluate employee exposure at the HJC will not be informative.

Background

Building:	Western Housing Court/Springfield Juvenile Court (HJC)
Address:	37 Elm Street/80 State Street, Springfield
Reason for Request:	Staff concerns related to possible mercury vapor exposure and perceived links to the development of amyotrophic lateral sclerosis (ALS), as well as general indoor air quality (IAQ) concerns
Date(s) of Assessment:	October 29 and November 2, 2018
Massachusetts Department of Public Health/Bureau of Environmental Health (MDPH/BEH) Staff Conducting Assessment:	Michael Feeney, Director, IAQ Program; Cory Holmes and Jason Dustin, Environmental Analysts of the IAQ Program
Building Description:	The HJC was constructed in the 1880s with an addition added in 1912.
Building Population:	Approximately 100 employees and several hundred visitors daily
Windows:	Openable in some areas

The Western Housing Court/Springfield Juvenile Court (HJC) is in a building complex with the Roderick Ireland Courthouse (RIC) (formerly the Hall of Justice) located at the corner formed by State, East Columbia, and Court Streets. The HJC shares an underground parking lot with the RIC to form the Springfield Court Complex. On October 29, 2018, IAQ staff conducted a general IAQ assessment of the RIC and the HJC buildings following its standard protocol for assessing indoor air quality in public buildings. In addition, IAQ staff conducted air sampling for airborne mercury vapor due to staff concerns regarding potential exposure to mercury vapor and perceived links to ALS. The IAQ Program returned to the HJC to conduct a second round of mercury sampling on November 2, 2018. The results for the HJC are the subject of this assessment. (Section 1 is a report on the RIC indoor air quality assessment.)

Methods

Please refer to the BEH IAQ Manual for methods, sampling procedures, and interpretation of results (<https://www.mass.gov/lists/indoor-air-quality-manual-and-appendices#indoor-air-quality-manual>). Air testing for mercury vapor was conducted using a Lumex Mercury analyzer

RA-915+. Mercury vapor air samples were taken within the breathing zone (approximately 3' above the floor³).

IAQ Testing Results

The following is a summary of indoor air testing results in the Western Housing Court/Springfield Juvenile Court (Table 1):

- **Carbon dioxide** levels were above the MDPH guideline of 800 parts per million (ppm) in over eighty percent of the areas surveyed, indicating a lack of adequate air exchange in the majority of the building at the time of assessment.
- **Temperature** was within the recommended range of 70°F to 78°F in most areas tested.
- **Relative humidity** was within or close to the recommended range of 40 to 60%.
- **Carbon monoxide** levels were non-detectable (ND) in all areas tested.
- **Fine particulate matter (PM_{2.5})** concentrations measured were below the National Ambient Air Quality Standard (NAAQS) limit of 35 µg/m³ in all areas tested, except rooms 135 and 307. Room 135 was having its floor cleaned during testing. Room 307 is a break room/kitchen, which had burning toast at the time of sampling.
- **Total Volatile Organic Compounds (TVOC)** were not detected in any areas tested except for Room 135. Cleaning materials containing TVOCs were being used in this room.
- **Mercury Vapor** levels were above outdoor ambient levels on both days in all areas tested (Tables 2 and 3).

Mercury Vapor

Background levels of mercury outside the HJC were measured in the range of 0.016 -0.019 µg/m³ on October 29, 2018. On November 2, 2018, the outdoor mercury level was 0.007 µg/m³. Indoor mercury levels were above outdoor measurements in all areas on both days, ranging from 0.024 to 3.22 µg/m³ on October 29th and 0.112 to 6.378 µg/m³ on November 2nd.

The highest reading measured was within a padded holding cell (B1) in Room B39 in the basement (Pictures 1 through 3). The padding appeared to be rubberized and was thought to be the possible source of mercury in the indoor air. Some polyurethane or rubber-like floorings manufactured from about 1960 to 1980 contain mercuric acetate. These floors are most often found in sports settings (e.g., gymnasiums, running tracks) but also can be found in industrial plants and hospitals, wherever a cushioned, all-weather, non-slip surface is needed. Some of

³ This is the height where people would be sitting and likely spending more time than standing.

these floors can release significant amounts of mercury vapor into the air, which can in turn be absorbed and re-emitted by furnishings and equipment (EH&E, 2018).

The mercury vapor may have been able to migrate into other parts of the building through a number of pathways, including the following:

- B39 is adjacent to the elevator that services all floors of the building (Picture 4). It is likely that mercury vapor enters the elevator shaft from the hallway and then travels upwards as the elevator moves.
- Elevated levels could be assumed in the elevator machine room B59, which contains an elevator pressurization equalization vent (Picture 5). B59 was not accessible during the site visit. However, B59 shares a wall with B39 cell B1. It is possible that mercury vapor has diffused through the shared wall and is drawn into the elevator shaft.
- Plans indicate that B39 has an air handling unit (AHU), HP1, located in Room B46. HP1 provides ventilation for B39 and for other basement areas as well as the first floor rooms 122 through 155.
- B46 also contains a 2nd AHU (HP2) that services rooms 119, 120, and 121 on the first floor. It is feasible that HP2 is drawing mercury vapor from HP1.

In all of these scenarios, it was considered highly likely that an elevated mercury vapor source was present in B39 B1. As noted above, this source was subsequently removed and mercury vapor levels were significantly reduced to below the screening level.

Mercury occurs naturally in the environment and can be found at low levels in air. Mercury (Hg) is a naturally occurring metal that has several forms. Elemental mercury (also known as metallic mercury) is a shiny, silver-white, odorless liquid at room temperature. When heated, it forms a colorless, odorless vapor. When elemental mercury is spilled or a device containing mercury breaks, the spilled mercury can vaporize. Exposure to elemental mercury primarily occurs by inhaling mercury vapors that are released into air. Although elemental mercury is not readily absorbed by the skin or stomach, people can also be exposed to elemental mercury vapors when mercury is handled.

Sources of mercury in buildings can typically include exhaust from vehicles/furnaces and broken fluorescent light bulbs, thermometers, thermostats, barometers, and sphygmomanometers (blood pressure cuffs). IAQ staff did not identify other possible sources of mercury vapor in the HJC beyond the rubberized padding in Room B39 Cell B1.

Evaluation of the Mercury Measurements

Whether exposure to an environmental chemical such as mercury affects a person's health depends on several factors including how much the person is exposed to, how long they've been exposed, their sensitivity to the chemical, and other factors. Exposure to low levels of mercury such as background air levels in the general environment does not pose a health risk. Some people who have a diet high in fish or shellfish may be exposed to higher levels of mercury in the form of methyl mercury. Methyl mercury is present in the environment when organisms in surface waterbodies transform other forms of mercury to its organic form which can build up in fish. If someone is exposed to high levels of mercury over a long period of time, it may harm the

nervous system, causing effects such as behavioral changes, tremors, changes in speech, hearing, or vision, or “pins and needles” in hands and feet. Those most sensitive to mercury are young children and developing fetuses. Women who are confirmed or suspected to be pregnant also require consideration as a sensitive population to protect the fetus. Studies of workers with long-term exposure to mercury vapor have found no clinical symptoms with chronic air levels less than $25 \mu\text{g}/\text{m}^3$, although some studies show possibility of slight or mild symptoms with exposure greater than $20 \mu\text{g}/\text{m}^3$ (the highest level measured at the HJC was $6.4 \mu\text{g}/\text{m}^3$).

To evaluate the mercury testing results in the building and possible health risks from breathing in identified mercury vapors, BEH Toxicology staff compared the results to a health-based screening level. This screening level was developed by the federal U.S. Centers for Disease Control and Prevention’s Agency for Toxic Substances and Disease Registry (ATSDR, 2012). ATSDR provides suggested action or screening levels for indoor concentrations of mercury vapor that should prompt public health and environmental officials to implement response actions. These screening levels are not considered to be “bright lines” indicators of health risk; rather, they are designed to identify when precautionary measures should be considered based on site-specific conditions. The ATSDR levels are derived to be protective against adverse health effects. For schools and commercial settings where mercury exposure is not expected in the normal course of work, ATSDR recommends an action or screening level of $3.0 \mu\text{g}/\text{m}^3$ of mercury in air. This value is appropriate for the Springfield Court Complex which includes building employees and short-term visitors (e.g., those attending hearings, including juveniles).

In order to develop recommendations for safe levels of mercury in homes or commercial settings, the levels are adjusted to create a time-weighted average that accounts for the duration of exposure. The ATSDR level for schools and commercial settings is based on a residential action level of $1 \mu\text{g}/\text{m}^3$ (which assumes 24 hours per day of exposure) and has been adjusted to be equal to an equivalent amount of exposure during a normal 8 hour work/school day. Then, the level is adjusted further by a safety factor to incorporate a margin of safety (i.e., for vulnerable individuals such as pregnant women and infants).

BEH concluded the following from its evaluation of the testing data at the HJC:

- With the exception of the padded holding cell area in the basement, the indoor air mercury levels were all below the screening level of $3 \mu\text{g}/\text{m}^3$ for schools and commercial settings. During the two days of testing of the 1st, 2nd, and 3rd floors, the levels ranged from $0.024 - 0.500 \mu\text{g}/\text{m}^3$.
- In the basement padded holding cell area, some of the indoor air mercury levels were above the screening level of $3 \mu\text{g}/\text{m}^3$, specifically in the padded cell B39 Cell 1. During the two days of testing of the basement area, the levels ranged from $0.062 - 6.378 \mu\text{g}/\text{m}^3$.
 - Although levels measured in the padded holding cell exceeded the screening level, with the highest measurement being $6.378 \mu\text{g}/\text{m}^3$, the ATSDR screening value incorporates conservative (that is, health protective) assumptions. The screening level for schools and commercial settings assumes that an individual is exposed 40 hours per week continually. Short-term exposure in the padded cell would not be expected to pose a health risk for transient occupants since the

- duration of exposure would be significantly less than in a school or commercial setting.
- For the other basement areas tested, outside the cells, the measured levels were below the screening level of $3\mu\text{g}/\text{m}^3$. These measured levels ranged from 0.062 – $2.755\mu\text{g}/\text{m}^3$.

Use of Biological Testing to Evaluate Exposure or Health Effects

While the highest level of mercury vapor measured in the indoor air samples exceeded the ATSDR action level for commercial settings, any potential exposure to this level is unlikely to result in an impact that may be quantified in terms of a biological *exposure* or health *effect*.

When evaluating biological *exposure* to a known mercury source in the workplace, the preferred method is to monitor the urine of the exposed workers (ACGIH, 2013). When conducting biomonitoring, airborne mercury exposure becomes measurable in urine once the level of exposure exceeds $10\mu\text{g}/\text{m}^3$ (ATSDR, 2012). Any exposure below this level is indistinguishable from background urinary mercury levels (Tsuji et al., 2003; Hryhorczuk et al., 2006). As sustained hypothetical exposure to even the highest concentration of mercury in the HJC building ($6.4\mu\text{g}/\text{m}^3$) would not be detectable in urine, the use of biomonitoring to evaluate employee *exposure* at the Western Housing and Springfield Juvenile Court would not be informative.

Sustained workplace exposure to mercury is capable of causing adverse effects once levels exceed $10\mu\text{g}/\text{m}^3$ (Ngim et al., 1992). This threshold level has been determined from evaluations of dentists having an average of 5.5 years of exposure to mercury vapor resulting in impaired performance on several neurobehavioral tests. Thus, this level of $10\mu\text{g}/\text{m}^3$ has been adopted by authoritative agencies (e.g., US EPA and ATSDR) as the lowest level of long-term exposure that is capable of causing toxicity in humans (i.e., the TClO). As estimates of vapor exposure at the Western Housing and Springfield Juvenile Court have been below this magnitude and duration, adverse health *effects* are unlikely to be observed or measurable in the employees.

Ventilation

A heating, ventilating, and air conditioning (HVAC) system has several functions. First it provides heating and, if equipped, cooling. Second, it is a source of fresh air. Finally, an HVAC system will dilute and remove normally occurring indoor environmental pollutants by not only introducing fresh air, but by filtering the airstream and ejecting stale air to the outdoors via exhaust ventilation. Even when an HVAC system is operating as designed, point sources of respiratory irritation may exist and cause symptoms in sensitive individuals.

The HVAC system in the HJC consists of 13 separate air handling units that are located in various mechanical rooms throughout the building. Fresh air is supplied by ceiling or wall mounted fresh air supply vents. Each area adjacent to a window is equipped with a fan coil unit (FCU). The FCUs do not provide fresh air, they only heat or cool recirculated air. Exhaust ventilation is provided by ceiling-mounted exhaust vents.

Of note are the holding cells in the basement level in Room B39. Typically, cells are designed with exhaust vents to draw air into the cells and then to eject the air directly outdoors, similar to the design of rest rooms. The HJC basement cells are equipped with a fresh air supply vent (Picture 6) which appears to be tied into the general HVAC system that services part of the basement as well as the first floor *without an exhaust vent* in each cell. In this configuration, odors or pollutants that originate in the cells are captured by the AHU and then recirculated to part of the basement and first floor.

The AHU unit in B17 was missing its filter panel (Picture 12). Without this panel in place the AHU can draw in dust, debris and odors (called filter bypass). Located in close proximity to this AHU was a moldy/water-damaged cardboard box (Picture 13). Also of note were dust and debris building up around supply vents and surrounding ceiling tiles (Pictures 14 and 15; Table 1).

It is recommended that HVAC systems be re-balanced every five years to ensure air systems function adequately (SMACNA, 1994). It was unknown when the last time these systems had been balanced.

Microbial/Moisture Concerns

Water-damaged ceiling tiles were observed in a number of areas (Pictures 7 and 8, Table 1), which may be evidence of current/historic leaks of the roof or plumbing system. Ceiling tiles are porous and may be a source of microbial growth if they are exposed to chronic moisture. Ceiling tiles should be replaced once leaks are found and repaired.

Some water-damaged plaster walls and ceilings were also observed, particularly in the basement (Pictures 9 through 11, Table 1). Plaster ceilings and walls are generally not susceptible to mold growth. Some walls were noted to have efflorescence. Efflorescence is a characteristic sign of water damage, but it is not mold growth. As moisture penetrates and works its way through porous building materials (e.g., brick, plaster, and cement), water-soluble compounds in the material dissolve, creating a solution. As this solution moves to the surface of the material, the water evaporates, leaving behind white, powdery mineral deposits.

BEH/IAQ staff noted that several areas of carpeting were soiled and/or water-damaged. Chronic water damage of carpeting may result in microbial growth in the carpeting. Carpeting is generally not recommended in areas prone to chronic moisture and/or condensation (e.g., basement areas). In addition, refrigerators and water dispensing equipment should be located in non-carpeted areas or on waterproof mats to prevent damage to carpet and subsequent odors. Plants/flowers can be a source of pollen and mold, which can be respiratory irritants to some individuals. Plants should be properly maintained and equipped with drip pans and should be located away from airflow to prevent the aerosolization of dirt, pollen, and mold.

Other Concerns

Exposure to low levels of total volatile organic compounds (TVOCs) may produce eye, nose, throat, and/or respiratory irritation in some sensitive individuals. BEH/IAQ staff tested for TVOCs and examined spaces and noted products that may contain VOCs, such as air fresheners, hand sanitizers, cleaning products, dry erase materials and fragrance diffusers (Table 1). Of note, the floor cleaning in Room 135 produced measurable levels of TVOCs (Table 1). Cleaning using TVOC-containing products should be done with adequate exhaust ventilation and preferably during non-work hours. Use of the VOC-containing products without proper exhaust ventilation can cause irritation to the eyes, nose, throat, and respiratory system of sensitive individuals.

Food and food preparation equipment were observed in some offices and common areas. Food should be kept tightly sealed to prevent pest access and food preparation equipment should be kept clean to prevent smoke and particulates from being emitted into the air, odors, and pests.

Items were observed on flat surfaces, such as windowsills, tabletops, counters, bookcases, and desks. Items, including boxes, were also stored on the floor. Items stored in offices provide a source for dusts to accumulate. These items also make it difficult for custodial staff to clean. Items should be relocated and/or be cleaned periodically to avoid excessive dust build-up.

In a few areas, ceiling tiles were missing or ajar/damaged (Table 1), which can allow dust and debris from above the ceiling tiles into occupied spaces. Ceiling tiles should be flush in the ceiling tile grid.

The offices were mostly carpeted. The usable life of carpeting is approximately 10-11 years (IICRC, 2002). Older carpeting cannot be adequately cleaned and may become a source of particulates and odors. Replacement of old carpeting should be considered. Carpets should be cleaned annually (or semi-annually in soiled/high traffic areas) in accordance with Institute of Inspection, Cleaning and Restoration Certification (IICRC) recommendations (IICRC, 2012).

Finally, sewer odors and occasional backups were reported in room B58. This area contains a number of file cabinets and paper storage (Picture 16). It is important to note that porous materials (e.g., carpet, paper, cardboard) that have been in contact with sewage *cannot* be effectively cleaned/sanitized or dried and *must be disposed of* properly.

Conclusions/Recommendations

Based on observations at the time of this assessment, BEH recommended the following to AOTC staff on November 6, 2018 regarding the possible presence of a mercury vapor source in Room B39 Cell B1:

1. Consider having the AOTC's IAQ consultant replicate the mercury vapor analysis throughout the HJC to confirm the BEH/IAQ Program's measurements, using a device of similar sensitivity as a Lumex Mercury Vapor Analyzer.

2. Confirm whether the rubberized padding in B39/B1 is the source of mercury vapor, and if so, remove the rubberized padding as soon as possible, using appropriate methods to minimize the release of mercury vapor into the building.
3. Determine with the AOTC's consultant the best method to remediate and vent residual mercury vapor from the building.

On November 9, 2018, AOTC staff and their consultant, Environmental Health & Engineering (EH&E), completed remediation of Room B39 Cell B1. EH&E confirmed that the rubberized padding and underlying plywood walls were sources of mercury vapor. The rubberized padding and attached plywood were removed and subsequent air sampling found that mercury vapor levels had dropped below the screening level. These measurements demonstrated that the rubberized padding was the source of mercury vapor in the HJC and that this source has been removed successfully from the HJC.

Other conditions were identified that could adversely affect general indoor air quality during the course of this assessment. While some problems can be addressed as soon as practicable, others will require planning and resources. For this reason, a two-phase approach consisting of short-term measures to improve air quality and long-term measures to address overall IAQ concerns is recommended.

Short-Term Recommendations

1. Repair the various HVAC system components as needed.
2. Increase fresh air (e.g., adjust intake louvres) to allow for adequate air exchange.
3. Set HVAC system controls to allow for continuous fresh air supply and exhaust ventilation during occupied hours.
4. Balance the HVAC system every 5 years in accordance with Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) recommendations (SMACNA, 1994).
5. Replace/install AHU filter access panel. Use MERV 8 (or higher) filters in univents and AHUs if these can be used with the current equipment. Change filters 2-4 times a year, or as the manufacturer recommends.
6. Discard the water-damaged/moldy box shown in Picture 13 and then clean the floor.
7. Clean supply and return vents and vent cabinets on a regular basis.
8. Repair leaks and replace water-damaged and stained/soiled ceiling tiles.
9. Review the ceiling tile grid to ensure it is complete and that tiles are flush with the grid.
10. Replace worn-out carpeting in the building, prioritizing areas that have been water-damaged. When carpeting is replaced, carpet squares should be used to allow for easier replacement of small sections if they get damaged. Refrain from installing carpet below grade or in areas prone to chronic moisture.
11. Clean carpeting annually or semi-annually in high-traffic areas, in accordance with IICRC recommendations (IICRC, 2012).
12. Repair plaster walls/ceilings following the repair of associated leaks.
13. Maintain plants and flowers properly to prevent water damage and odors.

14. Minimize use of products containing VOCs. Cleaning using TVOC-containing products should be done with adequate exhaust ventilation and preferably during non-work hours. Use low-VOC cleaning products in occupied areas.
15. Keep food in tightly-sealed containers and keep food preparation equipment clean to prevent odors and pests.
16. Work with a licensed plumbing firm and/or city engineers to resolve sewer backups in B58. In the event of further backups/incidents:
 - Follow EPA and industry guidelines on methods to remediate buildings impacted by sewage (i.e., blackwater). See <https://www.epa.gov/sites/production/files/2015-09/documents/floods.pdf> and ANSI/IICRC S500 - Standard and Reference Guide for Professional Water Damage Restoration.
 - Remove and discard all porous items and building materials (e.g., carpeting, wallboard, cardboard/papers) damaged by the backup of blackwater.
 - Use proper containment strategies when work is being performed (e.g., sealed return ducts, depressurization methods) to avoid further contamination.
 - Disinfect all impacted non-porous building materials, items, and surfaces prior to replacing building materials/furnishings.
17. Reduce the amount of stored items to make cleaning easier and periodically move items to clean flat surfaces.
18. Refer to resource manual and other related IAQ documents located on the MDPH's website for advice on maintaining public buildings. These documents are available at: <http://mass.gov/dph/iaq>.

Long-Term Recommendations

1. Have a building engineer examine the B39 cells to make recommendations to reconfigure the HVAC system components for this area.
2. Have a building engineer examine each of the HVAC system components to make recommendations regarding condition, adequacy of HVAC system function and control, and feasibility of replacement or repair.

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APPENDIX A

Excerpted Conclusions and Recommendations Made in the 2006 Indoor Air Quality Assessment of the Hall of Justice (now Roderick Ireland Courthouse)

Conclusions/Recommendations

The indoor air quality conditions at the HOJ are somewhat complex and interconnected. Decisions made concerning the design and construction of the building make it prone to entraining a variety of odors and pollutants from surrounding sources. In addition, the configuration of the roof and the type of window system installed make it difficult to control temperatures in the building. The subsequent subdivision of floors without consideration for the adequacy of ventilation also plays a significant role in temperature control. The lack of measurable TVOC levels would indicate that the HOJ does not appear to be impacted from the previous use of this site.

While some problems can be addressed as soon as practicable, others will require planning and resources. For this reason, a two-phase approach consisting of **short-term** measures to improve air quality and **long-term** measures to address the overall indoor air quality concerns is recommended.

Short-Term Recommendations

In view of the findings at the time of the visit, the following recommendations are made:

1. During times of odors from the Bondi Island area, continue to limit fresh air intake into the HOJ until the odor passes.
2. Do not install fans into the suspended ceiling as depicted in Picture 11.
3. Discuss with the City of Springfield the feasibility of decreasing the length of time that traffic is stopped at the State Street intersection.
4. No further subdivision of floor space should be conducted by building occupants unless this reconfiguration is done in consultation with the Bureau of Court Facilities to ensure that adequate airflow and temperature control can be provided for such space.
5. Consideration should be given to relocating thermostats to locations that have free airflow, or that materials obstructing airflow to thermostats be relocated.
6. Remove all waste heat producing electronic devices from close proximity to thermostats.
7. Use window shades/blinds as much as practical to reduce heat/cold transmission into offices. Operate the FCUs in a manner to heat/temper air in perimeter areas.
8. Seal the floor drain in the Registry of Deeds.
9. Remove antimicrobial pads from all FCUs.
10. Relocate photocopiers from vicinity of FCUs.
11. Remove the window from the interior wall of the Registry of Deeds room to facilitate airflow.
12. Examine the feasibility of connecting the self-contained air conditioner in the Registry of Deeds' server room to the drain system. Connect this drain to the main HVAC/FCU drain system. Any installation of air chilling equipment must provide for adequate means to

- drain condensation. Any installation of such equipment should be done in consultation with the Bureau of Court Facilities to ensure that adequate drainage for equipment exists.
13. Install properly fitted filters for FCUs. Consult with a ventilation engineer concerning the appropriate filter media for the FCUs.
 14. Consult a ventilation engineer concerning re-balancing of the ventilation systems. Ventilation industrial standards recommend that mechanical ventilation systems be balanced every five years (SMACNA, 1994).
 15. Repair the exhaust vent system for holding cells.
 16. For buildings in New England, periods of low relative humidity during the winter are often unavoidable. Therefore, scrupulous cleaning practices should be adopted to minimize common indoor air contaminants whose irritant effects can be enhanced when the relative humidity is low. To control for dusts, a high efficiency particulate arrestance (HEPA) filter equipped vacuum cleaner in conjunction with wet wiping of all non-porous surfaces is recommended. Drinking water during the day can help ease some symptoms associated with a dry environment (throat and sinus irritations).
 17. Remove debris from the short roof.
 18. Continue with replacement of wet ceiling tiles and channel leaking water into collection containers until roof repairs are complete. Once the roof repair is complete, repair the water damaged areas in the building in a manner consistent with guidelines set forth in "Mold Remediation in Schools and Commercial Buildings" published by the US Environmental Protection Agency (US EPA, 2001).

Long-Term Recommendations

1. Continue with repairs to establish a functional, insulated roof to eliminate water leaks and improve temperature control.
2. Consideration should be given to replacing the existing window system with an energy efficient, double-paned type in order to eliminate heat/cold transmission into exterior walls.
3. In order to improve air distribution from FCUs, consideration should be given to replacing floor-to-ceiling retrofitted walls with barriers that are open at the top to increase airflow.
4. Examine the feasibility of installing dedicated exhaust vents for all areas with cooking equipment.
5. While the parking garage does not appear to have an impact on the HOJ, consideration should be given to reconfiguring the exhaust system to eliminate its venting at sidewalk level.