FOUNDATIONS

REPORT

Roderick L. Ireland Courthouse

Prepared for: Massachusetts Trial Court

June 30, 2022

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Prepared exclusively for Massachusetts Trial Court

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1 Scope

9 Foundations, Inc. ('9F') was retained by the Massachusetts Trial Court with regards to the Roderick L. Ireland Courthouse, located at 50 State Street, Springfield, Massachusetts. The Massachusetts Trial Court requested 9F's opinion on three specific topics:

- Review Walt Baenziger's "Investigation of Indoor Mold at the Courthouse" dated March 3, 2022 ('Baenziger Report') and opine on whether or not the species and quantities of mold identified correlated to cancer or amyotrophic lateral sclerosis (ALS) risk.
- Review provided air sampling data on PCBs with regard to published airborne limits and any relation to cancer or ALS.
- Provide an expert opinion on if the overall building presents any immediately dangerous health hazards, including any factors that may relate to cancer and/or ALS.

This report is focused on the Roderick L. Ireland Courthouse and excludes in its entirety any assessment of the Western Housing and Springfield Juvenile Court located at 80 State Street, Springfield, Massachusetts.

2 Documents reviewed in this investigation

- Baenziger, W. Investigation of Indoor Mold at the District Courthouse. March 3, 2022.
- Environmental Health & Engineering (EH&E). Indoor Air Quality Assessment. April 15, 2022.
- TRC. DRAFT – PCB Air Sampling Report. April 19, 2022.
- Axiom. Indoor Air Quality Testing. March 11, 2022.
- Haleeb & Associates, Inc., & Architectural Engineers, Inc. HVAC Repairs, Springfield Court Complex. February 25, 2022.
- Axiom. Indoor Air Quality Testing. January 31, 2022.
- TRC. AC Unit Duct Inspection Mold Sampling Assessments. November 12, 2021.
- Axiom. Indoor Air Quality Testing. November 18, 2021.
- TRC. Indoor Air Quality and Mold Assessments. September 23, 2021.
- TRC. Results of Follow-up Microbial Air Sampling on 9/8/21. September 8, 2021.
- TRC. Results of Indoor Air Quality Screening and Mold Investigation. September 7, 2021.
- Massachusetts Department of Public Health. Indoor Air Quality Assessment. February 2019.

- EH&E. Springfield District Court, Mercury Air Sampling. October 17, 2018.
- Alpha Analytical. Analytical Report: Drinking Water Sample. December 28, 2017.
- Alpha Analytical. Analytical Report: Drinking Water Sample. November 13, 2017.
- TRC. 50 State Street, Springfield, Massachusetts – Indoor Air Quality Services. October 16, 2017
- TRC. 50 State Street, Springfield, Massachusetts – Indoor Air Quality Services. October 21, 2016
- Massachusetts Department of Public Health. Indoor Air Quality Assessment. March 2013.
- Massachusetts Department of Public Health. Indoor Air Quality Assessment. May 2006.

3 Summary of expert opinions

On Topic 1 (Walt Baenziger's report):

- The species of mold and quantities detected in the building since 2006 do not present a risk with regard to cancer or ALS.
- 9F disagrees with Baenziger's conclusions that:

  "There is strong evidence that there is presently a serious risk of harm to occupants in the Courthouse that is subject only to duration and type of exposure, and their inherent health conditions" on the basis of sterigmatocystin toxicity, risks associated with ALS, and that molecular analysis (PCR) is necessary to evaluate mold exposure.

And,

  "Repeated clearance assessments, have used inadequate procedures and analytical methods to make quantitative assertions regarding the safety of the indoor environment."

- 9F concurs with the findings from the recent report from Environmental Health & Engineering (EH&E) that: "Sampling for airborne mold spores in April 2022 did not indicate that sources of mold were impacting the indoor air in any locations of the Building, except G27C …. EH&E's observations and testing indicate that remediation efforts, upgraded building filtration, and the use of portable air cleaning units have been effective in addresses the mold impacted materials identified in the Building."
- 9F also agrees with EH&E's recommendation that continued management of mold and moisture conditions are warranted, including the implementation of a cleaning program, ensuring adequate ventilation and filtration, and developing specific mold sampling schedules and plans.

On Topic 2 (PCBs):

- The majority of air samples collected on March 18, 2022, did not find detectable levels of PCBs (18 of 20).
- Two air samples had detectable levels of PCBs but were at concentrations below published limits for PCBs in air and screening levels for workplaces.

- The firm that did the sampling (TRC) also compared the results to residential screening levels. This is not appropriate for the courthouse population because it assumes 350 days of exposure for 26 years.
- Because one sample was above the residential screening level, TRC conducted a risk assessment. The risk assessment used the residential exposure assumptions (24 hour/day, 350 days per year for 26 years). Even with these high exposure assumptions, the estimated cancer risk was very low (~2 $x10^{-6}$ cancer risk).
- Overall, the level of PCBs detected over the sampling period on March 18, 2022 do not indicate an elevated risk of cancer or ALS.

On Topic 3 (Overall Indoor Environmental Quality (IEQ))

- Mold and water damage are a recurring problem in the building. At least five major factors are contributing:

    1) Several windows repeatedly leak, and the issue has not been thoroughly addressed.
    2) The operation and design of the air handling system is failing to provide adequate dehumidification, and the temperature setpoints are not low enough to fully extract moisture from the air.
    3) Several stained ceiling tiles were observed in the interior of the building and the facilities team stated that the cause was condensate on piping.
    4) The fan coil units (FCUs) around the perimeter of the building have fiberglass insulation that is impacted from condensation forming on adjacent, uninsulated copper piping. In addition, the FCUs were designed in such a way that limits regular inspection, maintenance, and cleaning.
    5) The roof is nearing the end of its useful life. An inspection in February, 2022, noted moisture intrusion and degradation of insulation.

Overall, after reviewing the available reports, 9F's assessment is that at least these five core issues are contributing to the repeated mold issues in the building and need to be addressed and assessment and remediation of moisture and mold issues should continue until those root cause issues are addressed, but continued occupancy at this time is acceptable based on the most recent reports.

4 Review of prior mold investigations

4.1 There is a long history of moisture problems at the courthouse.

The courthouse has a history of moisture issues in the building, including active leaks, water intrusion, problems with window insolation, and excessive humidity. Building managers reported to have been addressing high indoor relative humidity issues ad hoc with portable dehumidifiers. There are longstanding dehumidification issues in the HVAC system, and windows that repeatedly leak. There is a condensate issue on interior piping due to poor insulation and the humidification issue. Third-party reports cite persistent staining and new leaks at each visit, stained ceiling tiles, water-damaged sills, and peeled paint were observed on a site visit in May 2022.

4.2 The Springfield courthouse has worked with environmental health and safety experts to evaluate mold in the building. None of the reports that were reviewed found conditions that were immediately hazardous to occupant health.

4.2.1 TRC conducted an initial, and follow up, mold assessment from in August and September 2021, and found that, after remediation, all locations[1] sampled by TRC acceptable for occupancy based on air sampling results.

TRC investigated several locations where mold growth was identified and concluded that the mold growth observed was related to the elevated relative humidity (range 62-78%) caused by increased airflow, associated with COVID-19 precautions that the ventilation system equipment was unable to handle. They sampled airborne concentrations of total fungal spores collected at 15 liters per minute for five-minute sampling. Samples were then analyzed to determine the quantity and identity of fungal spore types using bright field microscopy. To discuss potential health effects, they noted that there are currently no recommended allowable exposure limits. They also cite that the American Conference of Governmental Industrial Hygienists (ACGIH) indicated that an exposure may be considered unusual when indoor concentrations are significantly higher than outdoors, or when mold detected indoors vs outdoors differed. They concluded that after initial identification of mold, and consequent remediation including (wet wiping, vacuuming with a HEPA filter, air

[1] Report noted pending results from room 332, however, results were not available at the time of writing of this report. TRC recommended that the room be re-cleaned, to operate an air scrubber, and re-sample.

scrubbing, and possible re cleaning) all locations sampled by TRC were acceptable for occupancy based on the air sampling results. They also noted the need for further actions warranted to maintain and document building conditions (e.g., mold and humidity inspections, assessment of building envelope and HVAC systems).

4.2.2 TRC conducted an additional mold investigation and follow up air sampling on September 8, 2021. They concluded that the courthouse may open for occupancy. However, they did find that the 3rd floor records storage room and the ground floor mail room had slightly elevated penicillium-aspergillus spores. As such, they recommended follow up pre-cautions, remediation, and re-sampling. Following re-sampling, these rooms were considered to have acceptable air sampling.

4.2.3 TRC Environmental Corporation conducted dust and mold sampling in ventilation ducts in October 2021, and recommended duct cleaning and removal of internal duct insulation where present.

Surface (tape lift) sampling was conducted in ducts of all ventilation system present on the building. Mold growth identified in a portion of the samples on every floor, many were uninsulated ducts, greater positive mold growth with AC3 and AC4. They interpreted results based on the number of spores observed on the sample area and state that 1-10 is "unlikely to be indicative of growth," 11-100 is a "possible source," 101-1,000 is a "probably source" and >1,000 is a "likely source." They noted that the results suggest that supply air ducts are more likely than return to have sample results showing the presence of mold growth. However, they also noted that the presence of mold on surfaces should be interpreted with caution because the results of surface sampling for mold is not predictive of, or necessarily correlated with, the presence of airborne mold spores in the building. Finally, they recommended that it "would be prudent to conduct duct maintenance procedures to include duct cleaning and removal of internal duct insulation where it is present."

4.3 Axiom conducted air sampling for non-culturable mold in November 2021, January 2022, and March 2022, and did not identify any conditions or levels for measured parameters that were significantly outside of acceptable levels for air quality.

During each sampling period, 10 indoor and two outdoor air samples were collected for optical examination of mold and fungal spores, and analyzed by EMSL analytical, inc. located in Woburn, MA. Axiom concluded on all three

sampling dates that the "airborne fungal spore levels on the days of the sampling were not elevated, and amplification was note occurring."

4.4 Environmental Health, and Engineering (EH&E) conducted air sampling for mold spores in April 2022, as a follow up to sampling in 2019, and found that sources of mold were not impacting most locations in the building.

EH&E performed air sampling for mold prior to (August 2019) and after (April 2022) the Baenziger investigation. The EH&E investigation included collecting 51 air samples at locations throughout the courthouse basement, first, second, third and fourth floors on August 2019, and April 2022.[2] The average total concentration in August 2019 was 504 Spores/m^3 and levels on ranged from none detected to 2310 Spores/m^3. The average total concentration in April 2022, was 426 Spores /m^3 and levels ranged from none detected to 1000 Spores/m^3. Two outside samples were taken during each sampling event and the total outdoor mold spore concentrations were 50,800 and 4,600 on August 2019, and April 2022, respectively. In each case indoor concentrations of mold spores did not exceed measured outdoor levels. The data collected by EH&E showed a decrease in 80% of areas sampled between 2019 and 2022 sampling efforts. The reductions were attributed to remediation efforts, upgraded building filtration, and use of portable air cleaning units. Of note, the outdoor concentrations of mold spores were 11 times lower on 2022 (4,600) compared to 2019 (50,800) and may also have contributed to the reductions noted. EH&E identified an area with IAQ concern in Superior Courtroom 1 in 2019 that underwent remediation and had significantly lower concentrations in 2022. EH&E also identified a new IAQ area of concern in room G27C and recommended remediation.

EH&E compared their findings with visual inspections performed in 2019 where they identified 167 locations with evidence of water damage and/or mold growth. At that time, recommendations were made to identify and correct underlying causes of moisture and mold growth be appropriately remediated where applicable. They also recommended cleaning supply diffusers and replacing ceiling tiles with dust accumulation and mold growth. A follow up visual survey in April 2022, EHE reported 137 of the 167 locations had been addressed or were in the process of being addressed. EH&E also reported that renovation and repair activities were ongoing and that additional areas are scheduled to be addressed.

[2] Samples were collected at the same location on both dates.

The EH&E report included recommendations to establish an operations and maintenance plan to recognize control and mitigate potential mold growth in the building, manage conditions related to mold and moisture in the building, implement proactive cleaning program, ensure adequate ventilation and filtration, and specify mold sampling schedules and plans.

4.5 Air sampling is not always necessary to assess risk.

Health effects from excessive exposure to mold has been well documented in indoor office environments, and range from asthma, allergic reaction, irritation, and infections. According to the EPA,

> **"In most cases, if visible mold growth is present, sampling is unnecessary.** Since no EPA or other federal limits have been set for mold or mold spores, sampling cannot be used to check a building's compliance with federal mold standards."[3]

Since mold is ubiquitous in the environment, the presence of mold spores in an air sample is not unexpected. This is true especially in an environment where visible mold growth (bioamplification) is present. If mold is present in the building, there is typically a moisture problem which facilitates growth on building materials. In these cases, the sources of the moisture should be resolved and the mold remediated. These recommendations are not a function of air sample results.

In some cases, mold growth may not be visibly evident and potential mold bioamplification can be discovered by comparing the number and predominance of mold spore species indoor air and outdoors. It is presumed that under normal conditions, types of number of spores indoors should reflect those found outdoors and at lower concentrations. As long as indoor and outdoor air samples are consistently collected and analyzed, comparisons for this purpose should be valid regardless of the type of analysis used. Comparing numbers and species of fungi before and after remediation efforts is another use for air sampling data, as well as surface sampling.

4.5.1 The cause of ALS is not known, and as such, there is uncertainty around environmental factors and disease development.

According to the National Institutes of Health, and the National Institute of Neurological Disorders and Stroke, the cause of ALS is not known. Environmental

[3] https://www.epa.gov/mold/mold-testing-or-sampling

agents have been proposed as playing a role in the development ALS. Many possible, though not conclusive, environmental causative agents have been suggested for ALS such as viruses, fungi, environmental toxins, minerals, metals, pesticides, physical damage through occupational hazards, physical activity, and diet and body mass index.[4,5]

4.6 9F agrees with the methods used, interpretations, and conclusions of the prior investigations, and that mold in the building does not make the building unsafe for occupancy, and does not pose a risk of cancer and/or ALS.

Multiple IAQ assessments over a period of several years have consistently confirmed the presence of moisture, visible mold, and found instances of elevated airborne mold spore concentrations within the courthouse. These assessments have included recommendations to mitigate visible mold growth, perform cleaning, improved ventilation, and address sources of moisture were appropriate. The continued presence of moisture and visible mold warrants the implementation of a written comprehensive mold management program.

[4] National Institutes of Health, National Institute of Neurological Disorders and Stroke. "Amyotrophic Lateral Sclerosis (ALS) Fact Sheet." *Amyotrophic Lateral Sclerosis (ALS) Fact Sheet*, 2021.
[5] French, Peter W., et al. "Fungal Neurotoxins and Sporadic Amyotrophic Lateral Sclerosis." *Neurotoxicity Research*, vol. 35, no. 4, 2019.

5 Review of Walt Baenziger Report "Investigation of Indoor Mold at the District Courthouse, 50 State Street, Springfield, MA"

5.1 Many of the issues raised in the Baenziger report are incorrect or misleading.

5.1.1 The statement that there is "no safe level of uncontained pathogenic organisms" is not reflected in the current Biosafety reference manual.

The Baenziger Report states *"There is no safe level of uncontained pathogenic organisms"* and cites the AIHA Biohazards Reference Manual.[6] It has been nearly 40 years since the AIHA Biohazards Reference Manual was published and this publication has since been replaced with the AIHA Biosafety Reference Manual in 1995.[7] After repeatedly reviewing the AIHA Biosafety Reference manual and requesting the publisher search for the quoted text in the current edition, the statement could not be found and seems incongruous with modern biosafety principles. The statement implies that to be safe, the level of pathogenic organisms should be zero. Pathogen is defined as "any disease-producing agent or microorganism." This is impossible since there are viral, bacterial, and fungal "uncontained pathogenic organisms" naturally occurring throughout the environment in air, water, and soil.

Baenziger appears to have taken his quote from the *outdated* Biohazard Reference Manual. This publication was reviewed and the following sentence on Page 1 was identified:

> *"Although "safe" doses of chemical and physical agents are often specified in technical literature, there is no "safe" level of a noncontained pathogenic organism. Containment and safe handling of known or potentially biohazardous materials require strict adherence to prudent microbiological practices."*

This statement in full context concerns work, such as in a biological laboratory, that specifically involves pathogens and is highlighting the lack of occupational exposure limits (OELs) for biological agents. In contrast, on the first page of the introduction of the up-to-date and current AIHA Biosafety Reference Manual (Page 1, Sec. 1.) it is clearly stated that:

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[6] AIHA Biohazards Committee. *Biohazards Reference Manual*. American Industrial Hygiene Association, 1985.

[7] AIHA. *BioSafety Reference Manual*. Second, American Industrial Hygien Association, 1995.

> "The presence of an organism or biologically derived substance in the work environment does not necessarily represent a hazard. The hazard potential depends on a complex relationship between agent factors, host factors, and work environment factors. Each of these factors must be considered when assessing the health risk potential from biological agents."

The only reference along the lines of 'no safe threshold' that appears in the current AIHA Biosafety Reference Manual (Page 9 Sec. 2.C.1.) is: "…there is no 'safe' level of blood borne pathogens." This statement applies very narrowly to organisms such as HIV and Hepatitis viruses blood borne transmission and has no bearing on the indoor office environment under normal circumstances.

Therefore, the statement in the Baenziger Report is from an out-of-date text, incomplete, taken out of context, and inconsistent with current practice and principles.

5.1.2 The claim that PCR analysis is superior to optical analysis is misleading.

5.1.2.1 Despite a higher level of sensitivity and specificity, PCR analysis methods also have disadvantages.

The Baenziner report implies that previous sampling efforts were limited by optical analysis methods and that PCR analysis methods are superior. PCR analysis has very high sensitivity, high species level specificity, and allows for extended sampling times compared to optical and culture analysis techniques. However, there are disadvantages to PCR analysis. For example, interpreting a positive result can be difficult. PCR detects nucleic acid and does not differentiate between live, dead, spores, mycelia, or fragments. Often PCR results are reported in terms of copy numbers of nucleic acid detected. The data in the Baenziger report is shown as "Spore E./m^3". The "E" is for "equivalent" since PCR can't differentiate spore and non-spore nucleic acid (i.e. mycelia, fragments, viable, non-viable). The potential health effects from viable, non-viable cells and fragments vary greatly. It is not well established how these copy numbers or "Spore Equivalent" correlate to spore counts or health.

5.1.2.2 Despite claiming that optical methods were inferior for not being able to detect species information, the PCR analysis method used only identifies 36 species of fungi.

In referring to the limitations of optical analysis and advantages of PCR, the Baenziger report highlights the importance of species level information and overstates the capabilities of the PCR analysis used. Although the report states:

> *"There are over 700 known species that can be present in a trained technician identifies spores microscopically as Aspergillus/Penicillium"*

and

> *"The genus Aspergillus is currently composed of 339 known species…,"*

it fails to mention that PCR analysis methods by the laboratory used by Baenziger only reports on 36 species of fungi. The report also fails to recognize that the PCR analysis method (MSQPCR) is licensed to laboratories by the EPA, but has not been validated by the EPA and is considered a research tool not for public use:

> *"The EPA readily acknowledged that MSQPCR and ERMI have not been validated or peer reviewed by EPA for public use. The agency considers MSQPCR and ERMI to be research tools not intended for public use."*[8]

Furthermore, the PCR analysis methods used includes two groups of fungi. Group 1 represent water damage-related species and Group 2 common indoor molds. An algorithm developed by the EPA is used to calculate a ratio to determine an Environmental Relative Moldiness Index (ERMI) to objectively describe the mold burden present in a **home** (emphasis added). This index should not be applied to commercial buildings, but ERMI is mentioned in the report with respect to dust samples without note of this limitation. According to a report from the US EPA Office of Inspector General:

> *"…a licensed company produced an ERMI value for a commercial building even though the ERMI values are based on testing of residential homes. Consequently, homeowners and building owners are at risk of spending tens of thousands of dollars to remediate their homes or buildings based on test results that may or may not be accurate."*[9]

5.1.2.3 Environmental inhibitors can be a disadvantage to PCR testing.

[8] https://www.epa.gov/sites/default/files/2015-09/documents/20130822-13-p-0356.pdf
[9] https://www.epa.gov/sites/default/files/2015-09/documents/20130822-13-p-0356.pdf

Many agents in the environment, called PCR inhibitors, can interfere with the chemistry of sample preparation and the PCR reaction. PCR sample inhibition can cause false negative or under reporting of results. It is important that the presence of inhibitors are tested and reported with sample results to avoid data reporting errors. For example, there was a note regarding dust sample C3A, Probate, indicating the sample was unanalyzable due to chemical contamination. This statement is misleading since sample inhibition was likely the cause of the failed analysis. PCR inhibition may be the result of many substances, even in very small quantities, which could interfere with the PCR reaction. Particulate matter, heavy metals, constituents of bacterial cells, proteolytic enzymes, and high concentrations of non-target DNA have been associated with the inhibition of PCR in environmental samples.[10]

5.1.2.4 The statement regarding insufficient sample volumes in past sampling is misleading.

Due to concerns of overloading sampling media, many biological methods are limited by the volume of air which can be sampled. PCR analysis, conversely, can handle large sample volumes based on its wide range of detection. Although this is an advantage and the air samples collected by Baenziger were of greater volume, the volumes are marginally larger and would not be expected to yield different outcomes when interpreted volumetrically. Considering the variability in indoor fungal concentrations indoors, temporal variability is a more important factor. Taking samples at different times of the day and over multiple days would better characterize exposures to fungi. However, since presence of visible mold, air sampling results, and noted water infiltration adequately confirmed indoor air quality issues, additional granularity wasn't/isn't necessary for identifying sources of problems, developing action plans, or confirming adequacy of remediation.

5.1.2.5 The statement that human error is an issue with previous environmental testing is misstated and misleading.

The Baenziner Report cites "human error" as an issue associated with traditional sampling using optical analysis versus PCR analysis. "Human error" is an inaccurate description for the limitations of analyzing optical samples. Even when viewed under a microscope many mold spores lack unique morphology needed for identification. In these cases, categories are used that include general spore types. For example, single *Aspergillus* spores cannot be

[10] Wilson, I. G. "Inhibition and Facilitation of Nucleic Acid Amplification." *Applied and Environmental Microbiology*, vol. 63, no. 10, 1997

differentiated from *Penicillium* spores and are typically grouped as "Pen/Asp" in laboratory reports. This is not because of human error, but rather a limitation of the method. Note that these optical methods are well defined and governed by accreditation programs with proficiency testing requirements. Note that despite raising these issues with optical methods, Baenziger deemed these methods acceptable for air sampling inside of walls in their own investigation.

5.2 Exposure and risk identified with *aspergillus versicolor* found in dust samples is incorrectly characterized with respect to health risk in the indoor environment.

Below is an excerpt from the Baenziger report:

> *"The conducted toxicological tests proved that **Aspergillus versicolor** (emphaisis in original) is the most **dangerous** (emphasis in original) species for humans and animals in infected rooms owing the synthesis of toxic and carcinogenic* sterigmatocystin *ST (category 2B according to International Agency for Research on Cancer) in various quantities"*

It is spurious to associate toxicity claims associated with airborne exposure to the referenced *Aspergillus versicolor* associated sterigmatocystin toxin in the indoor environment. Illness associated with this toxin is associated with relatively very large doses that are typically connected with ingestion. Toxicity requires milligrams of toxin per kilogram of body weight. This is not conceivable with inhalation exposures.

Mycotoxins are non-volatile and do not evaporate from spores and substrate particles. Therefore inhalation exposure to mycotoxins results from breathing in spores or dust particles (Kelman et al.). Conservative computations show that based on the levels of *A. versicolor* measured in the environment at the courthouse and the amount of toxin in each spore, nanogram quantities of toxin dose would occur with 24 hours of continuous respiratory exposure.[11] This is greater than a factor of a million lower amount than what is associated with toxicity. These computations are supported by dose estimates for mycotoxins which were modeled using extreme conditions of exposure (200,000 spores/m^3 with 24 hours of continuous exposure), by Kelman et al. They concluded that mycotoxin exposure via inhalation is inefficient and

[11] Piontek, Marlena, et al. "Occurrence of the Toxin-Producing Aspergillus Versicolor Tiraboschi in Residential Buildings." *International Journal of Environmental Research and Public Health*, vol. 13, no. 9, 2016.

> *"…it is highly unlikely that the dose of mycotoxin received in an indoor home, office or school environment would occur at a level that would produce acute toxic effects…"*[12]

Furthermore, the authors of this study state that

> *"Under the exposure conditions commonly encountered in a visibly moldy environment, the potential for inhaling a toxic dose of mycotoxins is remote."*

Studies have shown the presence of sterigmatocystin toxin associated with environmental dust samples containing *A. versicolor*. Concentrations of toxin in these materials were, again, present in very low concentrations (picogram/milligram) and would require hundreds of grams of dust intake to achieve toxicity levels reported in the literature. The risk of toxin exposure is highly likely to be even lower. Although fungi such as *A. versicolor* are known to produce toxins, they are not typically produced in natural indoor environment and are produced in limited amounts.[13] In a review of mycotoxin production by indoor molds, the author notes that significant mycotoxin production does not occur until the water activity (a_w) of a substrate reaches 0.95.[14] The term a_w describes the amount of free water in a material that is available to support microbial growth. For reference, fresh fruits and vegetables have a_w ranging from 0.97-0.99, while dried fruit ranges from 0.6-0.65.[15]

Sterigmatocystin is classified group 2B carcinogen by the International Agency for Research on Cancer (IARC). The 2B designation corresponds to being carcinogenic in other species and is possibly carcinogenic to humans, but that a definitive link between human exposure and cancer has not been proven. The IARC classification sterigmatocystin is based on ingestion, injection, and dermal exposure of milligram level doses of sterigmatocystin in animals. No inhalation or human toxicology data was reported.[16]

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[12] Kelman, Bruce J., et al. "Risk from Inhaled Mycotoxins in Indoor Office and Residential Environments." *International Journal of Toxicology*, vol. 23, no. 1, 2004

[13] Jarvis, Bruce B., and J. David Miller. "Mycotoxins as Harmful Indoor Air Contaminants." *Applied Microbiology and Biotechnology*, vol. 66, no. 4, 2005.

[14] Nielsen, K. F.Mycotoxin production by indoor molds. Fungal genetics and biology, 39(2), 103-117, 2003.

[15] https://www.clemson.edu/extension/food/canning/canning-tips/39available-moisture.html.

[16] International Agency for Research on Cancer. *Sterigmatocystin, Volume 10*. 1976.

5.3 The references cited in the report on the relationship between fungal toxins and ALS are misleading.

The Baenziger report fails to recognize the uncertainty surrounding the cause of ALS, the many factors which have been suggested as being factors for causing ALS, and selectively highlights fungal toxins. Furthermore, the quoted references in the Baenziger report relating to ALS do not provide the full context of the publications cited.

5.3.1 Statements quoted from the referenced articles are taken out of context and are not indicative of risk from the mentioned environmental exposures and the development of ALS.

The referenced article in the Baenziger report entitled "Fungal-contaminated grass and well water and sporadic amyotrophic lateral sclerosis" by French et al., illustrates, as stated in the title, that the hypothesized connections between fungi and ALS are not representative of indoor environments. [17] The authors state:

> *"…an opportunistic neurotoxic fungal infection as a result of prolonged contact with plant or ground water that becomes a chronic opportunistic infection could be the cause of for many sporadic ALS cases."*

This statement is clearly not referring to exposures in indoor office environments. Many of the examples in the publication are associated with ingestion exposures which would be expected to have much higher doses than inhalation exposure. No definitive data was provided to support correlations and conjecture regarding the connection of fungi and ALS offered in the paper.

Bozzoni et al analyzed the role of environmental factors in ALS such as: heavy metals, electromagnetic fields and electric shocks, pesticides, cyanotoxins, physical activity, and sports.[18] Bozzoni was cited by the article in the Baenziger report (French et al., see above) when listing candidates for environmental factors associated with ALS, however fungi or fungal toxins were not included in the review by Bozzoni. Furthermore, Castendo-Vazaquez et al. reviewed infectious agents and ALS and concluded that, "… there is not currently

[17] French, Peter William, et al. "Fungal-Contaminated Grass and Well Water and Sporadic Amyotrophic Lateral Sclerosis." *Neural Regeneration Research*, vol. 14, no. 9, 2019.
[18] Bozzoni, Virginia, et al. "Amyotrophic Lateral Sclerosis and Environmental Factors." *Functional Neurology*, vol. 31, no. 1, 2016.

sufficient evidence for a role of fungi in ALS and further studies with larger sample sizes are needed before reaching a definite conclusion".[19]

The following quotation in the Baenziger Report:

> *"I found laboratory evidence of a poisoning in every patient with ALS examined. A search for specific poisons found evidence of mycotoxins. Treatment with antifungal agents corrected the laboratory findings."*

was from the journal Medical Hypotheses whose purpose is self-described as:

> *"To publish interesting theoretical papers. The journal will consider radical, speculative and non-mainstream scientific ideas provided they are coherently expressed. Medical Hypotheses is not, however, a journal for publishing workaday reviews of the literature, nor is it a journal for primary data…".*[20]

The quote is from on an article by Reid et al, which is based on subject matter from a non-peer-reviewed case report based on four patients written by the same author.[21] This is not a credible basis for the quote.

5.4 It is challenging to determine acceptable exposure concentrations of *Aspergillus fumigatus.*

A. fumigatus is a ubiquitous opportunistic fungus in the environment, is commonly found in indoor and outdoor air, and is a leading cause of allergic fungal disease. Although *A. fumigatus* is associated with disease in susceptible populations it has not been adequately characterized in terms of dose-response, which is consistent of all fungal spores. As such, risk is difficult to quantify in terms of acceptable or unacceptable exposure concentrations. Again, this is why it is important to minimize excessive moisture, identify sources of moisture associated with visible mold growth, and remediate visible mold growth on a continuing basis.

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[19] Castanedo-Vazquez, David, et al. "Infectious Agents and Amyotrophic Lateral Sclerosis: Another Piece of the Puzzle of Motor Neuron Degeneration." *Journal of Neurology*, vol. 266, no. 1, 2019.
[20] https://www.elsevier.com/journals/medical-hypotheses/0306-9877/guide-for-authors.
[21] Reid, William K. "Mycotoxins Causing Amyotrophic Lateral Sclerosis." *Medical Hypotheses*, vol. 149, 2021

5.5 Baenziger's air sampling investigation added limited additional value to past air sampling for mold.

The Baenziger investigation reported air sample and PCR analysis results taken at only five locations on February 8, 2022. The average total concentration was 426 Spores E./m^3 was and levels ranged from 97 to 1432 Spores E./m^3 of air based on PCR analysis. A single outdoor sample total spore concentration was 32 Spores E./m^3. Predominant spore types varied in each area.

Although very specific, the PCR analysis used only quantified 36 species of fungi and is a small subset of the total fungal community. While optical analysis often cannot make identification to the species level, it does quantify all visible fungi. PCR analysis may underestimate exposures to the hundreds of fungi types not identified or quantified by PCR and could potentially not detect amplification in the indoor environment depending on the species present.

The granularity of PCR analysis for some species of fungi, such as *Aspergillus sp.*, offers marginal usefulness in the present situation for identifying IAQ issues and sources. Had there been a specific illness or infection in the courthouse identified, specific analysis by PCR would have provided a means to match the source of exposure to the infection. However, this was not the case and PCR analysis added little additional value to the analysis, especially considering how few air samples were collected and analyzed.

5.6 Mold spores identified in the surface samples does not necessarily correlate to airborne exposure hazards.

Mold spores were detected, in some cases in relatively high numbers, in swab and vacuum samples. Considering that the mycelial matts which make up mold colonies can produce millions of spores and that visible mold was present in many locations in the courthouse, the presence of mold spores in surface samples is not unexpected. Mold on surfaces does not necessarily correlate to airborne exposure hazards without a means of release and dispersal. However, the presence of visible mold should be taken seriously, especially in ventilation supply ducts, since the potential for aerosolization and exposure is a possibility. As such, immediate remediation of visible mold and proactive cleaning and maintenance is warranted.

5.7 Mold spores detected inside walls, or that are otherwise "hidden," do not necessarily correlate to exposure hazards.

Mold spores were detected from inside wall air samples. The presence of mold from inside of walls does not necessarily equate with exposure. There must be communication of the air from within the walls to the general room air to facilitate inhalation exposures. However, considering the history of moisture issues in the courthouse, there is a potential for mold growth within walls that could lead to odor issues and inhalation exposure if the integrity of the walls are breached or if there is a poor air barrier. The recommendation for further investigation thermal imaging, moisture meters, or invasive methods to determine the need for remediation is warranted.

5.8 In conclusion, 9F disagrees with Baenziger's conclusions that:

> "There is strong evidence that there is presently a serious risk of harm to occupants in the Courthouse that is subject only to duration and type of exposure, and their inherent health conditions" on the basis of sterigmatocystin toxicity, risks associated with ALS, and that molecular analysis (PCR) is necessary to evaluate mold exposure.

And,

> "Repeated clearance assessments, have used inadequate procedures and analytical methods to make quantitative assertions regarding the safety of the indoor environment."

6 Review of the provided air sampling data on PCBs with regard to published airborne limits and any relation to cancer or ALS.

6.1 Review of the TRC Environmental Corporation industrial hygiene sampling for Polychlorinated Biphenyls (PCBs) on March 18, 2022.

TRC conducted air sampling for vapor phase and particulate bound PCBs at 20 locations within the building representing the ventilation zones serviced by each of four primary air handling units. Sampling was conducted on March 18, 2022 beginning at 8:00 am and ending at 7:30pm. Each sample collected a minimum of 2,200 liters for each sample. The minimum detectable sample concentration ranged from <15 to <18 nanograms per cubic meter (ng/m^3) of air. There were 20 samples taken. All of the samples for particulate-bound PCBs were below detection limits and two of the gas phase PCB samples were above detectable limits.

6.2 TRC concluded that the detected samples of PCBs were found to be below occupational exposure limits and the EPA's "Exposure Level for Evaluating PCBs in School Air" for children aged 1 to <3 years, and the EPA's commercial/industrial screening value.

The selection of occupational exposure limits, commercial/industrial screening levels, and EPA's 'exposure levels' for schools are valid comparison criteria. The results indicate that the two samples with detectable PCBs were below these thresholds (Table 1).

Table 1. Detected PCB concentrations and exposure and screening levels

Location	Concentration (ng/m^3)	Occupational Exposure limits (ng/m^3)	EPA Exposure Level for Schools (ng/m^3)	EPA commercial and industrial screening value (ng/m^3)	EPA Residential Screening Value (ng/m^3)*
Level 2, Room 249	20 Aroclor-1254	500,000	100	120	28
Level 3, Law Library by Building – North windows	60 Aroclor-1242	1,00,000	100	120	28

*See Section 6.3

6.3 TRC calculated excess cancer risk for Aroclor 1242 based on the residential value and found very low cancer risk.

TRC also compared the detected concentrations of PCBs to residential screening values. However, residential screening values are not appropriate for this setting because they are based on an exposure scenario of 350 days per year for 26 years. TRC did note that one sample was above the residential screening value of 28 ng/m^3, and they then conducted a cancer risk assessment using that one sample. Based on this information, cancer risk was calculated two in one million (2×10^{-6}). TRC claims that this is a "conservative (i.e., health protective) estimate," because individuals will not be occupying the building "24 hour/day, 350 days per year for 26 years." While I disagree with using the residential screening value and 350 day and 26-year exposure assumptions for this population, the assessed risk even under these high exposure assumptions, and only using the highest value from the 20 air samples, was still very low and well within acceptable cancer risk levels used by the EPA and in occupational health practice. In addition, when conducting a risk assessment, the full distribution of results should be considered, included non-detected values.

6.4 There is limited peer reviewed evidence evaluating the relationship between PCBs and ALS.

Occupational exposure, ambient exposure, and measured blood concentrations have been studied for a potential relationship to the development of ALS and exposure to PCBs (Table 2). Findings in the scientific literature vary and are limited in the generalizability to the exposures that may be relevant at the Springfield courthouse. In addition, these studies evaluated risk from known higher exposure scenarios, with confirmed presence of PCBs, yet most samples at the courthouse did not detect PCBs, and those that did, found low levels that were below the guidance and screening levels.

Table 2. Selected evidence related to PCBs and ALS

Study	**Finding**	
Andrew et. al 2022[22]	26,000 nationally distributed ALS diagnoses, matched by age and sex, estimates of geospatial airborne exposure to lead	Ambient

[22] Andrew, A., Zhou, J., Gui, J., Harrison, A., Shi, X., Li, M., ... & Bradley, W. (2022). Airborne lead and polychlorinated biphenyls (PCBs) are associated with amyotrophic lateral sclerosis (ALS) risk in the US. *Science of The Total Environment*, 153096.

	and PCBs from national emissions inventory. The study found association between PCBs and ALS.	
Malek et al. 2015[23]	Case control study involving sporadic ALS cases, and exposure to hazardous air pollutants (HAPs), including PCBs. Residential exposure to aromatic solvents significantly elevated the risk of ALS among cases compared to controls in 2002 (OR = 5.03, 95% CI: 1.29, 19.53) and 1999 (OR = 4.27, 95% CI: 1.09, 16.79) following adjustment for education, smoking, and other exposure groups. Metals, pesticides, and other HAPs were not associated with ALS.	Ambient
Su et al. 2016[24]	Case control study of exposure to 122 persistent environmental pollutants based on blood concentrations and occupation survey assessing exposures. A multivariable model of measured persistent environmental pollutants in the blood, representing cumulative occupational and residential exposure, showed increased statistically significant odds of ALS for 2 OCPs (pentachlorobenzene: OR = 2.57; 95% CI, 1.31-5.02; P = .006; and cis-chlordane: OR = 6.51; 95% CI, 2.05-20.73; P = .002) and 1 PCB (PCB 151: OR = 1.66; 95% CI, 1.03-2.67; P = .04).	Survey of occupational and residential exposures, and blood concentrations
Vincenti et al. 2017[25]	Cerebrospinal fluid was evaluated in 38 patients with ALS in Italy, findings were inconclusive.	Concentration in cerebrospinal fluid
Prince et al. 2006[26]	NIOSH previously reported on mortality for 2472 workers previously exposed to PCBs, at a manufacturer of electrical capacitors. They noted that four workers died from ALS, all women, (SMR 4.35, CI 1.19–11.14), but were unable to draw conclusions regarding PCB exposure and cause of death	Occupational – electrical capacitor manufacturer

[23] Malek, A. M., Barchowsky, A., Bowser, R., Heiman-Patterson, T., Lacomis, D., Rana, S., ... & Talbott, E. O. (2015). Exposure to hazardous air pollutants and the risk of amyotrophic lateral sclerosis. *Environmental pollution*, *197*, 181-186.

[24] Su, F. C., Goutman, S. A., Chernyak, S., Mukherjee, B., Callaghan, B. C., Batterman, S., & Feldman, E. L. (2016). Association of environmental toxins with amyotrophic lateral sclerosis. *JAMA neurology*, *73*(7), 803-811.

[25] Vinceti, M., Violi, F., Tzatzarakis, M., Mandrioli, J., Malagoli, C., Hatch, E. E., ... & Tsatsakis, A. (2017). Pesticides, polychlorinated biphenyls and polycyclic aromatic hydrocarbons in cerebrospinal fluid of amyotrophic lateral sclerosis patients: a case-control study. *Environmental research*, *155*, 261-267.

[26] Prince, M. M., Hein, M. J., Ruder, A. M., Waters, M. A., Laber, P. A., & Whelan, E. A. (2006). Update: cohort mortality study of workers highly exposed to polychlorinated biphenyls (PCBs) during the manufacture of electrical capacitors, 1940-1998. *Environmental Health*, *5*(1), 1-10.

Steenland et al. 2006[27]	Retrospective mortality study of 17,321 people. Serum levels from a sample of workers for PCBs were 10 times the US population. They found no overall excess of Parkinson disease, ALS or dementia BUT sex-specific analyses revealed women had an excess of ALS (SMR 2.26, 95%CI-1.08-4.15, 10 deaths)	Occupational exposure

6.5 9F agrees with TRC's assessment that "there was no evidence of elevated concentrations of PCBs on the day of sampling, or any excess cancer risk based on the measured PCB concentrations," and that scientific research has not found a conclusive link between PCB exposure and ALS.

[27] Steenland, K., Hein, M. J., Cassinelli, R. T., Prince, M. M., Nilsen, N. B., Whelan, E. A., ... & Schnorr, T. M. (2006). Polychlorinated biphenyls and neurodegenerative disease mortality in an occupational cohort. *Epidemiology*, 8-13

7 Review of Overall IEQ

The May 2006, MA DPH report states that there have been past reports of building occupants reporting symptoms including respiratory irritation, lethargy, tiredness, and eye irritation.[28] Over many years, several IAQ assessments have been performed. In addition to reviewing these reports, 9F also visited the facility in May 2022, and spoke with two facility managers.

7.1 The HVAC system of the building is close to 50 years old, and current building design and systems may be contributing to poor IAQ.

The court complex is a four-story, tiered, cement and steel frame building constructed in 1973. The building has approximately 227,00 square feet and approximately 400 employees. There are four air handling units (AHUs). The HVAC units in the building are original and in poor condition.

7.2 Mold and water damage are a recurring problem in the building. At least five major factors are contributing:

1) Several windows repeatedly leak and the issue has not been thoroughly addressed. At the time of 9F's site visit in May, 2022, the facilities team noted that an assessment and repair plan are currently underway.
2) The operation and design of the air handling system is failing to provide adequate dehumidification. The temperature setpoints are not low enough to adequately extract moisture from the air since the electric reheat coils were disabled in 1997 as part of energy-conservation measures. These conditions limit the temperature to which incoming air can be cooled without causing occupant discomfort. During 9F's site visit, the facilities team noted that a new dehumidification system for the air handler serving the courtrooms (AHU-1) was installed and expected to be operational in June, 2022, and system reheats for the other air handlers are in the process of being fixed which will allow for lower temperatures and therefore greater moisture extraction.
3) Several stained ceiling tiles were observed in the interior of the building and the facilities team stated that the cause was condensate on piping. At the time of 9F's site visit, the facilities team reported that they were addressing this by improving insulation on the piping.
4) The fan coil units (FCUs) around the perimeter of the building have fiberglass insulation that is impacted from condensation forming on

[28] Massachusetts Department of Public Health. Indoor Air Quality Assessment. May 2006.

adjacent, uninsulated copper piping. In addition, the FCUs were designed in such a way that limits regular inspection, maintenance, and cleaning.

5) The roof is nearing the end of its useful life. An inspection in February, 2022, noted moisture intrusion and degradation of insulation. An infrared survey identified 2% of the roof has localized wet areas of roof insulation.

In addition,

- There are reports of leaks at all five doors on the roof level, impacting the mechanical penthouse space.
- The operation of the air handling unit may not allow for proper pressurization of the building, leading to infiltration of outdoor air and humidity.
- Recommendations made in 2016 to repair deteriorated window sealants and the plaza roof were reported not to have been done.
- The repeated presence of visible mold and positive surface spore samples merits the need for continued evaluation, remediation, and operations and maintenance plans, until the root causes are addressed.

7.3 Potential exterior influences that may affect indoor air quality:

At least three sources adjacent to the Courthouse may adversely impact indoor air quality.

- The building is adjacent to major roadway (within 600 feet of I-91) and a railway.
- Across the river is a power plant, fueled by natural gas and/or fuel, that only operates during peak electrical demand.
- There are two AHU air intakes at ground level, one directly facing the city street.

7.4 The building has been sampled for heavy metals, including lead, and all consumer taps were below the action level for lead.

Two water sample reports were reviewed from Alpha Analytical dated November 13 and December 28, 2017. Water samples were taken at the basement pipe and 15 various water taps throughout the courthouse on November 2, 2017, and analyzed for arsenic, lead, and manganese. The basement pipe was also analyzed for total dissolved solids. The basement pipe

was sampled again on December 18, 2017 and analyzed for lead. All samples with the exception of the basement pipe were below EPA limits for drinking water for arsenic, lead, manganese, and total dissolved solids. The lead concentration in the basement pipe sample was 0.0166 and 0.0265 mg/L for November and December, respectively. The EPA establishes an action level of 0.015 mg/L for lead based on 90th percentile level of tap water samples in a public water system. The action level is based on consumer tap water samples and the "basement pipe" does not appear to be a "consumer tap." An action level exceedance is not a violation but can trigger other requirements that include water quality parameter (WQP) monitoring, corrosion control treatment (CCT), source water monitoring/treatment, public education, and lead service line replacement (LSLR). Although the basement samples exceeded 0.015 mg/L, interpreting these results is challenging since only the lab sampling results were provided without any additional reports or context. It is important to note that all samples taken at consumer taps were below the AL for lead.

7.5 Visual inspections during environmental sampling have consistently noted water stains, dirty diffusers, and other conditions that may contribute to poor indoor air quality.

Table 3. Selected building condition observations from IAQ reports

Date of sampling	Report Name	Selected Observations
February 24, 2022	Axiom -Indoor Air Quality Testing	No visible sign and no odors associated with mold/fungi. Numerous areas with dirty HVAC diffusers and adjacent tiles. Water-stained ceiling tiles by the windows in the law library, and in the corner of the registry of probate and in Office 204.
January 12, 2022	Axiom – Indoor Air Quality Testing	No visible sign and no odors associated with mold/fungi. Numerous areas with dirty HVAC diffusers and adjacent tiles. Water-stained ceiling tiles by the windows in the law library, and in the corner of the registry of probate and in Office 204. A trash receptacle used to collect water from a leaking window was noted in the 4th floor Jury Pool Room.
October 27,2021	Axiom – Indoor Air Quality Testing	There were numerous areas with dirty HVAC diffusers and adjacent ceiling tiles. No visible signs and no odors associated with mold/fungi were noted in the building. Water-stained ceiling tiles by the windows in the Law Library. Most areas in the building appeared to be relatively clean.
February 2019	Massachusetts Department of Health, Bureau	Dust and debris was noted on flat surfaces, particularly on ceiling tiles around fresh air supply vents. Water-damaged ceiling tiles were observed in a number of areas. Some water-damaged plaster walls

	of Environmental Health, Indoor Air Quality Program, Environmental toxicology program	and plaster ceilings were observed. BEH/IAQ staff noted that several areas of carpeting in the RIC were soiled and or water-damaged. Some FCUs were reported to have chronic leaks or condensation issues. BEH/IAQ staff noted a number of window gaskets that appeared to be in disrepair.
September 27, 2017	TRC – Indoor Air Quality Services TRC Project 288235	During TRC's visit no evidence of water intrusion was noted.
October 7, 2016	TRC – Indoor Air Quality Services TRC Project 265951	Water stains could be observed in various locations on the fiberglass insulation of the fan coil unit pipes; however, the insulation was dry at the time of TRC's assessment. Visible dust deposits were observed on supply air diffusers in the Criminal Office area. However, all the observed interior finish materials, as well as insulating materials at the fan coil units appeared to be dry during TRC's assessment, and no signs of mold growth nor musty odors were noted.
January 18, 2013	Commonwealth of Massachusetts, Executive office of Health and Human Services, Department of Public Health, Bureau of Environmental Health – Indoor Air Quality Assessment	Water-damaged ceiling tiles were observed in the second-floor staff break room and spaces on the third floor. Cardboard boxes stored in a closet in room 220 with evidence of water damage and possible mold growth/colonization. Plant soil may be a source of mold in certain locations. Ceiling tiles noted to be left open, and a number of air vents fans were observed to have accumulated dust.
April 21-25, 2005 and February 7, 2006	Massachusetts Department of Public Health, Center for Environmental Health- Indoor air quality assessment	Several conditions which may affect indoor environmental quality were identified, including but not limited to, improperly placed thermostats, cells being exhausted to nearby hallways, significant thermal comfort/control issues, single pane windows causing excessive heat/cold, heavy moss growth on the roof, extensive water damage, and water damaged ceilings.

7.6 There is a history of IAQ sampling of temperature, relative humidity (RH), carbon dioxide (CO_2), carbon monoxide (CO), total volatile organic compounds (tVOCs), and fine particulate matter ($PM_{2.5}$), in the building dated back to 2006.

The majority of parameters were measured at concentrations below health-based benchmarks. A summary of results from past sampling is presented in Table 4.

Table 4. Summary of IAQ sampling (average, maximum, and minimum), excluding mold assessments, dated from most recent to oldest.

Date of sampling	Report Name	Sampling Information	Temp (°F)	RH (%)	CO_2 (ppm)	CO (ppm)	TVOCs (ppb)	Particulate (ug/m^3)
February 24, 2022	Axiom -Indoor Air Quality Testing	35 representative locations, 10–20-minute run times	73 (58.3-77.3)	13.6 (10.7-25.9)	540 (444-765)	0 (0.0-0.1)	0[29] (0.0-2400)	4 (0-93)[30]
January 12, 2022	Axiom – Indoor Air Quality Testing	36 representative locations, 10–20-minute run times	72.4 (64.4-77.1)	11.2 (9.6-15.9)	566 (490-676)	0.03 (0.0-0.1)	10.9[31] (0-24)	8 (2-25)[13]
October 27,2021	Axiom – Indoor Air Quality Testing	30 representative locations, 10–20-minute run times	73.1 (63.6-76.7)	45.3 (54.5-56.8)	518 (464-882)	0.25 (0.1 - 0.8)	305[32] (86-456)	102 (0-40)[13]
September 27, 2017	TRC – Indoor Air Quality Services TRC Project 288235	TRC utilized a visual/olfactory inspection of the space coupled with real time measurements	63.1-78.3	30.3-51	395-618	ND (<3)	ND (<100)	1-13[34]

[29] A calibrated TSI GM460 Gas Monitor was used to take real-time spot readings for VOCs1 in multiple locations throughout the building. The GM460 is a hand-held device that detects and measures more than 600 of the most common VOCs and has a lower detection limit of 1.0 ppb.
[30] Total airborne particulate
[31] See previous.
[32] See previous.
[34] $PM_{2.5}$

Table 4. Summary of IAQ sampling (average, maximum, and minimum), excluding mold assessments, dated from most recent to oldest.								
Date of sampling	Report Name	Sampling Information	Temp (°F)	RH (%)	CO_2 (ppm)	CO (ppm)	TVOCs (ppb)	Particulate (ug/m^3)
		in "selected" locations[33]						
October 26 and 29, 2018	Massachusetts Department of Health, Bureau of Environmental Health, Indoor Air Quality Program, Environmental toxicology program	BEH IAQ Manual for methods, sampling procedures, and interpretation of results were followed[35]	Within or close to 70 to 78	"Below the MDPH recommended range of 40-60%"	Below 800	ND	ND	Below 35[17]
October 7, 2016	TRC – Indoor Air Quality Services TRC Project 265951	TRC utilized a visual/olfactory inspection of the space coupled with real time measurements to conduct the investigation.	68.7-75	47.0-55.1	496-627	ND (<3)	ND (<20)-45	2-14[17]
January 18, 2013	Commonwealth of Massachusetts, Executive office of Health and Human Services, Department of Public Health, Bureau of Environmental Health – Indoor Air Quality Assessment		71-75	11-15	< 800 ppm[36]	ND - 2 ppm	-	1-4[17]

[33] TRC also sampled outdoors, 9F summarizes here only indoor measurements. Ranges were given not averages.
[35] https://www.mass.gov/lists/indoor-air-quality-manual-and-appendices#indoor-air-quality-manual
[36] Report noted that the areas sampled were sparsely populated.

Table 4. Summary of IAQ sampling (average, maximum, and minimum), excluding mold assessments, dated from most recent to oldest.								
Date of sampling	Report Name	Sampling Information	Temp (°F)	RH (%)	CO_2 (ppm)	CO (ppm)	TVOCs (ppb)	Particulate (ug/m^3)
April 21-22, 2005	Massachusetts Department of Public Health, Center for Environmental Health- Indoor air quality assessment	"Tests were taken under normal operating conditions."	72-84	13-28	<800[37]	-	-	-
February 7, 2006			71-77	19-31	>800[38]	-	ND	-

7.6.1 Temperature was sampled nine times over the since 2005, and ranged from 58.3 to 84 °F.

The wide range in temperature may impact thermal comfort and performance and is an indicator of the temperature and humidity control issues in the building.

7.6.2 RH was assessed nine times since 2006 and ranged from 11.6 to 56.8 % RH. Lower humidity levels were found in the winter season.

Generally, the building humidity levels do not meet comfort standards during the winter season.

7.6.3 CO was assessed six times since 2006 and ranged from not-detected to 0.25 PPM.

These levels are low and do not indicate a risk for building occupants.

7.6.4 CO_2 was assessed nine times since 2006, and the majority concentrations were below 800 ppm. These levels Indicate adequate ventilation levels, but may not be fully representative of all locations and times.

The reported CO_2 ranged from 395 to "> 800 ppm". In the MA DPH assessment conducted on February 7, 2006, they found conditions that were above 800

[37] Report notes that a number of the areas were measured in occupied areas or with low population.
[38] Report noted that the boiler was not operating on this day, and therefore, to maintain heat fresh air supplies were intentionally closed.

ppm but they did not report the actual maximum concentration. They noted that the fresh air intakes were closed during the time of the sampling. Overall, the CO_2 measurements were only spot-measurements and the sampling was done during periods of low occupancy, which limits drawing firm conclusions about ventilation rates.

7.6.5 Total volatile organic compounds were assessed six times since 2006 and ranged from not detected to 2400 ppb. The averages all days were at levels typically found in buildings.

On the days where higher concentrations of VOCs were found (February 24th, 2022 and October 27, 2021) averages were respectively 0 and 304 ppb. VOC concentration can be affected by building activities, and these levels are typical for indoor spaces and below published thresholds. Air samples only reported total VOCs (TVOCs); no air sampling was performed that reported speciated VOCs.

7.6.6 $PM_{2.5}$ was assessed four times since 2006 and ranged from not-detected to less than 35 µg/m^3.

The levels of $PM_{2.5}$ were low and within ranges typically seen in office buildings. The short-duration sampling may not be representative of conditions throughout the building and at different times.

7.6.7 Total particulate matter was assessed three times since 2021 and ranged from not detected to 0 to 102 µg/m^3.

The levels observed on the day of sampling are consistent with total particle levels expected in typical office environments. 9F noted two issues with the Axiom reports. In all three axiom reports, they noted that the guidelines for total airborne particulate does not exceed OSHA permissible exposure limit (15.0 mg/m^3). While this is the correct legally enforceable occupational exposure limit, particles levels in settings like this courthouse would only approach this concentration under extreme conditions. Therefore, this limit is not useful as a point of comparison. A more appropriate comparison would be the EPA National Ambient Air Quality Standards for PM_{10} of 150 µg/m^3. In addition, on October 27, Axiom noted that the average total airborne particulate concentration was 102 µg/m^3, but in the same report stated that the maximum measured value was 4 µg/m^3. The measured concentrations do not appear to adversely affect IAQ.

7.7 There are limitations to the IAQ sampling that has been conducted.

All sampling periods were short in duration and will not capture variability throughout the day. There was also inconsistency in the reporting of summary statistics; some reports gave averages, some gave only ranges, and some provided raw-data plotted as time-series data. For example, TRC only reported ranges in October 2016, and 2017, which limits interpretability. As the reports noted, several sampling periods were conducted during periods of low or no occupancy, which may not be indicative of conditions during occupied hours, in particular for CO_2.

7.8 The building was investigated for possible mercury vapor exposure and was determined to have measured levels consistent with outdoor background levels.

In response to staff concerns over a possible mercury vapor exposure and perceived links to the development of ALS the Massachusetts Department of Health (MA DPH) conducted an investigation and did not identify any sources of mercury. Testing was conducted by EH&E on October 5, 2018, did not identify the presence of any mercury vapor, with all measurements were below the detection limit of 500 ng/m^3. MA DPH found that measured mercury levels were consistent with outdoor background levels, based on the findings from the EH&E investigation.

7.9 Overall conclusion related to IEQ.

After reviewing the available reports, 9F's assessment is that at least five core issues are contributing to the repeated mold and moisture issues in the building and need to be addressed, assessment and remediation of moisture and mold issues should continue until those root cause issues are addressed, additional longer-term real-time air sampling is recommended, in particular for particles, but continued occupancy at this time is acceptable based on the most recent reports.

8 Appendix A – Qualifications

9 Foundations, Inc., is a team of leading experts in the science of healthy buildings, infectious disease transmission, bioaerosols, industrial hygiene, exposure and risk assessment, and environmental health and safety. Expert bios are available at: www.9Foundations.com.

8.1 Dr. Joseph G. Allen, Professional Background

CEO, *9 Foundations, Inc.*
Associate Professor, *Harvard T.H. Chan School of Public Health*
Director, Healthy Buildings Program, *Harvard T.H. Chan School of Public Health*
Lancet Covid-19 Commission member and Chair, *Task Force on Safe School, Safe Work, and Safe Travel*
Author, *Healthy Buildings: How Buildings Can Make Us Sick, or Keep Us Well (Harvard Press)*
Contributor, *New York Times, Harvard Business Review, Washington Post*
Associate Editor, *Journal of Exposure Science & Environmental Epidemiology*
Associate Editor, *Indoor Air Journal*
Peer-reviewed papers:
https://scholar.google.com/citations?user=UkiJxbwAAAAJ&hl=en

8.2 Dr. Joseph G. Allen, Education and Certifications

D.Sc.	Doctor of Science (Exposure Assessment, Biostatistics, Environmental Epidemiology), Boston University School of Public Health
M.P.H	Master of Public Health (Environmental Health), Boston University School of Public Health
B.S.	Bachelor of Science (Biology), Boston College
C.I.H.	Certified Industrial Hygienist, American Board of Industrial Hygiene