Indoor Air Quality Investigative Report

Sheriff’s Department Bunnell Florida Investigation

ESi Project #: 63367F

12750 Commonwealth Drive
Ft. Myers, FL 33913

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Report Prepared For:

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Indoor Air Quality Investigative Report
July 12, 2018

Executive Summary

ESi was contacted by Flagler County Engineering to provide assistance in investigating air quality concerns reported by the employees occupying the building for the Flagler County Sheriff's Department Operations Center, 901 East Moody Boulevard, Bunnell, Florida 32210.

A number of the employees expressed concerns about air quality in the building and have complained about experiencing various symptoms, including headaches, rashes, watery eyes, and itchy skin. The EPA term "sick building syndrome" (SBS) is used to describe situations in which building occupants experience acute health and comfort effects that appear to be linked to time spent in a building, but no specific illness or cause can be identified. The complaints may be localized in a particular room or zone, or may be widespread throughout the building. In contrast, the term "building related illness" (BRI) is used when symptoms of diagnosable illness are identified and can be attributed directly to airborne building contaminants. The affected employees reported complaints could be related to SBS. BRI requires medical evaluation of employees. As of the writing of this report ESi has received no information that would support BRI has been evaluated or established with respect to the operations center.

The symptoms described by the employees can be caused by many different reasons. Determining the actual cause or combination of causes can be an extensive task that requires analysis of the affected individual's medical histories, combined with investigation into work and non-work-related exposures. ESi proceeded with the investigation and hypothesis development assuming that the complaints were valid as if already verified through medical confirmation of BRI and the symptoms reported were potentially caused by the conditions in the building. The exposure pathways that ESi considered significant to the investigation, as they related to air quality, included dermal contact and inhalation during the time the employees spent in the building.

ESi used scientific methodology to conduct the investigation starting with background research that allowed development of a hypothesis of how, and to what, the employees could potentially be exposed. Historical investigations and more recent air quality investigations were also used to supplement the hypothesis development. After development of the hypothesis was completed a testing protocol was established to test the hypothesis. The testing performed by H2H and Mold Spec were relied upon and the ESi testing supplemented the results of those investigations in order to provide additional information. ESi did not attempt to duplicate or repeat tests that were already done in these previous investigations, but instead expanded the scope of tests and utilized employee representative input to focus the investigation and provide additional supplemental data. All the testing results were used to evaluate the hypothesis.

The investigation considered the potential impact on air quality in the building, from the occupants, the HVAC system, the possible pollutant pathways and possible contaminant sources. This required evaluation of temperature and relative humidity, including carbon monoxide, carbon dioxide, oxygen, water vapor and ammonia. The mold investigation was supplemented by testing for total mold biomass. The sampling for Volatile Organic Compounds (VOCs) was supplemented by 7.5 hours of sampling in two locations under the slab and 5 locations in the building. XRF (X-Ray fluorescence) was used to gain elemental information on the slab, precast walls, block walls, painted and unpainted drywall, dust accumulation above the drop ceiling, ceiling tile, and dust in the occupant space under the ceiling.

The results of the investigation indicated that the hypothesis, regarding contaminants and moisture migrating from under the slab into the building at sufficient rates to impact the air quality of the building, is not supported by the test results and should be rejected.

The results of the investigation indicate that improved (Heating Ventilating and Air Conditioning) HVAC management, particularly with respect to ventilation, temperature and relative humidity, are likely to result in improvements in air quality and comfort levels in the building. This is likely to involve further analysis of the HVAC system based on the occupant load during the day and night, the typical and atypical use (higher occupant load such as during classroom training, meetings etc.) of certain portions of the building.

The observations and discussions with building personnel and employee representatives during ESi investigation indicate that an improved understanding of air quality control by occupants, people responsible for housekeeping and people in charge of the operations and adjustment of the HVAC systems is likely to lead to improvements and minimize the impact of inappropriate attempts to improve air quality by opening doors, overuse of fans, deodorants, aerosols, potpourri, antibacterial chemicals and disinfectants. Many of these approaches can actually adversely impact the air quality and interfere with the proper operation of the system.

1. Introduction

On May 15, 2018, ESi was contacted by Ms. Faith Alkhatib, of Flagler County Engineering, to provide assistance in investigating air quality concerns reported by the employees that occupy the building for the Flagler County Sheriff's Department Operations Center, located at 901 East Moody Boulevard, Bunnell, Florida 32210. A number of the employees expressed concerns about air quality in the building and have complained about experiencing various symptoms, including headaches, rashes, watery eyes, and itchy skin. The symptoms described by the employees can be caused by many different reasons. Determining the actual cause or combination of causes can be an extensive task that requires analysis of the affected individual's medical histories, combined with investigation into work and non-work-related exposures. The investigation by ESi was limited to work-related exposure associated with indoor environmental quality of the operations center building only. ESi was tasked with identification of potential factors that may be contributing to the reported symptoms. The factors could then be used by medical professionals to evaluate individual employees and determine if they were causative. ESi is not qualified to provide medical causative opinions with respect to the affected employees and no part of this report should be construed as such.

The investigation was conducted by Zdenek Hejzlar PhD CSP, a lead consultant on this project and Derrek Verlaan, ASP, Senior Staff Consultant. The qualifications of the consultants are included in Attachment A to this report.

2. Background

Indoor air quality problems in buildings are not a recent development. In 1991 EPA published a Fact Sheet related to Sick Building Syndrome (SBS). A 1984 World Health Organization Committee report suggested that up to 30 percent of new and remodeled buildings worldwide may be the subject of excessive complaints related to indoor air quality (IAQ). EPA states that often this condition is temporary, but some buildings have long-term problems. Frequently, problems result when a building is operated or maintained in a manner that is inconsistent with its original design or prescribed operating procedures.

EPA suggested the following approach to building investigation procedures:

> *The goal of a building investigation is to identify and solve indoor air quality complaints in a way that prevents them from recurring and which avoids the creation of other problems. To achieve this goal, it is necessary for the investigator(s) to discover whether a complaint is actually related to indoor air quality, identify the cause of the complaint, and determine the most appropriate corrective actions.*
> *An indoor air quality investigation procedure is best characterized as a cycle of information gathering, hypothesis formation, and hypothesis testing. It generally begins with a walkthrough inspection of the problem area to provide information about the four basic factors that influence indoor air quality:*
> - *the occupants*
> - *the HVAC system*
> - *possible pollutant pathways*
> - *possible contaminant sources.*

ESi used this scientific methodology to conduct the investigation. In this case, the scientific method begins with background research, which provides information that allows for the development of a hypothesis of how, and to what, the employees could potentially be exposed. After development of the hypothesis is completed a testing protocol is established to test the hypothesis. The testing then takes place and the results are used to evaluate the hypothesis. ESi accomplished this process in two parts. In part 1 of the process, ESI was provided historical documentation from the county. The list of the documents received and reviewed are included in the *Attachment B* to this report. This information was used to develop the initial hypothesis.

In Part 2 of the investigation, ESi conducted a walkthrough, refined the hypothesis by speaking with representatives from the county and the sheriff's office employee representatives, and established a consensus-based approach to the investigation.

The EPA term **"sick building syndrome" (SBS)** is used to describe situations in which building occupants experience acute health and comfort effects that appear to be linked to time spent in a building, but no specific illness or cause can be identified. The complaints may be localized in a particular room or zone or may be widespread throughout the building. In contrast, the term "**building related illness" (BRI**) is used when symptoms of diagnosable illness are identified and can be attributed directly to airborne building contaminants. The affected employees reported complaints that could be related to SBS. BRI requires medical evaluation of employees. As of the writing of this report, ESi has received no information that would support that BRI has been evaluated or established with respect to the operations center.

The symptoms reported by the employees can potentially be related to the presence of air quality contaminant(s) in the indoor environment of the workplace or they can be caused by other environmental factors and health issues not related to the air quality of the workplace. In the Sick Building Syndrome Fact Sheet Number 4 cautions:

> *It is important to note that (SBS) complaints may result from other causes. These may include an illness contracted outside the building, acute sensitivity (e.g., allergies), job related stress or dissatisfaction, and other psychosocial factors.*

In addition to the investigation described in this report, the Sherriff reportedly also engaged services of a medical professional to evaluate the affected employees and their specific symptoms to establish if there is a BRI. In a perfect world, a BRI investigation would be conducted first so that the information could be used to focus the environmental quality investigation. Due to time constraints and the fact that many of the employees were relocated out of the building until after the investigation was complete, ESi was asked to proceed with the testing at the earliest opportunity. Some of the information from ESi's investigation may become useful to the medical professional when they are evaluating the employees and their specific symptoms for BRI.

The county engaged the services of the State of Florida to evaluate the building for radiation. The county also engaged services of a licensed radon professional to conduct radon testing in the building. The findings from these independent investigations are not addressed in this report.

3. Analysis

3.1 Exposure Pathway Discussion

The document review and initial visit to the building followed by the public workshop on June 4, 2018, enabled ESi to begin the development of the hypothesis about exposure pathways. Information from Sheriff Rick Staly's letter, dated 05/29/18, noted that the employees moved into the building in September 2015. The letter identified the symptoms that the employees were experiencing - rashes, hives, itching, headaches, fatigue, breathing impairment and other symptoms of illnesses (not specified). ESi did not get access to any medical confirmation of the symptoms as building related illness (BRI) or records to analyze the information. ESi proceeded with the investigation assuming the information to be accurate and potentially caused by the conditions in the building. The exposure pathways that ESi considered significant to the investigation as they related to air quality included, dermal contact and inhalation. The dermal contact was considered based on reports of rashes, itches and hives. Under that hypothesis, when occupants come into contact with the dust that settles in the office their skin comes in contact with the potential contaminant. As occupants perspire, the contaminant can become dissolved on the moist skin and as they touch other parts of their bodies the contact can cause the contaminant to be transferred to other parts of their body. Depending on the contaminant and the sensitivity of the occupants an adverse reaction, such as a rash may result. ESi's investigation focused on settled dust to evaluate this exposure pathway. The inhalation pathway was also considered, as contaminants in the air such as VOCs, dust and mold could potentially be associated with the other symptoms listed in the letter.

Air quality problems can be caused by contaminants on the property from historical uses of the property that may have resulted in contamination. The contamination can be from chemicals used on the property or from demolition debris, underground storage tanks for chemicals or petroleum products. Some contaminants can be naturally occurring, such as, hydrogen sulfide, methane gas, and other Volatile Organic Compounds (VOCs). Some of the employees expressed concerns that there may be contamination under the slab of the building from the time when it was used as a hospital. This was selected as one of the hypothesis to investigate. In order to investigate this hypothesis, the team selected two locations to drill into the slab. The air from under the slab in the two locations was collected into a sampling canister for 7.5 hrs. The first under-the-slab sample was collected in the evidence portion of the building where the former plumbing lines were located. The second under-the-slab sample was collected in room 129, which was reportedly the portion of the building where the complaints first started. The under-the-slab samples were collected concurrently with samples of the air inside the building. Two of the inside air samples were collected in proximity of the two under-the-slab samples.

Air quality problems can also originate from the building materials and furnishings of a new building, including carpeting, wood products, paint finishes and ceiling tiles. Occupants can also contribute to the VOC levels in the building from the use of air fresheners, deodorants, and cleaning and disinfecting products. Air quality problems can also be caused by the HVAC (Heating Ventilating and Air Conditioning) system. If the air conditioning does not remove sufficient amount of humidity from the air, it can lead to occupant discomfort, increased off-gassing from materials in the building and an increase in the level of mold biomass in the air and settled dust. Extended periods of relative humidity levels above 60 percent can lead to active mold growth.

3.2 Historical Information on the Property

The property was initially developed as a hospital, which was built in 1979. Relatively speaking, that is not very old. It is not an old building on an old industrial site that had historical contamination, such as those contaminated sites around the country that have become Superfund sites. EPA came into existence in 1970 and a lot of environmental regulation followed within the next decade. A Phase I Environmental Site Assessment (ESA) was conducted by Universal Engineering Sciences (UES). UES followed ASTM and EPA standards to perform the Phase I assessment. UES researched the history of the property and surrounding area back to 1943. The assessment revealed no unresolved environmental issues. The only evidence of historical contamination of the property was associated with a 1989 diesel release. The release was related to the removal of an underground 6,000-gallon diesel tank. Clean-up was conducted, and the second 6,000-gallon tank was removed in 1999. This release resulted in soil and groundwater testing on the site and subsequent soil removal and soil and groundwater remediation. The clean-up involved installation of 23 monitoring and recovery wells. After the remediation was finished, the Florida Department of Environmental Protection (FDEP) issued a Site Rehabilitation Completion Order in March of 2004. Thus, from 1989 through 2004, this site was undergoing periodic testing and monitoring for contaminants with FDEP oversight until it was determined that further testing was not necessary. This represented a significant soil and groundwater investigation at the site.

In addition to the Phase I ESA report, UES also conducted asbestos testing, lead base paint testing, and mold assessment of the old building. This resulted in the building being gutted with removal of all the old drywall, which essentially removed the interior finishes and components that could have potentially been contaminated and any mold impacted materials.

When ESi first requested some historical records and documents from the county, the county also provided a series of photographs that were reportedly taken during the recent construction. The photographs depicted some rotten wood on the outside of the block wall along the top of the wall. ESi initially conducted a walk-through of the Sheriff's operation center on June 4, 2018, and Dr. Hejzlar then attended the public workshop on the same day. The team requested that ESi check further into the photographs and if the wood was replaced. ESi obtained the available documents from the county and was able to confirm that the wood was replaced and that it was verified by actually coring into the finished building to confirm the replacement. *Attachment C* includes documentation of the process demonstrating that the rotten wood depicted in the photographs was replaced.

Concerns (hypothesis) were raised that the hospital may have been dumping contaminants into the sewer. However, during the construction of the operations center the old plumbing was replaced. This required cutting into the slab to remove the old plumbing from underneath the foundation. Some of the old pipes and joints reportedly had leaks and a hypothesis emerged that the leaks existed for a long time and allowed the chemicals that were dumped into the sewer to leak and accumulate under the slab. It was also reported that during the plumbing replacement, in the areas where some of the concrete was cut, the slab did not have a plastic vapor barrier. Because of the leaks and potential lack of vapor barrier it was theorized that the chemicals could potentially migrate through the slab, through the finished flooring and into the air in the rooms. This hypothesis was also selected for further investigation.

A related concern on the slab hypothesis was also expressed. Because the slab may not have a vapor barrier, the concern was that the vapor transmission rate into the building could be high and the vapor was bringing the contaminants from under the slab into the building. ESi's review of county records and specifications revealed that the county required the slab to be tested for vapor transmission rate to meet the flooring manufacturers specifications. Mr. Richard Gordon reported that he specifically recalled the discussions of the tests and that they were conducted and the slab passed the specifications prior to installation of the new flooring. ESi's investigation included drilling through the concrete and taking air samples from below the slab in two rooms in the building. During the investigation ESi found the slab to be 6 inches thick. ESi also tested the slab for conductivity that provides a relative result indicating that the concrete contained moisture. This test indicates that there is a moisture drive through the slab, which is common, but the rate of the moisture drive can be only accurately determined by ASTM tests that were required by flooring manufacturers and conducted prior to the floor installation.

Another method to verify the evidence of long term moisture drive is analysis of the condition of the floor under the furnishings. Many of the employees were relocated from the building, which enabled ESi to look under furnishings, such as book cases and desks. ESi also removed a carpet tile to gain access to the slab. In buildings where excessive moisture is coming through the slab into the building, the floor coverings can become moist or wet and transfer moisture under the furniture and can start mold growth. With carpet tile and other flooring with glue down applications, excessive moisture causes the glue to start breaking down and turn into liquid. ESi found no evidence of slab moisture drive causing mold or glue problems. ESi also suggested that if the county wished to have additional confirmation, the county should have a structural engineer familiar with the construction and vapor barriers/transmission rate evaluate the issue and provide opinion with respect to any further analysis.

During the ESi investigation, a suggestion was proposed that the property should have been "hot baked" to get rid of VOC emissions from newly installed building materials and finishes. It should be noted that this practice is not widely accepted or recommended, as it can result in more damage and create new problems. Certain forms of the practice, such as increased ventilation rates and increasing the building temperature to accelerate the off-gassing of materials, can be used to reduce VOCs but should not be performed without first testing for VOCs to see if such procedures would work or would be warranted. Many of the specifications for the Operations Center building materials specified low off-gassing products. The off-gassing can be higher in new buildings where every portion of the building, including the slab, is new and can continue to off-gas for an extended period of time. ESi's investigation included testing for VOCs under the slab and inside the building over 7.5 hour period to provide better understanding of actual levels of VOCs.

3.3 Prior Air Quality Assessments of the Operations Center Building

In July of 2013, the County considered the potential impact of pathogens left over from the hospital operations. Given the total removal of drywall and interior finish, the pathogen survival rate appeared highly unlikely and supported by the professional opinion provided by Dr. Mark Wallace, M.D. The letter in included in *Attachment D*. The UV treatment that has been installed in the current HVAC system is additional method to further reduce current pathogens from the air.

In November 2017, H2H Indoor Air Solutions conducted an investigation. The results of the investigation were reported in the December 12, 2017 report. The investigation was not limited to mold but included infrared investigation of possible moisture sources, HVAC inspections, carbon dioxide and moisture testing and evaluations, respirable particle size evaluation, volatile organic compounds (VOC) investigation, formaldehyde screening, common allergens testing including dander, dog and cat allergens, and bacterial contamination screening.

H2H assessment focused on the two most suspect areas at the time, which they reported as room 129 and the IT room. The results and analysis came back very low, not indicating a SBS. H2H also tested for mold VOC (MVOC) which are produced by living mold and they were essentially non-existent, further supporting the indication that the building did not have a significand mold problem or SBS from mold. Under all the currently acceptable remediation guidelines, the H2H results did not indicate a mold problem sufficient to warrant remediation and yet, in an apparent abundance of caution to eliminate any doubt, the county conducted the remediation based on discovery of a few spores. Documents obtained relating to H2H investigation are included in *Attachment E.*

On March 6, 2018, Mold-Spec sampled for mold using spore traps in 21 different locations inside the building and one outside. The spore traps are a specifically designed, funnel style, container to trap certain size of particles (size of typical mold spore) on an adhesive backed surface inside the trap. Particles that are smaller, as well as bigger, may not be captured. This means that desiccated mold fragments that are smaller may not be captured and could escape detection. Individuals with mold allergies can experience adverse reaction to any mold biomass not just spores. Mold-Spec collected each sample using standard collection methodologies which take 5 minutes. Molds are living organism and their level in ambient air can change over time. A 5-minute sample can be useful in generating a snapshot in time of the conditions of the building, but they may not be representative of the environmental conditions in the building over long term. Mold-Spec sample results concluded that the air quality was within normal limitations. The results indicated that the mold spore counts were not sufficient to represent mold growth in the building at the time of the test. The documents from Mold-Spec investigation are included in *Attachment T*. ESi used these results as additional data points in supplementing its investigation of total mold biomass in the building.

4. Testing

ESi's sample collection and testing was conducted in part 2 of the investigation on June 14 and June 15, 2018. The air samples collected from under the slab and inside the building were sent off to a laboratory for analysis on June 15, 2007. After the testing, Dr. Hejzlar was asked to prepare a letter summarizing the investigation conducted on June 14 and June 15, 2018. That letter is included in *Attachment G.*

4.1 Temperature and Relative Humidity

ESi noted that the relative humidity in portions of the building was around 60% with higher excursions in some areas of the building. At the time of ESi testing, many of the employees were already relocated. The occupant load in the building can impact relative humidity and ESi started to request and gather additional records, particularly from the time that the building was occupied. With temperature settings in individual rooms from 68 to 72 degrees Fahrenheit, ESi noted that the conditions appeared clammy. Relative Humidity (RH) is expressed as a measure of the amount of water vapor the air contains as a percentage of the total amount it could contain at a specific temperature. In a room with indoor air at 75°F and 60% RH, if the air cools down to 70°F, the air can no longer hold as much moisture, however, the actual amount of moisture in the air has not changed, so the relative humidity increases to about 70%.

ESi inspected the mechanical room that houses the (4) HVAC Air Handler Units (AHU) for the building and the computer that monitors the conditions of the AHU systems. The operator of the system stated that essentially, he has been operating the system in the same manner since it was turned over to him and the only changes that were made were to adjust the temperature of individual rooms at the request of the employees. He also stated that when he first heard of the complaints he created a form and periodically documented the parameters including humidity sensor information. Those records were obtained and are included *in Attachment H*. During the inspection, ESi also noted that all (4) units had Ultra Violet Light treatment installed. They have been installed recently as another effort by the county to improve air quality in the operations center. Ultraviolet germicidal irradiation (UVGI) is a disinfection method that uses short-wavelength ultraviolet (UV-C) light to kill or inactivate microorganisms by destroying nucleic acids and disrupting their DNA, leaving them unable to perform vital cellular functions. UVGI is used in a variety of applications, such as food, air, and water purification. The effectiveness of germicidal UV depends on the length of time a microorganism is exposed to UV, the intensity and wavelength of the UV radiation, the presence of particles that can protect the microorganisms from UV, and a microorganism's ability to withstand UV during its exposure. In HVAC systems, the approach has been effective at reducing spread of some airborne viruses, bacteria, and other pathogens but has limited effectiveness against mold. Although it can interfere with mold life cycle, dead mold fragments still can cause allergic reaction in sensitive individuals. For this reason, if there is evidence of mold growth, the mold growth cause in the building must be stopped in order to reduce mold biomass in the building.

ESi's experience has been that relative humidity in a conditioned building in a hot and humid climate should be less than 60%. For people living in hot and humid climates, like Florida, the relative humidity concept is important to understand. University of Central Florida published an easy to understand article to explain this concept. The article is included in *Attachment I.* The article includes recommendations for indoor air:

> *The best target to maintain indoor relative humidity is between 45%- 55%. Bacteria, viruses, fungi, and some pests such as dust mites begin to thrive in humidity outside this range. Indoor relative humidity above 60% for several hours in an air conditioned or heated home indicates that the air quality control could be improved.*
>
> *Monitoring the indoor humidity is not a guarantee that mold will not develop. Indoor air at 75F and 60% RH that comes in contact with an exterior wall with an interior surface temperature at 63F will have a surface RH of 90%. Exterior walls that are not insulated well during long cold periods can have interior surfaces low enough to maintain surface humidity above 90% long enough for mold and mildew to develop. A period of just a few days can be enough for mold to begin to grow under the right conditions.*

In their publication, *Mold Remediation in Schools and Commercial Buildings,* which is included as *Attachment J*, the EPA provides the following tip to prevent mold growth:

- Maintain low indoor humidity, below 60% relative humidity (RH), ideally 30 – 50%, if possible.

In December 2013, the EPA published *Moisture Control Guidance for Building Design, Construction and Maintenanc*e. A copy of that publication is provided as an *Attachment K*. This publication provides many tested and verified references to sound approaches to manage moisture in buildings.

Indoor Air Quality Guide - Best Practices for Design, Construction, and Commissioning was developed by American Society of Heating, Refrigerating and Air-Conditioning Engineers, The American Institute of Architects, Building Owners and Managers Association International, Sheet Metal and Air Conditioning Contractors' National Association, U.S. Environmental Protection Agency U.S. Green Building Council. This guide provides approaches to minimizing air quality problems in buildings and demonstrates the complexity of designing and monitoring the HVAC system for maximum indoor air quality. It is a copyrighted document that can be downloaded free to registered users. Due to copyright it is not included as an attachment, but interested parties can readily obtain it. The document demonstrates the complexity of the problem with many variables including occupant loads and for this reason ESi suggested mechanical engineering review of the HVAC system.

In 2003, the Centers for Disease Control and Prevention (CDC) asked the Institute of Medicine (IOM) to review all scientific studies to date about the possible connection between damp or moldy indoor places and problems with breathing or allergies. In its report, *Damp Indoor Spaces and Health*, released in May 2004, IOM concluded the following:

- The growth of some bacteria (germs) and molds is one effect of indoor dampness. Damp indoor environments also benefit house dust mites. Standing water supports cockroach and rodent (rats and mice) problems as well. Too much moisture may cause toxic chemicals to be released from building materials and furnishings.

- Mold spores are found in indoor air and on surfaces and materials. No indoor space is free of them.

- Damp indoor spaces may also allow the growth of bacteria that can cause negative health effects.

- Controlling moisture is the main way to control indoor mold growth.

After reviewing the studies, IOM determined that potential health effects of exposure to either damp indoor environments or to mold indoors could be classified in one of three ways: 1) "sufficient evidence of an association" between the exposure and the health effect, 2) "limited or suggestive evidence" of an association, or 3) "inadequate or insufficient information" to determine if an association exists. The following tables summarize these findings. The full report is provided as *Attachment L.*

Table 1. Evidence supporting an association between exposure to damp indoor environments and certain health effects.

Sufficient Evidence	Limited or Suggestive Evidence	Inadequate or Insufficient Information
• Upper respiratory tract (nasal and throat) Symptoms • Cough • Wheeze • Asthma symptoms in sensitized asthmatic persons	• Shortness of breath • Respiratory illness in otherwise healthy children • Development of asthma in susceptible persons	A variety of other health outcomes, including acute idiopathic pulmonary hemorrhage in infants

Table 2. Evidence supporting an association between the presence of mold (otherwise unspecified) indoors and certain health effects.

Sufficient Evidence	Limited or Suggestive Evidence	Inadequate or Insufficient Information
• Upper respiratory symptoms • Cough • Wheeze • Asthma symptoms in sensitized asthmatic persons • Hypersensitivity pneumonitis (a relatively rare immune-mediated condition) in susceptible persons	• Respiratory illness in otherwise healthy children	A variety of other health outcomes, including acute idiopathic pulmonary hemorrhage in infants

It should be noted that the environments in the IMS study were confirmed to be damp and moldy places. The operations center has not been confirmed through any historical evaluations or ESi's investigation as a classical damp space and found no evidence of the operations center being moldy. The allegations of SBS were accepted in hypothesis development, but to date never confirmed as SBS or BRI. Households where the occupants prefer natural ventilation, by opening doors and windows and turning off air conditioners whenever they feel comfortable enough with outside temperature and humidity, can have significantly higher relative humidity levels than ESi noted at the operations center building. People living in hot and humid climates are often exposed to environment where the relative humidity level is a lot higher than ESi documented at the center. During fog or rain the relative humidity outdoors is close to 100%, even though the temperature may feel cool. Exposures outside of the operations center is a factor that should be considered when evaluating employee's total exposures to humid environments and attributing the symptoms to specific BRI.

4.1.1 Relative Humidity Evaluation Conclusions

Based on the above described investigation, and to a reasonable degree of scientific probability, the following findings and conclusions are offered with respect to relative humidity. As additional information becomes available ESi will supplement this report with appropriate technical input as may be appropriate.

4.1.1.1 ESi is of the opinion that at the time of the investigation and at the observed temperature settings the HVAC system in the building was not removing sufficient humidity from the air inside the building.

4.1.1.2 Appropriate and effective ventilation temperature and humidity control is a complex issue and ESi suggested that mechanical engineer review the design and operation of the system and make appropriate recommendations.

4.1.1.3 The historical documentation on the HVAC operations of the building and the assessment of the HVAC operation by the mechanical engineer may become useful to the medical professional evaluating the employees' specific symptoms.

4.1.1.4 The relative humidity measured at the building were around 60%. People living in hot and humid climates are often exposed to environment where the relative humidity level is a lot higher. During fog or rain the relative humidity outdoors is close to 100% even though the temperature may be cool.

4.1.1.5 The relative humidity levels in houses and other buildings that are frequented by employees including outdoors levels could be significantly higher. ESi has not been provided with any information regarding the employee exposures to high humidity in these other environments that can comprise 2/3 of the time during a typical day that they do not spend in the operations center building. Potential for those exposures should also be considered by medical professionals when evaluating employee symptoms and exposures and when attempting to establish and validate BRI connection to the operations building.

4.2 Mold Testing

Mold has two main components that are important to identifying levels of mold in the buildings. They are Spores, and Hyphae. Examples are depicted in Figure 1. In laymen's terms these mold components can be thought of in terms of plants. The spores are the seeds that in the figure are coming out of the seed pod (sporangium) and the hyphae are the plant stems and branches. These components together are called **mold biomass**.

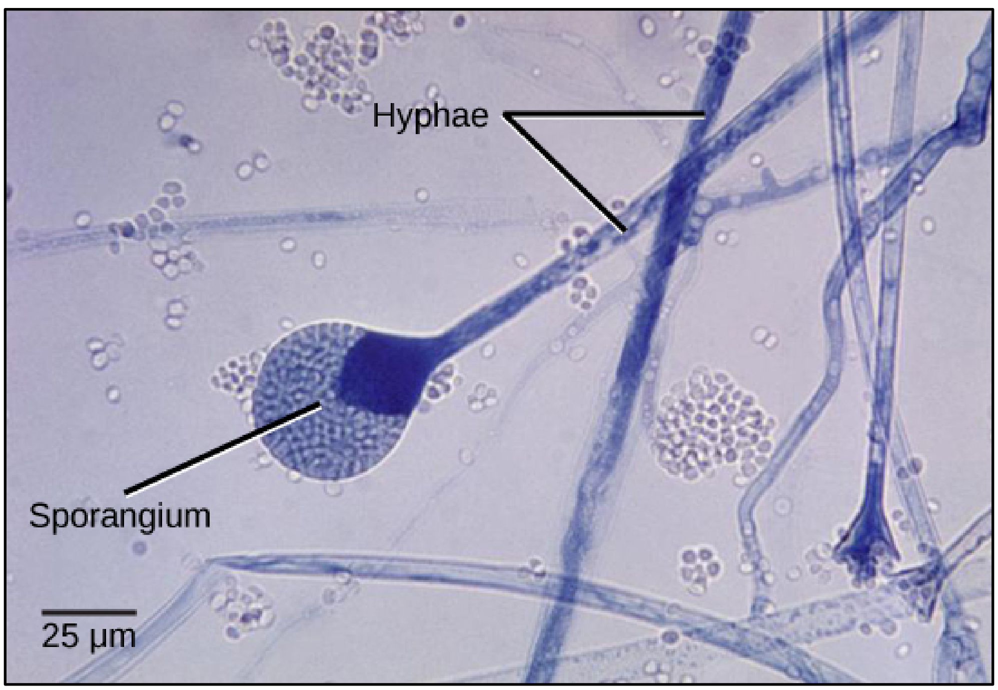

Figure 1. Release of spores from a sporangium: This bright field light micrograph shows the release of spores from a sporangium at the end of a hypha called a sporangiophore. The organism depicted is a Mucor sp. fungus: a mold often found indoors. Source (Lumen Boundless Biology Characteristics of Fungi,https://courses.lumenlearning.com/boundlessbiology/chapter/characteristics-of-fungi/.

When mold is actively growing, as depicted in Figure 1., all of these components can be seen under typical microscopic examination. If the mold growth is severe it can actually be seen by naked eye. It is referred to as **visible mold**. For this to occur mold needs sufficient supply of moisture to actively grow. As the moisture is removed, the mold starts drying out. Since the majority of hyphae and spores are made up of water, as the mold dries the stems and branches (hyphae) dry out and break apart into small pieces. These are called mold fragments and micro fragments. When spores dry, they may shrivel up a bit but retain their shape. Using the shape and color the lab scientist can identify the spore even when the mold is dry. They count the spores which they can use for concentration estimates and then speciate the mold into distinct types of mold. If they also see some hyphae that have not yet broken down into essentially unidentifiable fragments they can also identify those and that typically indicates to the lab scientist that the mold is actively growing because the hyphae that they see have not dried out yet.

When the Hyphae dry out the fragments are so small and so difficult to identify among the dust particles that although they are present, the laboratory may miss them altogether. Yet people that have adverse reactions to mold can be allergic to the fragments, as well as, the rest of the mold biomass.

The historical mold investigation by H2H at the operations center primarily included testing airborne mold and surface mold followed by microscopic analysis at the laboratory. Mold-Spec investigation only looked for airborne levels only and each of the 22 air samples were collected for 5 minutes. The samples indicated very low spore counts and no hyphae which indicated that active mold growth in the building was unlikely. ESI noted that neither investigation investigated mold biomass which means some portions or fragments of the mold biomass may not have been accounted for.

ESI decided to supplement the previous investigations by testing for total mold biomass using the MycoMeter technology. The MycoMeter-test has been developed and patented by microbiologists at the Copenhagen University in Denmark. The method is based on enzymatic detection of mold. Investigations have shown that the biomass of fungal colonies growing on surfaces correlate to ß-N-acetylhexosaminidase (enzyme) activity and that both hyphae, fragments of hyphae and spores possess this activity. The method is currently used for screening buildings suspected for mold growth and as a tool for decision making on remedial measures. The test is also used as quality control after mold remediation to verify that the mold remediation was successful.

The test is based on a fluorometric detection of N-acetylhexosaminidase activity. Sampling is performed with a cotton swab on a defined sample area (picture below) The cotton swab is then transferred to a buffer containing a synthetic enzyme substrate and incubated for specified time. The substrate is hydrolyzed by the enzyme releasing a fluorophore which can be quantified using fluorimetry (Figure 2). The result of a MycoMeter-test is a fluorescence-count (FC) attained under standard conditions.

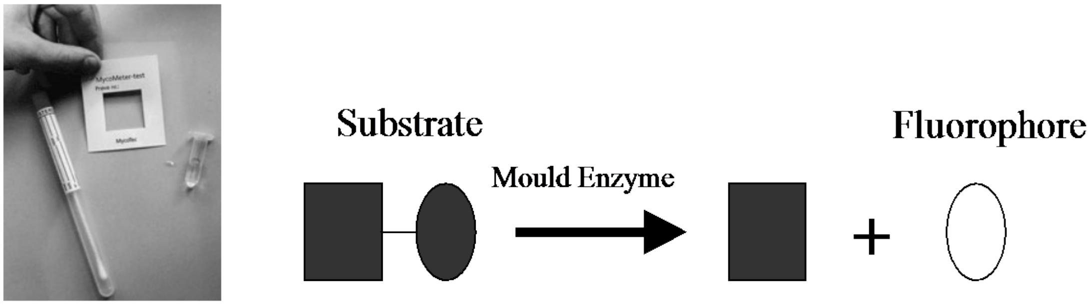

Figure 2. The photograph shows the sample collection template, the swab and wetting solution. These are used in collecting the sample. The graphic depicts the sequence of the analytical process. (Source – MycoMeter)

Additional information on the technology is provided in the *Attachment M.* The following excerpt from MycoMeter Manual describes the reasons for using Mold biomass as a measure of mold levels rather than counting spores and was one of the main reasons for ESi in selecting this methodology

> *Traditionally, quantification of fungi in the air has focused on counting fungal spores. Laboratory data have presented data as viable spores or total spores. However, it is important to recognize that some mold species growing on building materials only produce few or no spores. Even on nutrient rich growth media (agar), it has been shown that 95-100% of fungal biomass consists of hyphae, and thus only 0 to 5% is present as spores (8). In scientific literature the term fungal propagules are sometimes used. This term reflects the fact that airborne fungal particles consist not only of spores but also of hyphae or hyphal fragments. Hyphal fragments, which are not to be confused with micro fragments, occur when the mold mycelium break into smaller pieces. These fragments are easily aerosolized. Hyphal fragments can be defined as being bigger than 1 µ and recognizable (by microscopy) as originating from hyphae. Hyphal fragments have been shown to sometimes be released in greater quantities than spores (5). Incorporating counts of hyphal fragments (and not just spores) in epidemiological studies strengthened the relationship between fungal presence and the severity of asthma.*
>
> *In more recent studies, fungal micro particles have been shown to occur in indoor air. Micro fragments may originate from spores or hyphae but they are small (≤ 1 µ) and it is not possible to identify from microscopy whether they originate from spores or hyphae or are indeed of fungal origin at all. Micro fragments may also occur in the air in numbers much higher than the numbers of total spores (8). Some researchers believe that these micro-fragments can be important in connection with exposure and health symptoms. (Source – MycoMeter)*

Since some sensitized individuals can be affected by any mold biomass, the MycoMeter method is useful because it is **ultraconservative** (protective of health) at detecting mold biomass in a sample. In layman's terms the MycoMeter method used by ESi does not care what kind of mold it is, if it is dead or alive and it measures and quantifies total mold biomass including all of the fragments and micro-fragments from hyphae and spores. Further description of the methodology and EPA verification of it are included in *Attachment M.*

ESi collected dust samples for mold analysis in 23 different locations in the building. The locations included those that the employee representatives suggested that ESi test based on their communications with affected employees. Several times during the investigations the employee representatives reached out to the affected employees by cell phone to pinpoint areas of the investigation. In order to maximize the longer-term data collection ESi requested that cleaning chemicals and room deodorizers were not used and at least some portions of the offices were not cleaned to allow dust to accumulate. This combined with employee relocation prior to the investigation ESi samples are representative of more contaminated indoor environment than would be expected during fully occupied times. This also helped to minimize the interference of occupant load related mold and VOC impacts on the air quality of the building.

Unlike measuring gases, fungal biomass are particles that will settle in stagnant air. Theoretically, an average mold spore will fall by approx. 1 meter (3.28 Feet) per hour in completely stagnant air. In reality the settling occurs a lot faster if e.g. the particles clump together or if the spores are large like Stachybotrys Chartarum aerosols that settle in 10 minutes in stagnant air. Penicillium aerosols that are lighter than Stachybotrys, settle in 20-30 minutes in stagnant air. Thus, if there is mold in the building it will be in the settled dust. The amount of it depends on how long it took the dust to settle and how much mold is in the air.

Fungal spores enter buildings through ventilation air (doors, windows, make up air on HVAC system), on garments, ambient airborne particulate, footwear and other materials. Spores continually settle on the interior surfaces of buildings and are a normal constituent of interior dust. Poor cleaning results in excessive accumulation of spores in building dust. Certain activities can stir up dust, such as physical activity in a room and fans and HVAC systems that are turned on and off. A number of fans were noted around the building during ESi investigation. This typically indicates that employees find the HVAC inadequate to provide sufficient comfort in their work zone and use fans to increase their personal comfort levels. This can lead to increased levels of dust including mold biomass in the air. Exposure to dust and mold biomass may be irritating for sensitized persons with allergies. Housekeeping and the HVAC systems should be used to minimize the concentration of dust in the indoor air.

ESi concentrated sampling in locations with heavy dust settlement to evaluate worst case condition and representative of multiple days that it took for the dust to settle. ESi specifically did not test areas that were recently cleaned because this would result in artificially low results. Since many of the employees were moved out of the offices the samples included the dust that was stirred up as a result of the move and are representative of more contaminated environment that normal occupancy would generate. The historical mold investigation by H2H and Mold-Spec that were conducted during the time that the building was in use, identified very low quantities of mold. By the time ESi conducted the investigation many of the offices had visible dust accumulations on portions of the furniture. These conditions were documented by photographs including sampling locations. The photographs from the investigation appear in *Attachment N.*

Discussion of the MycoMeter Mold Biomass Testing and Interpretation of Results

Tables 3, 4 and 5 show the results of the MycoMeter testing at the operations center.

Table 3. MycoMeter results samples 1-5

MycoMeter Calculation Sheet

Date: 6/16/2018
Project Name: FCSOC
Test Ambient Temperature: 24.5 C
Incubation Time: 27' 11"
Instrument Standard Value: 645
Calibration Value: 645
Black Standard Value: 0.163

Sample No.	ESI Job No.	Description of Sample	BV1	BV2	(BV2 - BV1)*0.84	CV	AV	MV	CATEGORY
1	63367F	138-Narcotics Pipe (old dust)	11	25	12	37	53	16	A
2	63367F	139-BIO- top shelf	13	24	9	33	49	16	A
3	63367F	137-Evidence room (old dust)	11	29	15	44	91	47	B
4	63367F	134-Evidence-top of security camera	11	27	13	40	76	36	B
5	63367F	139-BIO- visible mold between cooler&freezer	13	27	12	39	438	399	B
					0	0		0	
					0	0		0	
					0	0		0	
					0	0		0	
					0	0		0	

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Sampling by: ZIH
Analysis by: DGV
Batch: 291
AV=9999=OVER

Table 4. MycoMeter results samples 6-15

MycoMeter Calculation Sheet

Date: 6/16/2018
Project Name: FCSOC
Test Ambient Temperature: 24.5
Incubation Time: 27' 11"
Instrument Standard Value: 645
Calibration Value: 643
Black Standard Value: 0.099

Sample No.	ESI Job No.	Description of Sample	BV1	BV2	(BV2 - BV1)*0.84	CV	AV	MV	CATEGORY
6	63367F	129A-Investigations Major Case Supv Office	10	19	8	27	41	14	A
7	63367F	129-Investigations desk dust	10	17	6	23	37	14	A
8	63367F	103-Records above ceiling	10	19	8	27	30	3	A
9	63367F	103 Records under tv	10	18	7	25	63	38	B
10	63367F	152-Commanders room	10	19	8	27	64	37	B
11	63367F	111-Investigations- Costello desk	10	19	8	27	97	70	B
12	63367F	111-Investigations- Sandberg	10	20	8	28	39	11	A
13	63367F	118-Victims Services- top book shelf	10	20	8	28	46	18	A
14	63367F	126-Monitor room desk	8	18	8	26	71	45	B
15	63367F	157-Accountant	10	19	8	27	49	22	A

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Sampling by: ZIH
Analysis by: DGV
Batch: 328
AV=9999=OVER

Table 5. MycoMeter results samples 16-23

MycoMeter Calculation Sheet

Date: 6/16/2018
Project Name: FCSOC
Test Ambient Temperature: 24.5
Incubation Time: 27' 11"
Instrument Standard Value: 645
Calibration Value: 643
Black Standard Value: 0.099

Sample No.	ESI Job No.	Description of Sample	BV1	BV2	(BV2 - BV1)*0.84	CV	AV	MV	CATEGORY
16	63367F	172-Chief Paul Bovinea- Bookshelf	9	19	8	27	39	12	A
17	63367F	105A-HR-clock	10	18	7	25	84	59	B
18	63367F	106-HR Director-Top of bookshelf	9	21	10	31	47	16	A
19	63367F	146-Muster/Training Top of flag	10	19	8	27	88	61	B
20	63367F	145-AHU 1 6/7/2018 7:35AM	9	19	8	27	209	182	B
21	63367F	145-AHU 2 6/7/2018 7:45AM	9	19	8	27	39	12	A
22	63367F	145-AHU 3 6/7/2018 7:55AM	9	18	8	26	83	57	B
23	63367F	145-AHU 4 6/7/2018 8:05AM	10	20	8	28	60	32	B
					0	0		0	
					0	0		0	

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www.epa.gov/etv

Sampling by: ZIH
Analysis by: DGV
Batch: 328
AV=9999=OVER

The test results are quantitatively expressed in the table in a column titled MV which represent the MycoMeter value in the second to last column on the right. The MycoMeter value determines what category of mold biomass was found, A, B or C, as indicated in the last column.

With respect to understanding mold contamination and mold growth MycoMeter has published the following information.

Excessive Levels of Fungi Indoors
Generally, a building will suffer fungal contamination when moisture conditions allow fungal spores to germinate and produce mycelia and spores, in other words, to grow.

There are three important aspects of fungal growth:
1. When fungal growth occurs, the amount of fungi can increase more than a million-fold compared to the normal background level (see box below). An effect of harmful compounds from fungi depends on the extent and duration of the exposure. Not all fungal species produce toxic compounds (mycotoxins); however, all species produce allergens, volatile organic compounds (VOC's) and beta-glucans. The potentially dramatic increase in exposure when indoor fungal growth occurs makes growth of any fungi a potential health hazard.

2. When fungi grow on surfaces, the hyphae (unlike the spores) adhere strongly to and often penetrate building materials. This necessitates the use of diligent and sometimes specialized clean-up methods in the remediation process.

3. Fungal growth is always an indication of a moisture problem. Therefore, solving a fungal problem always involves solving the moisture problem.

Growth and Biomass
One spore (Geotrichum candidum) weighs 50 x10^{-9} mg (reference 2). In moist conditions the spore will be able to germinate and produce hyphae and spores equal to a biomass of one mg in 3-6 days (doubling time 3-6 hours). This equals a 20 million-fold increase in weight (biomass); one spore is now equal to a biomass of 20 million spores. If moist conditions prevail, 50 viable spores in 1 mg of dust will germinate and in a matter of days, produce mycelia and spores equal to the weight of one billion spores. Contaminated insulation material may contain millions of spores per square centimeter of material. (Macher, 1999)

Categorizing the level of fungal contamination is critical when preparing a building evaluation. However, few guidelines exist, that are based on scientific data, for instructing professionals about acceptable or unacceptable levels. Therefore, an important part of the development of the MycoMeter method was to create a scientific, reliable, repeatable method of interpretation. MycoMeter has developed that method and verification. The scientific basis and validation is included in *Attachment M.*

The MycoMeter test results have been divided into three categories of interpretation. These categories were empirically derived by Mycometer from investigations of surfaces in a number of representative buildings. (see *Attachment M*)

A	Mycometer-Value ≤ 25	The level of fungi is not above normal background level.
B	25 < Mycometer-Value ≤ 450	The level of fungi is above normal background level. This is typically due to high concentrations of spores in dust deposits but may in some cases indicate the presence of an old fungal damage (fungal growth).
C	Mycometer-Value > 450	The level of fungi is high, above normal background level, due to fungal growth.

Mycometer Values below 10 should be reported as Below Detection (BDL) (significance level: 99%).

Mycometer values below 16 should be reported as Below Method Quantification Limit (BMQL) (significance level: 99%). For further details see Section: "Detection Limit", page 31.

If the fluorometer displays "over", the signal is over the maximum readable number. It should be reported as ">6000-8000".

ESi's investigation was focused on identifying potential health threat to employees. Category C represents a potential health threat to sensitized population. There are times where outdoor levels of mold reach Category C as evidenced by mold spore counts advisories published by local news media during certain part of the year. When Category C occurs on the inside of a building it is indicative of a mold growth problem inside the building.

Category A represents a clean environment with good housekeeping and little dust accumulations. It is also used when there has been a mold remediation and mold levels in the building before the remediation were Category C. Getting a Category A result after remediation indicates that the mold remediation was successful.

Mold level B comprises the conditions between Category A and C. Many households in Florida that have visible dust accumulations test with category B. Households where the occupants prefer natural ventilation by opening doors and windows and turning off air conditioners whenever they feel comfortable enough with outside temperature and humidity end up having enough mold biomass similar to outdoors conditions which are typically Category B unless it is in in hot and humid weather which typically results in mold growth and Category C. Well maintained households in Florida (without water leaks, significant moisture intrusion, vacuumed, dusted and air conditioned when outside relative humidity reaches 55%) are likely to maintain level A. Dust build up, occasional relative humidity excursions above 60% and occasional lapses in housekeeping or infrequently cleaned or difficult to access areas (elevated plant shelves, large entertainment centers/cabinets/furnishings) can cause shift from category A to category B.

All of the samples taken at the operations center resulted in either Category A and B and indicate that the building does not have an active mold growth problem. Individual results are discussed below.

Sample 1. Room 138 Narcotics sample was collected from a sprinkler pipe near the ceiling that has probably not been cleaned for an extended period of time, perhaps since the building was first occupied. Photos in Figure 3 show photos of the location of the pipe and the dust accumulation on the pipe in the location where the sample was taken. The cleaned square on the pipe is the result of sampling and removing the accumulations from the pipe and collecting them on the sampling swab. Historically, these levels of dust in warehouse locations in Florida result in high Category B results. The result was MV 16 which is a Category A. This indicates that this room does not have a mold growth problem. The mold value would essentially pass the post remediation criteria. Nonetheless dust accumulation as heavy as observed on the pipes in the room should be part of a periodic cleaning as this room including the pipes above the shelves are part of the occupant breathing space when people walk in and out and if disturbed could lead to dust irritants being inhaled or coming into contact with skin and eyes. Wiping the hard surfaces with moist cloth or vacuuming would minimize the potential for exposures. This room has HVAC vent that provides conditioned air to it. It has no return back to the HVAC, it has a vent directly to the outside of the building exhausting any potential irritants from this room.

.

Figure 3. Room 138 Narcotics – dust accumulations on a water sprinkle pipe above the file shelves. Sample 1 location.

Sample 2. Bio storage room top shelf. There were no visible accumulations of dust at this location and the result was MV 16 which is category A. The location is depicted in Figure 4.

Figure 4. Room 139 bio storage.

This room also houses the walk-in freezer and refrigerator. There was water on the floor from an apparent condensate leak or condensation issue and the wall behind and between the refrigeration units was damp and had some visible mold. The condition is shown in Figure 5. The test of this area is sample number 5 and returned MV of 399 Category B. This indicates that the mold was desiccated and not mobile and not spreading into the rest of the room. The leak needs to be fixed and the damaged drywall replaced. These activities are likely to generate dust and the area of repair should be isolated from the rest of the room to keep the dust contained.

Figure 5. Room 139 Bio storage; wall behind and between the refrigerator and freezer in need of repair.

Sample 3 Room 137 evidence room on top of sprinkler pipe. The dust accumulations here were similar to the narcotics room next door. The MV was 47 indicatives of accumulated dust but no evidence of Mold contamination. Figure 6 shows the dust on the pipe where the sample was taken from. Housecleaning and relative humidity management in these areas is likely to result in Category A, like in the adjacent rooms 138 and 139.

Figure 6 Dusty sprinkler pipe in evidence room # 137 where sample number 3 was taken.

Sample 4 was taken from the top of the security camera in evidence office in room # 134. The MV was 36 – a low Category B indicating that there is not a mold problem in this room. Housekeeping and relative humidity management is likely to result in bringing this area of the building back into Category A. Figure 7 shows the location of the camera in the corner of the room where the dust accumulations were sampled.

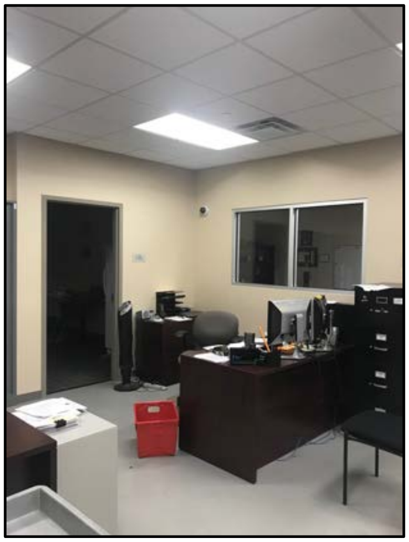

Figure 7. Security camera in the corner of the room where the sample was taken.

Samples 6 and 7 were taken in room 129A Supervisor's office and the dust accumulated on one of the desks in room 129 respectively. The sample from the supervisor's office was taken from the vent above the desk. Figure 8 shows the sampling locations. Both returned Category A. The MV count from both samples was 14 which is so low that it is considered Below Method Quantification Limit. This indicates that there is not any mold contamination in this part of the building. These rooms reportedly went through a mold remediation. The results indicated that the remedial efforts were successful. This room has not been in use for some time and the desk had significant dust accumulation including white specks that ESi found to originate from the tile used in the drop ceiling grid.

Figure 8. Sampling locations – Vent in room 129A(left) and dust on desktop in room 129(right)

Samples 8 and 9 were collected in Records – room 103. Sample 8 was taken from dust above the drop ceiling grid. Sample 9 was taken from dust accumulation on battery backup/surge protector under the TV. The MV for sample 8 was 3 which is Category A and the mold level is considered below detection limit in the area above the drop ceiling. The MV for sample 9 dust accumulations was 38 which is a Category B. The level in the room is higher than the area above the ceiling. This indicates that the mold in the room did not originate from the ceiling above but are from other sources. Housekeeping and relative humidity management is likely to result in bringing this area of the building back into Category A. Figure 9 shows the sampling locations.

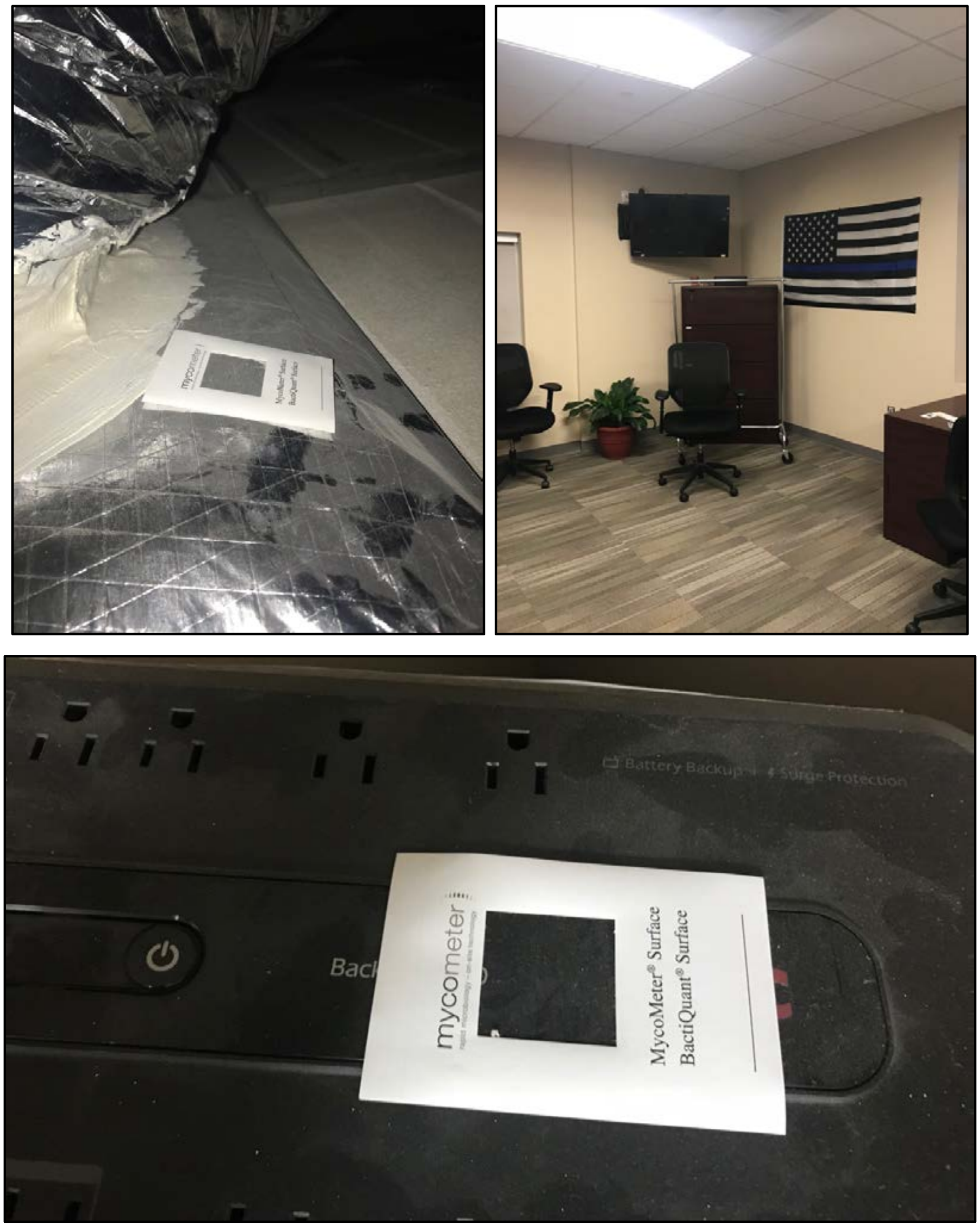

Figure 9. Sampling location above the ceiling (upper left) and under the TV (upper right); close up of the sample location on battery backup (bottom).

Sample number 10 was collected from room 152 Commanders room. The temperature in the room was set at 69 degrees. The sample was taken from top of the bookshelf. The MV vas 37 which is a low Category B. Housekeeping and relative humidity management is likely to result in bringing this area of the building back into Category A. Figure 10 shows the sampling location.

Figure10. Sampling location in room 152

Samples 11 and 12 were taken in the investigations room 111; sample 11 from heavy accumulations on Costello's desk and sample 12 from Sandberg's desk. Figure 11 depicts the sampling locations.

The MV were 70 (Category B) and 11 (Category A) respectively. The results demonstrate the impact of heavy dust accumulations that tend to have more settled mold biomass than the smaller dust accumulations. Housekeeping and relative humidity management is likely to result in bringing this area of the building back into Category A.

Figure 11. Room 111 sampling locations (Costello left, Sandberg right)

Sample 13 was taken from top of book shelf in Victim's services room 118. It returned MV 18 (Category A). The results indicate clean conditions with respect to mold. Sample location is depicted in figure 12.

Figure 12. Sampling location in room 118

Sample 14 was collected in room 126 Monitor room desk that had heavy dust accumulations on the corner portions of the desk away from the chair and behind the computer screen. The location is depicted in figure 13. The MV value was 45 (Category B). Housekeeping and relative humidity management is likely to result in bringing this area of the building back into Category A.

Figure 13. Monitor room # 126

Sample 15 was taken from Payroll Accounts payable room 157. The sample was collected in the vicinity of the accountant's desk. The location is depicted in Figure 14. MV value was 22 (Category A). The results indicate clean conditions with respect to mold. The righthand side of the figure has the dust with hand prints. This demonstrates the dermal pathway. Our hand and exposed skin are moist and will collect dust. Although the mold in this sample is low, sensitized individuals could experience adverse reaction to dust that they contact. The dust was most likely result of the recent evacuation but housekeeping during occupancy should minimize the level of dust accumulation that was noted in the building.

Figure 14. Sampling location from room 157.

Sample 16 was collected from room 172 Chief Paul Bovino bookshelf. MV value was 12 (category A). The results indicate clean conditions with respect to mold. The sampling location is depicted in Figure 15.

Figure 15 Room 172 sampling location.

Sample 17 was collected from HR room 105A from the top of the clock. The MV vas 59 which is a Category B. Housekeeping and relative humidity management is likely to result in bringing this area of the building back into Category A. Figure 16 shows the sampling location.

Figure 16. Sampling location in room 105 A

Sample 18 was collected from HR director room 106 top of the bookshelf. MV value was 16 (Category A). The results indicate clean conditions with respect to mold. The sampling location is depicted in figure 17.

Figure 17. Sampling location in room 106

Sample 19 was collected from Muster/Training room # 146 from the top of the wooden flag. The MV vas 61 which is a Category B. The sampling location was not particularly dusty, but the porous wood can provide mold food if excursions in relative humidity are above 60% and remain that way for sufficient length of time. This result indicates that the wood reached sufficient humidity to start to accumulate above normal mold biomass. Housekeeping and relative humidity management is likely to result in bringing this area of the building back into Category A. Figure 18 shows the sampling location.

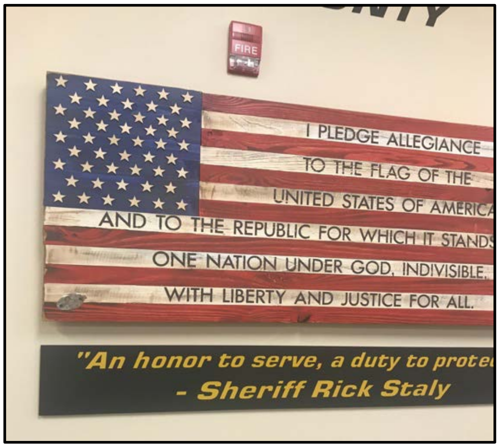

Figure 18. Sampling location in room # 146.

In addition to sampling dusty areas of the rooms ESi requested that the air filters for all four air handlers be preserved. The air filter tests are important part of the investigation because all of the air that the employees are exposed to passes through these filters and the particulate matter that is left behind includes mold biomass. Figure 19 indicates which air handler is associated with which part of the building. The amount of the particulate matter and mold is representative of longer term exposure scenario (since the last time the filters were replaced). The filters that were in units AHU 1 through AHU 4 were installed on 5/17/18 and were removed 6/7/18. They collected airborne mold and particulate matter for 20 days. The results from AHU 1 was MV 182; AHU 2 was MV 12; AHU 3 was MV 57 and AHU 4 was 32. Figure 20 shows the sections of HVAC filter material that were sampled. The sample results from the HVAC return filters represent values of mold that have been airborne and flowed through air returns and represent the amount of mold in the air generally under the airflow and room exchange rates for those respective air handlers. The MV 182 sample result in AHU 1 relative to the results of the other 3 AHU being either A or very low Category B is elevated. The filter from AHU 1 also appeared to have more dust on it when compared to the others. This could either be poor humidity control in the area served by AHU 1 including outside ventilation from opening doors, or increased personnel activity stirring up more dust in that part of the building served by AHU 1. AHU 1 also has the largest fresh make-up air duct of the 4 AHUs. The fresh make-up air also passes through the filters. Although the MV is elevated when compared to the other AHUs it is well below category C and not indicative of mold growth issues and potential health threat. ESi requested Mechanical engineering assessment of the HVAC system. ESi noted that during the investigation the fresh make up air does not appear to be conditioned, treated or separately filtered and is upstream of the AHU filter location. ESi requested that the fresh make-up air be included in the mechanical engineering review as it could contribute to humidity variations and may provide a pathway for outdoor mold, dust and debris to be deposited on the individual filters.

Housekeeping and relative humidity management based on the results of the HVAC system engineering review is likely to result in reducing mold levels on the air return filters into category A.

Since the filter is located at the air handling unit, after the building returns and introduction of fresh make-up air, the tests are also useful in if there is mold growing in the return duct system in sufficient quantity to be airborne. When that happens the MV from the air filters typically range from MV 450 to several thousands. The results indicate that there is not a water, moisture or mold growth in return ducts.

[redacted]

Figure 19. Security Plan Schematic for Air handler system on parts of the building it controls. (A1 through A 4 were sampled) Redacted for security reasons

Figure 20. Air handler unit filter sampling.

4.2.1 Mold Evaluation Conclusions

Based on the above described investigation and to a reasonable degree of scientific probability, the following findings and conclusions are offered with respect to mold evaluation. As additional information becomes available ESi will supplement this report with appropriate technical input as may be appropriate.

4.2.1.1 It is ESi's opinion that the operations center is not adversely impacted with mold.

4.2.1.2 None of the sample results indicated current mold growth or mold contamination.

4.2.1.3 Source of the water damaged area between the walk-in refrigerator and walk-in cooler needs to be fixed. The water damaged drywall including any water impacted insulation needs to be replaced or repaired as required.

4.2.1.4 Improved housekeeping and humidity control should be sufficient to return locations of the building that tested with category B levels to Level A – Normal background levels.

4.2.1.5 The results are representative of relatively low mold levels at the sheriff's operations building. The mold levels in houses and other buildings that are frequented by employees could be significantly higher. ESi has not been provided with any information regarding the employee exposures to mold in these other environments that can comprise up to 2/3 of the time during a day that they do not spend in the building. Potential for those exposures should be considered by medical professionals when evaluating employee symptoms and exposures and when attempting to establish and validate BRI connection to the operations building.

4.3 X-Ray Fluorescence Evaluation

ESi tested building substrates including the surface of the concrete slab, a concrete block wall, precast concrete wall (original construction), painted and unpainted drywall, and dust samples using a high precision XRF (X-Ray Fluorescence) Analyzer that detects elements including heavy and light ferrous and non-ferrous metals. This screening provides elemental data that is both qualitative (what is it?) and quantitative (how much is there?). The instrument being used in the investigations and analysis was the Thermo Niton Portable XRF Analyzer; model number XL3t900s, serial number 36951. The instrument is equipped with a silicon drift detector and the light filter provides detection of light elements. The elemental detection range for this instrument is magnesium (atomic number=12) to bismuth (atomic number=83).
ESi tested the drywall in room 103 including the paint. Another drywall test was conducted above the drop ceiling which was not painted. Room 103 also had unpainted concrete block wall that was visible above the ceiling and also a portion of the pre-cast concrete wall from the former hospital. ESi tested both of these substrates. The patched concrete floor in room 134 was tested. The old concrete between room 134 and 143 was tested. Another test was conducted on a patch that had a mark in it between room 143 and 142A. The painted block wall in the mechanical room was tested. The dust sample from room 103 was tested, White particles from the drop ceiling were also tested. All of the test results are included in Attachment O. The result of the XRF screening did not reveal any anomalies with respect to the construction materials including the walls and the concrete slab. The analysis of the dust sample from room 103 indicated that the white particles origin is from the ceiling tile. The particles are present in the room dust and not in the dust from above the ceiling. The white particles can potentially be an irritant to sensitized individuals if the humidity in the room causes occupants to sweat and their moist skin comes

into contact with the dust. Medical evaluation would be needed to determine if the white particles in the dust are related to employee complaints. Improved housekeeping and humidity control should be sufficient measure to minimize the potential for employee exposure to these particles.

4.3.1 XRF Screening Conclusions

Based on the above described investigation and to a reasonable degree of scientific probability the following findings and conclusions are offered with respect to XRF screening. As additional information becomes available ESi will supplement this report with appropriate technical input as may be appropriate.

4.3.1.1. The construction material test results did not reveal any anomalies.

4.3.1.2. There was no evidence that would support the hypothesis that the building materials from the former hospital building contain toxic compounds (heavy metals) that are being released into the indoor environment of the building above normal background levels. (also see VOC section)

4.3.1.3. The dust sample analysis confirmed that the origin of the white particles in the dust is from the drop ceiling tile. Improved housekeeping and humidity control should be sufficient measure to minimize the potential for employee exposure to these particles.

4.3.1.4. The results are representative of relatively low levels of white particles in the dust of the building. The dust levels and different components of dust irritants in houses and other buildings that are frequented by the employees could be significantly higher. ESi has not been provided any information regarding the employee exposures to dust in these other environments that can comprise up to 2/3 of the time during a typical day that they spend outside of the building. Potential for those exposures should be considered by medical professionals when evaluating employee symptoms and exposures and when attempting to establish and validate BRI connection to the operations building.

4.4 VOC Testing

In March 15, 2017, Construction and Toxicology Committees, and Green Building Working Group Sponsored by the AIHA (American Industrial Hygiene Association) published a paper on Volatile Organic Compounds (VOC) Criteria for New Construction. It represents recent publication information on the subject and provides a summary of scientific process on the VOC issues. This document as well as other research article are provided in Attachment P to this report. The report provides the following background and historical perspective on the subject.

> *VOCs are ubiquitous in both outdoor and indoor air. Sampling typically identifies between 50 and 300 different VOCs in indoor air, with individual compounds in the 1 to 10 µg/m3 range and TVOCs in the 200 to 5000 µg/m3 range. Indoor VOCs originate from construction materials in addition to outside sources, vegetation, bioeffluents, occupant activities, and building maintenance.*

Although the health effects of VOCs on building occupants have been recognized for over 100 years, the first chemical characterization of VOCs in building air (in Rotterdam) was not published until the 1960s. In the 1970s, the U.S. Environmental Protection Agency (EPA) measured the concentrations of air pollutants indoors and compared them to outdoor exposures, concluding that personal air exposures from chemicals indoors were greater than outdoor exposures.

VOC criteria for new and renovated buildings have been included in Leadership in Energy & Environmental Design (LEED) credits by the U.S. Green Building Council (USGBC), the American Society for Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) high-performance green building standard, the International Green Construction Code (IgCC), the WELL Building Standard3a and Green Globes.3b The most commonly used VOC criteria for indoor air are those specified by LEED. The most recent iteration of LEED VOC criteria are included in standard version 4 (v4), which sets concentration limits for 33 individual VOCs and for total VOCs (TVOCs). ASHRAE 189.1 and IgCC also specify concentration limits for 33 VOCs, including 29 listed by LEED

ESi included these criteria when evaluating the VOC data from the operations center testing. It should be noted that ESI VOC testing includes more than the 33 VOC chemicals by ASHRAE and 29 by LEED. The 33 chemicals are associated with building materials that could be potentially harmful at concentrations above the VOC criteria thresholds. Many VOCs in occupied buildings are present as a result of people in the building including items like potpourri, perfumes, deodorants, detergents, cleaning chemicals, air fresheners and other items brought into the office environment by occupants. Many of these products include items such as Freon, alcohol, isopropyl alcohol and acetone that have not been associated with adverse reaction at the part per /billion levels in indoor air.

It should be also noted that the initial review of the materials provided by County Engineering Department included the specification of the materials used in the construction. The review demonstrated that the construction materials were tested and certified to applicable industry standards. This included many of the low VOC emissions and safety standards in the industry. Those documents are listed in *Attachment B.*

ESi also used the results of H2H VOC investigation to compare the results with ESi's result to assess if the results were generally consistent given the different methodologies, time of the year and occupant load. ESi also used a conservative guidance proposed by Prism Analytical technologies and is depicted in Table 6.

Table 6. Prism Analytical Inc. Suggested VOC levels

Total VOCs in Air

d.

In order to investigate the hypothesis that VOCs were entering into the building from underneath the slab, the slab was drilled in two locations agreed upon by the investigative team and the air from under the slab was collected into a sampling canister for approximately 7.5 hrs. The first under-the-slab sample was collected in the evidence portion of the building where the former plumbing lines were located. The second under-the-slab sample was collected in room 129 which was reportedly the portion of the building where the complaints first started. The results indicate that the concrete slab is effective as a barrier from the VOC compounds migrating through the slab and significantly affecting the air quality on the inside of the building.

Five (5) additional samples were collected inside the building above the slab including two next to the sub-slab sample locations and three additional locations inside the building as controls with one of the controls specifically placed in the Evidence portion of the building. The sampling location identification for the 7 VOC canister tests are:

Sample ID 1- Secure Corridor between Evidence Cage 137 and Narcotics Rm 138
Sample ID 2- SUB-SLAB, next to plumbing repair in slab, RM 134 Evidence Forensics (Just outside the corridor where Sample 1 is)
Sample ID 3- SUB-SLAB, Supervisors RM 129 (Main Room)
Sample ID 4- Supervisors RM 129- Main Room outside supervisor's office (office door open, Room 129 door closed)
Sample ID 5- Main Hall outside Commanders RM152
Sample ID 6- RM 103 Records
Sample ID 7- RM 111 Investigations

The laboratory result from the (7) VOC sample cannisters is included in *Attachment Q* to this report. Some of the samples showed highest values for Alcohol based compounds used in many aerosol products including air fresheners and disinfectants. Another confirmation of use of aerosols was the detection of Freon compounds since they are used as accelerants in sprays including Asthma inhaler's. Ethanol is not even listed as one of the (33) VOC compounds by ASHRAE. Isopropyl alcohol (Isopropanol) used as a common disinfectant is listed by ASHRAE at limit value of 7000 micrograms per cubic meter. For this reason, the TVOC results from the ESi study were adjusted in Table 7 for alcohol compounds.

Table 7. Total VOC results and adjusted VOC results for the seven canister tests. The results are in Micrograms per cubic meter. The adjusted VOC exclude Alcohol and Isopropanol values.

Sample Id	Total VOC	Adjusted VOC
1- Secure Corridor between Evidence Cage 137 and Narcotics Rm 138	150	77
2 - SUB-SLAB, next to plumbing repair in slab, RM 134 Evidence Forensics (Just outside the corridor where Sample 1 is)	730	696
3- SUB-SLAB, Supervisors RM 129 (Main Room)	2000	1970
4- Supervisors RM 129- Main Room Outside supervisor's office (door open)	190	114
5- Main Hall outside Commanders RM152	220	119
6- RM 103 Records	640	90
7- RM 111 Investigations	220	88

In addition to VOCs, the canisters were tested for Carbon Monoxide, Oxygen, Water Vapor, Carbon Dioxide and Ammonia. The results are representative of the minimum 7.5-hour duration of each samples.

Carbon Monoxide
Carbon Monoxide was negative below detection limit in all 7 samples.

Oxygen
Oxygen levels ranged from 22 to 27 percent in all seven samples. Normal atmosphere level on earth in 20.9 % oxygen. Higher oxygen levels are indicative of better air quality.

Water Vapor
Water vapor results ranged from 15 to 100 mg per liter air above the slab. The levels below the slab were 40 and 29 mg per liter of air. These results appear to indicate water vapor in the evidence portion of the building above the slab is higher than all other results indicating the source of the vapor is likely due to HVAC operation, one-way exhaust system in the narcotics room and a water leak in the bio evidence room.

The doors in to these rooms were opened during portion of the sampling to get a wider sample footprint. The results also indicate that the moisture is not migrating from under the slab.

Carbon Dioxide
According to the EPA, the primary source of CO_2 in office buildings is respiration of the building occupants. CO_2 concentrations in office buildings typically range from 350 to 2,500 ppm (Seppänen et al., 1999). At concentrations occurring in most indoor environments, CO_2 buildup can be considered as a surrogate for other occupant-generated pollutants, particularly bioeffluents, and for ventilation rate per occupant, but not as a causal factor in human health responses. The Threshold Limit Value for 8-hour time-weighted-average exposures to CO_2 is 5,000 ppm (ACGIH, 1991). Currently, the American Society of Heating, Refrigeration, and Air-conditioning Engineers (ASHRAE) recommends a minimum office building ventilation rate of 10 L/s-1 per person, corresponding to an approximate steady state indoor concentration of 870 ppm (ASHRAE, 1999), based on the assumptions that outdoor CO_2 is 350 ppm and indoor CO_2 generation rate is 0.31 L/min-1 per person.

A guidance document from Kane International LTD based in United Kingdom provided these reference guidelines.

250-350ppm	Normal background concentration in outdoor ambient air
350-1,000ppm	Concentrations typical of occupied indoor spaces with good air exchange
1,000-2,000ppm	Complaints of drowsiness and poor air.
2,000-5,000 ppm	Headaches, sleepiness and stagnant, stale, stuffy air. Poor concentration, loss of attention, increased heart rate and slight nausea may also be present.
5,000	Workplace exposure limit (as 8-hour TWA) in most jurisdictions.
>40,000 ppm	Exposure may lead to serious oxygen deprivation resulting in permanent brain damage, coma, even death.

Carbon Dioxide level during the ESi sampling on all 7 samples ranged from 600 to 660 ppm. Given the concentrations obtained during ESi testing the CO2 levels were typical of occupied indoor spaces with good air exchange and did not reach the level of poor air quality complaints in occupied indoor spaces. These results are consistent with H2H findings and further Mechanical engineering review can provide additional comment with respect to these findings. It should be noted that the building at the time of this test had few occupants and CO2 levels should be verified during normal occupancy of the building.

Ammonia
Ammonia was below detection limits on all samples. The detection limit was 24 parts per million.

4.4.1 VOC and Related Parameters Test Result Conclusions

Based on the above described investigation and to a reasonable degree of scientific probability the following findings and conclusions are offered with respect to VOC evaluation. As additional information becomes available ESi will supplement this report with appropriate technical input as may be appropriate.

4.4.1.1 The VOC test results did not reveal any VOC levels in the building above currently accepted guidelines. The results for VOC in the operations center as compared with criteria for residential and office environment fall into an ideal category for off gassing and are below the criteria for individual compounds proposed by ASHRAE and LEEDS.

4.4.1.2 The results do not support the hypothesis that there are significant levels of toxins under the slab of the building and that toxins or VOCs are migrating through the slab into the air of the building.

4.4.1.3 The test results indicate that the soil under the former hospital building does not contain sufficient quantity of toxic compounds that are resulting in vapor intrusion and being released into the indoor environment of the building.

4.4.1.4 Carbon dioxide level during the ESi sampling on all 7 samples ranged from 600 to 660 ppm. Given the concentrations obtained during ESi testing the CO2 levels were typical of occupied indoor spaces with good air exchange and did not reach the level of poor air quality complaints in occupied indoor spaces.

4.4.1.5 The results of this VOC investigation are consistent with and supplement the results of the H2H investigation

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4.4.1.6 The results are representative of very low levels of VOC compounds being released into the building. The VOC levels in houses and other buildings that are frequented by the employees could be significantly higher. ESi was not provided with any information regarding the employee exposures to VOCs in these other environments that can comprise 2/3 of the time during a typical day that they spend outside of the operations center building. Potential for those exposures should be considered by medical professionals when evaluating employee symptoms and exposures and when attempting to establish and validate BRI connection to the operations building.

5 Summary of Findings and Conclusions

In section 4 of this report individual findings and conclusions were provided as they relate to that particular section of the investigation. In the air quality investigations many of the individual sections also are interrelated and are thus summarized here as they are ultimately the result of the overall investigation not just individual parts.

Based on the above described investigation and to a reasonable degree of scientific probability the following findings and conclusions are offered with respect to air quality investigations at the operations center. As additional information becomes available ESi will supplement this report with appropriate technical input as may be appropriate.

5.1 ESi is of the opinion that at the time of the investigation and at the observed temperature settings the HVAC system in the building was not removing sufficient humidity from the air inside the building.

5.2 Appropriate and effective ventilation, temperature and humidity control is a complex issue and ESi suggested that mechanical engineer review the design and operation of the system and make appropriate recommendations.

5.3 The historical documentation on the HVAC operations of the building and the assessment of the HVAC operation by the mechanical engineer may become useful to the medical professional evaluating the employees' specific symptoms.

5.4 The relative humidity measured at the building were around 60%. People living in hot and humid climates are often exposed to environment where the relative humidity level is a lot higher. During fog or rain the relative humidity outdoors is close to 100% even though the temperature may be cool.

5.5 The relative humidity levels in houses and other buildings that are frequented by employees including outdoors levels could be significantly higher. ESi has not been provided with any information regarding the employee exposures to high humidity in these other environments that can comprise 2/3 of the time during a work day that they do not spend in the operations center building. Potential for those exposure should also be considered by medical professionals when evaluating employee symptoms and exposures and when attempting to establish and validate BRI connection to the operations building.

5.6 It is ESi's opinion that the operations center is not adversely impacted with mold.

5.7 None of the sample results indicated current mold growth or mold contamination.

5.8 Source of the water damaged area between the walk-in refrigerator and walk-in cooler needs to be fixed. The water damaged drywall including any water impacted insulation needs to be repaired.

5.9 Improved housekeeping and humidity control should be sufficient to return locations of the building that tested with category B levels to Level A – Normal background levels.

5.10 The mold sampling results are representative of relatively low mold levels at the sheriff's operations building. The mold levels in houses and other buildings that are frequented by employees could be significantly higher. ESi has not been provided with any information regarding the employee exposures to mold in these other environments that can comprise up to 2/3 of the time during a day that they do not spend in the building. Potential for those exposures should be considered by medical professionals when evaluating employee symptoms and exposures and when attempting to establish and validate BRI connection to the operations building.

5.11 The construction material test results did not reveal any anomalies.

5.12 There was no evidence that would support the hypothesis that the building materials from the former hospital building contain toxic compounds (heavy metals) that are being released into the indoor environment of the building above normal background levels. (also see VOC section)

5.13 The dust sample analysis confirmed that the origin of the white particles in the dust is from the drop ceiling tile. Improved housekeeping and humidity control should be sufficient measure to minimize the potential for employee exposure to these particles.

5.14 The results are representative of relatively low levels of white particles in the dust of the building. The dust levels and different components of dust irritants in houses and other buildings that are frequented by the employees could be significantly higher. ESi has not been provided any information regarding the employee exposures to dust in these other environments that can comprise up to 2/3 of the time during a typical day that they spend outside of the building. Potential for those exposures should be considered by medical professionals when evaluating employee symptoms and exposures and when attempting to establish and validate BRI connection to the operations building.

5.15 The VOC test results did not reveal any VOC levels in the building above currently accepted guidelines. The results for VOC in the operations center as compared with criteria for residential and office environment fall into an ideal category for off gassing and are below the criteria for individual compounds proposed by ASHRAE and LEEDS.

5.16 The results do not support the hypothesis that there are significant levels of toxins under the slab of the building and that toxins are migrating through the slab into the air of the building.

5.17 The test results indicate that the soil under the former hospital building does not contain sufficient quantity of toxic compounds that are resulting in vapor intrusion and being released into the indoor environment of the building.

5.18 Carbon dioxide level during the ESi sampling on all (7) samples ranged from 600 to 660 ppm. Given the concentrations obtained during ESi testing the CO_2 levels were typical of occupied indoor spaces with good air exchange and did not reach the level of poor air quality complaints in occupied indoor spaces.

5.19 The results of this VOC investigation are consistent with and supplement the results of the H2H investigation

5.20 The results are representative of very low levels of VOC compounds being released into the building. The VOC levels in houses and other buildings that are frequented by the employees could be significantly higher. ESi was not provided with any information regarding the employee exposures to VOCs in these other environments that can comprise 2/3 of the time during a typical day that they spend outside of the building. Potential for those exposures should be considered by medical professionals when evaluating employee symptoms and exposures and when attempting to establish and validate BRI connection to the operations building.

Respectfully submitted,
ESi

ATTACHMENT A

12750 Commonwealth Drive
Ft. Myers, FL 33913

ZDENEK (ZED) HEJZLAR, Ph.D., CSP
SENIOR MANAGING CONSULTANT

wesystems@engsys.com

Dr. Hejzlar is a Senior Managing Consultant with ESi, with over 28 years of experience in premises/occupational safety and various aspects of the environmental and toxic health fields. He directs multidisciplinary projects in human factors' systems safety and accident reconstruction related to a broad range of environmental and industrial issues, chemical and hazardous material dangers, risk assessment, fire/explosion, slip, trip, and fall, premises/occupational safety and health hazards. He also has extensive experience in textile and other polymeric material failure analysis and design applications. In addition to the litigation related projects, Dr. Hejzlar is involved in accident prevention consulting research in slip resistant shoe design and risk mitigation consulting with major cruise lines and resorts.

Areas of Specialization

Industrial and Premises Safety
Environmental and System Safety Consulting
Textile and Polymeric Material Failures
Chemical and Physical Hazard Investigations
Fire/Explosion
Chemical Risk Analysis

Education

Ph.D., Occupational Safety and Health Engineering. Columbia Southern University, 1999
M.S., Business Administration. University of South Florida, 1990
B.S., Textile Chemistry. Philadelphia College of Textiles and Science, 1980

Certifications

Certified Safety Professional (CSP) #13230, Board of Certified Safety Professionals
X-ray Florescence Registration, Florida JR 44809000
Certified Walkway Auditor Safety Specialist WACH (Walkway Auditor Certificate Holder), ANSI/NFSI
Certified Fire and Explosion Investigator (CFEI), National Association of Fire Investigators
Certified Mold Assessor, Florida Department of Business Regulation MRSA 329

January 2018

Appointments and Professional Affiliations

Dr. Hejzlar taught technical professional courses in environmental and safety risk management, property condition assessments and occupational safety and health. Projects include deployment, health and safety, risk evaluations, training and standards development for the U.S. Department of Defense, property evaluations for the U.S. Department of Agriculture, Technical Professional Training for ASTM, RIFS and HAZWOPER training for clients in Asia, and environmental risk training for World Bank Group members in Europe. Dr. Hejzlar has also been appointed and served as panel expert for the Transportation Research Safety Board. In addition to numerous technical papers on accident investigation, ASTM has published his three editions of technical manual on the Phase I and Phase II process and CD-ROM computer based assessment training. He served for over 10 years including chairmanship on the Committee for Publications for ASTM International overseeing publications of ASTM's industry technical journals. Dr. Hejzlar is involved in standards development related to safety of walkways surfaces and in tribometry research. He is an NFSI Certified Walkway Auditor Safety Specialist and ANSI/NFSI Walkway Auditor Certificate Holder. He chairs the ANSI/NFSI B101.9 Subcommittee developing standard for "Identification and Elimination of Interior and Exterior Trip Hazards on Walking Surfaces, Stairs, and Ramps."

American Chemical Society (ACS)

Member, 1993 – 2015

The American Institute of Chemists (AIC)

Certified Chemical Engineer (CChE), National Certification Commission in Chemistry and Chemical Engineering, 1993 – 2005
Certified Professional Chemist (CPC), National Certification Commission in Chemistry and Chemical Engineering, 1993 – 2005

American National Standards Institute (ANSI)

ANSI/NFSI Standards Committee B101 on Safety Requirements for Slip, Trip and Fall Prevention, Member, 2013 – present
ANSI/NFSI B101.4 Test Method for Measuring the Wet Barefoot Condition of Flooring Materials or Products, Member, 2014 – present
ANSI/NFSI B101.7 Standard Test Method for Lab Measurement of Footwear Outsole Material Slip Resistance, Member, 2014 – present
ANSI/NFSI B101.9 Identification and Elimination of Interior and Exterior Trip Hazards on Level and Un-Level Walking Surfaces, Stairs, Steps and Ramps, Chairman, 2014 – present

American Railway Engineering and Maintenance-of-Way Association

Member Committee 13 – Environmental, 2007 – 2012

American Society of Safety Engineers (ASSE)

Professional Member

American Society for Testing and Materials (ASTM)

Committee C11 on Gypsum and Related Building Materials and Systems
 Subcommittee C11.01 on Specifications and Test Methods for Gypsum Products
Committee F13 on Pedestrian / Walkway Safety and Footwear
Committee E30 on Forensic Sciences
Committee E34 on Occupational Health and Safety
Committee E35 on Pesticides and Alternative Control Agents
Sub Committee E35.26 Safety to Man, Chair 2007 – 2009
Committee C15 on Manufactured Masonry Units
Committee F15 on Consumer Products
Committee E50 on Environmental Assessment, Risk Management and Corrective Action
 Data Collection Requirements for Military Deployments
  Task Force Chairman, 2004 – 2009
 Environmental Health Site Assessment for Military Developments Standard
  Development Task Force Chairman, 2001 – 2003
 Environmental Assessment Phase II Training Development
  Task Group Chair, 1998 – 1999
 Environmental Assessment Phase I Training Development
  Task Group Member, 1993 – present
Committee on Publications - Appointed Member, 2005 – 2010
 Vice Chair, 2010 – 2013
 Chairman, 2014 – 2017

City of Fort Myers Brownfields Advisory Board

Vice Chairman / Member, appointment by the Mayor and the City Council, 2001 – 2005

Florida Department of Financial Services

Education Section CE – 2-20, General Lines Property Casualty Approved Instructor, 2007 – 2009

The National Academies

Advisers to the Nation on Science, Engineering and Medicine, Transportation Research Safety Board, Cooperative Research Programs Advisory Expert on Project Panel HM-06, 2007 – 2010

National Association of Fire Investigators

Member

National Floor Safety Institute (NFSI)

Certified Walkway Auditor Safety Specialist
Member, 2013 – present

Texas Region IV

Region IV Texas Mold Licensing Training Development, Task Group for Assessors and Remediation Professionals Contributing Member, 2003 – 2004

Texas House Bill 329 / Texas Department of Health / Texas Mold Rules and Regulations Task Group Contributing Member on behalf of Texas Region IV School District, 2003

U.S. DOD/ASTM

Task Group Leader on Military Deployment Assessment Standards, ASTM/DOD, 2002 – 2009

Positions Held

Engineering Systems Inc., Fort Myers, Florida

Senior Managing Consultant, 2010 – present
Senior Consultant, 2005 – 2009
Director of Environmental Programs, 2001 – 2005

K.C. Breen & Associates, Inc., Fort Myers, Florida

Director of Environmental Management, 1993 – 2001
Director of Research, 1990 – 2001

Parker Seal/Parker Hannifin, Naples, Florida

Quality Assurance and Engineering Manager, 1986 – 1990
Quality Assurance Manager, 1984 – 1986

Madison Bay Marina Campground & Restaurant, Madison, Maryland

Owner Operator / Consultant, 1982 – 1984

Polymer Corporation, Reading, Pennsylvania

Engineering Specialist, 1980 – 1982

Scholler Brothers, Inc., Philadelphia, Pennsylvania

Research Laboratory Chemist, 1979 – 1980

Scottish College of Textiles, Galashiels, Scotland

Laboratory Chemist Trainee, 1976 –- 1977

BASF, Ludwigshafen, West Germany

Laboratory Technician, 1976

S.A. Fine Worsteds Co., Capetown, South Africa

Finishing Foreman, 1974 – 1975

Continued Education

CMA - NORMI® Certified Mold Assessor for FL Mold License Requirements
Estero, Florida, July 2016

Walkway Auditor Certificate Holder (WACH) Course Assessment, National Floor Safety Institute (NFSI)
Southlake, Texas, February 2015

Premises Safety Training - Slip, Trip, and Fall, Engineering Systems, Inc.
Ft. Myers, Florida, June 2014

Computer Fire Modeling, National Association of Fire Investigators
Sarasota, Florida, August 2013

Walkway Auditor Safety Specialist Certification Training, National Floor Safety Institute
Southlake, Texas, February 2013

Field Service and Maintenance Marathon Training School on RAMJET Compactors and Vertical Bailers
Vernon, Alabama, May 2011

Thermo Fisher Scientific Niton XRF Analyzer Operational Training Course, Thermo Fisher
July 2009, Florida Certificate Number 11:250038000000 eXD8a

National Fire, Arson & Explosion Investigation Training Program
National Association of Fire Investigators, National Fire Protection Association
Denver, Colorado, Spring 2009

Pedestrian / Bicycle Crash Investigations, IPTM, University of North Florida
Jacksonville, Florida, Summer 2006

Residential Inspection Seminar
Houston, Texas, Winter 2005

MycoMeter Mold Assessment and Testing and Training Course
Ft. Myers, Florida, Spring 2004

Mold: Effective Defense Strategies Seminar
Houston, Texas, Spring 2003

Hazardous Substances Workshop and Bioterrorism Training
Tampa, Florida, Spring 2003

40 Hour Hazardous Waste Operations and Emergency Response Course
Tampa, Florida, Winter 2000

Publications / Presentations

"Carbon Monoxide Poisoning," Brochure for U.S. Coast Guard, © 2017 National Marine Manufacturers Association - Development Peer Review

"Reducing the Risk of Slip and Fall Accidents on Cruise Ships," Z. Hejzlar, speaker, presented at Slips, Trips, and Falls International Conference 2017, Toronto Rehabilitation Institute, June 2017

"Manual 43 Technical Aspects of Phase I / II Environmental Site Assessments, Third Edition," Publisher ASTM, Library of Congress ISBN 978-0-8031-7043-8, April 2015

"3rd Annual Southwest Florida Brownfield Symposium," Florida Department of Environmental Protection, Z. Hejzlar - speaker, presented at Lee County Public Education Center, Ft. Myers, Florida, March 20, 2015

"Manual 73 Safety and Occupational Footwear," Z. Hejzlar as ASTM COP representative, ASTM, April 2014

"Evaluation of the Dynamics of Heel Contact in Flip-flop Sandals Under Dry and Wet Conditions," Z. Hejzlar, International Conference on Fall Prevention and Protection, Tokyo, Japan, October 2013

"Risk Assessment of Walkway Surfaces Using Dynamic and Static Coefficient of Friction Tribometers and Update on Slip Resistance Measurement Standards," Z. Hejzlar speaker, presented at American Society of Safety Engineers (ASSE), Ft. Myers, Florida, August 2013

"Evaluation of the Dynamics of Heel Contact in Flip-flop Sandals Under Dry and Wet Conditions in Heel Plant Portion of Gait Cycle Using High-Speed Video," Z. Hejzlar, ASTM International Committee of Publications Annual Meeting, September 2012

"Analyzing the Risk of Daily Life-Revisited for Consumer and Recreational Products," K. C. Breen, W. J. Fischer, Z. Hejzlar, International Legal Guide, Global Legal Group, May 2011

"Applications of X-Ray Fluorescence in Corrosive Drywall Investigations - The Use of X-Ray Fluorescence (XRF) in Detecting and Evaluating Sulfur Impacts on Exposed Copper," Z. Hejzlar, K. Klosinski, R. Granica, meeting on Materials Science & Technology 2010, symposium proceedings on Failure Analysis and Prevention Editor(s), MS&T Publications Department, October 2010

"Applications of X-Ray Fluorescence to Confirm Sulfur Impact of Corrosive Drywall," Z. Hejzlar, Journal of Testing and Evaluation, Vol. 39, No. 1, Paper ID JTE 103027, August 2010

"X-Ray Fluorescence in Corrosive Drywall Investigations: Strontium Levels in Several Corrosive and Non-Corrosive Drywalls and Effects of Drywall Finish on XRF Strontium Detection," Z. Hejzlar, Journal of Testing and Evaluation, Vol. 39, No. 1, Paper ID JTE 103087, July 2010

"Industry Update: Foreign Drywall," Z. Hejzlar speaker presentation Cape Coral Construction Industry Association Cape Coral, Florida, May 2010

"Materials Analysis - Portable X-Ray Fluorescence," Z. Hejzlar speaker presentation, Technical Symposium on Corrosive Imported Drywall, UF, USF, Hinckley Center and FL DOH, Tampa, Florida, November 2009

"Applications of Portable X-Ray Fluorescence in Problematic Drywall Investigations," Z. Hejzlar / Engineering Systems Inc., J. Pesce / Thermo Fisher Scientific, poster presentation, Technical Symposium on Corrosive Imported Drywall UF, USF, Hinckley Center and FL DOH, Tampa, Florida, November 2009

"Problematic Drywall Impacts in U.S. Residential Construction: Investigating Problematic Drywall Issues," Z. Hejzlar, J. McDougal, M. L. Hanks, M. Underwood, July 2009

"Science of Drywall," Z. Hejzlar, presented at Harris Martin Chinese Drywall Conference, Orlando, Florida, June 2009

"Technical Guide for the Collection of Environmental Sampling Data Related to Environmental Health Site Assessments for Military Deployments (NMCPHC TM-PM 6490.2 also USACHPPM as the TG-317)," Co-author FDPMU Program Science & Technology, Navy & Marine Corps Public Health Center

"Manual 43 Technical Aspects of Phase I / II Environmental Site Assessments, Second Edition" Publisher ASTM, Library of Congress ISBN 978-0-8031-4273-2, September 2007

"Use of ASTM Risk Based Corrective Action Standards with Innovative Management Approaches to Achieve Timely Site Closures," Railroad Environmental Conference, University of Illinois, Chicago, Illinois, October 2007

"Documentation and Preservation of Information in Claims Investigations Using the ASTM Standards," Catmando Inc. Tampa, Florida, February 2007

"Innovative Site Remediation Technologies Training Course," presented to Geo-Environmental Technology Research Center, Tokyo, Japan, April 2004

"Environmental Health Site Assessment Process for Military Deployments," ASTM Standard Guide E2318-03, Co-author

"Technical Aspects of Mold Investigations," presented to Nationwide Insurance, Plantation, Florida, March 2003

"Environmental Assessment - Train the Trainer," presented to Geo-Environmental Technology Research Center, Tokyo, Japan, January 2003

Department of Defense Deployment Assessment Training, various Military Installations in the U.S. and abroad, 2003 – 2009

40 Hour Hazwoper Training, presented to ECO Solutions, Seoul, Korea, April 2001

"Remedial Investigations Feasibility Study - EPA Methodology Applications in Asia," presented to ECO Solutions/ KARICO Poil-dong, Seoul, Korea, March 2001

"Training the Trainer - Applications of ASTM Standards," presented to ECO Solutions, Seoul, Korea, December 2000

"Computer Based Technical Course Developed for ASTM Environmental Site Assessments for Commercial Real Estate," ASTM, CD-ROM Format

"Solving Environmental Management Risk Issues for Clients in European Countries," presented to Zurich Insurance Company internal technical training, Zurich, Switzerland

"Environmental Aspects of Commercial Real Estate Transactions Management," presented to ARVIDA Realty Continuing Education, Bonita Springs, Florida, November 2000

"Solving Environmental and Brownfields Issues for Clients," presented to Professional Business Brokers Association, Ft. Myers, Florida, October 2000

"ASTM Standards in Products and Personal Injury Litigation," presented to Lee County Bar Association, Ft. Myers, Florida, March 2000

"Technical Aspects of Quick Response Assessments Course," presented to DEP Hazardous Materials Response Department, New York, New York, January 2000

"The Use of ASTM Standards in Forensic Investigations," The Chemist, 1999

"Manual 43 Technical Aspects of Phase I / II Environmental Site Assessments," publisher ASTM, Library of Congress ISBN 0-8031-2084-2, December 1999

"Human Factors of Slips and Falls," presented at Challenges Conference sponsored by the Florida Department of Health, Lee Memorial Health Systems and Florida Injury Prevention for Seniors, Ft. Myers, Florida, April 1998

"Developments in Alternate Marine Transportation," SAE 951892, Society of Automotive Engineers, Costa Mesa, California, August 1995

Phase I and Phase II Environmental Site Assessment Training Courses, ASTM Technical Professional Training system, various locations worldwide, 3-5 courses per year, 1994 – present

"Investigation and Analysis of Marine Accidents," SAE 930658, Society of Automotive Engineers, Detroit, Michigan, March 1993, Reprinted with permission by the Society of Accident Reconstructionist

"Operator and Environmental Factors Associated with Off-Road Equipment Risk," SAE 921711, Society of Automotive Engineers, Milwaukee, Wisconsin, September 1992

Dr. Hejzlar's training and experience relates to the Flagler County Sherriff operation center project.

Dr. Hejzlar's expertise with respect to this particular project includes extensive research and experience in projects that involved analyzing exposure pathways and evaluating environmental exposures to deployed troops, workers, residents and vehicle occupants. His Ph.D. dissertation was on Phase I and Phase II environmental assessment and was peer reviewed by and published by ASTM (Library of Congress ISBN 0-8031-2084-2). The book was translated into Japanese and he traveled to Japan to present the translation and I taught the ASTM Course on the standards in Japan and Korea. Since that time ASTM has published a second and third edition of that manual. Photographs of the front pages of the manuals are included in this attachment.

Dr. Hejzlar is a technical professional trainer for ASTM. ASTM is the largest standards organization in the world and their standards are used in the industry worldwide. As a technical professional trainer for ASTM he has developed and taught ASTM courses on environmental investigation in the US, Europe, Korea and Japan.

Dr. Hejzlar chaired an ASTM task group that developed exposure assessment procedures and guidelines for the Army, Navy and the Air Force. Together the task group developed standards and procedures to assess deployment sites in order to identify hazards, assess them and protect the troops against exposure to non-battle hazards. He was then hired by the US Navy to teach the standards and over several years I trained all the Navy Preventive Medicine teams that were deployed to Iraq, Afghanistan and portions of Africa. A copy of the article that was published by ASTM news about the work is included in this attachment.

Dr. Hejzlar was hired by New York city Hazardous material response team to develop an ASTM training course for them in how to generate scientific approach to rapid hazard assessment. After developing he taught that course in New York.

Dr. Hejzlar completed 40-Hour Hazardous Waste Operations and Emergency Response Course at USF in Tampa, Florida in winter 2000. Later he was hired to develop a new 40-hour HAZWOPER course for environmental clients in Korea and taught it there in April 2001.

Dr. Hejzlar competed Hazardous Substances Workshop and Bioterrorism Training in Tampa, Florida in the Spring 2003

Dr. Hejzlar attended and was a presenter on Mold: Effective Defense Strategies Seminar Houston, Texas, Spring 2003. He worked with the Texas School districts and Texas health department to develop Texas mold laws and to develop effective strategies for mold in schools.

Dr. Hejzlar completed the MycoMeter Mold Assessment and Testing and Training Course in Ft. Myers, Florida, Spring 2004

He attended Residential Inspection Seminar in Houston, Texas, Winter 2005

Dr Hejzlar completed Thermo Fisher Scientific Niton XRF Analyzer Operational Training Course, Thermo Fisher July 2009, Florida Certificate Number 11:250038000000 eXD8a

Dr. Hejzlar also worked with the Florida Department of Health and the Consumer Product Safety Commission on the investigation of airborne exposures related to construction materials, mold and corrosive drywall.

He was selected by ASTM to serve on committee of publications overseeing publications and peer review of technical manuals. He served as a member 2005 – 2010 Vice Chair, 2010 – 2013 and finally as a Chairman, 2014 – 2017.

Dr. Hejzlar is licensed by the state of Florida in Mold Assessment. Mold investigation in Florida is regulated and only licensed professionals are allowed to investigate and provide opinions about mold in the course of doing business.

Dr. Hejzlar also served as a Cooperative Research Programs Advisory Expert on Project Panel HM-06, 2007 – 2010, for The National Academies, Advisers to the Nation on Science, Engineering and Medicine, Transportation Research Safety Board.

Dr. Hejzlar is a member of ASTM committee that developed ASTM E2600 - 15 Standard Guide for Vapor Encroachment Screening on Property Involved in Real Estate Transactions

Dr. Hejzlar has testified as an expert witness in both federal and state courts and has been qualified as an expert in this field.

The following publications and presentations from Dr. Hejzlar's CV are also relevant to this investigation:

"Carbon Monoxide Poisoning," Brochure for U.S. Coast Guard, © 2017 National Marine Manufacturers Association - Development Peer Review

"Manual 43 Technical Aspects of Phase I / II Environmental Site Assessments, Third Edition," Publisher ASTM, Library of Congress ISBN 978-0-8031-7043-8, April 2015

"3rd Annual Southwest Florida Brownfield Symposium," Florida Department of Environmental Protection, Z. Hejzlar - speaker, presented at Lee County Public Education Center, Ft. Myers, Florida, March 20, 2015

"Applications of X-Ray Fluorescence in Corrosive Drywall Investigations - The Use of X-Ray Fluorescence (XRF) in Detecting and Evaluating Sulfur Impacts on Exposed Copper," Z. Hejzlar, K. Klosinski, R. Granica, meeting on Materials Science & Technology 2010, symposium proceedings on Failure Analysis and Prevention Editor(s), MS&T Publications Department, October 2010

"Applications of X-Ray Fluorescence to Confirm Sulfur Impact of Corrosive Drywall," Z. Hejzlar, Journal of Testing and Evaluation, Vol. 39, No. 1, Paper ID JTE 103027, August 2010

"X-Ray Fluorescence in Corrosive Drywall Investigations: Strontium Levels in Several Corrosive and Non-Corrosive Drywalls and Effects of Drywall Finish on XRF Strontium Detection," Z. Hejzlar, Journal of Testing and Evaluation, Vol. 39, No. 1, Paper ID JTE 103087, July 2010

"Industry Update: Foreign Drywall," Z. Hejzlar speaker presentation Cape Coral Construction Industry Association Cape Coral, Florida, May 2010

"Materials Analysis - Portable X-Ray Fluorescence," Z. Hejzlar speaker presentation, Technical Symposium on Corrosive Imported Drywall, UF, USF, Hinckley Center and FL DOH, Tampa, Florida, November 2009

"Applications of Portable X-Ray Fluorescence in Problematic Drywall Investigations," Z. Hejzlar / Engineering Systems Inc., J. Pesce / Thermo Fisher Scientific, poster presentation, Technical Symposium on Corrosive Imported Drywall UF, USF, Hinckley Center and FL DOH, Tampa, Florida, November 2009

"Problematic Drywall Impacts in U.S. Residential Construction: Investigating Problematic Drywall Issues," Z. Hejzlar, J. McDougal, M. L. Hanks, M. Underwood, July 2009

"Science of Drywall," Z. Hejzlar, presented at Harris Martin Chinese Drywall Conference, Orlando, Florida, June 2009

"Technical Guide for the Collection of Environmental Sampling Data Related to Environmental Health Site Assessments for Military Deployments (NMCPHC TM-PM 6490.2 also USACHPPM as the TG-317)," Co-author FDPMU Program Science & Technology, Navy & Marine Corps Public Health Center

"Manual 43 Technical Aspects of Phase I / II Environmental Site Assessments, Second Edition" Publisher ASTM, Library of Congress ISBN 978-0-8031-4273-2, September 2007

"Use of ASTM Risk Based Corrective Action Standards with Innovative Management Approaches to Achieve Timely Site Closures," Railroad Environmental Conference, University of Illinois, Chicago, Illinois, October 2007

"Documentation and Preservation of Information in Claims Investigations Using the ASTM Standards," Catmando Inc. Tampa, Florida, February 2007

“Innovative Site Remediation Technologies Training Course,” presented to Geo-Environmental Technology Research Center, Tokyo, Japan, April 2004

“Environmental Health Site Assessment Process for Military Deployments,” ASTM Standard Guide E2318-03, Co-author

“Technical Aspects of Mold Investigations,” presented to Nationwide Insurance, Plantation, Florida, March 2003

“Environmental Assessment - Train the Trainer,” presented to Geo-Environmental Technology Research Center, Tokyo, Japan, January 2003

Department of Defense Deployment Assessment Training, various Military Installations in the U.S. and abroad, 2003 – 2009

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“The Use of ASTM Standards in Forensic Investigations,” The Chemist, 1999

“Manual 43 Technical Aspects of Phase I / II Environmental Site Assessments,” publisher ASTM, Library of Congress ISBN 0-8031-2084-2, December 1999

Phase I and Phase II Environmental Site Assessment Training Courses, ASTM Technical Professional Training system, various locations worldwide, 3-5 courses per year, 1994 – present

Dr. Hejzlar's CV in included in this attachment. Related photograph of his publications and publications he was involved in as part of the ASTM – COP are also included