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WONDER MAKERS
ENVIRONMENTAL

June 15, 2009

Mr. Vincent Sugent
7768 Pleasant Lane
Ypsilanti, MI 48197

RE: Review of scope of work, specifications (FAA-DTW-ATCT-2697), drawings, and other documents developed by B. Hebert and D. Morse related to mold remediation in the DTW ATCT; WME project GC09-8593.

Dear Vince:

We have had an opportunity to review the above mentioned documents. Once again, they are examples of the Agency's total lack of understanding regarding the situation at the DTW ATCT. The best way to describe these documents is sloppy. The Agency continues to seek out simple solutions to the complex problems that have plagued the facility for the past several years.

The formal Scope of Work (SOW) is laid out in the first part of the document. The second part of the document is the actual Specifications (FAA-DTW-ATCT-2697), which include a repeat of the entire Scope of Work in its General Requirements section. Other areas covered by the Specifications include Thermal and Moisture Protection, Doors and Windows, and Finishes.

In this letter we will offer a few general examples of the problems with the Scope of Work. Attachment 1 will look specifically at the many difficulties with the Scope of Work for Rooms 928 and 1028 in the DTW ATCT as examples of the level of problems present in the document. Attachment 2 will be a brief room-by-room critique of the specifications.

Some blatant discrepancies in the Scope of Work can be seen with a quick comparison:

- In Room 328 the SOW indicates that:
  - A mini containment shall be established consisting of a single layer of 6-mil polyethylene sheeting. A negative pressure enclosure system shall be established as described in section 1B.10 Remediation area.
  - The east (elevator shaft) wall, up to a height of 2', and the south (elevator shaft) wall, up to a height of 2', shall be HEPA vacuumed and then wet wiped with an approved cleaning solution.

- Compare this entry to the one made for Room 527A that says:
  - A mini containment shall be established of a single layer of 6-mil polyethylene sheeting but a negative pressure enclosure system is not required. Mist any contaminated areas prior to removal. Upon completion, the work area shall be HEPA vacuumed and then wet wiped with a detergent solution.
  - Cleanup and removal of moisture and microbiological contaminated gypsum board, shaft liner, and insulation in accordance with the guidelines established by the New York City Department of Health Entitled *Guidelines on Assessment and Remediation of Fungi in Indoor Environments* (GARFIE) (See Specification Attachment 1).
  - Remove and replace gypsum board and insulation totaling approximately 5 square feet on the south wall, between the east wall and the door to Room 527, 2' wide to a height of 18" (surface layer) and 2' wide to a height of 12" (concealed layer).

In the above example the authors of the specification are requiring a mini enclosure with negative pressure for cleaning, yet the enclosure that will be used in conjunction with drywall removal does not merit the protection of negative pressure. This is contrary to both logical thinking and the New York City (NYC) guidelines they claim to be following. Page 9 of 17 of the NYC guidelines notes in bold print that, **"The goal of remediation is to remove or clean contaminated materials in a way that prevents the emission of fungi and dust contaminated with fungi from leaving a work area and entering an occupied or non-abatement area, while protecting the health of workers performing the abatement."** The removal of drywall from Room 527A is much more likely to generate dust than the cleaning of drywall in Room 328. As a result, it makes much more sense to put the negative pressure in Room 527A rather than Room 328. Given that a large number of employees at the DTW ATCT are sensitized to the mold in the building it is recommended that *any* action taken to remediate mold in this facility be conducted under negative pressure.

A second example of the problems with this SOW is the fact that the authors have no understanding of negative pressure. In Room 928 the SOW indicates that "a containment and negative pressure enclosure system shall be established as described in section 1B.9 Remediation Area." Section 1B.9 of the Specifications notes that "negative pressure enclosures shall have a minimum of four air exchanges per hour and shall be maintained and recorded with a magnehelic gauge or equivalent device under a minimum negative pressure differential of -0.02 inches of water relative to adjacent non-work area space." Both requirements are in keeping with the industry standard of care and the NYC guidelines. This plan falls apart, however, when the SOW for room 928 requires that the shaft liner be removed. Because of the volume of space in the elevator shaft that then will be part of the containment, upon removal of any part of the shaft liner the negative pressure inside the enclosure will drop to near zero. As a result, work that is going on in Room 928 will likely cross contaminate other areas of the building. Neither the SOW nor the specification for this project deal with what should be done if negative pressure is

lost, nor do the specifications deal appropriately with how to maintain negative pressure once the elevator shaft is opened in this and other rooms.

Specifications for a critical use facility such as this should be written by persons with an in-depth knowledge of mold remediation and building components/structures. Time and time again the Agency has shown that they have neither.

Please do not hesitate to contact me if you have questions.

Sincerely,

Michael A. Pinto, CSP, CMP
CEO

Attachments: Attachment 1
Attachment 2

Attachment 1
Representative Problems with Scope of Work

The first two requirements in the SOW and the specifications for the mold remediation work that would be done in Room 928 and Room 1028 are the same. Both requirements indicate that:

1. A containment and negative pressure enclosure system shall be established as described in section 1B.9 Remediation Area. A decontamination unit shall be established as described in Section 1B.10 Decontamination Area.
2. Cleanup and removal of moisture and microbiological contaminated gypsum board, shaft liner, and insulation in the DTW ATCT rooms 928, in accordance with the guidelines established by the New York City Department of Health Entitled *Guidelines on Assessment and Remediation of Fungi in Indoor Environments* (GARFIE) attached and incorporated herein by reference (see attachment 1).

Item 3 for Room 928 requires workers to:

3. Remove and replace gypsum board, shaft liner and insulation totaling approximately 311 square feet:
   a) The east (elevator shaft) wall, 8' wide to a height of 5' (surface layer), 8' wide to a height of 4'6" (concealed layer), and 8' wide to a height of 4' (shaft liners).
   b) The south (elevator shaft) wall, 10' wide to a height of 5' (surface layer), 10' wide to a height of 4'6" (concealed layer), and 10' wide to a height of 4' (shaft liner).
   c) The northwest column beam enclosure, on the north wall, 6' wide to a height of 3' (surface layer), 6' wide to a height of 2'6" (concealed layer), and 6' wide to a height of 2' (shaft liner).
   d) The west wall, 3' wide to a height of 3' (surface layer), 3' wide to a height of 2'6" (concealed layer), and 3' wide to a height of 2' (shaft liner).
   e) **Elevator Shaft liner removal and replacement requires coordination with the Elevator Maintenance company and Air Traffic to schedule limited elevator shutdown time.**

Items 3–5 in Room 1028 require the following:

3. The north wall shaft liner in its entirety shall be HEPA vacuumed and then wet wiped with an approved cleaning solution.
4. Remove and dispose of existing carpet.
5. Remove and replace gypsum board, shaft liner, and insulation totaling approximately 792 square feet:
   a) The north (elevator shaft) wall, 22' wide for the full height (surface layer, concealed layer and shaft liner).

ISSUES OF CONCERN

1. The drawings for Rooms 928 and 1028 do not indicate the locations of decontamination units.
2. The drawings do not indicate the location of fungus-contaminated finish building materials that must be removed.
3. The SOW for Room 928 indicates that materials will be removed from the south wall of the elevator shaft. The south wall is not accessible from Room 928. In order to reach the south wall of the elevator shaft contractors will need to access it from Rooms 927 and 927A. In addition, equipment such as cable trays and transformers will need to be removed in order for contract workers to access the south wall of the elevator shaft.
4. The SOW for Room 928 indicates that materials will be removed from the west wall of the elevator shaft. The west wall of the elevator shaft includes the elevator door. There is no indication of which side of the doorway materials are to be removed. Is it the north, the south, or both sides of the elevator door?
5. The SOW for Room 1028 notes in step 3 that "the north wall shaft liner in its entirety shall be HEPA vacuumed and then wet wiped with an approved cleaning solution." Step 5 indicates that the entire north elevator shaft wall will be removed including the shaft liner. Why is the contractor required to clean the shaft liner? In addition, there is no indication in the SOW or the drawings that the top of the elevator car will be considered part of the negative pressure containment.

   One safety concern relates to the lack of fall protection provided to workers once the elevator shaft is opened. The north, east, and south sides of the shaft are wide enough for a person to fall through. Provisions should be made for installing a guardrail system or having workers wear personal fall arrest systems when they are working on top of the elevator car. If the personal fall arrest system is chosen anchor points must be selected in accordance with MIOSHA regulations.
6. At the front of the SOW there are steps for work that apply to all floors. Item 5 on this list indicates that "once the mold has been removed and clearance has been achieved, and the stained surfaces have been cleaned, then remove all partition walls, doors and door frames, except those around the elevator core and stairwell." The ninth floor drawing has a note outside the floor plan that says, "Dashed lines denote walls to be removed after remediation." The dashed lines on the drawing include the north and east walls of Room 928.

   Analysis of bulk samples taken from the back side of the drywall located in the northeast corner of this room indicated that fungal contamination was present on these finish materials. As a result, achieving clearance for the work on the walls surrounding the elevator shaft will be difficult. In addition, remediating the sections of drywall along the perimeter of the room should be done along with the work that is being done on the elevator shaft. This will ensure that all work is conducted inside a negative pressure enclosure.

Attachment 2
Critique of:

Specification
Microbiological Remediation
at
Detroit Metropolitan Airport
Air Traffic Control Tower
FAA-DTW-ATCT-2697
August 08, 2008
Diane I. Morse

The following critique will address work specified in the document referenced above. The material review begins on page 3 of the specifications and continues through the entire set of documents. Where possible, items cited will include a page number and/or title(s) used in the specifications.

Page 3, ALL FLOORS

1. This item indicates that "all critical penetrations and openings to the work area" shall be sealed with "a minimum of two layers of 6-mil polyethylene". Do these openings include doorways? Installing an S-flap door in each door frame where work is being performed is one way of minimizing the transfer of fungal spores and dust during remediation.
2. This step says, "Remove any MCM between the bottom metal runner/track and the concrete floor; between the top metal runner/track and the structural deck; and between the metal stud and exterior concrete wall." Removing mold contaminated materials (MCM) in this manner is likely to spread contamination. This step does not indicate what level of engineering control should be used during this process.
3. This step indicates that all work will be done in accordance with the New York City Department of Health, *Guidelines on Assessment and Remediation of Fungi in Indoor Environments* (GARFIE). Although following the guidance in this document is important, it is critical to understand that there are additional documents that make up the industry standard of care for the mold remediation industry. Some of the most important additional documents include:
    - Texas Mold Assessment and Remediation Rules (25 TAC Sections 295.301-295.338)
    - Occupational Safety & Health Administration (OSHA), *A Brief Guide to Mold in the Workplace*
    - Health Canada, *Fungal Contamination in Public Buildings: A Guide to Recognition and Management*
    - American Conference of Governmental Industrial Hygienists, *Bioaerosols: Assessment and Control*

- American Conference of Governmental Industrial Hygienists, *Field Guide for the Determination of Biological Contaminants in Environmental Samples*
- The Institute of Inspection Cleaning and Restoration Certification (IICRC), *S500 Standard and Reference Guide for Professional Water Damage Restoration*
- The Institute of Inspection Cleaning and Restoration Certification (IICRC), *S520 Standard and Reference Guide for Professional Mold Remediation*
- American Industrial Hygiene Association, *Report of Microbial Growth Task Force*
- Environmental Protection Agency, *Mold Remediation in Schools and Commercial Buildings*

Several of these documents, including the EPA's *Mold Remediation in Schools and Commercial Buildings,* the ACGIH, *Bioaerosols: Assessment and Control*, and OSHA's *A Brief Guide to Mold in the Workplace*, suggest that mold remediation contractors consider following the requirements in several documents rather than just one.

4. The requirement to discharge HEPA filtered negative pressure equipment out-of-doors is impractical given the fact that floors 3–10 at the DTW ATCT have no windows or exterior doorways. While filtering the air through a second HEPA filter provides additional protection it will reduce the airflow and negative pressure inside the containment.
5. This requirement addresses the removal of doors and drywall believed to be mold free. Such a provision is dangerous because a thorough mold assessment has not been conducted in the DTW ATCT. The authors are assuming that there is no mold behind any of the partition walls. What plan will be followed if mold is found behind these walls? Given the fact that this building is a critical use facility we strongly recommend that any drywall removal be conducted under negative pressure inside an enclosure.
6. This step requires the contractor to cut a half-inch gap between the bottom of the gypsum board and the concrete deck. Like #5 above, this assumes that no mold is growing on the hidden side of the drywall. This is not likely to be the case since the reason for wanting the gap cut in the first place is that moisture is likely wicking up the drywall from the concrete deck. Again, we strongly recommend that any work requiring drywall cutting in the ATCT be done under negative pressure inside an enclosure.
7. This step requires the contractor to paint the "elevator core exterior." This term is not used anywhere else in this document and is inconsistent with the other terms used to describe the wall structure that makes up the elevator shaft in the ATCT. This term should either be defined or replaced. The step also requires surfaces to be painted with mold resistant paint. This should be done only after a thorough visual inspection is conducted to ensure that the wall surfaces are clean and free from fungal contamination.

Page 3, ROOM 327

1. This step states, "The contractor shall provide additional cleaning procedures and pipe insulation removal/replacement." Since these materials are likely contaminated with fungus (see step 2 for Room 327) we recommend that this work be conducted inside a glovebag system similar to ones used by asbestos contractors to remove asbestos pipe and fitting insulation.

Page 4, ROOM 328

1. This step is curious since it requires the building of a mini-containment *and* a negative pressure enclosure. The author may have intended to require a negative pressure mini-enclosure, but that is speculation. We looked at the attached floor plan of 3rd floor but there is nothing on the drawing that indicates where an enclosure should be placed once it is built.
2. This step says that portions of the east and south elevator shaft walls should be HEPA vacuumed and wet wiped with an approved cleaning solution. There are three concerns related to this step:

   First, according to Section 1C.8D of these specifications (see page 13), "No chemical cleaners, disinfectants, mold inhibitors, fungicides, encapsulants, spray adhesives, odor masking agents, air fresheners or similar materials are authorized for use during this project…" The requirement further states that the Agency will only allow "small quantities of low odor consumer type hand dishwashing detergent may be used when mixed with water for the purpose of wetting cleaning cloths used for damp wiping surfaces." This is a BAD idea. Previous attempts to use this method inside the elevator shaft have increased the fungal contamination in the elevator shaft, due to the fact that residual detergent left by inadequate rinsing becomes mold food rather than a mold inhibitor.

   There are a variety of safe cleaning chemicals that are available to help contractors clean mold-contaminated finish materials. Properly used, these cleaners/sanitizers are just as safe as the sanitizers and disinfectants used to clean bathrooms and kitchenettes located in the tower and base building.

   The second concern with this step deals with the cleaning of the elevator shaft walls altogether. According to the drawings provided with this specification, the elevator shaft wall is inside the elevator shaft. Is this process to occur inside the mini-enclosure built in accordance with step #1 of this section? If so, does that mean the enclosure will be built on top of the elevator car? If not, what is the mini-enclosure for? Is it the intent of the authors to move the mini-enclosure after each wall is cleaned? If so, the enclosure should be cleaned prior to being moved so that mold from one location does not cross contaminate the elevator shaft or the next area to be cleaned.

   The final concern deals with fall protection. Once sections of the shaft wall liner are removed a person could accidently fall down the elevator shaft. If a mini-containment is built and then connected and sealed to the walls near the areas to be

cleaned what provision are being made to ensure that workers inside the containment cannot accidentally enter the elevator shaft?

Page 4, ROOM 427

See comments under Room 327.

Page 4, ROOM 428

The steps in this section are related to creating a negative pressure enclosure in this room and removing drywall from the east and south walls of the elevator shaft. A final step (3.c.) requires coordination with the elevator maintenance company for removal and replacement of the elevator shaft liner. This means that the elevator shaft will become part of the negative pressure enclosure while the walls are being replaced. However, there are no requirements in the specifications for the elevator maintenance personnel to have respirator training or mold training.

Another concern deals with negative pressure. Once the shaft liner is penetrated the negative pressure will plummet because the elevator shaft will effectively become part of the negative pressure enclosure. Provisions need to be made to ensure that negative pressure will be maintained throughout this work effort.

There are no provisions for fall protection once the wall to the elevator shaft is opened. Provisions should be made for installing a guardrail system or having workers wear personal fall arrest systems. If the personal fall arrest system is chosen anchor points must be selected in accordance with MIOSHA regulations.

Page 4, ROOM 527

1. This step states, "A mini containment shall be established…but a negative pressure enclosure system is not required." Step 4 indicates that approximately 15 ft^2 of drywall will be removed from this room; however, the work will not be done under negative pressure. This is irrational. The drywall *cleaning* that was described in the steps for Room 328 required that it be done in a negative pressure mini-enclosure. Contrast this with the requirement that says that the work in Room 527 involving drywall *removal* does not require negative pressure. As stated earlier, any work requiring drywall removal in the ATCT should be conducted in a negative pressure enclosure.

   Step 1 also requires misting of contaminated areas prior to removal. This is a crossover remediation procedure that comes from the asbestos industry. While it makes sense to use water to keep asbestos fibers from being released into the air, the use of misting on a mold project can do more harm than good. The IICRC S520 *Standard and Reference Guide for Professional Mold Remediation* says on pages 169-170:

   > Misting is a method of atomizing water or other aqueous solutions into the air for the purpose of controlling airborne and surface particulates during remediation. Applying misting during demolition, prior to removing contaminant or during final cleaning, is controversial in the remediation industry. Some remediators

routinely advocate using misting techniques in the field, while others believe misting is inappropriate and do not use such techniques.

Some documents and organizations recommend using misting during mold remediation. Other research indicates that the hydrophobic nature of mold spores and hyphae unreasonably promotes aerosolization of mold spores and growth fragments during the misting process, and introduces moisture into the work environment possibly promoting further mold growth. Further research is needed to determine the effectiveness and propriety of using misting during mold remediation. Therefore, if deemed acceptable, in the professional judgment of a remediator, misting may be considered for dust suppression and clean-up purposes, when applied in conjunction with adequate engineering controls.

Spraying, wetting or misting moldy building materials can release or disperse mold spores, and mold growth may be promoted by introducing excessive moisture.

The use of a mini-containment that does not incorporate negative pressure during the removal of finish building materials does not constitute "adequate engineering controls," especially in an air traffic control tower.

2. The drywall removal in this room will involve working around a number of critical electrical components. There is no mention of this challenge in the specification, and no explanation from the authors on how to conduct the work.

Page 4, ROOM 527A

1. See concerns raised regarding the specifications related to Room 527.

3. The directions in this step are not clear. The description reads, "Remove gypsum board and insulation totaling approximately 5 square feet on the south wall, between the east wall and the door to Room 527, 2' wide to a height of 18"(surface layer) and 2' wide to a height of 12" (concealed layer). This description is confusing when compared to the drawing of this floor provided in the specifications. The south wall of Room 527 is not covered with drywall. We assume that the authors meant the south side of the elevator shaft, however, this is not clear.

Page 5, ROOM 529

1. See concerns raised regarding the specifications related to Room 328.

2. The description in this step is confusing. It states, "The portion of the east wall, between the south wall and stairwell doorframe, 2" wide to a height of 8', shall be HEPA vacuumed and then wet wiped with an approved cleaning solution." The east wall of Room 529 is the elevator doors and the adjoining walls on the north and south sides of the door. The south wall in Room 529 is actually a doorway to Room 527, and the stairwell door frame is actually on the west wall. The drawings contained in the specifications do not provide any additional details about these work instructions.

Page 5, ROOM 627

See comments under Room 327.

Page 5, ROOM 628

See comments related to Room 328.

Page 5, ROOM 727

See comments related to Room 327.

Page 5, ROOM 727A

See comments related to Room 328.

3. (Page 6) The directions in this step are confusing. It says, "The south wall above the door to room 727, 3'wide to a height of 3', shall be HEPA vacuumed and then wet wiped with an approved cleaning solution." The drawing included in these specifications indicates that the door leading to Room 727 is on the west wall of Room 727A, not the south wall. According to the drawing the south wall is an exterior wall. These directions need to be clarified.

Page 6, ROOM 728

See comments related to Room 328.

Page 6, ROOM 827

See comments related to Room 327.

Page 6, ROOM 829

See comments related to Room 328.

2. The directions in this step are confusing. They state, "The portion of the east wall, between the south wall and stairwell door frame, 2" wide to a height of 8', shall be HEPA vacuumed and then wet wiped with an approved cleaning solution." According to the drawing that was included in these specifications the stairwell door frame is on the west wall. These directions need to be clarified.
3. The directions in this step are confusing. They state, "The adjacent south wall, from the southeast corner westward, 1' wide to a height of 8', shall be HEPA vacuumed and then wet wiped with an approved cleaning solution." The south wall is primarily made up of the doorway leading to Room 827. It is unclear whether the author is referring to the wall that is on the east side of the doorway or the wall that is on the west side of the doorway. Based on the confusing directions given in the previous step it appears that the authors of the document may be uncertain about which way is north. The drawings enclosed in the specification do not provide any clarification.

Page 6, ROOM 927

See comments related to room 327.

Page 6, ROOM 928

See comments in Attachment 1.

Page 7, ROOM 1028

See comments in Attachment 1.

Page 7, SECTION 1B – SPECIAL REQUIREMENTS

1B.2 This item indicates that all work will be done in accordance with the New York City Department of Health *Guidelines on Assessment and Remediation of Fungi in Indoor Environments* (GARFIE). Although following the guidance in this document is important it is critical to understand that there are additional documents that make up the standard of care for the mold remediation industry. These documents were listed on pages 1 and 2 of this attachment. Several of these documents, including the EPA's *Mold Remediation in Schools and Commercial Buildings,* the ACGIH's *Bioaerosols: Assessment and Control*, and OSHA's *A Brief Guide to Mold in the Workplace*, suggest that mold remediation contractors consider following the requirements in several documents rather than just one.

1B.3D (Page 8) This entry states, "The Contractor shall be certified by the Indoor Air Quality Association (IAQA), the Institute of Inspection, Cleaning, and Restoration (IICR), the National Duct Cleaning Association (NADCA) or equivalent." There are three concerns with this statement. First, the name of the Institute of Inspection, Cleaning and Restoration Certification is inaccurately written, as is its acronym (IICRC). Also incorrect is the name of the National Air Duct Cleaners Association.

The above requirement implies that certification through any one of these three organizations is equivalent to any of the others. This is incorrect. The IAQA no longer conducts training. Classes previously taught by IAQA are now conducted through an organization known as the American Indoor Air Quality Council. This organization certifies individuals in various disciplines related to indoor air quality including mold remediation. The American Indoor Air Quality Council does not certify entire companies under one blanket certification.

The IICRC, on the other hand, does certify companies as well as individuals working for the company. The IICRC notes on its website that in order "to qualify for IICRC Certified Firm status businesses must demonstrate proof of insurance, maintain a written customer complaint policy with documented follow-up and provide ongoing education and training leading to certification for **all technicians** (*emphasis added*). IICRC Certified Firms are also required to abide by the IICRC Code of Ethics. Services provided by IICRC Certified professionals range from flooring inspection and cleaning to mold remediation to water and fire damage restoration." The IICRC offers a variety of certifications from rug cleaning to mold remediation. Those people responsible for selecting

contractors need to ensure that the contractors' employees are trained to conduct the appropriate type of work.

Finally, NADCA has three distinct certifications for individuals:

- Air System Cleaning Specialist (ASCS)
- Certified Ventilation Inspector (CVI)
- Ventilation System Mold Remediator (VSMR).

Like IAQA, NADCA does not certify companies. NADCA's website defines Regular Members as "companies that are actively engaged in the business of performing residential, commercial and/or industrial air duct cleaning services while retaining at least one certified Air System Cleaning Specialist (ASCS) on staff at each location." The member organization is not required to have a VSMR on staff. Finally, cleaning and remediating mold contaminated HVAC ducts is not the same as conducting a full mold remediation involving evaluation and cleaning of contents and the removal of contaminated finish building materials.

If the Agency wants to do this properly two contractors will be needed. The first contractor will need to have employees that are trained and certified to conduct mold remediation. The certifications should come from recognized industry trade associations such as the Restoration Industry Association (RIA), the IICRC, or the American Indoor Air Quality Council. The second contractor should be a member of NADCA and have at least one person on staff that is certified as an ASCS and a VSMR.

1B.8 (Page 9) This section says that the "contractor shall provide workers and government representatives with sufficient sets of protective full body clothing. Such clothing shall consist of full body coveralls including head covers, foot covers and hand covers." This type of disposable clothing does not come equipped with "hand covers", commonly known as gloves. Contractors should require their employees to wear surgical style gloves under heavier work gloves.

1B.13 (Page 10) The three page document entitled *Mold Remediation Project Clearance Protocol* is another example of shoddy work produced by someone who does not have a clear understanding of the intricacies of the mold remediation industry or the complexities of the situation at the Detroit tower. For example, post-remediation clearance is to be based on a thorough visual inspection as well as the collection of air samples using Air-O-Cell cassettes. Both of these requirements are part of the standard of care accepted by a majority of professionals in the field. However, the ensuing descriptions of the sample collection and interpretation procedures are seriously flawed.

Sample collection periods inside the containment that have passed a visual inspection are listed as five minutes. This short sampling time is further justified with the following statement: "Environmental conditions may warrant the sample collection period to be reduced to one-minute intervals, in order to reduce the collection of non-microbial particles that can mask the presence of mold spores." If a proper visual inspection is completed the work area where the mold contamination was removed will have no visible dust. In such circumstances it is

beneficial to have a significantly longer sampling period to meet the manufacturer's recommendation that enough particle deposition on the slide is produced so that "the edges of the trace are sharply defined and the particles dispersed well enough to enable good microscopic evaluation" (Air-O-Cell Bioaerosol Sampling Cassette Application brochure 03504 Rev. 3). Our experience with thousands of post-remediation samples utilizing Air-O-Cell cassettes indicates that a sample run time of fifteen minutes is appropriate in a post-remediation situation. Any overloading of the sample with drywall dust or other materials that would obscure the analysis should not result in a shorter sample runtime but in improved engineering controls and additional cleaning of the work area.

The post-remediation procedures call for collection of twelve samples for each remediation area: five inside the containment area, three outside the containment area but inside the building, three outside the building, and one lab blank. The protocol then notes that "the area will be considered 'clean' when the average airborne total mold spore concentration measured inside the containment area was not statistically higher than the average airborne concentration measured outside the containment area..." This description again indicates that the author does not grasp the difference between "clean" and "normal". Comparison to outdoor fungal spore concentrations does not necessarily guarantee that a work area is clean. Many experts in the mold remediation field understand that criteria used to judge the effectiveness of remediation efforts inside containment areas need to be much more stringent than "normal" to be considered clean; and to verify that all mold contamination sources within the containment have been addressed.

Even beyond the confusion between clean and normal, the protocol author further confuses the issue by suggesting that a statistical method known as the "Z test" be used to determine statistical significance when reviewing the post-remediation samples. While this particular process has been validated for asbestos abatement projects there is little supporting evidence that it is appropriate for mold remediation. It is clear that this language was excerpted from an asbestos standard because it notes that if the initial set of samples fails the Z test "an additional set of ten samples must then be collected, as defined above..." A sample set of ten is what is utilized in the asbestos industry (five inside the containment and five outside), but a few paragraphs earlier the protocol requires eleven samples and a field blank.

The protocol also requires that the genus level constituents be similar for all samples taken inside the containment compared to those taken outside. Similarity is to be evaluated using the Spearman Rank Order Correlation (SROC). Although one of the suggestions for using that analytical technique for mold projects is found in the American Industrial Hygiene Association's (AIHA) *Field Guide for Determination of Biological Contaminants in Environmental Samples* it is recommended for cases where an investigator is trying to determine if airborne mold concentrations are normal—not as a process for determining if remediated areas are clean. Even then, the AIHA guide notes that the Spearman

correlation must be used with caution. The paragraph following the example using the Spearman correlation is of particular interest:

> A word of caution, however, for interpretation of this particular example and for the conclusions that one might draw from other cases. Although the ranking is similar, the actual species found and their concentrations should also be used in drawing conclusions, especially when the presence of *Stachybotrys chartarum* (*atra*) is indicated in the indoor sample(s). (page 52)

One of the reasons for the caution in the AIHA guide is that the Spearman correlation is a non-weighted statistical measure. In other words, each data point carries the same weight as every other. Professionals dealing with mold contamination problems on a regular basis understand that certain data points need to carry more weight for a meaningful analysis of conditions in buildings where *Stachybotrys* and other toxigenic types of fungi have proliferated—particularly when such buildings have multiple reports of occupant illnesses that appear to be related to their presence in the structure.

Page 13, SECTION 1C – SUBMITTALS

1C.5 The following entries under this section should be revised. Our suggested revision is in italics.

A. The contractor shall submit all the following:
   3. Certificate of training, accreditation, qualification *for the company and for each employee working at this site.*

1C.8D This item states that "no chemical cleaners, disinfectants, mold inhibitors, fungicides, encapsulants, spray adhesives, odor masking agents, air fresheners or similar materials are authorized for use during this project and may not be brought onsite. When approved by the FAA prior to use, small quantities of low odor consumer type hand dishwashing detergent may be used when mixed with water for the purpose of wetting cleaning cloths used for damp wiping surfaces."

This makes little sense from a big picture perspective. There are several concerns with regard to chemical usage.

- The standard of care for the mold remediation industry is to remove fungus-contaminated building materials rather than clean them.
- Soap left behind due to improper rinsing can become a nutrient source for mold.
- Cleaning contractors hired by the Agency use a variety of chemicals such as cleaners, disinfectants, odor masking agents and air fresheners to do their work. Use of these chemicals is not prohibited by the Agency for obvious reasons: properly used chemical cleaners and disinfectants are an effective way to control microbial contamination in a public facility.

  As such, the mold remediation contractor should be allowed to use EPA registered commercial cleaners, sanitizers, and/or disinfectants to accomplish this project where required instead of dish soap.

APPENDIX 1. FORM 3900-8, FAA PRE-CONSTRUCTION AND MAINTENANCE PROJECT SAFETY AND HEALTH CHECKLIST

This form appears to have been filled out incorrectly.

Section 2 of the form is entitled Facility Procedures. The instructions below the heading state, "Review site specific FAA procedures and considerations with the contractor. For example, discuss when or how during the project, emergency plans will be used/required. After the procedures have been reviewed, perform a site walk-through with the contractor."

One of the listed procedures is Lock Out/Tag Out. The person filling out the form checked the N/A (not applicable) box. This is in direct contradiction to the entry made on the back side of this form in Section 4 that indicates that the elevator will need to locked or tagged out of service during this project.

Section 4 of this form is entitled Site Safety and Health. The instructions below the heading state, "After reviewing the potential hazards and risks in block 3, ensure that the contractor has identified measures and controls to address applicable site safety and health risks (e.g. through discussions, available site safety plans, or other applicable documents). In your judgment, if the contractor has appropriate measures to address the potential project hazards (see block 3), check the appropriate YES boxes below. If a potential project hazard has been identified in block 3 and no associated measures or controls are evident, then check the appropriate NO boxes below. If a NO box is checked, use the close-out date box to indicate when appropriate measures or controls have been incorporated into the contractor's site safety and health approach."

Even though a contract has not yet been awarded for this work we have one concern. The entry titled Provisions for GFCI under the Electrical Power Systems has the N/A box checked. Per OSHA (29 CFR 1926.404(b)(1)(ii)) ground fault circuit interrupters are required to be used during construction projects in conjunction with all 120 volt, single phase, 15–20 ampere receptacle outlets that are part of the temporary power system for a project. OSHA has interpreted this to include the use of extension cords during a project. Therefore, the YES box should have been checked under this section.

9

FOH Federal Occupational Health
a component of the US Public Health Service

PROGRAM SUPPORT CENTER PSC

INDOOR AIR QUALITY/FUNGAL VISUAL ASSESSMENT AND CONSULTATION

Conducted

For the

FEDERAL AVIATION ADMINISTRATION
REGIONAL OCCUPATIONAL SAFETY AND HEALTH
OPERATIONS BRANCH, AGL 471C
GREAT LAKE REGIONAL OFFICE
2300 DEVON AVENUE
DES PLAINS, IL 600018

At the

FEDERAL AVIATION ADMINISTRATION
Detroit Metropolitan Wayne County Airport (DTW)
Air Traffic Control Tower (ATCT)
Building 801
Romulus, MI 48242

May 5, 2006

Conducted by

U.S. PUBLIC HEALTH SERVICE
FEDERAL OCCUPATIONAL HEALTH SERVICES
1301 Young Street, Suite 772
Dallas, Texas 75202

FOH

Indoor Air Quality/Fungal Consultation

Federal Aviation Administration

FEDERAL AVIATION ADMINISTRATION
Detroit Metropolitan Wayne County Airport (DTW)
Air Traffic Control Tower (ATCT)
Building 801 Romulus, MI 48242

Project Reference Number:
A105952, S116930, P116941
port Date: February 1, 2005

Federal Occupational Health
a component of the U.S. Public Health Service
Department of Health and Human Services

PROGRAM SUPPORT CENTER
PSC

I. INTRODUCTION

At the request of Federal Aviation Administration (FAA) the U.S. Public Health Service (USPHS), Federal Occupational Health Program (FOH) conducted a visual assessment of the FAA Air Traffic Control Tower (ATCT) facility, located at the Detroit Metropolitan Wayne County Airport (DTW), Building 801 in Romulus, MI 48242. This request was made in response to Indoor Air Quality (IAQ) concerns and reports of possible exposure to fungal contaminates from previous mold abatement activities. On February 1, 2006, Mr. Stephen Lindsey, under the direction of Captain Douglas C. Pickup, MS, CIH, REHS, performed a visual inspection and assessment of the entire DTW ATCT. This assessment also focused particular attention on conducting an in-depth visual examination of the facility's elevator shaft relative to potential fungal growth or ongoing moisture problems. In addition to the visual inspection and assessment, several FAA site employees were interviewed and numerous reports and documents were reviewed relative to past conditions, mold remediation activities and fungal sampling that have taken place in the facility. This work was conducted under an Inter Agency Agreement (IAA) between FAA and FOH.

II. BACKGROUND

The ATCT facility is a Leo Daily standard design; approximately 230' in height with a three level base building constructed in 1990. The ATCT shaft is constructed of both load bearing pre-cast and cast-in-place concrete panels. The floors at all levels are composite decks on steel frame. The upper levels (occupied) are constructed of structural steel frame with architectural pre-cast panel cladding. Interior walls throughout the facility are gypsum wallboard on metal stud framework. Fire rated gypsum wallboard covers the wall surfaces within the stairwell, cable and mechanical chases, and within the central elevator shaft.

It appears from review of past documentation, that numerous IAQ and mold evaluations have been conducted in the facility by various parties. During 2005 several significant activities took place with subsequent reports being prepared, relative to mold growth and fungal exposure issues in the facility. From reported data initial fungal remediation was conducted in January 2005. A subsequent fungal remediation project was conducted at the facility in May of 2005. This work was completed by MIS Corporation (MIS) under contract to the FAA and the work was overseen by Clayton Environmental Group (CEG). These remediation

efforts involved removal of fungal contaminated wall board. At the conclusion of the May 2005 remediation activities, CEG conducted air sampling for mold and fungi in the facility. This was done to assure that the remediation activity had not resulted in an elevated concentration of airborne viable organisms in the structure; and that upon conclusion of all remediation efforts and all cleaning and re-cleaning, airborne fungi in the facility were significantly less than outdoor concentrations and that fungal species found inside the building were consistent with those found outside the structure. The results of the sampling conducted in the building on May 21, 2005 as reported by CEG found that the "average outdoor concentration.....is approximately 24 times greater than indoor concentrations" and that "the biodiversity of the fungal taxa identified on the 9th Floor...was similar to that identified in the samples collected outdoors".

Following these projects and activities, a Moisture Assessment Report was completed in August 2005. This assessment was conducted by Jacobs Facilities Inc. (JFI). The report from this assessment "identified a small amount of mold growth in a few localized areas of interior surface gypsum wallboard in the elevator shaft liner, primarily at levels 6-9 of the ATCT. The mold was observed on the surface paper of the wallboard and did not appear to penetrate the surface". The report goes on to note that some dry water stained areas were observed in the elevator shaft "but no mold growth was apparent". At the conclusion of this assessment JFI concluded that "the minor mold conditions noted on a few areas of the elevator shaft wall does not appear to pose a health concern to the occupants..." The report does recommend some surface cleaning activities to remove any old mold growth and water stains, as well as ongoing visual inspections to assure that no reoccurring moisture or water infiltration is occurring in the building and that no additional mold growth is occurring. Additional mold evaluations or clean-up work may have been conducted in the building; however, FOH did not have access to any additional reports or data of such efforts.

Following review of the past materials and reports concerning the structure, FOH traveled to the ATCT and on the evening of February 1, 2006, conducted an in-briefing with the FAA Regional Safety & Health Manager, Mr. Wayne Vogelsburg, Certified Industrial Hygienist (CIH); DTW Facility Operations Manager, Mr. Steve McClinchey; and the DTW Facility Manager, Ms. Monica Keyes. Following the in-briefing, a walk-around of the exterior of the building was conducted and a floor-by-floor walk-through of the interior of the facility was completed to examine all areas

of concern. During this walk-through measurements for temperature (T), Relative Humidity (RH), carbon monoxide (CO) and Carbon Dioxide (CO^2) were conducted. Moisture content measurements were performed on wallboard throughout the structure and elevator shaft. In addition an inspection was conducted of the facility Heating, Ventilation, and Air Conditioning (HVAC) systems and mechanical rooms. Following the walk-through of the facility, an inspection of the elevator shaft was completed at 10:00 pm. An out-briefing was held with the above mentioned staff and the NATCA Consultants CIH and NISC contractor, Mr. Mousa Abuzir. During this out-briefing the safety of the shaft in regards to fungal contamination and employee health concerns was discussed. At that time it was conveyed to the NATCA representative that in the opinion of FOH there was no apparent conditions that would be adversely affecting the health of the FAA employees in the facility or the NATCA representatives conducting the inspection of the facility. This was done prior to the NATCA representative's inspection of the elevator shaft later that evening.

III. FINDINGS

A. Facility Exterior. During the inspection of the exterior of the building, several areas were observed where water infiltration could occur in the building. This included the following areas:

1. On the Cab floor level while accessing the Catwalk, it was found that the caulking used to seal the expansion joints of the exterior cast-in-place concrete panels was weathered and separating from the concrete panels. This caulking was thinly applied resulting in the creation of a gap of approximately ½" to ¾" between the expansion joints and concrete wall panels, exposing the foam-backing rod in several areas around the catwalk. The applied caulking was also insufficient to fill the void between the exterior of the building and the foam backing rod.

2. In the areas of the Microwave Antennae Balconies on the junction floor, various penetration points where possible moisture intrusion could occur were observed, this included poorly sealed or caulked areas around joints, windows and floor drains.

3. Additional penetration points on the exterior of the facility where possible sources of moisture intrusion may be occurring included poorly caulked areas around exterior electrical outlets, security

lighting, cameras, doors, windows, and HVAC and utility penetrations and flashing.

In addition, evidence of where standing water or ponding had occurred was observed in several areas on the decking floor and in locations where pipe and cable penetrated thru the floor deck. Water staining and water trails were observed on the ceiling of the balcony from possible wind and heavy or driving rains.

B. Facility Interior. A walk-through of all floors and a visual assessment of all areas which had previously undergone mold abatement was conducted. During this walk-through assessment of the following environmental conditions were recorded:

1. Temperature (F°) in the facility ranged from 64 F° to 72.5 F°;
2. Relative humidity (RH) averaged between 31% and 35%;
3. Carbon dioxide (CO^2) concentrations ranged between 648 and 660 parts per million (ppm); and
4. Carbon monoxide (CO) concentrations were at 0 ppm.

These IAQ measurements were collected using a *TSI Q-Track™* IAQ Monitor, Model 8554. CO^2 is measured using a Non-Dispersive Infrared (NDIR) sensor with a range of 0-5000 ppm. It is accurate to +/-3% of the reading +/- 50 ppm at 77 F°, and has a resolution of 1 ppm. Temperature is measured using a Thermistor sensor with a range of 32 to 122 °F, an accuracy of 1.0 °F, and a resolution of 0.1 °F. Humidity is measured using a thin-film captive sensor with a range of 5 to 95% RH, with an accuracy of +/- 3% RH and a resolution of 0.1% RH. This unit is factory calibrated annually and calibration checks are conducted prior to each use.

All of the measurements taken for F°, RH, CO^2 and CO were all well within acceptable guidelines for Indoor Air Quality as established by the American Society of Heating, Refrigerating and Air-conditioning Engineers (ASHRAE) and the American National Standards Institute (NIST). Detail of these recommended standards can be found in NIST/ASHRAE publication Standard 62.1-2004.

Visual observations of the areas where past mold abatement had taken place along with review of the documents provided by FAA and interviews with the facility staff, found that all appropriate methods and measures were followed to ensure the health and safety of the federal

employees in the facility during the abatement activities of affected gypsum wallboard on the 3rd, 4th and 9th Floors.

During the various abatement projects approximately 2' of water damaged and/or mold contaminated wallboard was removed above the floor decking. From our evaluation it was found that when new wallboard was installed in the abated areas, it was done so in a manner that has the wall board in direct contact with the floor decking in many areas. This direct contact allows for a "wicking" of moisture between the wallboard and the floor to occur should the floor become wet or if gross moisture intrusion were to occur in these areas. Typical installation allows a ½" to ¾" gap between the bottom of the wallboard and the floor, providing for a natural moisture barrier between wall and floors.

Dried moisture staining was observed on the structural beams and wallboard along ceilings on the interior walls on many of the floors. These signs of moisture intrusion appear to be similar in size and location on all floors and are confined to the interior core walls of the structure. Similar signs of staining can be found within the elevator shaft in similar locations. The exterior walls are of concrete and were free from staining. In the interviews with the facility staff there was no known or recorded occasions where flooding or significant water damage had occurred in the facility.

During the survey moisture readings were made on wallboard surfaces throughout the interior of the facility. Special attention was placed on making readings in water stained areas or where there appeared to be past moisture problems. All of the measurements taken indicated that the current moisture content/levels within the wallboard materials in the facility were well below alarm levels (<0.05% moisture content). These measurements demonstrate and indicate that the condition of wallboard during our assessment was essentially dry.

Moisture readings were collected with the use of a Delmhorst *MoistureCheck* moisture meter. This unit is factory calibrated annually and calibration checks are conducted prior to each survey. The operation of this unit is based upon resistance technology to display reading as a percent moisture content value in the "pin" mode or on a relative scale in the "scan" mode. The *MoistureCheck* operates on the principle of electrical resistance. It uses building materials such as wood or gypsum wallboard as the element in a circuit by driving two electrode pins (pin mode) into it or touching (scan mode) the *MoistureCheck* sensor unit on the building material. Scan mode is used to estimate the relative moisture

levels in various building materials through non-invasive contact. The meter sends a signal through the material being tested and responds to an electromagnetic "echo" (Copyright 2005, Delmhorst Instrument Co. 9). The feedback is displayed in terms of a numeric, *relative value* over the range of 0-200, where lower readings indicate drier conditions than higher readings. This information helps the user determine if a moisture problem exists, and whether to proceed with more extensive pin meter measurements (Pin Mode). The "ALARM" feature in the meter provides the user with a set point, at which readings above a specified value (considered "WET" or unacceptable) generate an audible alarm. Threshold values range from 0.05% MC to 39.5% MC in the "pin mode" and 150 on a relative scale in the "scan mode

All records and visible observations indicated that the facility is very well maintained and operated. All unoccupied areas of the ATCT were found to be clean and free of house keeping issues.

C. Elevator Shaft. The observation of the elevator shaft was conducted with the Elevator Maintenance Contractor (hereafter referred to as the Operator) operating the elevator from the roof of the elevator car traveling from floor to floor beginning at the CAB level. The shaft wall surface is covered with unpainted "Fire Rated" gypsum wallboard. Located at the floor levels within the shaft are several areas of visible moisture staining and water trailing. This staining or trailing begins at each of the floor decks and travels down to the next floor, with visible signs of dried mold growth at approximately 2' to 3' around the floor deck. This dry or dormant visible fungal material within the shaft is what would be considered minimal in size in any one area. The approximate size of these areas range from a ½" spot to an area covering approximately 2 to 3 square feet and is found at approximately 2' to 3' above or around the floor level. This finding along with the similar signs found on the interior walls is typical of what would be found in a building that has been involved in a flooding event. This flooding event could have occurred as a result of a heavy rain during construction of the building prior to completion of a sealed roof or cap; or as a result of a leaking or damaged main water line, HVAC chill water line or facility fire suppression system. However, there are no current signs of any ongoing water infiltration or leaking.

As with the interior wallboard of the facility, moisture readings were conducted on numerous areas of the fire rated wallboard in the elevator shaft. Again these reading indicated moisture levels well below the

MoistureCheck alarm level (<0.05% moisture content) indicating essentially dry wallboard.

At the ceiling level of several floors within the shaft a small HVAC supply and return was found, reportedly dedicated to the elevator shaft to temper the environment of the shaft. These supply and return ducts were found to be clean and free from dust, debris, and fungal growth. The elevator shaft pit was clean and free from debris.

In the interview with facility staff, there were reports and concerns that the size of the fungal affected areas within the elevator shaft were growing and becoming darker. By interviewing the Operator while inspecting the shaft, it was discovered that this information originated with the Operator and was conveyed by him directly to the FAA staff. While the intentions of the Operator were good, his estimations of the effected mold growth areas were conducted in a size restricted area with limited light and visibility. This coupled with his lack of experience and training in indoor mold issues and due to the fact that he is not a trained and qualified environmental professional, resulted in the transfer of inaccurate information concerning the areas of concern. It is the opinion of FOH that these areas of old mold growth are not currently viable or "growing". This conclusion is based on observation of the areas and due to the fact that all measurements indicate that wallboard throughout the facility and in elevator shaft is currently very dry and there is no evidence of an ongoing source of moisture which would is required by all fungal organisms to remain viable.

D. HVAC. The HVAC units were found to be clean and free of debris and moisture and drain pans were dry and biocide tablets were in place. Records indicated that all HVAC filters are changed on a quarterly basis and were clean and free of debris at the time of our assessment. All HVAC and floor drains were clean and free of debris. The second floor Mechanical/HVAC Room was found to have had flooding due to a "pop-off valve" failure. Verbal and visual findings of this incident indicate all appropriate measures were conducted to clean-up and abate any water-damaged materials. Gross water was removed, gypsum wallboard was dried by removing base cove and drilling 1" holes approximately 2" above floor level, an industrial air mover and dehumidifiers were placed throughout the area to remove moisture from wetted material and indoor air. The HVAC room and surrounding areas were cleaned and dried within 24 hours. It appears that all appropriate measures were followed to abate this issue.

IV. Conclusions

As a result of the evaluation conducted by FOH prior to and on February 1, 2006 at the FAA DTW ATCT it is concluded that a gross moisture intrusion event occurred at some point in the past and was associated with the majority of the floors around the core of the building. This conclusion is based on the water staining in similar locations on the interior walls and within the elevator shaft. This moisture intrusion resulted in water damaged building materials and signs of artificial mold growth inside the structure.

It is further concluded from the assessments, reviews and interviews conducted, that the remedial activities to abate the water damaged building material and fungal issues at the facility were conducted properly and within "Best Practice" of the FAA and contract industrial hygiene professional involved in these efforts. Since there are no federal regulations regarding the issue of fungal contamination and or exposure levels, the industry follows various guidelines such as the New York City Department of Health 2004 Guidelines for Assessment and Remediation of Stachybotrys atra in Indoor Environments; and Remediation of Microbial Contamination and Bioaerosols - Assessment and Control issued by the American Conference of Governmental Industrial Hygienists (ACGIH). It is the opinion of FOH that these industry standard guidelines were followed during all remediation activities conducted by FAA at the ATCT. These guidelines indicate that the remedial activities can be safely conducted by maintenance workers without any containments or precautionary measure for areas less than 32 square feet (ft^2) of visible fungal contamination. From the reports and interviews, the areas of fungal were just at or below the 32 ft^2 in any one location. Despite this fact, the efforts conducted during the abatement activities at this ATCT utilized negative air containments, personnel protective equipment (PPE), and followed the removal practices in New York guidelines for all work conducted even though many of the areas were less than the 32 ft^2 of contamination.

Following all remediation activities, records indicate that comparative air sampling was performed to clear the containments, demonstrating that the fungal burden within the containments was significantly less than the fungal burden outside of containment and in the outdoor environment. Mold of all species can be found everywhere; there is not a standard or established level to determine what is an acceptable airborne level of mold or fungi. In the abatement process, the goal is to abate the affected area in a controlled environment to manage gross release of

fungal spores and debris, thoroughly clean the containment; and then use sampling and analysis along with the oversight of the events to determine if the efforts have been successful. The analysis interpretation must be done by a qualified professional in order to make the determination that the efforts were successful and completed according to industry standard protocols. In review of all data provided, these abatement activities were successful. The ongoing daily effort of FAA in the monitoring and inspection of the facility for water damage or fungal growth is in line with FOH standard recommendations and follows "Best Practice" of the profession.

The reports of gross fungal contamination from the abatement activities within the facility are very difficult to determine as all remedial efforts appear to have been conducted properly. In addition any remaining fungal debris within the elevator shaft is minimal in an area non-accessible to employees. Airborne sample results taken following the last abatement event, indicate that airborne fungal concentrations inside the ATCT were 24 times less than the concentrations found outside the Tower and that the biodiversity of the organisms found inside the building and outside the facility were similar. It is our opinion that if this sampling were conducted at this point in time the results would be similar; in that the airborne fungal concentrations inside the facility would be significantly less than those found outside the structure and that the biodiversity of the types of fungi preset would be similar or consistent.

Environmental data collected inside the ATCT indicated that air quality and ventilation inside the structure is acceptable. Each facility mechanical system is properly maintained and working effectively. All drywall materials and other building components were found to be dry and in good condition. The facility was clean, well organized and maintained and free of clutter.

Several locations and areas were identified as noted above where water infiltration might be able to occur. This was primarily due to old or deteriorated caulking which needs to be replaced. Despite these minor areas of possible moisture infiltration, there is no evidence to indicate that there are any ongoing water problems or mold growth inside the structure.

In summary, the abatement activities conducted at this facility were performed properly and in a safe manner to ensure the health and safety of the federal employees. This facility was found to have excellent housekeeping practices in place, is properly maintained and was found to be one of the cleanest FAA facilities FOH has inspected to date. It should also be noted that during our evaluation it was observed and demonstrated on numerous occasions, that the health and safety of the federal employees within this facility was and is the foremost priority of FAA management.

V. Recommendations

A. Continue to document and map all moisture intrusion events.
B. On occurrence of moisture intrusion, determine and correct the source of moisture infiltration. Abate any affected areas following properly developed and approved procedures using qualified and environmentally trained personnel.
C. Monitor and oversee all future fungal abatement activities from development to completion with proper documentation.
D. Utilizing a HEPA vacuum, vacuum all surfaces within the elevator shaft under negative pressure and monitor for new occurrence of fungal growth. Should the decision be made to encapsulate these walls, verify any product used to assure that the integrity and "Fire Rating" status of the walls is not compromised.
E. Educate, and inform employees of ongoing fungal abatement activities within the facility.
F. Investigate the facility link between the terminal and the FAA to determine the +/- pressure effect to the FAA.
G. Inspect and repair all expansion joints for failing caulking. Review data on replacement materials to ensure proper materials are utilized in repair efforts.
H. Correct gypsum wallboard in contact with decking floor that would allow a "Wicking" to occur should gross moisture intrusion occur.
I. To reduce the potential for microbiological growth in the facility, the relative humidity should be adjusted and maintained within the ASHRAE recommended range of 30% to 60%.

VI. Documentation Review

A. DTW ATCT Investigation Report Consolidation dated March 30, 2005.

B. Clayton Group Air Sampling and Consultation during Remediation of Fungally-Contaminated Gypsum Wallboard dated July 29, 2005.

C. DTW ATCT Moisture Assessment report dated August 2005.

D. DTW ATCT Monthly Visual Walkthrough Inspection Checklist Reports dated January 25th to 27th, 2006.

9b

WONDER MAKERS

ENVIRONMENTAL

June 13, 2006

Mr. Vincent Sugent
Detroit Metro Tower FACREP
Building 801
Romulus, MI 48242

RE: Review of Federal Occupational Health's *Indoor Air Quality/Fungal Consultation, Federal Aviation Administration, Detroit Metropolitan Wayne County Airport (DTW), Air Traffic Control Tower (ATCT), Building 801, Project Reference Number: A105952, S116930, P116941* dated May 9, 2006.

Wonder Makers Environmental Project #GC06-6598

Dear Vinnie:

This letter serves as a response to the Indoor Air Quality/Fungal Visual Assessment and Consultation developed by Federal Occupational Health (FOH), a component of the U.S. Public Health Services, Department of Health and Human Services. The inspection was conducted at the DTW ATCT on February 1, 2006, by Mr. Stephen Lindsey.

Overall, this report is disappointing as it relies on a seriously flawed inspection process to reiterate the FAA's position that mold is not a cause for concern at this facility. It is clear that the FAA limited the information it provided to the FOH as there is no mention of NATCA personnel being interviewed by the FOH investigator. It also appears the FOH investigator was not provided with documents that have been provided to the Inspector Generals office which detail many of the indoor air quality problems in the building.

Our primary concern regarding this report is that it appears to be very one-sided. As stated above, it does not appear that the FOH investigator was provided the opportunity to interview those impacted by the mold in the building, nor was he provided with the reports that refute the information provided him by the FAA

regarding sampling results taken after mold remediation was conducted in the DTW ATCT.

A list of our concerns, by paragraph, is attached. Please do not hesitate to contact me if you have any questions about this letter or the detailed list of our concerns regarding the work plan.

Sincerely,

Michael A. Pinto, Ph.D., CSP, CMP
CEO

Enclosure: Elevator shaft work plan concerns
Published clearance criteria

cc: Pat Forrey
Dave Batts
Troy Wilkinson

9c

Specific Concerns Regarding Federal Occupational Health's
Indoor Air Quality/Fungal, Visual Assessment and Consultation, Detroit Metropolitan Wayne County Airport (DTW), FAA Air Traffic Control Tower (ATCT)

(All direct references to original document are designated in bold print.)

I. Introduction

This section indicated that FAA employees were interviewed during this investigation. Interestingly, the FAA employees interviewed had not suffered from adverse health effects related to the mold exposure in the DTW ATCT. The obvious concern regarding this statement is why adversely impacted employees weren't interviewed to offer their concerns. During a subsequent phone conversation with NATCA member Dave Parker, the inspector was specifically questioned whether any occupants claiming injury were interviewed and the inspector said, "No, I wasn't asked to."

"Numerous reports and documents were reviewed relative to past conditions, mold remediation activities and fungal sampling that have taken place in the facility." It is blatantly obvious that the FOH investigator did not review, or chose to ignore, the evidence provided by NATCA to the Department of Transportation Inspector General regarding the gross ineptitude exercised by the FAA and contractors hired by the FAA during the past 19 months.

Another disturbing point of concern is this investigation was done without taking any air samples to support the investigator's findings, conclusions, and recommendations. As in the past, the investigator conducted **"...an in-depth visual examination of the facility's elevator shaft relative to potential fungal growth or ongoing moisture problems."** Biological air monitoring was not conducted by the investigator. Instead, he relied on one set of air monitoring data taken in July 2005 to determine current conditions in the DTW ATCT. As we have indicated in the past, a thorough investigation, including a detailed sampling strategy, moisture mapping, and visual inspection should be conducted at this facility. The use of results from air samples taken ten months ago to draw conclusions about current conditions is, in our opinion, professionally irresponsible on the part of the FOH.

II. Background

Second Paragraph - This paragraph correctly indicated that initial fungal remediation (this was described as "fungal remediation" not "removal of water-damaged materials") was conducted in January 2005 and that subsequent fungal remediation was conducted May 2005. It also correctly indicated that MIS was the contractor that conducted each remediation project. It then indicated that **"the work was overseen by Clayton Environmental Group (CEG)."** This statement is incorrect. CEG only supervised the work performed in May 2005. The fungal remediation project conducted in January 2005 was overseen by Musa Abuzir of NISC. Post-remediation

samples were not taken at that time. Wonder Makers Environmental (WME) was brought in at the request of NATCA to conduct a visual inspection of finished work and to take representative air samples to determine if the fungal remediation project was a success. Based on the visual inspection and supporting air monitoring data collected by WME, the fungal remediation project was deemed ineffective (see letter dated January 27, 2005, WME Project #IA05-5776).

"At the conclusion of the May 2005 remediation activities, CEG conducted air sampling for mold and fungi in the facility. This was done to assure that the remediation activity had not resulted in an elevated concentration of airborne viable organisms in the structure; and that upon conclusion of all remediation efforts and all cleaning and re-cleaning, airborne fungi in the facility were significantly less than outdoor concentrations and that fungal species found inside the building were consistent with those found outside the structure. The results of the sampling conducted in the building on May 21, 2005 as reported by CEG found that the 'average outdoor concentration....is approximately 24 times greater than indoor concentrations' and that 'the biodiversity of the fungal taxa identified on the 9th floor...was similar to that identified in the samples collected outdoors.'" That statement cannot be supported by data. Data from the ninth and fourth floors indicated that *Stachybotrys* and hyphal fragments were found in the post-remediation samples and were not found in any of the out-of-doors samples. *Stachybotrys* is a type of mold that can produce potent mycotoxins and is often associated with significant health symptoms. These particular spores are not easily aerosolized; as such, most industry experts agree that any indoor airborne *Stachybotrys* spores should trigger investigative action and additional post-remediation cleaning. Hyphal fragments are the fungal filaments on which mold spores form. Because hyphae are not as easily aerosolized as spores, the presence of hyphal fragments indoors, especially at levels higher than those found out-of-doors, is often an indicator that a mold source is at or near the site of the sample.

It should be noted that an objective clearance criteria was not established for the January 2005 and May 2005 fungal remediation projects.

Third Paragraph - The investigator discussed the moisture assessment report submitted to the FAA by Jacobs Facilities, Inc (JFI) dated August 31, 2005. The FOH investigator indicated, **"The report from this assessment 'identified a small amount of mold growth in a few localized areas of interior surface gypsum wallboard in the elevator shaft liner, primarily at levels 6 – 9 of the ATCT. The mold was observed on the surface paper of the wallboard and did not appear to penetrate the surface'."** The FOH investigator failed to mention that a worksheet in the JFI report recommended that 6,100 square feet of material in the elevator shaft be washed/cleaned. This is not a small amount of material and designates a large or extensive mold remediation project as described in several documents that make up the industry standard of care for this type of work.

This statement also indicated that the FOH investigator did not have access to all the reports and information generated during the past year and a half. If he had he would have seen that there is clear evidence that mold was growing on both sides of the drywall that enclosed the elevator shaft, not just inside the elevator shaft as this report indicated.

The FOH reported, **"At the conclusion of this assessment JFI concluded that 'the minor mold conditions noted on a few areas of the elevator shaft wall does not appear to pose health concern to the occupants...'."** The FOH investigator failed to mention that there is no supporting documentation, evidence, or air monitoring data to support this conclusion. In addition, the FOH investigator failed to mention that the JFI investigator did not talk with medical personnel that treated affected employees nor did he interview any of the affected employees. As a result, the JFI conclusion that the minor mold condition in the elevator shaft did not appear to pose a health concern to occupants is without foundation. To our knowledge, no one on the JFI staff is a medical doctor.

The FOH investigator indicated again that JFI suggested surface cleaning activities for mold contamination in this building. The FOH investigator failed to mention that cleaning mold on porous materials is not the recommended practice. Multiple documents in the current industry standard of care, including documents written by OSHA and the EPA, indicate that porous building materials contaminated by mold growth should be removed, not cleaned.

Fourth Paragraph – The FOH investigator traveled to DTW ATCT on February 1, 2006, to perform an inspection of the facility. He indicated that an in-briefing meeting was held with three FAA personnel; however, there was no NATCA representative at this meeting. There was no explanation as to why a NATCA representative was not present. It is our understanding that NATCA was never informed of this meeting. As a result, no NATCA representative was present during the walk-around of the exterior of the building and the floor-by-floor walkthrough of the interior of the facility, including the elevator shaft. This was a direct violation of Article 53 in the contract between NATCA and the FAA.

This paragraph also indicated that the FOH investigator actually had and utilized equipment that would assist him with his inspection of the facility, including instruments that measured temperature, relative humidity, carbon monoxide (CO), and carbon dioxide (CO_2). This is a privilege that the FAA has consistently denied WME during recent surveys of the facility. This is especially galling as WME representatives have often had more sophisticated equipment on site than that used by the FOH or NISC representatives during recent surveys of the facility.

The fourth paragraph indicated an out-briefing was held after the completion of this survey and this time NATCA was represented. However, NATCA was represented by their on-site safety and health representative, not the **"NATCA Consultants CIH"** as the report indicated. According to the FOH report, **"During this out-**

briefing the safety of the shaft in regards to fungal contamination and employee health concerns was discussed. At that time it was conveyed to the NATCA representative that in the opinion of the FOH there was no apparent conditions that would be adversely affecting the health of the FAA employees in the facility or the NATCA representative conducting the inspection of the facility." The FOH investigator provided no basis for this opinion. Nowhere in the report did he indicate that he took any type of mold samples anywhere in the facility. As a result it appears that he was relying on subjective observations to support this opinion rather than objective data. In addition, the FOH investigator did not indicate that he sought, reviewed, or discussed any of the medical information that was available for review regarding the nature of the symptoms related to mold exposure in the DTW ATCT experienced by occupants.

III. Findings

B. Facility Interior

Third Paragraph - The FOH report indicated that, **"Visual observation of the areas where past mold abatement had taken place along with review of the documents provided by the FAA and interviews with the facility staff, found that all appropriate methods and measures were followed to ensure the health and safety of the federal employees in the facility during the abatement activities of affected gypsum wallboard on the 3rd, 4th and 9th floors."** This could not be farther from the truth. On January 21, 2005, WME was contacted by NATCA to conduct a visual inspection of the third and ninth floors. Mold remediation was conducted on these floors on January 19 and 20, 2005. A comparison of the work site to the paperwork revealed that many areas of the FAA work plan were not followed. WME pointed out major problems, including visible debris on the floors and ample evidence of a "rip and run" approach to remediation. Air and surface samples were collected and subsequent analysis indicated that mold contamination had been spread throughout the facility. In particular, *Stachybotrys, Chaetomium,* and elevated levels of *Aspergillus/Penicillium* were recovered in samples from the fourth, ninth, and tenth floors.

The visual evidence was stunning in its proof that the standard of care for mold remediation was not adhered to. There was a general agreement from both the AF and AT managers during the out-briefing that the project had been poorly implemented and managed by the project representative from Tech Ops. Based on the observed conditions, WME recommended that the fourth, ninth, and tenth floors be isolated and that a qualified contractor be brought in to "stabilize" the situation on the fourth and ninth floors by sealing the open wall cavities with 6-mil poly sheeting. The FAA hired its own industrial hygienist who took samples on January 22, 2005. Result from these samples showed levels lower than those taken the previous day; however, the FAA's industrial hygienist concurred with WME's

recommendations and added that mold discovered in the elevator shaft should be sprayed with an "approved microbiologic biocide."

The FAA did hire a contractor to stabilize the fourth and ninth floor as per WME's recommendations. Sadly, the contractor was also tasked by FAA representatives to spray the elevator shaft with a biocide. Within two hours of the spraying of this material several controllers working in the cab became ill and eight of them required medical attention. The cab was evacuated for five hours.

For the FOH investigator to indicate that **"...all appropriate methods and measures were followed to ensure the health and safety of the federal employees in the facility during the abatement activities..."** is to grossly misrepresent the facts in evidence.

Fourth Paragraph - The FOH indicated that two feet of contaminated wallboard was removed above the floor decking in these areas. The investigator found that the wallboard used to replace removed materials was touching the concrete decking. The investigator recommended that a gap of ½" to ¾" between the bottom of the wallboard and the concrete floor be used to provide a natural moisture barrier between the wallboard material and the concrete floors. WME agrees with this recommendation.

Fifth Paragraph – It was noted that dried moisture staining was observed on the structural beams and wallboard along the ceilings on the interior walls on many floors. There was no mention of the large stains on the sprayed-on insulation in Rooms 628 and 528. Questions have been raised by both NATCA and WME as to whether or not this material could be harboring fungal or other microbial contamination. To our knowledge this material has never been tested. The NISC contract environmental, safety, and health representative viewed the material through a digital camera on November 30, 2005, and indicated that, based on this observation alone, there was no mold present on the stained fireproofing. WME is not aware of any sampling or analytical methodology that utilizes a digital camera to make such determinations. The FOH investigator did not take any samples of the water-stained materials he observed nor did he offer any concerns about these materials.

Sixth and Seventh Paragraphs - Details were offered about moisture detection equipment used by the FOH investigator. Interestingly, representatives from WME have had similar equipment on site during recent visits to the DTW ATCT and other FAA facilities but were not allowed to use them.

C. Elevator Shaft

First Paragraph - The FOH investigator minimized rather than attempted to quantify the amount of mold-damaged material in the elevator shaft. He indicated that mold colonies observed on the interior elevator shaft walls varied in size from

a ½" spot to 2-3 square feet. While these measurements are important, the current industry standard of care requires that the amount of mold be quantified in order to determine proper engineering controls and personal protective requirements for each project. WME estimated that the total amount of mold inside the elevator shaft far exceeds 100 square feet. As previously stated, JFI recommended that 6,100 square feet of wallboard be cleaned inside the elevator shaft.

Interestingly, the Gypsum Association published a document in 2003 entitled *Assessing Water Damage To Gypsum Board* (GA-231_03). In this document the author notes that, "In general, gypsum board should not be exposed to elevated levels of moisture for extended periods. Examples of elevated levels of moisture include, but are not limited to, exposure to rain, condensation, water leakage, and standing water. Some board exposed to these conditions may not need to be replaced, depending upon the source of the moisture and the condition of the gypsum board being considered for replacement. However, IF THERE IS EVER A DOUBT ABOUT WHETHER TO KEEP OR REPLACE GYPSUM BOARD THAT HAS BEEN EXPOSED TO MOISTURE – REPLACE IT" (emphasis placed by WME). The document further states that, "Gypsum board exposed to water should be replaced unless all of the following conditions are met:

- The source of the water or moisture is identified and eliminated.
- The water or moisture to which the gypsum board was exposed was uncontaminated.
- The gypsum board can be dried thoroughly before mold growth begins (typically 24 to 48 hours, depending on environmental conditions).
- The gypsum board is structurally sound and there is no evidence of rusting fasteners or physical damage that would diminish the physical properties of the gypsum board or system.

Clearly, the first and third conditions have not been met since the source of the water in the elevator shaft has yet to be determined and mold is already growing on the interior of the wallboard that lines the elevator shaft in the DTW ATCT.

Second Paragraph - The FOH investigator used a MoistureCheck instrument to record moisture content of the wallboard in the interior of the elevator shaft. It continues to be of interest to WME as to why the FAA would allow investigators from one government organization to use these types of instruments, when their own NISC contract environment, safety, and health representative did not do the monthly moisture surveys of the facility with this type of instrumentation. Perhaps the NISC contract environment, safety, and health representative had a special talent for visually checking the moisture content of wallboard and other finish building materials that the FOH investigator lacked?

Fourth Paragraph - The FOH investigator suggested that the elevator operator from Tyssen Elevator was the person that indicated to the FAA that the mold in the elevator shaft was continuing to grow and the amount of mold in the shaft had increased since being discovered some 18 month ago. Michael Pinto, Ph.D., CSP, CMP of WME noted in a letter dated December 29, 2005, that several areas of the building, particularly the sixth, fourth, and third floors, had more fungal growth than that found six months previously. This is not the comment of an inexperienced worker but the observation of a qualified indoor environmental professional that has been involved in this project from the beginning. The FOH investigator's opinion was based on one visit and one conversation. In this matter WME feels much more qualified to make this assessment than the FOH investigator.

It is also important to remember the results of the moisture survey of the DTW ATCT that was conducted by the NISC contract environmental, safety, and health representative on December 28, 2005. The NISC representative noted additional fungal growth was present in the elevator shaft that had not been documented in the previous month's survey. However, the NISC representative explained away the obviously deteriorating situation with the comment that this was growth that he must have missed during the previous month's survey as opposed to new growth.

The FOH investigator offered another unsubstantiated opinion in the fourth paragraph. He indicated that, based on his observations, the mold in the elevator shaft was **"...old mold growth..."** and was **"...not currently viable or 'growing'."** His support for this opinion was the fact that the drywall in the elevator shaft was dry according to the moisture measurements taken during the survey and the fact that there was currently no ongoing source of moisture. He further indicated that a moisture source **"...is required by all fungal organisms to remain viable."** These comments can be misleading. First, the only way to determine with any level of scientific certainty that mold is viable or not is to sample it. Any other method is purely speculation or, in the case of the FOH investigator, an opinion. Second, the fact that mold remains in the building is a significant cause for concern. Whether dead or alive, viable or not, mold should not be growing on finish building materials as it can cause adverse health effects in some occupants. The cavalier attitude of the FOH investigator regarding his opinion is surprising given the extent of the contamination in the elevator shaft.

IV. Conclusions

First Paragraph - The FOH investigator concluded that a single gross moisture intrusion event was the cause of moisture infiltrating the DTW ATCT. However, this was not supported by his own report as he indicated three specific places where water could be currently infiltrating the building under the right conditions (see Section III. A.). A thorough building survey of the DTW ATCT has yet to be conducted by

anyone to determine the cause and extent of the water-damaged finish materials in the structure. Interestingly, the FOH investigator used a term that WME is not familiar with: **"artificial mold growth"**. To WME's knowledge, all the mold growth inside the structure is real and is posing a health risk to building occupants.

Second Paragraph – The FOH investigator concluded that the remedial activities used to remove mold-contaminated building materials from the DTW ATCT followed the industry's best practices. This is not the case, as explained previously. The practices utilized by the remediation contractors and FAA industrial hygienists throughout this process were minimal at best and without concern for the occupants of the building.

The investigator indicated that the remediation contractor followed guidelines established for the project with regard to personal protective requirements, engineering controls, and removal practices. As stated previously, (see Section III. B.) visual evidence of the remediation work areas and post-remediation monitoring by several environmentalists indicated that the industry's best practices were not followed during remediation.

Finally, as in previous paragraphs, the FOH investigator continued to minimize the amount of mold found in the building. Worse yet, he misinterpreted old documents to buttress this improper assessment of the conditions at DTW ATCT. For example, the FOH investigator indicated that, according to New York City Department of Health's *2004 Guidelines for Assessment and Remediation of Stachybotrys Atra in Indoor Environments*, projects that are less than 32 square feet can be done by facility maintenance personnel. He is incorrect on several points. First, the most recent major revision of these guidelines was in 2000 with further minor edits in 2002. The current title of this document is *Guidelines on Assessment and Remediation of Fungi in Indoor Environments*. The title cited by the FOH investigator refers to the 1993 version of the guidelines. A second error is the inspector's reference to 32 square feet of mold. This amount is not used as a separation point in the guidelines. The New York City guidelines describe four levels of projects based on the "size of the area impacted by fungal contamination". In each case, the level of engineering controls and personal protective requirements increases as the impacted area gets larger. The project levels are as follows:

- Level I: Small Isolated Area (10 sq. ft. or less)
- Level II: Mid-Sized Isolated Areas (10-30 sq. ft.)
- Level III: Large Isolated Areas (30-100 sq. ft.)
- Level IV: Extensive (>100 contiguous sq. ft. in an area)

In addition to making mistakes regarding the details of the guidelines, the FOH inspector made a number of mistakes regarding the intent of the New York City guidelines. The document urges a thorough visual assessment and encourages the use of equipment such as boroscopes "...to view spaces in ductwork or behind walls". Given the documented mold growth on the interior side of the shaft liner, as well as the elevator side, these problem areas should be combined to determine the total

amount of material impacted by fungal growth. Clearly, the combination of fungal contamination on the interior side of the shaft liner and the elevator side is substantially greater than 100 square feet. Therefore, the FOH inspector should have indicated that any remediation activity would qualify as Level IV. Level IV projects require negative pressure enclosures built from plastic sheeting as well as more stringent personal protective requirements.

Third Paragraph – **"Following all remediation activities, records indicate that comparative air sampling was performed to clear the containments, demonstrating that the fungal burden within the containments was significantly less than the fungal burden outside of containment and in the outdoor environment."** As described previously, there are serious concerns about the interpretation of the data provided by the FAA.

The next sentence in this paragraph stated, **"Mold of all species can be found everywhere; there is not a standard or established level to determine what is an acceptable airborne level of mold or fungi."** There are peer-reviewed clearance criteria for mold remediation projects that were published in the November 2004 issue of Professional Safety Magazine (see attachments). Section III, Chapter 2 of OSHA's Technical Manual indicates that environments found to have greater that 1,000 cfu/m^3 should be considered unhealthy. *Fungal Contamination in Public Buildings: A Guide to Recognition and Management,* published by the Federal-Provincial Committee on Environmental and Occupational Health in Ottawa, Canada, says that 500 cfu/m^3 is an indication that the building environment is contaminated.

The third sentence states, **"In the abatement process, the goal is to abate the affected area in a controlled environment to manage gross release of fungal spores and debris, thoroughly clean the containment; and then use sampling and analysis along with the oversight of the events to determine if the efforts have been successful."** As documented previously, this was not the case for the work performed in January 2005 and May 2005.

The fifth sentence indicates, **"The ongoing daily effort of FAA in the monitoring and inspection of the facility for water damage or fungal growth is in the line with FOH standard recommendations and follows "Best Practice" of the profession."** It is again important to note that the NISC environmental, safety, and health representative used by the FAA conducts only visual moisture surveys. He has, to our knowledge, never used any type of instrumentation to conduct or document his findings during these surveys with the exception of a digital camera that is apparently capable of detecting mold on surfaces such as spray-on fireproofing located more than 30 feet above his head. This is just one of many violations of recognized "Best Practices" for the indoor air quality industry.

Fourth Paragraph – **"The reports of gross fungal contamination from the abatement activities within the facility are very difficult to determine as all remedial efforts appear to have been conducted properly."** As noted previously,

this was not the case at all. WME documented on numerous occasions that the work performed did not pass visual examination nor did samples taken by WME and other industrial hygiene firms indicate that the work was completed according to the industry standard of care (see letters dated January 27, 2005,WME Project #IA05-5776; March 10, 2005, WME Project #IA05-5776; March 31, 2005, WME Project #IA05-5776; April 13, 2005, WME Project #IA05-5913; April 18, 2005, WME Project #IA05-5776; May 3, 2005, WME Project #GC05-5988; May 20, 2005, WME Project #GC05-5988).

The FOH investigator makes the following statement in the last sentence of this paragraph, **"It is our opinion that if this sampling were conducted at this point in time the results would be similar; in that the airborne fungal concentrations inside the facility would be significantly less than those found outside the structure and that the biodiversity of the types of fungi preset would be similar or consistent."** Interestingly, the FOH investigator took no samples to support this hypothesis. Each time WME has taken samples, two important pieces of information have consistently been found:

- Target organisms such as *Stachybotrys* and *Chaetomium* were found in air and microvacuum samples taken in multiple locations in the DTW ATCT. Target organisms are fungal species that require significant amounts of moisture to grow. As a result, they are not generally found inside buildings. When found inside, it generally indicates that there has been a significant water infiltration or a continuous source of moisture in the building.
- On several occasions several species were found indoors that were not found in out-of-doors comparison samples. This can also be used as an indication of water infiltration in a building.

FAA experts have chosen to ignore or reduce the importance of this information rather than acknowledge that the building has ongoing moisture issues that are causing mold growth, making some building occupants ill.

Sixth Paragraph - The FOH investigator noted that there were places where water infiltration might occur in the building. He further indicated **"there is no evidence to indicate that there are any ongoing water problems or mold growth inside the structure."** WME has evidence to the contrary. We have multiple pictures that indicate that FAA remediation contractors did not remove all the mold-contaminated finish materials during past remediation projects. There is ongoing evidence that indicates an unidentified moisture source exists in the elevator shaft that continues to support fungal growth inside this structure. We have regularly recommended that a thorough investigation of the entire building be done to characterize all of the moisture and mold issues in the DTW ATCT. This would then allow the FAA to develop a meaningful plan that would address all issues and attack the source of the moisture problem in the building rather than putting Band-aids on individual issues.

Seventh Paragraph - **"...the health and safety of the federal employees within this facility was and is the foremost priority of FAA management."** Over the past 19 months WME has actually found this to be the exception rather than the rule. The FAA has continuously denied that mold was causing ill health among its controllers, even when medical evidence was provided. They have, during the past year, prevented the duly-authorized representative of NATCA the ability to conduct a thorough indoor air quality investigation to identify where moisture is entering the building and specific locations of mold. The FAA has not provided NATCA with formally requested documents, such pictures and reports, that are the result of surveys conducted by the FAA or its representatives.

V. Recommendations

We generally agree with each of the recommendations provided by the FOH with the exception of Items A and D. We suggest that Item A be rewritten so that it says, "*...continue to document and map all moisture events by conducting monthly inspections. Persons conducting this survey should utilize moisture meters, thermometers, hygrometers, and other instruments that will assist in these endeavors.*"

Item D should be replaced with a recommendation that insists that the mold-contaminated building materials be removed from the building rather than cleaned. This would include the mold-contaminated wallboard located in the elevator shaft.

VI. Documentation Review

It is obvious that the FOH investigator was not able to review all documents related to the ongoing health issues at the DTW ATCT during the past 19 months. We recommend that the FOH review the same set of documents that were provided by NATCA to the Inspector Generals office. This would provide FOH investigators with a much more complete picture of what has been happening at the DTW ATCT. It is interesting to note the FAA provided the FOH with two documents that neither NATCA nor its representatives have seen: Items A and B.

Overall, the number of serious errors in the report undermines its credibility. Perhaps if the FOH inspector would have conducted the inspection in a comprehensive, objective fashion and made even modest attempts to procure and evaluate some of the data which has been provided to the FAA by NATCA, the report would not be riddled with so many factual errors and unsupported conclusions.

9d

WONDER MAKERS
ENVIRONMENTAL

May 12, 2006

Mr. Vincent Sugent
Detroit Metro Tower FACREP
Detroit Metro Tower
Building 801
Detroit, MI 48242

RE: Review of the *General Work Plan for Microbial Remediation of the Elevator Shaft at the Detroit Metropolitan Airport(DTW) Air Traffic Control Tower, Romulus, Michigan,* submitted to the FAA by Clayton Group Services, Inc. (Clayton Project No.: 12-06075.00)

Wonder Makers Environmental Project GC06-6598

Dear Vinnie:

This letter will serve as a response to the work plan for mold remediation in the DTW elevator shaft dated April 27, 2006, that was submitted to Virginia Marcks of the FAA by Andrew Crause and Barbara Woodhull of Clayton Group Services, Inc.

Overall, the work plan is inappropriate for the amount and extent of mold contamination that is in the elevator shaft at the DTW ATCT. This assessment is based on a variety of concerns regarding the described work, as well as the absence of many industry recommended safety measures.

Our first and primary concern is that the work plan was written as if the amount or extent of contamination in the elevator shaft was less than 10 square feet when, in fact, the amount of visible mold inside this structure is closer 100 square feet or more. Remediation projects of this magnitude require much greater levels of engineering controls and personal protective equipment than is described in this work plan.

One requirement that is obviously missing from this work plan is there is no mention of negative pressure being used to control the levels of spores in the elevator shaft during the remediation activities. Negative pressure in the work area protects the contractor by reducing the levels of spores in the work area. Negative pressure also ensures that persons working outside the remediation area are protected by preventing spores from traveling outside the work areas while remediation work is being performed. Without this engineering control in place it is possible that NATCA and FAA employees could be exposed to high levels of mold during the remediation work described in this work plan.

Wonder Makers Environmental, Inc. P. O. Box 50209 • Kalamazoo, MI 49005-0209 • 269.382.4154 • Fax 269.382.4161 • www.wondermakers.com

Given that previous mold remediation work in the elevator shaft resulted in a shut down of the tower and hospitalization of eight occupants, the FAA's resistance to instituting redundant safety procedures like negative pressure in the shaft and air scrubbers in the CAB is unconscionable.

Our most serious concerns are described in a more detailed list of comments, enclosed. Please do not hesitate to contact me if you have any questions about this letter or the detailed list of our concerns regarding the work plan.

Sincerely,

Michael A. Pinto, Ph.D., CSP, CMP
CEO

Enclosure: Specific Concerns Regarding the Elevator Shaft Mold Remediation Work Plan

cc: Pat Forrey
Dave Batts
Troy Wilkinson

Specific Concerns Regarding the Elevator Shaft Mold Remediation Work Plan

Section 1.0 Instruction

- This section describes four primary goals of the project:
  - Cleaning the greenboard that forms the inside of the elevator shaft
  - Minimizing the potential for dissemination of mold spores from the elevator shaft to the remainder of the building
  - Protection of personnel during remediation
  - Visual inspection criteria for post remediation.
- Interestingly, the means for achieving each of these goals as described in the rest of the document do not meet the current industry standard of care for mold remediation. The following documents contribute to the current industry standard of care:
  - Texas Mold Assessment and Remediation Rules (25 TAC Sections 295.301-295.338)
  - Occupational Safety & Health Administration (OSHA) *A Brief Guide to Mold in the Workplace*
  - Health Canada *Fungal Contamination in Public Buildings: A Guide To Recognition And Management*
  - American Conference of Governmental Industrial Hygienists *Bioaerosols: Assessment and Control*
  - American Conference of Governmental Industrial Hygienists *Field Guide for the Determination of Biological Contaminants in Environmental Samples*
  - Association of Specialists in Cleaning and Restoration (ASCR) *Recommended Professional Practice for Remediation of Mold Contamination in Building Interiors*
  - The Institute of Inspection Cleaning and Restoration Certification (IICRC) *S500 Standard and Reference Guide for Professional Water Damage Restoration*
  - The Institute of Inspection Cleaning and Restoration Certification (IICRC) *S520 Standard and Reference Guide for Professional Mold Remediation*
  - New York City Department of Health *Guidelines on Assessment and Remediation of Fungi in Indoor Environments*
  - American Industrial Hygiene Association *Report of Microbial Growth Task Force*
  - Environmental Protection Agency *Mold Remediation in Schools and Commercial Buildings*
  - Wonder Makers Environmental *Fungal Contamination: A Comprehensive Guide for Remediation*

Section 1.1 Scope of Work

- This section describes how the surface paper on the innermost greenboard in the elevator shaft will be cleaned. The inner paper surface of the greenboard is a porous material. Multiple documents within the standard of care, including the EPA's guide entitled *Mold Remediation in Schools and Commercial Buildings*, indicate that porous materials colonized with mold should be removed. Cleaning porous finish building materials is not an effective means of long term mold remediation.

- The second sentence in this section states that the use of water sprays and biocides is prohibited. We agree with the first part of the statement water sprays will not serve any useful purpose in this situation and could actually make the problem worse by dispersing spores into the air. The second part of this statement regarding biocides makes little sense in light of the variety of commercial antimicrobial products that are available through legitimate distributors. These products are manufactured by a variety of companies including Fiberlock, Fosters, and Microban. Products from each of these manufacturers have been developed to effectively clean and kill mold on semi-porous and non-porous surfaces. As stated above, cleaning porous materials is not recommended in the current industry standard of care.

Section 1.2 General Work Sequence

- Item #2 – states that the ventilation units used to heat the elevator shaft will be shut down during remediation.
    - Critical barriers may need to be attached to duct grills to prevent the deposition of spores in the ventilation system. If this is not done spores could accumulate in the duct system and be dispersed back into the elevator shaft when the system is turned back on.
    - No mention was made in the scope of work of placing critical barriers over the elevator shaft doors on each level. This is a critical step in ensuring that the work performed inside the elevator shaft does not affect NATCA or FAA personnel on the floors where work is not being performed.

- Item #6 – indicates that the contractor will use a soft bristle brush attachment with the HEPA vacuum. While the standard of care recommends removal of porous materials with mold growth on them, if cleaning is attempted why not use a stiff bristle rather than a soft bristle brush attachment? The stiff bristle brush attachment will do a much better job of removing mold spores and hyphal fragments from the surface of the material. If used properly, damage to the surface paper would be minimal.

- Item #7 – indicates the remediation contractor should use a household dish detergent, water, and rags or sponges to clean the surface of the greenboard paper located in the elevator shaft. This suggestion is fraught with all sorts of misconceptions.
    - First and foremost, common household soaps and detergents can leave a residue that can become a food source for mold.
    - Second, the use of rags or sponges for cleaning is not thoroughly described. Rags and sponges should be changed out frequently so that they are not a source of cross contamination. Rags and sponges will not adequately clean the paper surface of the greenboard. Some level of agitation is required to remove the mold from all surfaces. Scotchbrite pads or similar products would provide an adequate level of agitation and do little or no damage to the surface of the greenboard.
    - It should be reiterated that the current industry standard of care requires that porous materials with fungal growth be removed rather than cleaned.

- Item #8 – states that as each area is cleaned the Environmental Consultant will perform a visual inspection to determine if the area has been adequately cleaned by the remediation contractor. This, in fact, follows the standard of care; however, multiple documents in the standard of care require post-remediation air sampling for large projects or projects that involve high risk occupants. The American Conference of Governmental Industrial Hygienists, in their book *Bioaerosols: Assessment and Control*, recommend in section 15.2.3.4 that after a final visual inspection, air sampling by spore trap or other means may be used to verify that spore concentrations are similar to outdoor air. They further recommend surface sampling as a means of determining the level of cleanliness achieved on porous surfaces. Visual inspections should be used as the first rather than final means of determining if an area has been cleaned properly.

- Item #8 – also includes a statement that will provide a level of confusion if not corrected prior to the beginning of the project. The second sentence in this item indicates that after the Environmental Consultant has deemed the area was cleaned adequately "...the Contractor will work with the elevator maintenance Contractor to convey the elevator car to the next higher level, and the process will be repeated." This is in direct conflict with the direction given in item #4 of this section that states "the Contractor shall work from the top of the elevator shaft to the bottom of the shaft." This discrepancy needs to be resolved before the project begins.

Section 2.1 Worker Certification

- This section requires that documentation regarding physicians approval to wear a respirator and respirator fit testing be available for all contract personnel, including supervisors. It does not require in this or any other section that contract employees be trained. As described in the *IICRC S520 Standard and Reference Guide for Professional Mold Remediation*, all remediation workers should be trained in the principles of mold remediation that are appropriate to their work responsibilities, including, but not limited to safety and health, engineering controls, containment methods and appropriate work practices. Contract employees should be trained in accordance with these requirements and the contractor should be able to produce documentation of such training from a recognized industry training group such as ASCR, IAQA, or IICRC.

Section 2.3 Respiratory Protection

- This section requires that at a minimum the Contractor shall provide employees with NIOSH approved half face negative pressure respirators that are equipped with P100 filters. This is not consistent with the current industry standard of care. Multiple documents require that for large projects (those involving more than 100 square feet of mold) contract employees should wear at a minimum full face piece respirators with HEPA (N100 or P100) filters.

9e

Mold Clean-Up Projects

Post-remediation criteria are crucial to success

By Michael A. Pinto, Mike Davis and Sara Eager

AS CONCERNS ABOUT INDOOR MOLD contamination become more prevalent, the need for standards—to cover both mold remediation and post-remediation—grows rapidly within the industry. Nonstandardized post-remediation inspections cause several problems, including project failure, contractor confusion, increased liability, limited comparisons between projects, and a breakdown in the public's confidence. Although the post-remediation evaluation process includes many parts, including sample collection and analysis procedures, this article focuses on the importance of logical and effective post-remediation sample interpretation from a macro approach.

Post-remediation evaluation is a critical component of any mold remediation project [AIHA(a) 38]. Often, due to the lack of concrete standards, remediation work is performed incorrectly or ineffectively. This can excacerbate the problem and spread the contamination [ACGIH(b) 15.2]. For example, if a proper decontamination unit is not correctly set up, the risk of contaminating clean areas increases dramatically. In other situations, more than one mold source may be contributing to the problem. If all sources are not revealed and properly cleaned, mold will continue to be an issue even after remediation. A post-remediation evaluation process can identify poor-quality remediation efforts as well as undiscovered mold sources that may continue to affect indoor air quality.

Despite the obvious need for generally accepted criteria to use as a comparison for post-remediation samples, no universally recognized document currently exists. In fact, many industry professionals have taken the stance that such criteria are impossible to develop as too many variables are involved [ACGIH(a) 2; Tiffany, et al 523]. It is important to recognize and address multiple impacts—and to acknowledge that "difficult" does not equate to "impossible." Therefore, the first step in the process is to identify and categorize the critical variables to be addressed in the development of a clearance criterion.

Lack of Standard Post-Remediation Procedures

Consider the number of different approaches and methodologies an industrial hygienist or indoor environment professional can use to collect a sample. For surface samples, one might use swab, tape, bulk or dust collection methods. For air samples, gravitational sedimentation plates, air impact cassettes, spore trap on slides, collector sieves, liquid impingers or agar impaction methods could be used.

Now consider the various ways to analyze and interpret the sample data: cultured, noncultured, chemical (to identify mycotoxins or microbial volatile organic compounds) and others. Furthermore, diverse geographic locations have very different spore levels as a normal part of their environment. In addition, many argue that any post-remediation criteria must also take into account the considerable range in individual susceptibilities to mold [ACGIH(a) 2]. Finally, and most important, the manner in which contractors conduct remediation varies widely, often failing to combine effective work practices with proper isolation and containment, engineering controls, decontamination procedures, and effective air flow and pressure management. Consequently, the difficultly in creating clear, concise mold remediation criteria is no surprise.

Past Efforts

Because mold spores are naturally occurring organisms found in all environments, it is difficult to pinpoint an exact number on exposure limits. Furthermore, selection of specific sampling locations has a direct impact on what spore levels might be found. While most agree that mold growth indoors is unacceptable (Pinto and Janke 5-15), what exactly con-

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stitutes appropriate levels of mold spores in indoor air or dust is vigorously debated (Johanning 19).

A large body of relevant data exists for post-remediation sampling. Personal research, guidance documents, peer-reviewed studies and articles all contribute to the wide range of information available. Tables 1 through 4 organize—by sample type and in chronological order—much of the currently available data related to indoor mold levels. Most of these data consist of qualitative numbers concerning health issues, building and structure contents, and exposure limits (for both building/home occupants and workers).

A wide range of questions is also addressed in the data. For example, what determines normal spore levels (backgrounds)? What spore levels are indicative of an impacted environment? What levels are appropriate to determine whether remediation is necessary? What spore levels determine whether an area is clean (post-remediation)?

After collecting and reviewing the data sources cited in the tables, highlights were charted, categorized by analytical method, and a simple statistical analysis was applied to find the mean (average), median (center value) and mode (most frequent value) of the collective data.

Tables 1 through 3 address cultured air samples, the most prevalent sample technique of all the data collected. However, noncultured air sample analysis (Table 4) has been used frequently in the recent past and has gained considerable acceptance in the industry (Tiffany, et al 527). The resultant data have increased the debate about which method is most appropriate. With noncultured air samples, analysis can be performed directly with a microscopic exam, with results reported in counts per cubic meter of air; turnaround time is faster as well. One drawback to these samples is that the analysis is less-detailed, producing identification only to the genus level. By comparison, cultured sample analysis can identify to the species level; however, such analysis requires a longer processing time, and imposes media limitations and difficult handling demands.

Examination of the tables reveals some common deficiencies among past studies and their approach to post-remediation sampling: 1) a small number of the approaches focus on post-remediation sampling; 2) there is a heavy reliance on sampling; and 3) a broad approach is lacking. In other words, most of the studies focus on trying to apply a single number to spore levels everywhere and anywhere, placing a heavy emphasis on sample results. These deficiencies suggest that the mold industry needs to realize that many factors must be considered when conducting post-remediation clearance sampling.

Past recommendations for post-remediation values include suggestions for reviewing data by comparing types of fungal spores and their relative proportion in a sample (called a rank/order review); comparisons to out-of-doors levels; and requirements that no pathogenic organisms be detected in post-remediation sampling [ACGIH(b) 7.4.2]. To apply rank/order values to a mold remediation project, one would collect an air sample from out-of-doors and another sample from the remediated area within the building. Analysis results of each sample would then be compared, listing spore types from the most common ones observed to the least common.

In a healthy environment, the most common spore types identified within the structure should also be the most plentiful in the out-of-doors sample. Building on this, the indoor sample should reflect similar spore type occurrences at a reduced level. For example, if an unusually high count of an uncommon spore type is found on the indoor sample that is not prevalent on the out-of-doors sample, it is feasible to conclude that an active mold source exists indoors. The rank/order method seems logical because it accommodates the issue of different geographic locations with different naturally occurring types of spores.

Interpreting the Data

In examining the body of data available on cultured fungal air sample analysis summarized in Tables 1 through 3, it is clear that the level of 1,000 colony forming units per cubic meter of air (CFU/m^3) is considered significant. This amount was most frequently mentioned (the mode) as the appropriate indicator of background levels of mold (e.g., Burge; OSHA). Indeed, a tight range of numbers emerged from the statistical analysis with 1,341 CFU/m^3 as the mean and 650 CFU/m^3 as the median. According to the collective data, results below 1,000 CFU/m^3 of common types of outdoor molds indicate no evidence of water intrusion and that no heath effects would be expected.

However, target fungal types are discussed in many documents, with an overall agreement that further investigation should be conducted if fungal types do not mimic the variety seen in proximate outdoor samples. Many of these cited authors agree that significant consideration should be given to the presence of even small amounts of target organisms which have been found in conjunction with water-damaged or contaminated buildings. In particular, many authors suggest that elevated levels of Penicillium and Aspergillus mold species are not only health concerns, but coincide with water-damaged building materials [AIHA(b) 9]. In addition, many mold types that are associated with elevated levels of mycotoxins (e.g., Stachybotrys, Fusarium, Memnoniella) are also tied to water-damaged buildings, even if they are detected only in small quantities [AIHA(b) 9].

As shown in Table 4, historical interpretations of "normal" (background) levels for noncultured air samples ranged from 2,000 counts per cubic meter of air (c/m^3) as the mode, to 4,786 c/m^3 as the mean; 2,500 c/m^3 was the median value; its similarity to the mode gives it increased validity as the dividing line between background levels and those found when contamination is present. Again, many studies implied that no health effects are expected if fungal

Table 1

Cultured Air Sample Analysis Guidelines: Part 1

Date	Source [Reference]	Guidelines Cultured Air Sample Analysis for Fungi (CFU/m³*) Normal	Impacted	Remediated	Interpretation
1979	Berk, et al [A]	<700	>700**		
1979	Graveson (General) [B]	<3,000 Cladosporium; <100 Alternaria—threshold for evoking allergic symptoms.	3,000 Cladosporium; 100 Alternaria—threshold for evoking allergic symptoms.		
1983	Berstein, et al [B]		5,000 to 10,000		
1984	Solomon, et al [A]	<1,600	>1,600		
1984	Holmberg [A]	<2,200	>2,200**; 10,000 to 15,000—surface mold present.		
1984	Morey, et al [A]	<1,000**	>1,000—need to investigate.		
1986	AIHA: *Biohazard Reference Manual* [A]				No safe level of an uncontained pathogenic organism.
1986	Morey, et al [B]	<10,000 total fungi or <500 one species.**	>10,000 total fungi or >500 one species—need for investigation or improvement.		
1987	Burge, et al [B]				Indoor spore levels one-third of outdoor, same species spectrum recommended indoor limit, rank/order assessment.
1987	Ohgke, et al [A]	<100**	>100		
1988	WHO: IAQ—Biological Contaminants [A]	<150 mixture of species or <500 Cladosporium or other common phylloplanes.	>50 of one species—investigate; >150 mix of species**; >500 common phylloplanes.**		
1988	Canada Mortgage and Housing Corp.: Determination of Fungal Propagules in Indoor Air [A]	<200 if several species; <500 if mainly Cladosporium and Alternaria.	>50 if one species; >200 if several species; >500 if mainly Cladosporium and Alternaria (investigate further for all).		
1988	Hunter, et al (Homes) [B]	<5,000**	>5,000 level most often exceeded when surface mold present.		
1988	Miller, et al (Homes) [A]	<150 mixture of species or <300 common phylloplanes.	>50 of one species of concern—investigate; >150 mix of species**; >300 common phylloplanes.**		Toxic/pathogenic unacceptable.
1989	ACGIH: Guidelines for the Assessment of Bioaerosols [A]	<100	>100**		Indoor/outdoor ratio <1 is okay if similar taxa or complaint area/non-complaint area ratio >10 is unusual.
1989	Netherlands: Research Methods in Biological Indoor Air Pollution [A]	<10,000 total fungi or <500 of one species of a potentially pathogenic nature are a health threat.**	>10,000 total fungi or >500 of one species of a potentially pathogenic nature are a threat to health.		

**Colony forming units per cubic meter of air.*
***Interpreted levels.*
References are listed in Table 3.

Table 2

Cultured Air Sample Analysis Guidelines: Part 2

Date	Source [Reference]	Guidelines Cultured Air Sample Analysis for Fungi (CFU/m³*) Normal	Impacted	Remediated	Interpretation
1989	AIHA: Practitioner's Approach to IAQ Investigations [A]	<1,000**	>1,000		High indoor/outdoor ratio indicates indoor amplifier, rank/order assessment.
1990	Burge [A]	<1,000**	>1,000—investigate		If indoor microbial aerosols qualitatively different from outdoors and indoor levels consistently more than double outdoor and exceeding 1,000 CFU/m³ should be investigated.
1990	Reponen, et al (Homes not farms) [A]	<500 (winter only)**	>500 (winter only)		Indoor/outdoor ratio >1 may indicate abnormal indoor level in summer.
1990	Reynolds, et al [A]	<500**	>500—indoor source indicated		Significant indoor/outdoor differences indicate indoor source; speciation and rank ordering recommended.
1991	Godish [A]	<1,000**	>1,000	<100 "mold-free environment"	
1991	Nordic Council: Criteria Documents from the Expert Group [A]	10 to 10,000 typical in "sick buildings"	10 to 10,000 typical in ambient air		
1991	Canada Mortgage and Housing Corp.: Testing of Older Houses for Microbial Pollutants [A]	<200 variety of species or <500 including Alternaria and Cladosporium**	>200 variety of species or >500 including Alternaria and Cladosporium—investigate		
1992	Miller, et al [A]				Indoor mycoflora qualitatively similar to outdoors is okay or indoor mycoflora quantitatively lower than outdoors is okay.
1992	OSHA—Technical Manual [A]	<1,000**	>1,000		
1993	Council of the European Community: Report #12: Biological Particles in Indoor Environment [A]	For houses: <50 (very low); <200 (low)** Nonindustrial indoor: <25 (very low); <100 (low)**	<1,000 (intermediate); <10,000 (high); >10,000 (very high)** <500 (intermediate); <2,000 (high); >2,000 (very high)**		
1993	Yang, et al [A]	<200	>200**		Critical analysis of results is required if pathogenic or toxigenic fungi are detected.
1993	AIHA: Industrial Hygienist's Guide to IAQ Investigations [A]				Rank order assessment, indoor/outdoor comparison recommended.
1994	National Health and Welfare, Canada: IAQ in Office Buildings: A Technical Guide [A]	<150 mixture of species,<500 if common tree/leaf fungi.	>50 if one species—investigate; >150 mix of species**; >500 common tree/leaf fungi**		Toxigenic/pathogenic unacceptable.

**Colony forming units per cubic meter of air. **Interpreted levels. References are listed in Table 3.*

Table 3

Cultured Air Sample Analysis Guidelines: Part 3

Date	Source [Reference]	Guidelines Cultured Air Sample Analysis for Fungi (CFU/m³*) Normal	Impacted	Remediated	Interpretation
1994	Cutter Information Corp.: IAQ Update: Biocontaminants in Indoor Environments [A]	<300 common fungi; <150 mixed fungi; <200 total fungi; <100 if immunocompromised population**	>300 common fungi; >150 mixed fungi; >200 total fungi; >100 unless immunocompromised population		
1994	OSHA: Proposed IAQ Standard [A]				Levels of bioaerosols in the indoors would reflect those outdoors, rank/order assessment.
1994	Healthy Buildings International [A]	<750 if species not infective or allergenic	>750 if species infective or allergenic**		
1995	ACGIH: Air Sampling Instruments for Evaluation of Atmospheric Contaminants [A]	<100 (low)**	100 - 1,000 (intermediate)**; >1,000 (high)**		
1995	IAQ Association Inc.: IAQ Standard #95-1 Recommended for Florida [A]	<300 common fungi; <150 mixed	>300 common; >150 mixed**		
1995	Health Canada: Fungal Contamination in Public Buildings: A Guide to Recognition and Management [C]	<150 mix of species; <500 if Cladosporium or other tree/leaf fungi	<150 mix of species; <500 if Cladosporium or other tree/leaf fungi**		
1995	NYCDH: Guidelines on Assessment & Remediation of S. atra in Indoor Envirnmts. [A]		103-104 S. atra immediate evacuation		Indoor/outdoor ratio indicates contamination.
1997	Robertson [D]	<300 total fungi; <50 individual species (excepting Cladosporium)	>300 total fungi; >50 individual species (excepting Cladosporium)—investigate		
1999	Analytical Services Inc. [I]	<550	>550**		
1999	Mycotech Biological Inc. [J]	<300; <50 individual contributing excluding Cladosporium	>300—investigate		
2001	Godish: Indoor Environmental Quality [E]	>300 - <1,000	>1,000		
2001	Clark [F] Residential Buildings	<500	500-1,000 (possible); >1,000 (probable)		
	Commercial Buildings	<250	250-1,000 (possible); >1,000 (probable)		
2002	Mold Free [G]	<250	>250		
2003	Auburn Environmental [H]	<1,000	>1,000		

**Colony forming units per cubic meter of air.*
***Interpreted levels.*

Mean:	1341.666667	1476.394737
Median:	650	700
Mode:	1000	1000
SD:	2324.727327	2320.562811

References

[A] *Rao, C.Y., et al. "Review of Quantitative Standards and Guidelines for Fungi in Indoor Air."* Journal of Air and Waste Management Assn. *46(1996): 899-908.*

[B] *Singh, J., ed.* Building Mycology: Management of Decay and Health in Buildings. *London: Chapman and Hall, 1994.*

[C] *Health Canada. "Fungal Contamination in Public Buildings: A Guide to Recognition and Management." Ontario: Health Canada, Federal-Provincial Committee on Environmental and Occupational Health, 1995.*

[D] *Robertson, L.D. "Monitoring Viable Fungal and Bacterial Bioaerosol Concentrations to Identify Acceptable Levels for Common Indoor Environments."* Indoor Built Environments. *6(1997): 295-300.*

[E] *Godish, T.* Indoor Environmental Quality. *Boco Raton, FL: CRC Press LLC, 2001.*

[F] *Clark, G. "Assessment and Sampling Approaches for Indoor Microbiological Assessments."* The Synergist. *Nov. 2001.*

[G] *Mold Free: A Division of Integrated Microbiological Services. www.1877moldfree.com/index.html.*

[H] *Auburn Environmental. Akron, OH. www.auburnenvironmental.com.*

[I] *Analytical Services Inc. Huntsville, AL. www.asihsv.com.*

[J] *Mycotech Biological Inc. Jewett, TX. www.mycotechbiological.com.*

[K] *Wonder Makers Environmental Inc. Kalamazoo, MI. www.wondermakers.com.*

Table 4

Noncultured Sample Analysis Guidelines

Date	Source [Reference]	Guidelines Noncultured Air Sample Analysis for Fungi (spores/m^3) Normal	Impacted	Remediated
1988	Lacey, et al [A]	1,000 to 10,000		
1993	Russian Federation: MAC of Harmful Substances [A]	1,000-10,000 cells/m^3	>10,000 cells/m^3*	
1999	Mycotech Biological Inc. [J]	<2,000	>2,000—investigate	
2001	Godish: Indoor Environmental Quality [E]	>3,000 to <10,000	>10,000	1,000 to 3,000
2001	Clark [F]			
	Residential buildings	<5,000	5,000-10,000 (possible), >10,000 (probable)	
	Commercial buildings	<2,500	2,500-10,000 (possible), >10,000 (probable)	
2003	Wonder Makers Environmental [K]	<2,000 mixed types, <1,000 Aspergillus, Penicillium; <500 outdoor types	>2,000	
				Mean: 4,786
				Median: 2,500
2003	Auburn Environmental [H]	<2,000	>2,000*	*Mode:* 2,000
				SD: 3,718

**Interpreted levels.*

References

[A] *Rao, C.Y., et al. "Review of Quantitative Standards and Guidelines for Fungi in Indoor Air."* Journal of Air and Waste Management Assn. *46(1996): 899-908.*

[B] *Singh, J., ed.* Building Mycology: Management of Decay and Health in Buildings. *London: Chapman and Hall, 1994.*

[C] *Health Canada. "Fungal Contamination in Public Buildings: A Guide to Recognition and Management." Ontario: Health Canada, Federal-Provincial Committee on Environmental and Occupational Health, 1995.*

[D] *Robertson, L.D. "Monitoring Viable Fungal and Bacterial Bioaerosol Concentrations to Identify Acceptable Levels for Common Indoor Environments."* Indoor Built Environments. *6(1997): 295-300.*

[E] *Godish, T.* Indoor Environmental Quality. *Boco Raton, FL: CRC Press LLC, 2001.*

[F] *Clark, G. "Assessment and Sampling Approaches for Indoor Microbiological Assessments."* The Synergist. *Nov. 2001.*

[G] *Mold Free: A Division of Integrated Microbiological Services. www.1877moldfree.com/index.html.*

[H] *Auburn Environmental. Akron, OH. www.auburn-environmental.com.*

[I] *Analytical Services Inc. Huntsville, AL. www.asi-hsv.com.*

[J] *Mycotech Biological Inc. Jewett, TX. www.mycotechbiological.com.*

[K] *Wonder Makers Environmental Inc. Kalamazoo, MI. www.wondermakers.com.*

counts are at or below background levels as long as no target fungal types are present.

Learning from History

Despite the controversy over acceptable levels and numbers, post-remediation guidelines that include numbers are feasible. However, numbers are only part of the solution; process and interpretation must also be considered. One must understand that initial post-remediation criteria will not be set in stone. Once any criteria gains substantial industry acceptance, it is prudent to expect that experience with those criteria will lead to future adjustments. For example, consider historical issues concerning acceptable levels of asbestos, radon and lead. Initially, exposure limits for these substances were controversial, but eventually the impacted industries adapted work procedures to meet the criteria. As the acceptable control level became more commonplace, research validated its effectiveness. Many substances that are considered contaminants in buildings have gone through multiple cycles in which the acceptable level was adjusted based on continuing application and research. These same trends can be expected for the mold remediation industry.

Clarity Is Needed

It is not unusual for post-remediation sampling to fail to meet clearance criteria. Communication problems, along with failure to follow specifications, have a significant impact on post-remediation clearance. Since many industry guidance documents recommend that a mold remediation work area be left free of visible dust (Pinto and Janke 5-17), obvious visual problems are the first clue that something has not gone according to specifications.

For example, if visible dust is present within the containment, the isolated area has not been carefully cleaned, and unacceptable levels of mold spores may still be present. Clearance testing need not be conducted if the area is obviously not clean. In addition to identifying visual mold growth, hidden mold that may be impacting the area must be considered. Work plans must consider multiple aspects of a remediation project—specifically the possibility of hidden mold. EPA and AIHA documents warn about hidden mold in remediation projects [EPA 8; AIHA(a) 8]. Without careful reference to documents such as these, crucial information could be missed, potentially causing a multitude of problems later in the project.

Post-Remediation Evaluation Criteria for Mold Contamination

Step 1: Visual Inspection
Were specifications followed? Was the moisture source identified and corrected? Were the contents and debris removed? Was the work area white-glove dust-free?

Step 2: Total Spore Concentration
Is the total spore concentration less than 2,000 c/m^3 (typical of normal fungal ecology)? If less than 800 c/m^3, go to Step 4.

Step 3: Comparison to Make-Up Air Source
Is the total spore concentration on the inside sample below that on the comparison sample? *Comparison sample collected from out-of-doors or inside building but outside work area, depending on location of containment entry point.*

Step 4: Rank/Order Comparison
Is the level of each fungal type (and hyphae) recovered inside less than 100 c/m^3 above the level of the same fungal type (and hyphae) in the comparison sample?

Step 5: Indicator Organisms
Was Aspergillus/Penicillium on the inside sample less than 200 c/m^3?

Step 6: Target Organisms
Was the inside sample free of target fungal types, both counted and observed? *Zero tolerance of Stachybotrys sp., Fusarium sp., Trichoderma sp., Memnoniella sp., Chaetomium sp.*

Source: Wonder Makers Environmental Inc.

Improper setup of remediation projects can also impact post-remediation sampling results. Consider an isolation area without a decontamination chamber. Something that seems as trivial as a sheet or two of 6-mil plastic could cost the contractor several more days on the site (and substantial additional costs) after the post-remediation sampling failed due to an improper setup that caused recontamination of the project site. Remediation project specifications must be created and followed with care; small details can determine the project's success.

The easiest way to satisfy post-remediation evaluation criteria is to make the containment or work area a nonvariable. If contractors consistently establish effective engineering controls, such as isolation barriers and negative pressure enclosures, the surrounding environmental factors should not matter. Proper isolation of the work area will provide a uniform baseline between remediation projects, regardless of the type of building.

Professionals in the mold industry want clarity. Contractors, building owners and occupants, insurance adjusters, industrial hygienists and SH&E professionals are all directly impacted by the lack of clarity often found in regulations. As such, contractors must understand the expected endpoint before beginning a remediation project. When all parties understand that remediated areas are to be dust-free and meet a predetermined criterion for levels of fungal material, the communication process between contractor and client is drastically improved. Having a clear endpoint also reduces surprises at the end of a project, and helps contractors and consultants work together with the same goals in mind, ultimately reducing costs. It is also an important concept that must be considered when developing the industry's standard of care.

General Recommendations for the Post-Remediation Sampling Process

Contractors and SH&E professionals need to take a macro approach to any jobsite before post-remediation sampling begins. Having an independent or third-party consultant write specifications and aid in the facility inspection is usually a good idea (IICRC 4.2.1). In the event of legal action, having a third-party consultant helps ensure that actions taken during remediation are agreed on and documented.

The post-remediation process should always start with a visual inspection. Small indicators such as dust and debris should immediately alert the inspector that specifications were not followed. Understanding that post-remediation samples would most likely not meet clearance criteria due to the unclean condition of the site, such sampling would be senseless.

To ensure that the data collected at a project site are valid, sampling and analytical techniques should be consistent. Using different techniques for post-remediation samples as compared to earlier project sampling may alter the results and, ultimately, cause additional problems, expenses and frustration. Therefore, the same sample collection and analysis methods should be used at the beginning and the end of the project.

The final general recommendation is to remember that people's health is involved. If any concerns are raised, err on the conservative side to protect building occupants. On any remediation project, contractors' primary concern should be protecting themselves, the work crew and the building occupants. One must also recognize that mold remediation occurs in a wide range of situations. These recommendations are designed to be applied to normal residential and business environments. Structures with immunocompromised occupants or other at-risk populations may require the application of more-stringent standards on fungal contamination clean-up efforts.

Putting It All Together

At some point, the historical data and general concepts must be distilled into a workable process. The sidebar above is based on the authors' ongoing research and mold remediation project experience; it is based on noncultured sampling. All procedures for a post-remediation evaluation are captured in a

six-step process. In Step 1, a visual inspection is conducted before any samples are collected. This inspection helps determine whether project specifications were followed; whether the moisture source was identified and corrected; and whether the work area is dust-free (white-glove test). Only after the area passes a visual inspection are noncultured samples collected.

In Step 2, initial interpretation of the sample data compares the total fungal spore concentration to the set number of 2,000 c/m^3. This number is derived from the supporting reference data (Table 4) in which the mode value is 2,000 c/m^3. As the table shows, several studies agree that this value is typical of an environment that is not impacted by adverse interior fungal growth—in essence, a "normal fungal ecology." Data also show that very low total counts are possible based on seasonal variability or location. The authors' experience is consistent with that expressed by many others: When comparing samples from various areas, the reliability of a gross comparison (i.e., total fungal spores) drops off considerably at low spore concentrations. Therefore, an exemption from Step 3 is provided for samples from inside the contained area that have a total spore concentration of less than 800 c/m^3.

In Step 3, evaluation of the remediation process continues with a comparison of the total spore count inside the work area to the total spore count in the makeup air source, based on the location of the containment entry point. Subsequently, a rank/order comparison of the fungal types (to the genus level only) and concentrations, including hyphal fragments inside the work area, are compared to the types and amounts naturally occurring in the comparison sample (Step 4).

At this point, it is recommended that the levels of hyphal fragments be reviewed. Hyphal fragment is a term that many laboratories use to describe fragments of fungal organisms which are not spores. Since hyphal fragments generally do not have enough characteristics to allow them to be correlated with a specific genus of fungi, they are recorded separately. The authors' experience indicates that when concentrations of hyphal fragments found inside are higher than those found out-of-doors, an indoor source of fungal growth is usually present. Thus, this secondary comparison is included in Step 4.

The levels of fungal spores and hyphal fragments recovered in the work area sample(s) must be not more than 100 c/m^3 higher than the levels of corresponding fungal spores or hyphal fragments in the comparison sample. This limit is based on the principle that all analytical methods have a limit of detection which must accommodate the limitations of the equipment used in the laboratory and for sample collection. In an indoor environment with a normal fungal ecology, the ranking of the spores types found inside the work area should reflect the ranking of the comparison sample. For example, if Cladosporium was the most common spore type identified in the comparison sample, one would expect to find Cladosporium as the top-ranking spore type inside the work area, only at a significantly lower level.

During Step 5, indicator fungal types are considered. Fungal types are designated as "indicator" if they are associated with water damage to building or indoor finish materials. One must keep in mind that these fungi may also come from outdoors and make up a natural part of the existing flora. While several molds are discussed as potential indicators of water-damaged environments, Aspergillus/Penicillium types are mentioned frequently in the reference documents.

Aspergillus and Penicillium spores are lumped together when analysis is performed by direct microscopy because the spores are indistinguishable from one another. Oddly, this turns out to be a benefit in the post-remediation evaluation process. Certain species of both are early colonizers of water-damaged materials that grow quickly and disperse many spores. When these growth properties are matched with the negative health effects associated with these spores, their value as an indication of acceptable mold remediation procedures is enhanced. Experience with post-remediation criteria and the documents referenced in the tables has led the authors to the conservative but achievable criteria that indicator fungal types must be recovered at levels below 200 c/m^3.

In Step 6, target organisms are considered. These organisms are identified by their characteristic need for high moisture content and/or water activity to grow, their ability to naturally produce toxins and their common degradation of cellulose-containing materials. Spores from these target organisms are not typically found in clean indoor environments so the criterion for them is zero tolerance. The presence of these organisms in a cleaned work area indicates ineffective remediation and can result in continued issues with the structure or ill health effects for occupants.

Any time one step in this process exceeds the criteria, the area must be recleaned and retested as many times and as thoroughly as needed to meet the criteria for that step before proceeding to the next step. When the work area has met the criteria in all six steps, it is considered to be clean with a normal fungal ecology, and the project has been successfully completed.

Key Points

Throughout the effort to collect and review historical data, develop post-remediation criteria, then field-test the process, several overarching concepts emerged.

Lack of standardization creates problems. Projects often fail due to incorrect or subpar efforts to follow specifications. However, many projects are currently categorized as ineffective because no widely recognized verification protocol or criteria is available for comparison of post-remediation samples. As a result, the project becomes seemingly endless, costs skyrocket and liability becomes an issue.

Previous efforts have not focused on post-remediation as a separate subset of data, which leaves the field wide open. Much research has been related to

Industry Trends: Examples of Post-Remediation Protocols

As the mold remediation industry grows, many are recognizing the need for a commonly accepted post-remediation protocol. A literature search found several examples of post-remediation guidelines. Two examples are U.S. Micro-Solutions Inc. (Greensburg, PA; www.usmicro-solutions.com) and P&K Microbiology Services Inc. (Cherry Hill, NJ; Miramar, FL). While the details differ, it is reassuring that the industry seems to be moving in the same direction in terms of establishing criteria for post-remediation.

U.S. Micro-Solutions Inc.: Spore Trap Samples (Previously Affected Area)

A spore trap sample will be collected in the area(s) of concern. These samples should show no Stachybotrys conidia. The total spore count should be below background (outdoor) air (certain exceptions apply to this guideline, particularly when outdoor spore counts can be negatively impacted by snowfall and other factors). On total spore counts over 3,000, no one genera or grouping may exceed 75 percent of the total spore count. Where prior air results exist, the total spore counts should be reduced by 70 percent where unusually high spore counts (greater than 10,000 spores per cubic meter) have existed in the past. Otherwise, a general reduction in total spore count is favorable with a marked reduction in any predominant spore type. Older buildings, with poor HVAC filtration or heavy outside air infiltration may be evaluated at the discretion of the site visitor. (Total sample volume should be 75 liters on Air-O-Cell cassettes, 25 liters on Micro5 cassettes or 60 liters on Cyclex-D cassettes.) Areas corresponding to air samples not meeting these guidelines will be recommended for further action.

Like the authors' proposal, total spore counts are compared to an outdoor sample or, when they exist, to earlier air results. While both guidelines set a total spore count limit, U.S. Micro-Solutions proposes a limit of 3,000 c/m^3 as compared to 2,000 c/m^3. In addition, rather than a rank/order comparison, this group adds the condition that no one genera or spore type may exceed 75 percent of the total spore count. The goal is a general decrease in the total spore count and a "marked" reduction in any predominant spore type. While both protocols indicate that no Stachybotrys conidia is acceptable on post-remediation samples, the approach detailed in this article proposes an enlarged list of zero tolerance indicator/target organisms. This list includes species that grow in environments similar to Stachybotrys, are early colonizers of water-damaged materials and/or produce toxins.

P&K Microbiology Services Inc.

This firm has also developed an interpretation for fungal bioaerosol samples. It proposes a 12-step process, similar to the authors' proposal in many respects. Both set an acceptable total spore concentration, involve comparison samples (indoor to outdoor, complaint to noncomplaint areas) and involve a rank/order comparison between samples. Many of the later steps in the P&K protocol look for indicator or "signature" fungi, similar to the indicator/target organisms in Steps 5 and 6 of the process described in this article.

The main difference between the two protocols is that P&K relies on culturable air samples. Rather than a limit, this protocol sets an upper range of 150 to 250 CFU/m^3 for acceptable total spore counts, and the list of marker or "signature" fungi reflect cultured air sample results.

identifying background levels or levels that can be linked to specific health effects. Few studies have focused on identifying post-remediation criteria that verifies the effectiveness of the remediation and cleaning techniques—even if those criteria cannot be clearly linked to health risk. History has shown that many times a "best guess" must be made so that research can validate the effectiveness of a particular level or criterion. Separating post-remediation criteria from the debate over background levels or other confounding issues would allow the industry to advance while further scientific data are collected.

Conclusion

Developing post-remediation evaluation criteria for mold projects should be a process. Comparison numbers are only a small part of the process. However, the endpoint must be clearly detailed and communicated before the project begins. The proposed strategy for post-remediation criteria includes six steps. Failure in any step means the evaluation process must start over at Step 1. Incorporation of visual criteria and interpretation of sample data is crucial to the success rate of remediation projects.

Controversy continues to surround indoor air quality, especially related to mold and its effects. Setting and using post-remediation evaluation criteria in all remediation projects is an effective way to strengthen the industry and, in the long run, help define industry standards. Each mold remediation project should be viewed from a macro perspective, considering all related factors. ■

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ATCT at Detroit Metropolitan Wayne County Airport - DTW

Delivery Order 07

Moisture Assessment Report

August 2005

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FEDERAL AVIATION ADMINISTRATION

Jacobs Facilities Inc. 1100 North Glebe Road, Suite 500, Arlington, VA 22201 Phone (571) 218-1000 Fax (571) 218-1301

MOISTURE ASSESSMENT REPORT

THE ATCT AT
DETROIT METROPOLITAN WAYNE COUNTY AIRPORT

(DTW)

ROMULUS, MICHIGAN

August 31, 2005

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1.0 EXECUTIVE SUMMARY

1.1 GENERAL

The Moisture Assessment Report is hereby submitted for the Airport Traffic Control Tower (ATCT) at Detroit Metropolitan Wayne County Airport (DTW), in Romulus, Michigan. It has been prepared in accordance with the Scope of Services developed for this task under the Jacobs' Change Proposal CP 007-032A, dated May 26, 2005, approved June 15, 2005.

The objectives of this report include collecting sufficient data to perform a qualitative evaluation of excess moisture evident within the tower portions of the facility, resultant damage, and measures necessary to prevent or correct it, and generate a Rough Order of Magnitude (ROM) construction cost estimate for those corrective measures.

1.2 BACKGROUND

The ATCT is a Leo Daly standard design; approximately 230' in overall height, with an attached 3 level base building was constructed in 1990. The ATCT shaft is constructed of both load bearing pre-cast and cast-in-place concrete panels. The upper occupied levels are constructed of structural steel frame with architectural pre-cast panels cladding. The floors at all levels are concrete composite decks on steel frame. Interior partitions throughout the facility consist of gypsum wall board on metal studs.

1.3 CONCLUSIONS

The environmental survey observed small amounts of mold growth in a few localized areas on the interior surface of gypsum wallboard of the elevator shaft liner, primarily at levels 6-9 of the ATCT. The mold was observed on the surface paper of the wallboard and did not appear to penetrate the surface. We also observed some dry water stains in a few areas in the elevator shaft, but no mold growth was apparent. At this time, the minor mold condition on a few areas of the elevator shaft wall does not appear to pose a health concern to the occupants, but should be addressed in the near-term by cleaning the surfaces with a bleach solution, as recommended in this report, to remove the mold, and to mitigate additional future growth. Then, periodic visual inspections (monthly or quarterly) are recommended to reassess, identify, and address any additional mold growth in a timely manner. It is also recommended that other areas in the building that may have high probability of being a recurring moisture source (leaky pipe/valve, malfunctioning ventilation equipment, blocked drain, condensation, etc.) be included in the periodic visual inspection.

The architectural survey identified a number of possible contributing factors to excessive moisture and moisture related damage found in the ATCT. These factors include location and placement of gypsum wall board (GWB) panels, possible water infiltration and migration at and though the pre-cast concrete (P/C) panel joints, and water penetration at concrete slab edges. We recommend correction of these conditions to prevent and avoid recurrences of moisture related problems.

The observed mold on the elevator shaft liner does not compromise the fire-rating of wall construction.

The mechanical survey found that the cooling systems appeared to be in working order. However, the tower is under negative pressure; the HVAC system brings in moisture-laden outside air, and operates on

economizer cycle which is in violation of FAA Orders 6480.7C & D. The vestibule ventilation system is not currently operating. The building automation system is un-reliable, has aged beyond its useful life, out of calibration, and the local staff should be provided adequate training on its operation. Hence, the recommendation is made to install a new cooling coil in the outside air intake of vestibule ventilation system, revise the HVAC operation to a non-economizer operation, and provide a new building automation computer with proper training.

The observations, recommendations, and ROM cost estimate contained in this report reflect a professional assessment of the condition of the facility related to the problems investigated, and the probable costs to mitigate the observed deficiencies in the facility and prevent further occurrences. They are based on good professional practice and judgment.

1.4 ROUGH ORDER OF MAGNITUDE (ROM) - COST ESTIMATE

The ROM construction cost estimate to implement the recommendations of this report by a general contractor is $489,793. It includes, in addition to labor and material, general conditions, mobilization and demobilization, small job premium, general contractor (GC) overhead & profit and bond costs. It should be noted that the majority of the cost is in the re-sealing of the vertical caulk joints of the P/C concrete panels at the "flare" of the ATCT shaft due to the difficulty of executing this type of work. While interior sealing may be performed at potentially lesser cost, it will provide limited surety of access to all locations, and effectiveness in dealing with the issues. The ROM cost schedules are included in the appendix.

There are additional costs associated with carrying out these construction projects that should be included for budgeting purposes. Such costs include A/E design fees for each project, associated A/E construction administration support (shop drawing review and responding to field RFIs), and F&E plant costs borne by the FAA in supporting the construction project(s).

2.0 OBSERVATIONS

2.1 INTRODUCTION

Jacobs's survey team comprised an architect, a mechanical engineer, and a certified industrial hygienist (CIH) environmental engineer performed a site visit to the facility on Tuesday and Wednesday, June 21 and 22, 2005. A sub-contracted skilled laborer accompanied the team to assist with any intrusive exploration required within the facility.

The goals and level of effort of the site survey consisted of the following:

1. Gather field data to assist in performing an objective qualitative multi-discipline evaluation of the existing conditions, and note obvious pertinent deficiencies as encountered and collect data for use in developing this report.

2. Meet with regional FAA personnel to solicit their input on the current condition of the facility, remediation efforts previously undertaken related to the problems observed, and to report the field observations and address the deficiencies in this report, as indicated above.

3. Provide sufficient data to generate a Rough Order of Magnitude (ROM) cost estimate, as required to remediate the deficiencies noted in the report.

The construction documents made available indicate the ATCT is a 207'-0" (to cab floor) Leo Daly standard design. Prior to conducting the site visit, Jacobs obtained a copy of some of the design drawings for the ATCT from the FAA Great Lakes Regional office, and some additional documents were obtained at the site.

A coordination meeting was held at the facility on Tuesday afternoon, June 21, 2005 at the ATCT with FAA and Jacobs representatives. The actual survey began Tuesday evening and was started with an attendance and safety meeting. The attendance list from both coordination and the pre-survey meetings are included in the Appendix.

In order to minimize impacts to facility operations the team surveyed the full height of the elevator shaft during the night hours of Tuesday, June 21st . The elevator roof hatch was opened and the interior of each level of the shaft was observed from a ladder placed inside the elevator cab, where pictures and notes were taken by all disciplines. Later the survey team surveyed the fourth and ninth floors to investigate the source of the moisture reported there by the FAA.

On Wednesday morning, the team returned to the ATCT and surveyed each level to further investigate any possible sources of moisture.

During the survey, Jacobs conducted a limited visual inspection of observed mold growth. Jacobs did not conduct any mold sampling.

2.2 OBSERVATIONS AND RECOMMENDATIONS

2.2.1 ARCHITECTURAL

General

The Architectural survey focused on identifying any potential sources of moisture penetration into the ATCT, the resulting damage, and recommendations to repair and mitigate those conditions. Both the building envelope and interior construction were observed in order to define the extent of any physical deficiencies contributing to the problems of moisture within the building. Described here-in are the architectural observations and the recommended solutions to the noted deficiencies.

A. Observations

1. In some interior spaces, specifically the 4th and 9th floors in the ATCT, the FAA had found moisture or mold at the bottom of gypsum wallboard panels (GWB, and had removed and replaced the affected GWB to a height approximately 3'-0" above the floor. This includes GWB along the exterior walls, interior partition walls and the outer layers of the gypsum board shaft liner surrounding the elevator shaft. There are a number of concerns regarding the existing conditions of the GWB, including the replacement portions.

    a. Much of the new GWB has been placed in direct contact with the concrete floor slabs, to match existing GWB. This allows for "wicking" of any condensation or moisture present on the floor into the panels causing further water damage and decay of the gypsum board.
    b. In accordance with the building codes, the intermediate shaft levels (1-10) below the Sub-Junction Levels the "Leo Daly" standard ATCT are to remain "unoccupied". At DTW, levels 3 through 10 have been built-out as storage and offices spaces, creating non-compliant "occupied" spaces. The moisture problems identified in this survey typically manifest themselves at areas within these levels.
    c. Visual inspection of the elevator shaft revealed minor surface mold growth on the interior shaft-liner at levels 6 through 9. This growth is primarily found on the GWB panels above the floor slab and partition sill track. Additionally, some surface corrosion was observed on these sill tracks, further indicating the damage may be a result of moisture at the floor slab.

2. A number of existing conditions were observed at the exterior envelope of the occupied junction and existing sub-junction levels that may have contributed to the moisture found at the lower levels.

    a. The joints between the pre-cast panels at the "flairs", above the vertical tower shaft on levels 10 through 13 (cable access), have what appear to be urethane type foam caulk joints. These joints show significant signs of deterioration. The joints on the interior face of these same panels have a solid non-flexible sealant material that shows no sign of failure or water leakage. The space between the inner and outer sealant lines could not be observed, it is however possible that water could migrate between these lines to the lower levels of the tower shaft.
    b. A possible source of moisture infiltration was observed at the Microwave Antennae balconies at the 10th floor Junction Level. At the south and west corner balconies the

floors are open metal grating above an interior areaway accessed from the Electronic Equipment Room. The floor drain located within the areaway of the west balcony shows evidence of past blockage and subsequent ponding of water. During the inspection this drain had some debris consisting primarily of the light-weight fireproofing from the surrounding steel structural framing, partially obstructing the drain. It can be assumed that the south balcony, which could not be inspected, is in a similar condition. The north and east balconies have bare concrete floor decks that, being exposed to the elements are potential source of moisture penetration particularly at the outboard deck edges.

B. Recommendations

1. In order to mitigate observed problems and return the ATCT to code compliance, all non-rated internal partitions and associated doors, frames, and hardware within the tower shaft defining "occupiable spaces" should be removed (approx. 1100 square feet, 9 doors and frames).

2. In the affected areas not addressed by the previous comment, the bottom edge of gypsum wall board should be cut back approximately ¼" above the floor slab to prevent wicking of moisture into the panel. At rated assemblies, an appropriate UL approved, fire rated sealant should be installed between the slab and GWB. A rubber or vinyl wall base should also be installed to conceal the cut (approx. 30 linear feet).

3. The shaft liner panels within the elevator shaft should be wet-wiped cleaned and may be painted in a manner described in the environmental observation portion of this report (approx. 6100 square feet).

4. All vertical exterior pre-cast panel joints should have the sealant joints stripped, and appropriate new backer rod and sealant installed (approx. 1300 feet).

5. The concrete decks at the north and east and below the south and west microwave balconies should have a fluid applied waterproof traffic membrane installed, with particular attention paid to the perimeter slab edge where leaks are most likely to occur (approx. 600 square feet).

2.2.2 MECHANICAL

General

The existing mechanical system of the ATCT was reviewed as it relates to the reported moisture conditions. The review focused on how the system managed airborne humidity and ventilation throughout the tower and the elevator shaft. Special attention was paid to the fourth and ninth floors of the facility.

A. Observations

1. The HVAC system for the ATCT includes: air-handling units, chilled water cooling coils and hot water heating coils, exhaust fans, unit heaters, air distribution, HVAC control systems and instruments.

2. Two constant volume air conditioning units AHU-11 and 12 (one is a standby) located on the sub-junction level serve the offices and the electronic equipment room on the Junction level. Two constant volume air conditioning units (AHU-13 and 14, one is a standby) serve both the cab and restrooms. The stairwell vestibule is provided with a ventilation system which includes outside air intake plenum; supply fan and ductwork; return air ductwork; exhaust fan and discharge louver.

3. The fourth level storage room has had a water flood sometime in the past, according to the facility Staff. The bottom of the outside air intake and some separate small ductwork are located in this room. It is possible that the flood was due to the water accumulation in the outside air plenum and seepage from the small ductwork. This water could have gone undetected, ponding up in the room and wetting the gypsum wall board. This room is not ventilated although it is close to the vestibule. Measured temperature and humidity was 76 F and 46% RH.

4. The vestibule ventilation system could bring in moisture-laden outside air and distribute it throughout of the facility This system was inoperative at the time of the survey. When the system is running there is no air balance in the facility. Supply air fan (SF-2) draws in and distributes 3525 CFM raw, untreated moisture laden outside air. Exhaust fan (SF-1) removes 5290 CFM air from the tower. That means that the tower is constantly under negative pressure. This is a violation to the FAA Orders 6480.7 C & D, which requires that the facility should be under positive pressure all the time.

5. The survey did not reveal other indications of water coming from any plumbing system.

6. The ninth floor storage room has no ventilation. Temperature and humidity were 76 F and 46% RH. There was no evidence of moisture from any mechanical or plumbing system.

7. The tenth floor NATCA room was previously used as a smoking room. It has a de-energized exhaust duct/fan system. Make-up air is provided from the stairwell vestibule supply air ductwork. There was a self-contained portable room air conditioner operated in this room, but presently it is disconnected. The room does not have any ventilation and the temperature was 74.5 F., and humidity 55% RH.

8. At the sub junction level several ceiling tiles were removed; no indication of damage from the plumbing system above the ceiling was found. Temperature and humidity were 69.5 F and 56.8% RH. On the north corner balcony of the ATCT we found evidence that some time ago there was a drain pipe burst (confirmed by the ESU Staff) and the discarded elbow is still on the floor. Also found was a rotten cardboard box over the floor drain indicating that the floor has been flooded at some point in time, possibly resulting in water seepage into the tower shaft's interior.

9. Several ceiling tiles were removed in the Junction Level to observe possible water seepage protrusion from above, and none was found. Room temperature was 72 F, humidity was 55% RH.

10. The cab level AHU system operates in the economizer cycle mode when weather permits. This system brings in untreated moisture-laden air into the facility. This is a violation of FAA Order

6480.7C & D which prohibits economizer cycles for critical operational areas such as the cab, electronic equipment rooms and TRACON.

11. The building automation computer system is malfunctioning and its temperature sensors are out of calibration beyond its useful life. The computer is an old 362 system, which can't pull-down menus or print trend reports. The computer operators do not have sufficient training to operate or adjust system functions.

12. Outside air intake louvers are clogged-up with dirt and need cleaning.

B. Recommendations

1. Reactivate the vestibule ventilation system and install a cooling coil into the ductwork to remove the moisture from the outside air. Revise air flow of SF-2 and SF-1, so that SF-2 will have a higher air flow than SF-1, thus putting the tower under positive pressure (positive pressure prevents untreated moisture and dust laden air entering into the facility).

2. Change the control system to prevent operation of the economizer cycle. Disconnect damper operators from return, economizer relief air, and outside air dumpers. Set outside air volume constant as per the number of occupants. Install a new building automation computer system and provide sufficient training in its use.

3. The entire ATCT HVAC system needs to be rebalanced to provide positive pressure at all times.

4. Close the air gap under the door to the ESD's area. Presently unconditioned moisture laden outside air enters to the ESD's control room increasing the loads on the newly installed AHU.

5. Recommend removal of the drywall from all the "storage" rooms in the tower.

2.2.3 ENVIRONMENTAL

The environmental assessment focused on evaluating potential moisture and mold sources. Typically, mold issues start with long-term moisture areas on sources of organic nutrients with prolonged temperature and humidity conditions that promote mold growth. Common moisture issues include, but not limited to, leaking valves, sweating pipes, condensation (hot and cold surfaces), rain/snow water infiltration, blocked drains, poor ventilation, mechanical maintenance, etc. Common sources of nutrients may be the cellulose in ceiling tiles or paper, carpet, etc. The heating, ventilating and air conditioning (HVAC) system plays an important role to control mold growth inside buildings.

There are five basic conditions that may raise the risk of mold growth:

1. Long-term moisture – most important
2. Temperature range between 40 – 100°F
3. High humidity – greater than 60%
4. Organic nutrient base

5. High concentration of mold spores

Some common conditions that may result in a mold issue include:

a. Improper building ventilation and maintenance
b. Mechanical equipment that is inaccessible, non-drainable, or non-cleanable
c. Poor waterproofing, caulking, sheet metal details / workmanship that allows water infiltration
d. Leaking water lines as a result of poor workmanship or damage
e. Water damage of building materials prior to or after installation
f. Plugged drains or inadequate drainage slope
g. Frozen pipes due to inadequate insulation
h. Improper design or installation of vapor barriers
i. Inadequate slope to drain

A. Observations

As part of this moisture survey, Jacobs conducted a visual inspection of the accessible areas, above ceilings and behind walls, to evaluate current building conditions for moisture accumulation and possible mold growth areas. Jacobs did not conduct mold sampling.

1. During the initial building walk-through on Tuesday afternoon, June 21 and the late evening of June 21 through June 22, a wide range of temperature, humidity, and ventilation controls were noticeably different at various levels of the tower and fluctuated significantly from day to night time. On some levels the room conditions appeared to be directly dependent on outside weather conditions.

2. Discussions with the maintenance personnel indicated difficulty to control and operate the ventilation mechanical system. See Mechanical Section for details.

3. Throughout the tower, the rooms have concrete floors, and most have finished walls and ceilings. Some ceilings and walls are open to the pre-cast concrete steel structure. The structural steel is covered with spray-on fireproofing. On the non-occupied levels of the tower, there is no mechanical ventilation and stagnate air conditions were encountered in closed rooms. The elevator piston action does force air movement in the elevator lobby areas of each level, but adjacent rooms are closed and have minimal air circulation.

4. At various levels throughout the tower there were a few exposed spots of structural steel, such as near a pipe hanger or edge, metal surface corrosion was noticeable and indicated high humidity conditions have occurred in the space probably due to ambient weather conductions.

5. Most wallboard extends to contact the concrete floor. The metal stud walls are constructed of a gypsum wallboard, fiberglass insulation in walls along the exterior structure, and an interior thicker wallboard. Typically, there is approximately 8-12" of air space between the interior wall board and the pre-cast concrete structure exterior wall. No accumulation of moisture or mold was identified.

6. One small accumulation of moisture was identified behind a GWB column cover on the 9th floor, Room 928 northeast corner, but no mold growth was identified in the area. This area was directly behind the wallboard that was removed during the mold abatement in the spring 2005.

7. Prior mold remediation areas on the 4th and 9th floors were inspected and currently no mold growth was visible or detected by a musty odor.

8. Elevator Shaft – A small amount of surface mold growth was identified in a few localized areas of the upper elevator shaft (9th through 6th floors). The mold was identified only on the surface paper (green back) of a few wallboards lining the elevator shaft. The mold was identified on the surface paper and did not penetrate into the wallboard. The growth is primarily found on the wallboard panels above the floor concrete slab and metal partition sill track. Additionally, some minor surface corrosion was observed on these metal sill tracks, indicating damage may be a result of moisture at the floor slab. A direct cause for the current areas of minor mold growth on the elevator shaft walls was not determined. Since the elevator shaft draws air and vents to the outside atmosphere, changing ambient weather (humidity, temperature, etc.) conditions may affect the elevator shaft conditions to promote mold growth. Also in the elevator shaft, a few areas of minor, dry, water stains were identified, but no mold growth was present on the water stains.

9. One small water stained (8" diameter) on a ceiling tile was identified outside the Junction level Men's Restroom but no mold grow was present.

10. A surface, dry, water stain (1'x1') on the wall board was noted under a duct in Room 827 but no mold growth was present.

11. A few locations of dry, water stained pipe insulation were noted above a few ceilings, but no mold growth was visible.

B. Recommendations

The environmental recommendations emphasize preventing and reducing the risk of mold issues by using preventive maintenance checks, good building HVAC system operation and maintenance, and prompt repair of water damaged areas (with in 48 hrs.). If visible mold growth, discoloration stains, or a musty odor is identified, the moisture source must be identified and eliminated to prevent reoccurrence. Each case needs to be assessed individually to determine specific sources and implement appropriate corrective actions.

1. Assess mechanical ventilation system and improve operational control.
   Conduct a full assessment of the HVAC system to identify repairs and upgrades to properly control and operate the building ventilation in the tower. See the Mechanical Section of this report of detailed recommendations.

   a. Inspect drains, mechanical drip pans and filters for proper drainage and installation.
   b. Check cooling coils and drip pans frequently for microbial growth. Be sure drip pans drain properly.
   c. Check interior duct linings, such as fiberglass or felts, for moisture and mold growth if water damage is reoccurring in specific locations.

2. Conduct routine visual mold inspections. Compile a list of locations to periodically inspect where mold has been identified and removed for recurrence or additional moisture accumulation. Also, include areas with high probability of being long-term moisture source that may sustain mold growth, such as leaking pipes/valves, poor ventilation, water damage, condensation, poor drainage, or areas of condensation. Inspections are recommended monthly for known mold growth areas and quarterly for other potential areas. If an area has a musty odor or mold is discovered, the condition should be dealt with immediately. During the visual inspection, it is highly recommended that special attention be paid to ceiling tiles, gypsum wall board, paper or cardboard, and other surfaces that may contain cellulose, since cellulose is a common nutrient source for molds to grow. Conduct periodic inspection of the building for the following indicators:

   a. Evidence of water damage, i.e., stained ceiling tiles, etc.
   b. Evidence of high humidity or condensation (i.e. sagging ceiling tiles, wet building or pipe insulation, damp walls, etc.)
   c. Musty odors
   d. Mold growth on cellulose-based materials (paper, wood, chairs, etc.)

   If after implementing the recommended mitigation no future growth is observed the FAA may decide to change the frequency of the inspections.

3. Elevator Shaft walls. Clean the interior shaft wall surfaces by wet-wiping with a bleach solution (1 part bleach to 10 parts water). Although surface bleach cleaning may not prevent a mold problem from recurring; the FAA can implement a system of periodic monitoring to determine the effectiveness in preventing or limiting mold growth. Should the FAA determine the results unsatisfactory, and as it is recommended in this report long-term action may be considered. The long-term actions include thorough bleach cleaning and painting of the shaft walls. The shaft walls must be thoroughly dry before applying paint. To limit mold growth, paints containing zinc can be used to encapsulate the area *after* surface cleaning and preparation. Two possible paint products are SheildZ®Plus by Zinsser Co., and Foster 40/20® by H.B. Fuller. NOTE: Do not paint or caulk over mold.

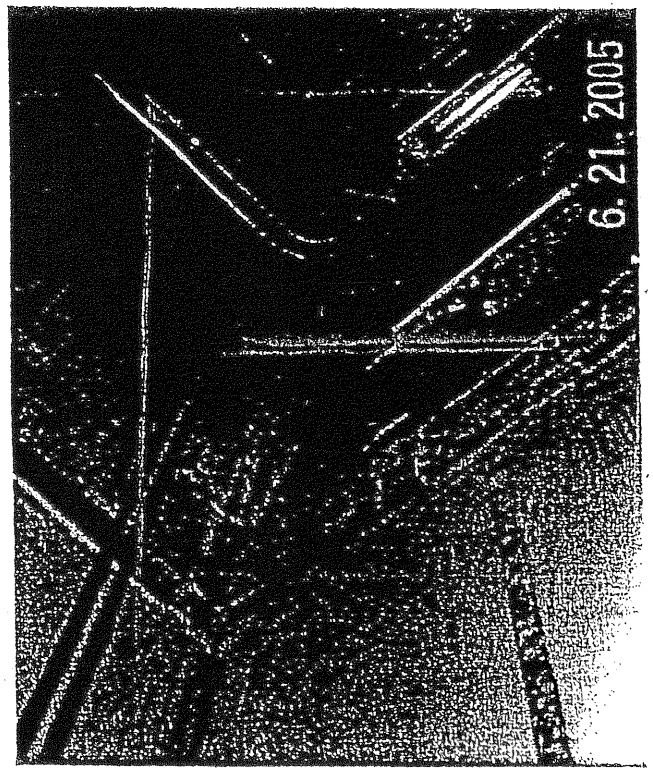
4. During periodic visual inspections, wet materials (ceiling tiles, drywall, etc.) may be discovered. The moisture source must be identified and corrected to prevent reoccurrence. Wet materials that appear to be free of mold should be dried within 48 hours using equipment such as fans and dehumidifiers. If feasible, wet materials should be removed and replaced. If mold growth is visible, contact qualified personnel to determine the best corrective action(s). The observation should include the cavity behind or under the material. It must be noted that concealed parts of drywall may remain damp allowing mold to grow, even when the surface appears dry.

   a. The drying process may take up to six weeks. Installation of replacement building materials (e.g., carpet, sheetrock, paint) should be delayed until water-damaged materials are completely dry.
   b. If the materials are wet for long periods of time, they should be removed and replaced. Drywall should be removed at least 12 inches past the edge of mold growth (some recommend 3 feet if large scale water damage) or 12 inches above the highest watermark

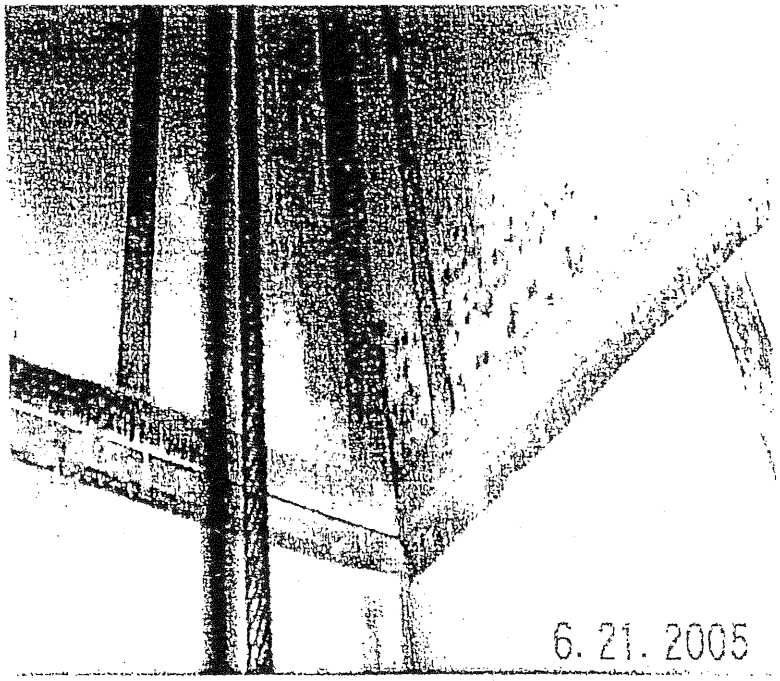
5. Remove gypsum wallboard where it is in contact with concrete floor to create a minimum ¼ inch gap between the concrete floor and wallboard to prevent moisture wicking.
6. Check and evaluate waterproofing at exterior joints, corners, and structure penetrations to prevent water intrusion
7. Check and ensure all chilled water and exterior drain pipes are properly insulated.
8. Where there is recurring water damage, check building utilities for leaks or improper installations.
9. Eliminate situations where moist, warm air is allowed to contact cool surfaces.
10. Maintain floor areas clean by periodic cleaning, and eliminate unnecessary clutter or storage.

APPENDIX 1

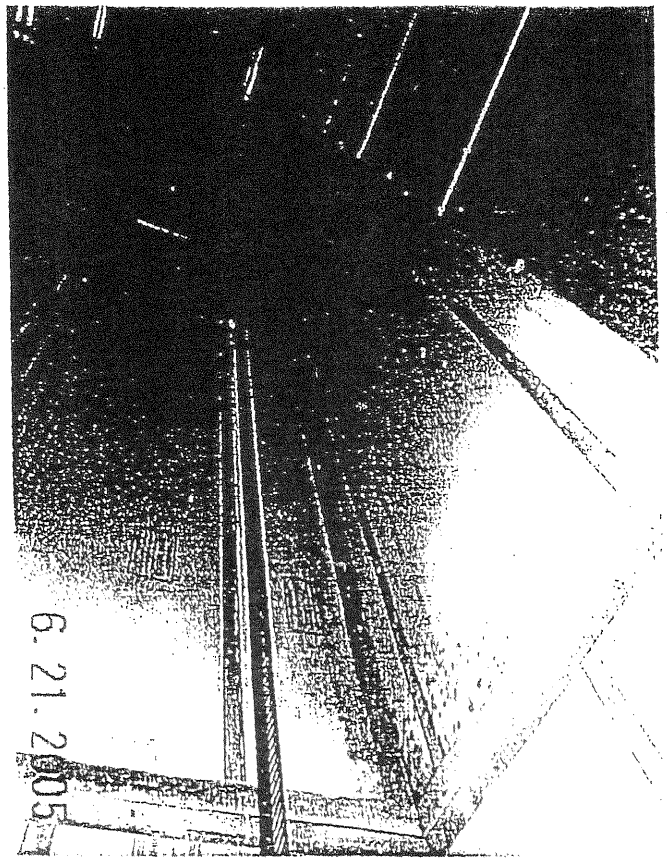
PHOTOGRAPHS



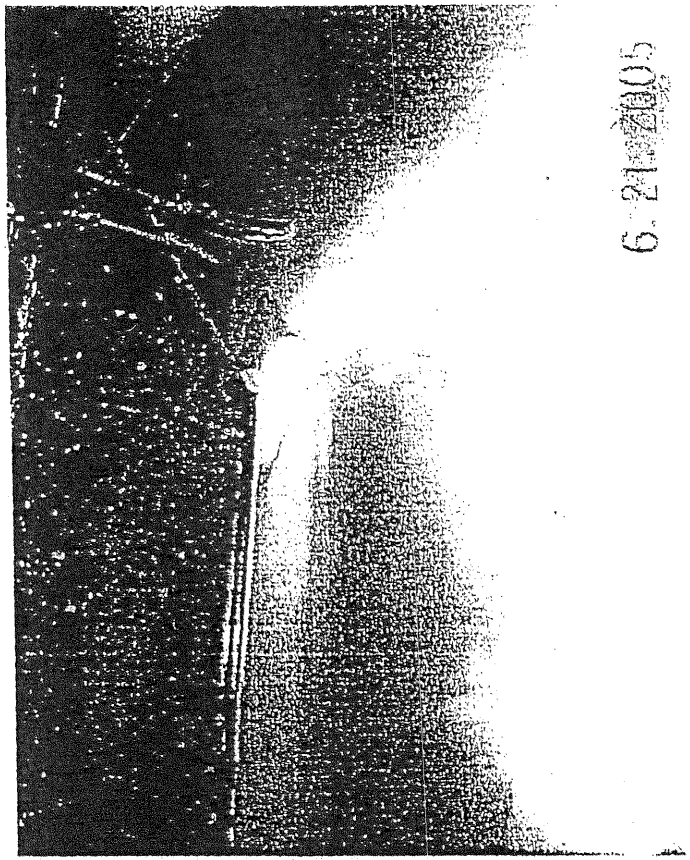
Surface corrosion on elevator shaft GWB liner panel sill-track indicating presence of moisture.



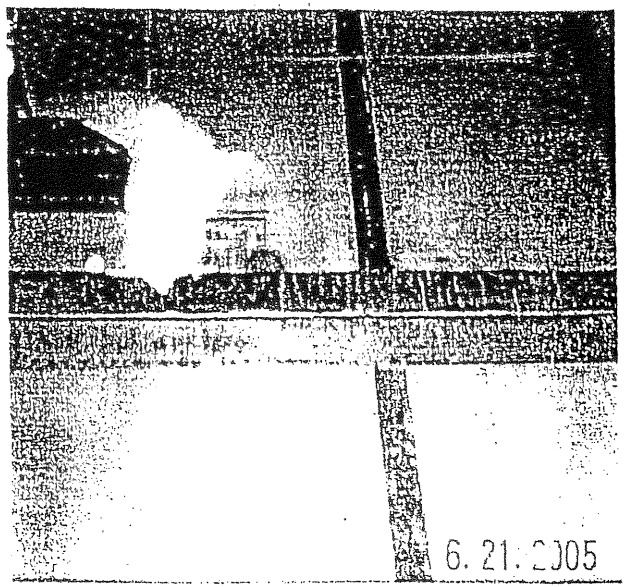
Minor mold on surface of elevator shaft GWB liner, just above the floor line.



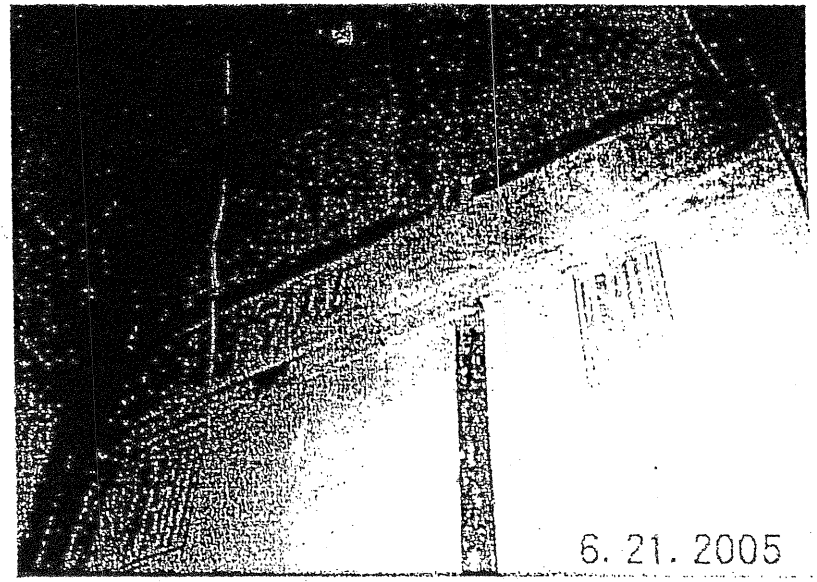
Minor surface mold on elevator shaft liner just above floor line.



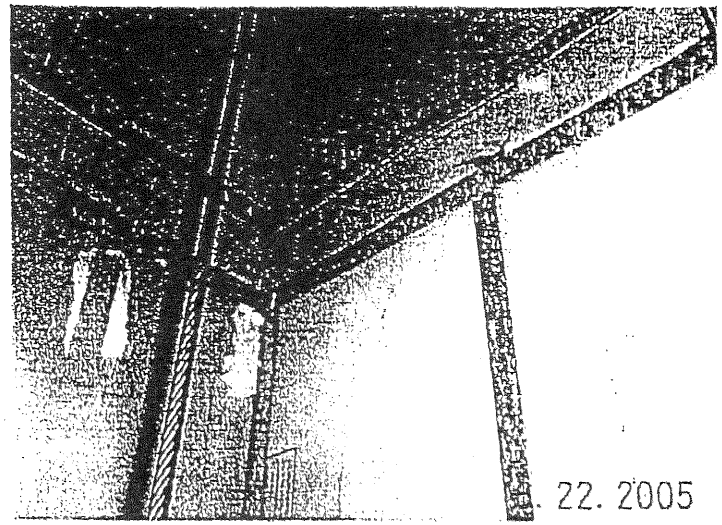
Water stains to gypsum wall board at mechanical ductwork at 4th level Storage Room.



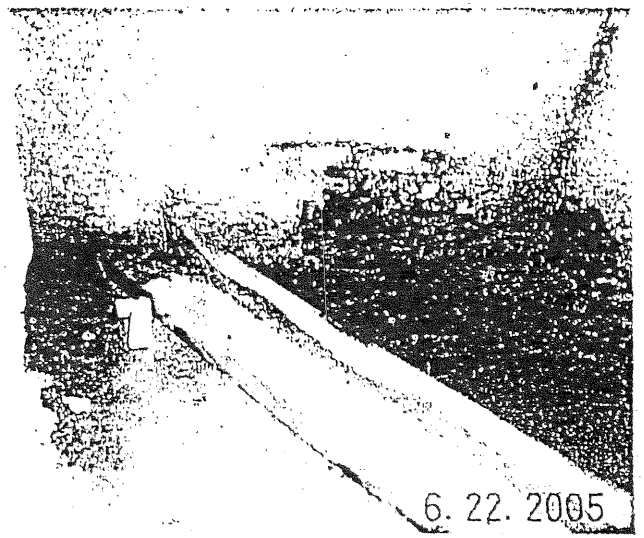
Minor surface mold on elevator gypsum shaft liner panel just above floor line.



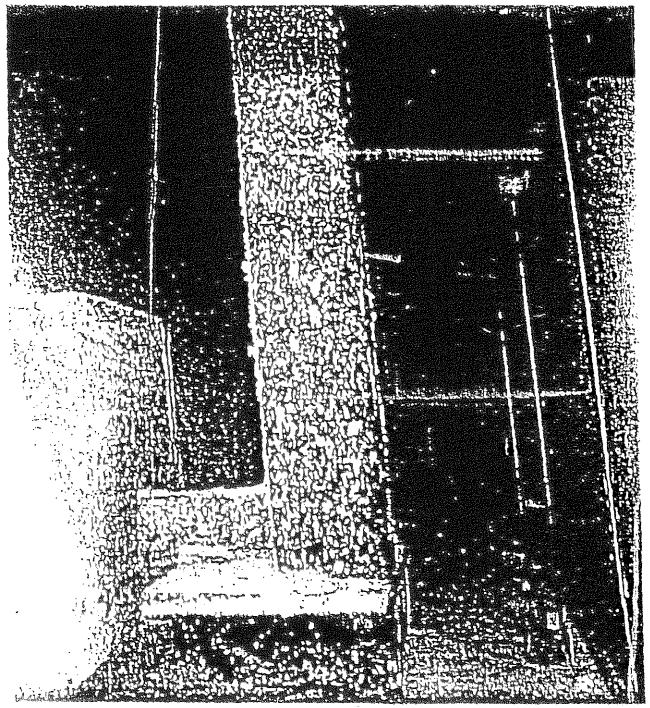
Minor surface mold and water stains on gypsum liner panel below floor slab location.



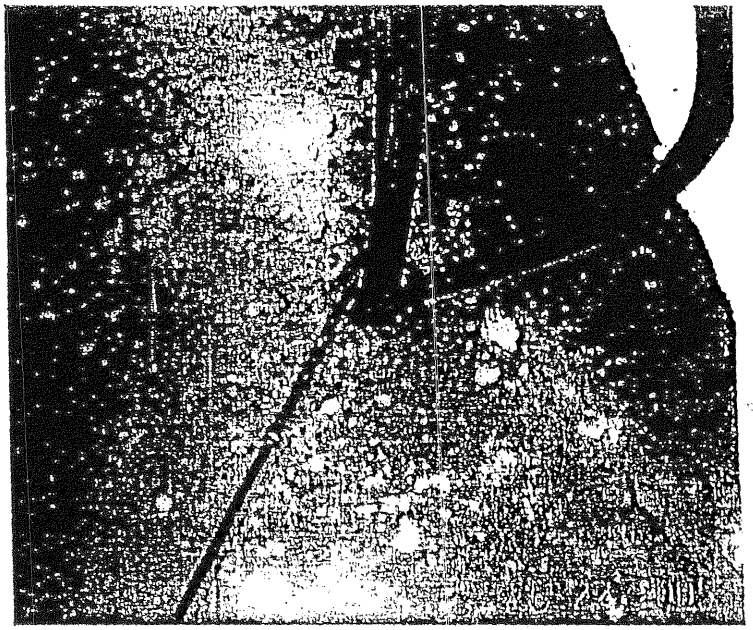
Water stains on elevator gypsum shaft liner panel below location of floor slab.



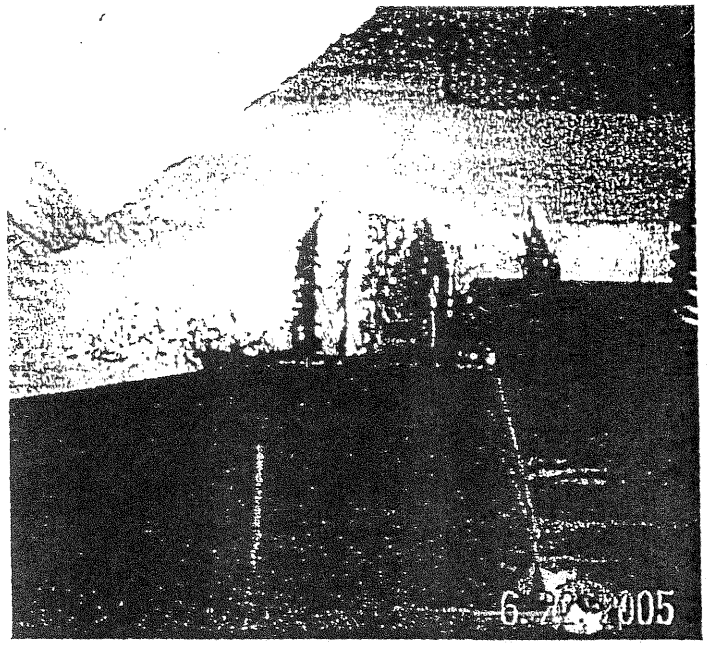
Damp concrete and surface corrosion on unpainted steel embed plates at 10th level indicating presence of moisture.

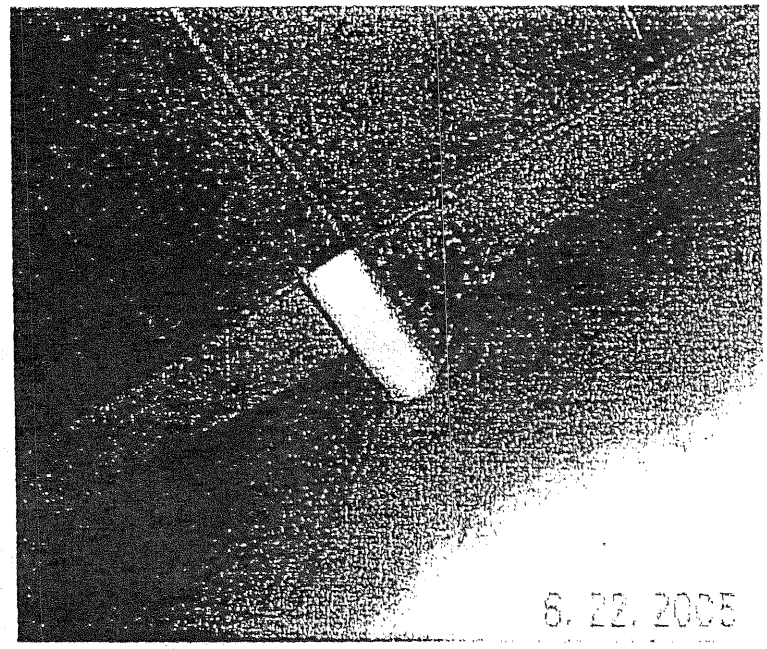


Surface corrosion on unpainted structural steel at 10th level indicating presence of moisture.

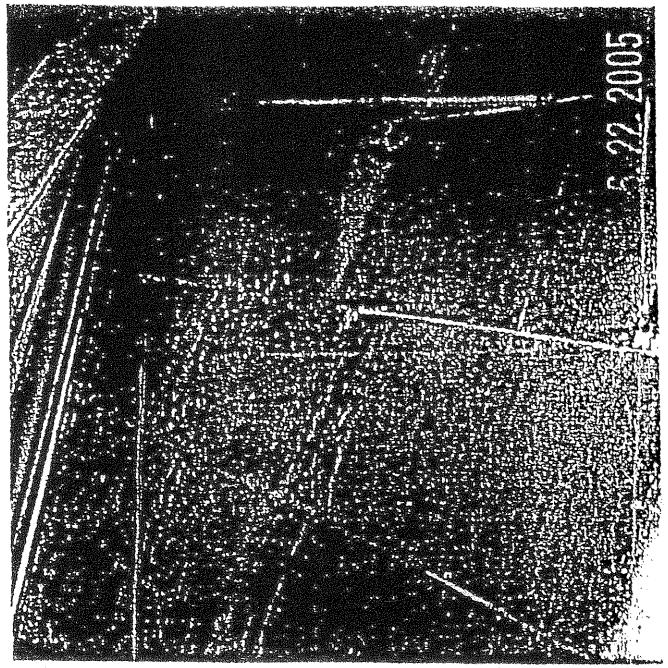


Unprotected cable penetration in floor of microwave balcony.

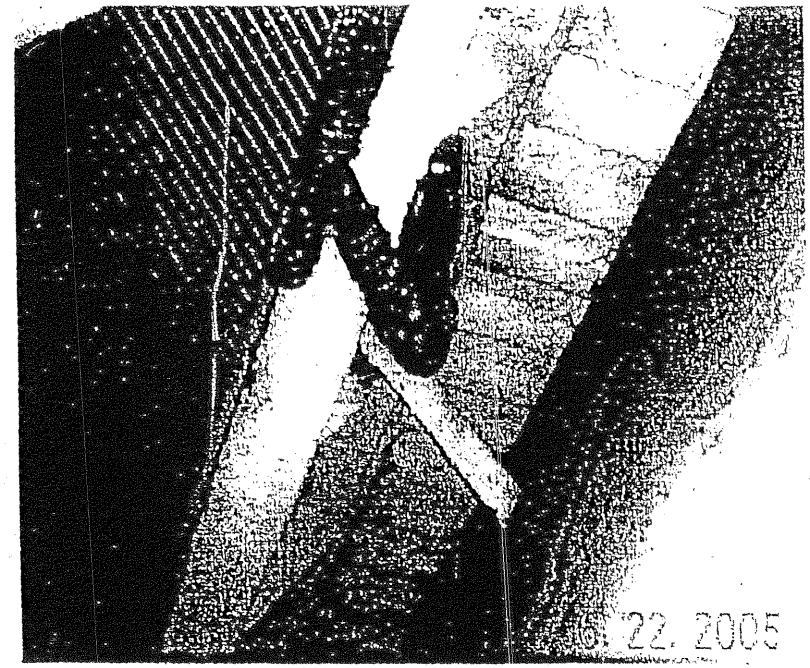




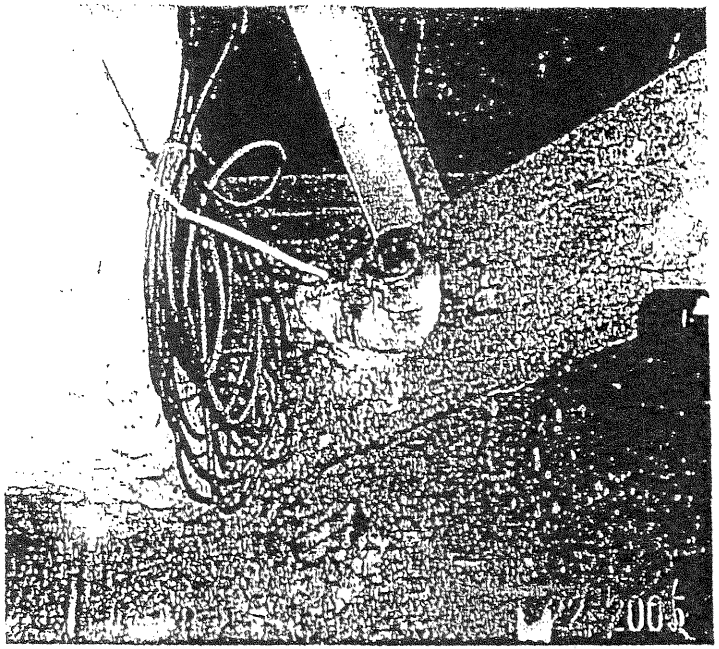
Evidence of past drain leak.



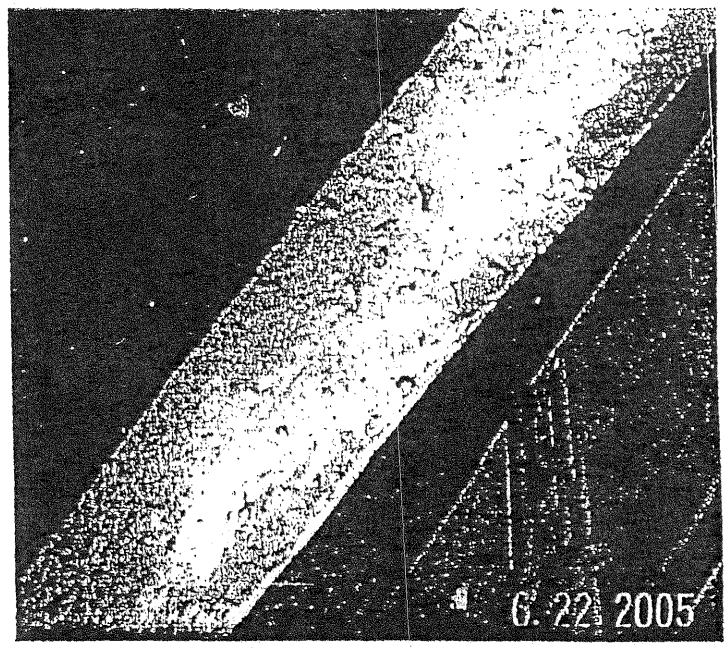
Water stains on inside surface of pre-cast panels below grating at microwave balconies.



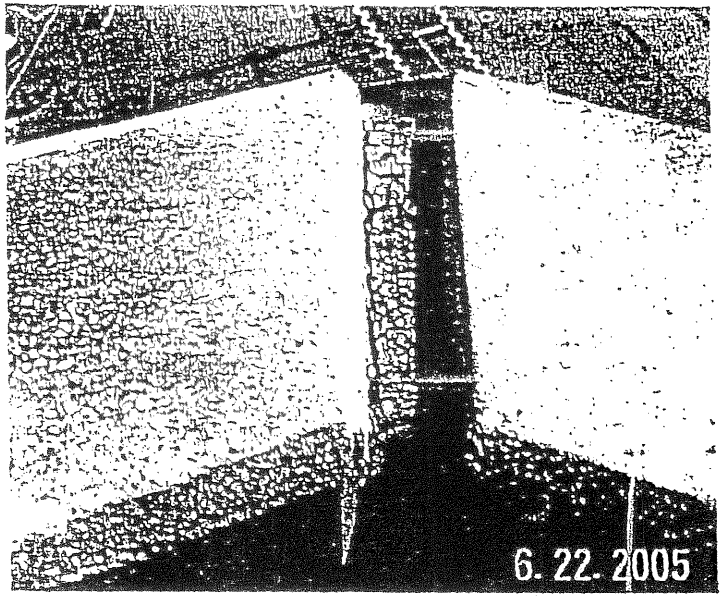
Repaired floor drain from past break and subsequent flooding.



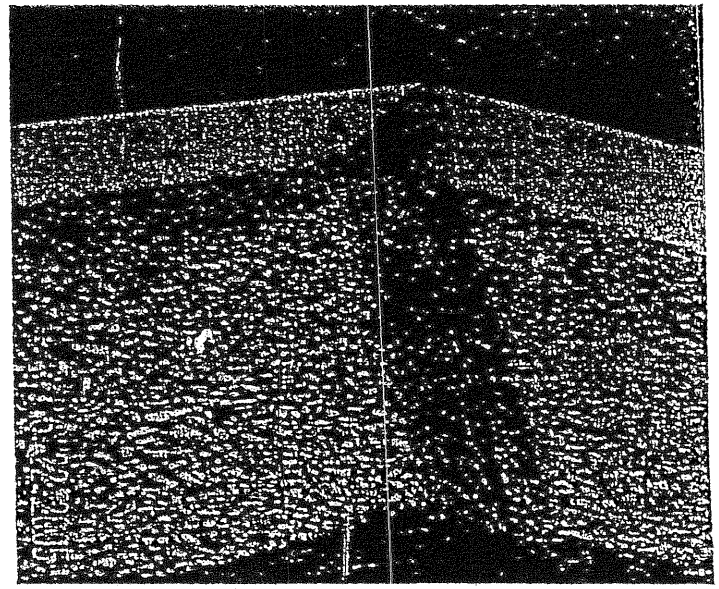
Discarded pipe elbow, indicating repair of a past drainpipe break.



Lightweight fire proofing on structural steel below the microwave balcony. Rainwater from grating above has washed off some of this material, which is blocking the floor drain below.



Typical example of failing exterior caulk joints between pre-cast panels.



Typical example of failing exterior caulk joints between pre-cast panels.

APPENDIX 2

ROM COST ESIMATE SCHEDULES

Estimate Worksheet	CLIENT: Federal Aviation Administration	TASK/SITE NO. F5W54207	JOB NO.	DATE SUBMITTED 26-July-05
	PROJECT AND CITY ATCT At Detroit Metro Wayne Co. Airport Moisture Assessment Detroit, Michigan	ACTIVITY: Moisture Assessment		
		ITEM: SUMMARY		

ESTIMATE VALID TO:	ESTIMATED BY:	DATE:	SHEET NO.
December 2005	TH	30-Aug-05	2 OF 3

DESCRIPTION OF WORK	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	MATERIAL PER UNIT	MATERIAL SUBTOTAL	LABOR PER UNIT	LABOR SUBTOTAL	EQUIPMENT PER UNIT	EQUIPMENT SUBTOTAL	TOTALS
DIVISION									
DIVISION 02 - Demolition				1,525		38,043		152,504	192,072
DIVISION 07 - Thermal/Moisture Protection				3,165		30,843		925	34,937
DIVISION 09 - Finishes				1,788		7,050		211	9,049
DIVISION 15 - Mechanical				21,275		41,400		1,242	63,917
SUB - TOTAL				27,757		117,336		154,883	299,975
Material Delivery, Freight and Taxes	12.00	%							3,331
General Conditions	20.00	%							59,995
Labor Premium - Installing Contractor	0.00	%							0
SUB - TOTAL									363,301
Subcontractors Overhead & Profit	15.00	%							54,495
General Contractors Overhead	10.00	%							41,780
General Contractors Profit	5.00	%							22,979
Escalation	0.00	%							0
Bond	1.50	%							7,238
TOTAL PROJECT COST									489,793

Estimate Worksheet	CLIENT: Federal Aviation Administration		TASK/SITE NO. F5W54207	JOB NO.	DATE SUBMITTED 26-July-05			
	PROJECT AND CITY ATCT At Detroit Metro Wayne Co. Airport Moisture Assessment Detroit, Michigan		ACTIVITY: Moisture Assessment		Moisture Assessment Report			
			ITEM: ARCHITECTURAL/MECHANICAL					
ESTIMATE VALID TO: December 2005	ESTIMATED BY: TH	DATE: 30-Aug-05			SHEET NO. 3 OF 3			

DESCRIPTION OF WORK	QUANTITY NO. UNITS	QUANTITY UNIT MEAS.	MATERIAL PER UNIT	MATERIAL SUBTOTAL	LABOR PER UNIT	LABOR SUBTOTAL	EQUIPMENT PER UNIT	EQUIPMENT SUBTOTALS	TOTALS
ARCHITECTURAL/MECHANICAL									
DIVISION 02 - Demolition									
1. Demo Drywall Partitions	1,100	SF	0.00	0	4.03	4,428	0.12	133	4,560
1. Demo Doors	9	EA	0.00	0	40.25	362	1.21	11	373
1. Demo Door Frames	9	EA	0.00	0	74.75	673	2.24	20	693
2. Cut Drywall 1/4" from Floor/Slab Interface	30	LF	0.00	0	17.25	518	0.52	15	533
3. Wash/Clean Shaftwall	6,100	SF	0.25	1,525	1.58	9,638	0.25	1,525	12,688
4. Remove Caulk at Interior and Precast	1,300	LF	0.00	0	17.25	22,425	116.00	150,800	173,225
DIVISION 07 - Thermal/Moisture Protection									
2. Fire Sealant	30	LF	5.18	155	4.60	138	0.14	4	297
4. Caulk Joints	1,300	LF	1.15	1,495	17.25	22,425	0.52	673	24,593
5. Waterproof Traffic Membrane	600	SF	2.53	1,518	13.80	8,280	0.41	248	10,046
DIVISION 09 - Finishes									
2. Vinyl Base	30	LF	1.15	35	1.15	35	0.03	1	70
3. Paint Shaftwall	6,100	SF	0.29	1,754	1.15	7,015	0.03	210	8,979
DIVISION 15 - Mechanical									
1. New Cooling Coil in Vestibule Vent. System	1	EA	5,750.00	5,750	6,900.00	6,900	207.00	207	12,857
1. Remove SVF-1 & SVF-2 Fan Motors	2	EA	0.00	0	575.00	1,150	17.25	35	1,185
1. Install New Motors	2	EA	1,725.00	3,450	575.00	1,150	17.25	35	4,635
1. Chilled Water Piping 1"	50	LF	11.50	575	11.50	575	0.35	17	1,167
2. Control, Thermostat & Control Valve	1	LS	0.00	0	2,875.00	2,875	86.25	86	2,961
2. Disconnect Damper Operators	1	LS	0.00	0	2,300.00	2,300	69.00	69	2,369
2. New Building Automation Computer System	1	LS	11,500.00	11,500	0.00	0	0.00	0	11,500
2. Operator Training	4	EA	0.00	0	2,875.00	11,500	86.25	345	11,845
2. Add Control to Software	1	LS	0.00	0	5,750.00	5,750	172.50	173	5,923
3. Balance Tower HVAC System	1	LS	0.00	0	9,200.00	9,200	276.00	276	9,476
TOTAL ARCHITECTURAL				27,757		117,336		154,883	299,975

APPENDIX 3

SITE VISIT ATTENDANCE LIST(S)

1. Coordination Meeting Tuesday afternoon, June 21, 2005
2. Site Survey, Tuesday Night, June 21, 2005

Site Coordination Meeting
June 21, 2005- Afternoon Meeting

Sign-In

NAME	COMPANY	TITLE
Diane Morse	FAA-AGL-473	Civil Engineer
Ward Stallworth	Jacobs	Architect
Andy Szente	Jacobs	Mechanical engineer
Dave Bennett	Mr. Handyman	Carpenter
Pravin Putel	FAA-AGL-473	Mechanical engineer
Michael Pinto	Wonder Makers	Consultant
Vinnie Sugent	NATCA DTW	FACREP
John Guth	FAA ATCT	OPS Mgr
Mike Prieur	FAA	DTWB
Jana Lienemann	Jacobs	HSE

Elevator Evaluation Meeting
June 21, 2005- Evening Meeting

Sign-In

NAME	COMPANY	TITLE
Diane Morse	FAA-AGL-473	Civil Engineer
John Guth	FAA ATCT	OPS Mgr
Jana Lienemann	Jacobs	HSE
Mike Prieur	FAA	DTWB
Vinnie Sugent	NATCA DTW	FACREP
Michael Pinto	Wonder Makers	Consultant
Dave Bennett	Mr. Handyman	Carpenter
Pravin Putel	FAA-AGL-473	Mechanical engineer
Ward Stallworth	Jacobs	Architect
Andy Szente	Jacobs	Mechanical engineer
Jeff Wesley	Thyssen Krupp Elevator	Elevator Technician

10b

WONDER MAKERS
ENVIRONMENTAL

September 26, 2005

Vince Sugent
Detroit Metro Tower FACREP
Detroit Metro Tower
Building 801
Detroit, MI 48242

RE: Response to Jacobs Engineering Moisture Assessment Report
Wonder Makers Environmental Project GC05-5988

Dear Vince:

Thank you for the opportunity to review the moisture assessment report dated August 2005 for the ATCT at Detroit Metropolitan Wayne County Airport. We have provided our specific comments related to individual areas of the report in the paragraphs below. **However, we are extremely disappointed that the engineering study did not address a multitude of significant mold-related problems in the building, as was promised by the FAA during their April 27 informational meeting regarding the response to continuing fungal contamination problems in the building.** At that meeting the Airway Facilities (AF) team leaders stated that the mold issues were being addressed in a short term plan and a long term plan. Despite our concerns that the FAA was improperly ignoring evidence of mold contamination on the tenth floor and other areas of building, we were assured that mold exposures in areas other than those targeted during the short term remediation would be addressed as part of the long term response. This is clearly not the case.

There is no mention of the *Stachybotrys* contamination identified on the tenth floor and confirmed through sampling on multiple occasions. Even worse, there is no recognition that previous attempts at remediating mold in the elevator shaft resulted in the evacuation of the tower and eight controllers seeking medical attention! The extent of observed fungal growth in the elevator shaft is minimized in the written descriptions and in the photographs selected for inclusion in the report. Our ability to offer an effective counterpoint to their assessment of the situation is handicapped by the FAA's outrageous policies that restricted us from taking photographs during the inspection, even though the representatives from Jacobs were allowed to use cameras without limitation.

Another substantial flaw is that the report does not address the primary question that prompted the survey. There is no information that explains the source or travel path for the moisture that is entering the elevator shaft in quantities sufficient to support fungal growth on the shaft walls.

Given these serious deficiencies, as well as the specific concerns enumerated below, it is apparent that the FAA has no intention of addressing the health concerns of the controllers in the tower that are a result of the fungal contamination still present in the building . We stand by our

earlier recommendations that a comprehensive mold assessment should be conducted and that appropriate remediation of both visible fungal growth and airborne spores be completed by individuals in accordance with the standard of care that is in place for the mold remediation industry.

Specific Concerns with the Moisture Assessment Report from Jacobs Engineering

Section 1.1: The objectives of the report are different than those publicly stated at the April 27 meeting. At that time, the mold related issues were segregated into two tracks: items to be addressed in the short term and items postponed for long term resolution. The participants at the meeting were assured by the AF representatives that issues of cross contamination and unidentified areas of fungal growth (particularly on the tenth floor) would be addressed in the long term efforts. They even went so far as to confirm that qualified contractors would be engaged to look at the sources of contamination as well as the moisture that was causing the contamination. However, according to the Executive Summary, the charge to Jacobs Engineering was to focus on the moisture with no mention made of cross contamination, past remediation problems, or evaluation of the actual conditions that led to the evacuation of the tower in January.

Section 1.3: The characterization of the fungal situation as "... small amounts of mold growth in a few localized areas on the interior surface of gypsum wallboard of the elevator shaft liner..." is a gross mischaracterization of the situation. The report notes that growth is primarily on levels 6-9, which indicates that mold contamination has impacted at least four floors of the elevator shaft. While the water damage and fungal growth was indeed more pronounced on those floors, I observed evidence of visible fungal contamination all the way down to the third floor. In many areas the mold was visible on three sides of the elevator shaft. This hardly constitutes "...a few localized areas..."

The overall description of the mold problem in the Executive Summary of the report does not even coincide with the cost estimate put forward by the Jacobs team at the back of the report. The estimate worksheet included in Appendix 2 labeled "sheet no. 3 of 3" designates 6,100 square feet of material in the elevator shaft to the washed/cleaned. Given that all of the major documents related to mold remediation agree that projects involving more than 100 square feet of material to be remediated should be treated as a "large" or "extensive" project, an estimate of impacted material that is over 6,000 square feet should not be intentionally downplayed as "small amounts".

The report also states that "the mold was observed on the surface paper of the wallboard and did not appear to penetrate the surface". However, no samples were collected or other investigative methods utilized to confirm this judgment. More importantly, this statement ignores the fact that extensive mold growth was observed on the back side of the shaft liner. With visible mold growth confirmed on both sides of the gypsum wallboard material the speculation that the mold growth has not penetrated the surface is without foundation.

This consistent minimization of the actual fungal conditions is then translated into a risk assessment that parrots the FAA's disparaging attitude toward the concerns raised by occupants of the tower:

> "At this time, the minor mold condition on a few areas of the elevator shaft wall does not appear to pose a health concern to the occupants, but should be addressed in the near term by cleaning the surfaces with a bleach solution, as recommended in this report, to remove the mold, and to mitigate additional future growth."

The Jacobs team offers absolutely no legitimate support for their health assessment. No employee interviews or surveys were conducted. No review of medical records of individuals who were previously injured during the January mold remediation activities was conducted. No recognition was given to the fact that at the time of the inspection one controller was on extended sick leave from work in the CAB because of recurring rashes on his body that developed when he was at work. No medical professional was consulted as part of the deliberations. No air or surface samples were collected to evaluate the type of mold contamination or extent of its spread despite the fact that elevator shafts are well known to have a major impact on air movement throughout a building. The Jacobs team does not even reference all the previous sampling data that was available to them that show that fungal contamination was widespread in the building. Nor does the team even acknowledge that three different attempts at substantial mold remediation had been conducted in the building.

The recommendation that the wall surfaces be cleaned with bleach is another indication of the ineptitude of the Jacobs team in addressing the mold situation. Although a bleach water solution for cleaning mold from surfaces is mentioned in a number of government publications, these references are typically directed to homeowners, not building owners and managers who are responsible for the health of the occupants. Indeed, the EPA's guidance document entitled *Mold Remediation in Schools and Commercial Buildings* specifically states "The use of a biocide, such as chlorine bleach, is not recommended as a routine practice during mold remediation..." (pg 18).

Despite these glaring errors, the Jacobs team does offer one positive piece of advice in Section 1.3 when they recommend that periodic visual inspections be conducted to identify and address any additional mold growth in a timely manner. Given the history of the building, such proactive inspections are prudent. However, the fungal contamination situation should be properly assessed and corrected as a prelude to such preventive inspections.

The Jacobs report is much more accurate when it deals with moisture and mechanical issues. Their comments regarding the poor performance of the ventilation system in the vestibule and recommended corrective actions should be heeded.

Section 1.4: The Rough Order of Magnitude (ROM) costs estimated for corrective actions is nearly half a million dollars. However, no distinction is made between costs for sealing the exterior caulk joints and those necessary to deal with the fungal contamination situation. As such, there is a distinct possibility that relatively low cost quick solutions that would improve the

conditions for the building occupants (*e.g.*, cleaning of the 10th floor office, proper remediation of the mold in the elevator shaft, etc.) will be further delayed while planning for correction of the exterior seals grinds on.

Section 2.1: Throughout the discussion of the survey activities there is no indication that NATCA representatives accompanied the Jacobs team or that the NATCA representatives were restricted from taking samples, measurements, or photographs. This oversight would not be important except that the report describes the survey procedures used for the elevator shaft. That section states:

> "The elevator roof hatch was opened and the interior of each level of the shaft was observed from a ladder placed inside the elevator cab, where pictures and notes were taken by all disciplines."

The statement implies that all of the participants were able to participate equally in collecting necessary data. As indicated above, this was not the case.

This section also provides a confirmation that no member of the Jacobs team conducted any sampling for mold.

Section 2.2.1A.1.c.: The characterization of mold contamination as "minor surface mold growth on the interior shaft liner at levels 6 through 9" is reemphasized here. As discussed above, this is an improper description of the conditions.

Section 2.2.1B.1.: This section recommends that a number of interior wall partitions in the tower section of the building be removed. There is no warning given to the fact that many of the partition walls in this portion of the building could have mold contamination. Improper removal of partition walls with mold would have much worse consequences in terms of potential contamination than leaving them intact.

Section 2.2.1B.2: The Jacobs team offers a reasonable solution for addressing the wicking of moisture from the floor slab to the drywall, but they do not explain how the water from the exterior seal leaks could be migrating to the interior wall partitions.

Section 2.2.1B.3: This item recommends cleaning the gypsum wall panels in the elevator shaft. It does not address the mold contamination identified on the opposite side of the gypsum boards: the fungal material that was covered over with drywall during the short term phase of the remediation. The AF representatives deferred dealing with the elevator shaft wall until after the moisture survey was completed. As such, it now appears that the FAA is ignoring this problem for the second time.

Section 2.2.2A.8.: The Jacobs team found evidence of water intrusion and a "rotten cardboard box" but did not indicate that the box could be another source of fungal contamination in the building.

Section 2.2.2B.3.: The recommendation to rebalance the entire HVAC system does not address whether the system needs to be cleaned. Because of the past contamination in the building a thorough cleaning of the duct system may be necessary to remove residual fungal contamination.

Section 2.2.3A.3.: The fact that the elevator acts as a piston to force air into each level of the building is noted here. Nevertheless, no connection is made between the air movement from the elevator and the fact that visible mold growth is present in the elevator shaft. These two conditions combine to create a situation where fungal contamination can be moved from the shaft to all areas of the building.

Section 2.2.3A.5.: In the discussion of the wall cavity related to the exterior walls the Jacobs report notes that "no accumulation of moisture or mold was identified". Yet the very next observation is at odds with this statement and refers to standing water and significant corrosion in a wall cavity in the northeast corner of the storage room on the ninth floor.

Section 2.2.3A.7.: The Jacobs team states that no mold growth was visible or detected on the fourth and ninth floors where mold remediation had taken place. They fail to mention that the areas where mold remediation was conducted had been covered with new drywall. This covering prohibited the team from visually examining the back side of the elevator shaft wall which was previously documented as having significant mold growth.

Section 2.2.3A.8.: This section again presents the inappropriate description of the mold contamination in the elevator shaft. The team does admit that "a direct cause for the current areas of minor mold growth on the elevator shaft walls was not determined". As such, the primary purpose that initiated the moisture inspection was not resolved by the efforts of the engineering team. In this section and the three following sections the Jacobs team notes that water staining was identified on the elevator shaft wall, ceiling tile, wallboard and pipe insulation at different spots in the building. The report does not reference current industry studies which show that a high percentage of the porous building materials that are water damaged support fungal growth, as verified through testing, even if it is not yet visible.

Section 2.2.3B.: The environmental recommendations allude to the problem that water-stained building materials present a problem in regards to mold contamination when it notes that mold growth, discoloration stains, and musty odors all must be identified and eliminated.

Section 2.2.3B.2.: Jacobs recommends monthly proactive mold inspections until the moisture sources identified in the report are mitigated. This is a prudent recommendation except for the fact that the report admits that it does not know the cause of the moisture that is supporting the fungal growth in the elevator shaft. Therefore, even if the suggested corrections are implemented, conditions may still exist that support continued mold contamination in the elevator shaft.

Section 2.2.3B.3.: A detailed recommendation regarding the cleaning and/or painting of the elevator shaft walls is provided by Jacobs. As discussed in earlier sections, their recommendation for a bleach wash is inappropriate. More important, one of the core principles of mold remediation is that porous materials that support mold growth should be removed.

Section 2.2.3B.4.: This section provides general information about the proper response to water intrusion incidents. It reaffirms that qualified personnel should be utilized to address mold contamination problems. It further notes that concealed parts of drywall may remain damp, allowing mold to grow even when the surface appears dry.

Please do not hesitate to contact me with questions about this letter. I am disappointed that the restrictions imposed on NATCA and Wonder Makers during the initial inspection made it impossible for me to reinforce these criticisms with photographic documentation. However, that does not ameliorate the significant problems presented in the Jacobs report.

Sincerely,

Michael A. Pinto, Ph.D., CSP, CMP
CEO

11

Jacobs Facilities, under contract to the ATO, will be performing an engineering evaluation of the DTW ATCT. The team will be on site the period June 21 – 22, 2005. The scope of their evaluation is to visit all spaces within the ATCT; survey the elevator shaft; and inspect all mechanical systems to identify the source of the moisture in the building and to evaluate any associated structural impacts. To minimize disruptions at the facility, the elevator shaft survey will be completed in a two-hour period between 11PM, June 21 and 1AM on June 22.

This risk assessment is based on a previous assessment where similar risks were assessed during a larger scaled project. (Ref: Moisture Remediation Short Term Project, dated May 10, 2005)

All known risks based on the following "Project Execution Work Plan for DTW" have been assessed in the attached risk management plan (RMP). This is a living document and can be amended as necessary.

11b

Wonder Makers
Environmental, Inc.

June 27, 2005

Mr. Pat Forrey
National Air Traffic Controllers Association
Great Lakes Regional Office
1910 Highland, Suite 210
Lombard, IL. 60148

RE: Response to the FAA's initial efforts related to their "long term" plan for mold remediation at the Detroit Metro Airport; Wonder Makers Project GC05-5988

Dear Pat:

On Tuesday, June 21, 2005, I was present at the Detroit Metro Air Traffic Control Tower (ATCT) to participate in the initial building survey related to the Federal Aviation Administration's (FAA) long term mold remediation efforts. This survey and inspection of the elevator shaft was conducted by representatives from Jacobs Engineering, an organization contracted to provide specialty engineering and environmental expertise. The inspection effort was organized and led by Diane Morse – AGL 473. The survey efforts were divided into three parts:

1. A general orientation meeting and familiarization tour of the facility on Tuesday afternoon
2. An inspection of the elevator shaft and closer inspection of structural areas of interest on Tuesday night/Wednesday morning
3. A review of the mechanical systems and the collection of humidity measurements on Wednesday

Although I have a number of procedural concerns that I have detailed below, I feel that the most important aspect of the tour was the negative attitude and false information provided by the FAA's project leader. **In addition to the restrictions on taking photographs and the onerous and demeaning instructions to observers, Ms. Morse provided deceptive answers to direct questions from Vince Sugent and me that precluded our participation in an out-briefing meeting.**

At 01:30 the inspection of the elevator shaft was completed. Vince and I proceeded to the Airways Facility (AF) conference room to pick up my briefcase. The project leader and members of the Jacobs Engineering team were in the conference room discussing their initial observations. After retrieving my briefcase and saying goodbye to the inspectors, we questioned Ms. Morse for a second time regarding the remaining activities. We were told that at 09:00 the Jacobs team

would reassemble to visually inspect HVAC units, observe the exterior of the building at points where water may be entering, and collect humidity measurements. We specifically asked if an out-briefing was to be held. Her response was that no meeting was to occur. She went on to add that the only discussion that members of the inspection team had to complete was a telephone conversation with their supervisor to get their next assignment. Based on this information, we informed the group that we would not accompany them for the next part of the inspection. Vince was explicit in his request that NATCA be informed of any meetings or discussions related to the inspection process in which we had participated.

Late Wednesday afternoon Vince learned of a teleconference where the inspection process in which we had participated was discussed by representatives of a number of levels of the FAA. None of the participants from either the Airway Facilities side or the Air Traffic (AT) branches of the FAA provided any advance warning to Mr. Sugent about this meeting. Adding insult to dishonesty, the meeting participants decided that there were "no urgent issues" (6/22/05 e-mail at 2:37 p.m. from Earl to Vinnie and Russ).

My experiences last week fit the pattern of incompetence and cover-up that have been the hallmark of the FAA's response to the mold situation since we became involved in January. Apparently, the fact that eight people were sickened as a result of the January mold remediation efforts to a point that they had to seek medical attention, and the onset of significant health symptoms by at least two controllers at the time of the last remediation project in May does not rise to the level of "urgency".

During an April 27, 2005, informational meeting regarding the FAA's response to continuing fungal concerns in the building the AF team leaders (including Diane Morse) stated that the mold issues were being addressed in a short term plan and a long term plan. At that time I argued that the FAA was improperly ignoring the evidence of mold contamination on the tenth floor and other areas of building. We were assured that mold exposures in areas other than those targeted during the short term remediation would be addressed as part of the long term response. However, last Tuesday the project leader went to great lengths to describe the efforts by the inspectors from Jacobs Engineering as a "moisture investigation". No real consideration was given to the fact that the tenth floor NATCA office is currently unusable and that the most recent investigation showed evidence of active mold growth in the elevator shaft, an area where the mold was sprayed in January.

I also believe that it is no accident that NATCA has limited information to refute the FAA's conclusion regarding "no urgent issues" being present at the site. It is difficult to address professional opinions without data. By their actions the FAA has prevented your organization from collecting information in the form of samples or photographs that would dispute their position. The prohibition on NATCA collecting samples or taking photographs was enforced even though FAA representatives were allowed to do both.

In summary, it is clear that the FAA refuses to acknowledge even the potential for continuing problems related to mold in the Detroit tower. Their intransigence is not just a matter of politics as the health of the controllers and other occupants has been seriously impacted in the past with significant evidence to suggest that the problems have yet to be resolved.

Please let me know if you can convince the FAA to work with NATCA to provide a comprehensive assessment of the structure's current condition.

Sincerely,

Michael A. Pinto, Ph.D., CSP, CMP
CEO

cc: Vince Sugent

Enclosures: Instructions to observers provided by the FAA on June 21(undated and unsigned)
Hold harmless statement required of Wonder Makers prior to participation in the June 21/22 inspection
June 22 e-mail from Earl