



Heating, Ventilation and Air Conditioning (HVAC) System Investigation

450 N Street, Sacramento, California

Report

Project No. 2372.02-572



Prepared for:

Mr. Mike Moore
Department of General Services
Project Management Branch
707 3rd Street, 3rd Floor
West Sacramento, CA 95605

Prepared by:

Chris Corpuz, MS, CIH
Senior Manager
LaCroix Davis LLC

Report Date:

June 5, 2012

TABLE OF CONTENTS

1. BACKGROUND..... 1
2. INVESTIGATION 1
3. FINDINGS 4
4. CONCLUSIONS..... 4
5. LIMITATIONS AND QUALIFICATIONS 5

FIGURES

- Figure 1 HVAC Sample Locations Mechanical Floor
- Figure 2 HVAC Sample Locations Floor 21

APPENDICES

- Appendix A Laboratory Reports

1. BACKGROUND

Facility historical records and discussions with occupants of the Board of Equalization (BOE) building at 450 N Street, Sacramento, California, have indicated the presence of musty odors of unknown origin on the 21st floor of the building. From December 11, 2009 through April 1, 2010, the 21st floor was turned over to the Department of General Services (DGS) Project Team as part of the building mold remediation project. During this period, multiple measures were taken to identify and eliminate any possible sources of the odors. An extended period of time (greater than that spent on other non-odor floors) was spent in ensuring the floor had been thoroughly investigated and remediated wherever warranted. In April 2010, the floor was returned to the BOE for re-occupancy.

During the ensuing year, complaints of odors appeared to be non-existent. However, in March 2011, the DGS-BOE Project Management Team was notified by BOE Management that odors were reported on February 24th on the 21st floor. After a discussion between the floor occupants, Hygiene Technologies Inc. (HTI) and LaCroix Davis LLC (LCD), it was discovered that the floor occupants had begun experiencing the musty odors only a short time after re-occupying the floor in April 2010.

On March 4, 2011, Liz Houser, BOE Deputy Director Administration, met with representatives from DGS, HTI, and LCD to discuss the recent odor complaints. It was in this meeting that an odor investigation of the 21st floor was initiated; the scope eventually included investigations of the building heating, ventilation, and air conditioning (HVAC) systems and of floor coverings in the form of vinyl composite tiles (VCT).

This report addresses the HVAC component of the investigation. The odor investigation component is addressed in a separate summary report.

2. INVESTIGATION

The HVAC investigation project team included all of the members of the DGS BOE Remediation Project Team, including project managers, industrial hygienists, architects, and other project contractors/consultants. The following table outlines in chronological order the activities that occurred during the HVAC investigation:

Chronology of HVAC Investigation Events

Activity Date	Location	Activity	Conclusions/Comments
Jan 09	Floor M	Water Damage Assessment	Included in LCD Water Damage Assessment Report 02/25/09
03/07/11	Floor M Fan Room 3/4	Pipe Surface Testing	VMG discovered on pipe surfaces in the HVAC fan rooms.
03/16/11	Floor M Fan Room 3/4	Various Surface Testing	VMG discovered on other surfaces in the HVAC fan rooms.
03/21/11	Floor M Fan Room 1/2	Various Surface Testing	VMG discovered on other surfaces in the HVAC fan rooms.
04/02/11	Fan Room 3/4	Remediation	Completed
05/14/11	Fan Room 1/2	Remediation	Completed
06/18/11	Fan Room 3/4	Install Access Doors and Sample	Completed
06/27/11	Fan Room 3/4	Filter Bank Sampling	Completed
07/29/11	Fan Room 3/4	Install Additional Access Doors and Sample	Completed
07/30/11	Fan Room 1/2	Install Additional Access Doors and Sample	Completed
07/31/11	Outside Air (OA) Intake Rooms	Collect Air Samples	Completed
08/08/11	Floor 1 Mezzanine Fan Rooms	Inspected and Sampled	Kitchen makeup air unit not investigated. Inaccessible NW mezzanine ducting. SE mezzanine OA duct has been disconnected (mold growth was detected on duct interior insulation).
08/5-10/11	Floor 21	Supply Vents Surface Sample Interiors	Completed
08/21/11	Floor 1 Day Care and Cafeteria	Supply Vents Surface Samples	Completed
08/21/11	Floors 8, 11, 21	Collect PCR samples	Completed
10/11/11	BOE Board Room	Town Hall Meeting	Completed
10/12/11	BOE Board Room	Town Hall Meeting	Completed
12/30/11	Odd-Numbered Floors	December Monthly Air Monitoring	Completed
01/27/12	Even- Numbered Floors	January Monthly Air Monitoring	Completed
02/24/12	Odd-Numbered Floors	February Monthly Air Monitoring	Completed
03/30/12	Even-Numbered Floors	March Monthly Air Monitoring	Completed
04/27/12	Odd-Numbered Floors	April Monthly Air Monitoring	Completed

The building tower HVAC main supply fan units are located on Floor M of the building, along with other major mechanical system components. Floor M was included in the 2008-2009 initial water damage assessment (WDA) of the building. Photographs from the initial WDA showed the presence of water staining on some of the piping insulation in the building tower HVAC main supply fan rooms and other HVAC system entry vestibules.

Floor M is a floor normally restricted to DGS personnel, and was not included in the mold remediation schedule along with other BOE-occupied floors. It was not until the project team noticed what appeared to be possible mold on the piping insulation that Floor M was further assessed and subjected to the mold remediation process applied to the other floors of the building.

Evaluation of the building tower HVAC system started with evaluating possible surface mold on fan room piping, fan room surfaces, and fan unit housings. The evaluation included the collection of air and surface tape lift samples. The findings of the evaluation resulted in the remediation of mold and the cleaning of all of the fan room. In some situations, remediation of the mold required the removal and replacement of pipe insulation.

When mold was identified in the building tower HVAC supply fan rooms, the project team elected to access the inside of the fan units to determine whether a similar mold condition existed inside the HVAC system fans and ductwork. In order to fully access the interior of the ductwork, additional access doors were added to supplement the existing HVAC access hatches. The inside of the fan housings are unlined and the main supply ducts on Floor M are lined with fiberglass insulation. The duct insulation was evaluated using a combination of tape lift surface, bulk, and microvacuum sampling methods. Polymerized chain reaction (PCR) was used in the analysis of these samples.

The HVAC distribution plenums located on Floor M are not lined. The main HVAC risers (i.e., vertical distribution ducts) and square air supply ducts that horizontally branch off of the main HVAC risers on each floor are lined with fiberglass insulation. Two fire damper access doors located on each floor were used to collect microvacuum samples from inside these lined supply ducts. PCR was used to analyze these samples.

The square supply air ducts terminate at variable air volume (VAV) boxes which then distribute air to the floor through a system of unlined flex ducts and diffusers. Surface tape lift samples were collected from the surfaces of various VAV boxes and diffusers.

During the assessment of the main HVAC duct system, bulk and tape lift samples were also collected from the HVAC filter bank located on Floor M. Air and surface tape lift samples were subsequently collected from the Outside Air Intake vestibules also located on Floor M.

Concurrent with the building tower HVAC investigation, the following areas were investigated and evaluated:

- Two Floor 1 mezzanine HVAC systems
- Floor M chilled process water piping system (refer to the LCD Floor M Closure Report, February 17, 2012, for details of this evaluation).
- Building tower HVAC coils and filter banks (refer to the LCD HVAC and 21st Floor Odor/Condensation Investigation Report, April 20, 2012, for details of this evaluation).

LCD was contracted to provide monthly (once per month) air monitoring of the building. The first monthly air monitoring event occurred in December 2011. Refer to details for each monthly sampling event in the LCD Monthly Air Monitoring Summary Reports. Five Monthly Air Monitoring Reports have been published to date.

3. FINDINGS

Prior to initiating the above formal building HVAC system evaluations, there were no air samples collected in the general tenant areas of the building that resulted in any remarkable findings affecting the building indoor air quality.

Varying degrees of surface contamination, including visible mold growth (VMG) were observed on some of the exterior surfaces of the various HVAC system components. Anywhere surface contamination or mold was observed in accessible areas of the building, it was remediated and cleared in accordance with the remediation protocols established mold remediation that had been performed in the building. During this process, no air samples collected in the general tenant areas of the building resulted in any remarkable findings affecting the building indoor air quality.

Visible mold growth, primarily in the form of *Cladosporium sphaerospermum*, was detected on the internal duct lining of the building tower HVAC system. Of significance was the fact that the mold detected in both the bulk and the microvacuum samples of the duct lining was predominantly this single mold species.

4. CONCLUSIONS

Both industrial hygiene consulting firms (LCD and HTI) associated with the 450 N Street mold remediation project have continued to collect and analyze multiple samples on each floor on a monthly basis. These air samples are analyzed using a PCR test panel focusing on four different *Cladosporium* species, as well as a PCR test panel focusing on twenty-three of the most common indoor mold species. To date, no air samples collected in the general tenant areas of the building have resulted in any remarkable findings affecting the building indoor air quality. Because the building indoor air quality has not been affected, there are no current plans to remediate the visible mold growth inside the main tower HVAC duct system.

In order to maintain conditions that will minimize the probability of future mold growth, the building property management needs to be diligent in adopting and fully implementing the Operations and Maintenance (O&M) procedures and protocols that have been developed throughout the remediation of the building.

DGS has elected to continue to monitor the indoor air quality of the building tenant spaces until such time as the results of this air monitoring indicate that conditions in the building require additional action on the part of the property management and owner.

5. LIMITATIONS AND QUALIFICATIONS

The assessment performed by LCD does not include or cover the following matters: Matters that are subsequently discovered that could not have been reasonably foreseen or detected, using industry standards, during the performance of the assessment. Matters that could not have been discovered by LCD because of barriers, lack of access or other matters affecting accessibility. Matters that were not disclosed to LCD prior to, during, or after the performance of the assessment. Any new deficiency that arose after the completion of the assessment by LCD.

To the extent that additional information becomes available to LCD, LCD reserves the right (without any obligation to do so) to modify its evaluation and/or this Report at any time, based upon further review and analysis of any such additional information or data.

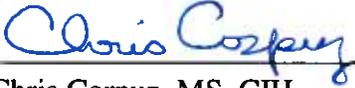
Certain items mentioned in the Report were performed by others not involving the supervision of, or management by, LCD, but were relied upon by LCD in making its evaluation and assessment.

The assessment performed by LCD is not meant or intended to supplement, modify, or extinguish any warranty or representation made or given by third parties performing any of the recommended corrective work.

When consultation involves microbiological growth, or any assessment thereof, such microbiological growth may reoccur if the source of the growth is not remedied. All remediation of fungi in indoor environments can be inherently limited in the sense that conclusions are drawn and recommendations developed from information obtained from limited research and site evaluation. Except as may be noted in the assessment performed by LCD, subsurface areas, latent defects, or non-accessible areas and conditions were not field investigated and may differ from the conditions implied by the surface observations. Additionally, the passage of time may result in a change in the environmental characteristics at the subject property and the surrounding properties. No investigation or assessment can absolutely rule out the existence of any microbiological growth at any given site. LCD does not remediate or remedy sources of microbiological growth.

This Report and the assessment/survey conducted by LCD is prepared, and was performed, solely for the use and benefit of the client identified at the beginning of this Report. No other party may rely on this Report for any other purpose.

Report prepared by,



Chris Corpuz, MS, CIH
Senior Manager
La Croix Davis LLC

Report reviewed by,



Stephen C. Davis, MS, CIH
Principal
La Croix Davis LLC