

Beale AFB Indoor Air Quality Investigation for the Military Family Housing

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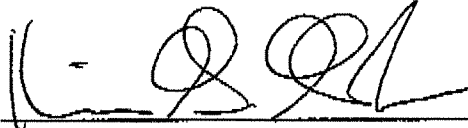
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Date 27 Oct 06



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1. ASSESSMENT SUMMARY:

Northrop Grumman Mission Systems was tasked by the Air Force Institute for Operational Health's (AFIOH) to conduct an independent assessment of mold remediation activities at Military Family Housing (MFH) units located at Beale AFB, California. Water intrusions are the major source of the indoor air quality complaints in MFH units at Beale AFB. Recurring water intrusions from roofs, windows, exterior walls and Heating, Ventilation, and Air Conditioning (HVAC) plumbing create a damp environment favorable for mold proliferation. Beale AFB officials have been proactive in the creation of a base Mold Working Group and have taken appropriate actions to ensure the health of military family housing occupants. All mold assessment and remediation work is done in accordance with established industry guidelines. The lack of sufficient maintenance funds to adequately repair housing units contributes to the potential for water intrusion and limits Beale AFB's ability to remediate all damage caused by water intrusion. At the time of the AFIOH visit, approximately 440 of the 1552 housing units were inactive. The majority of these (approximately 229 units) were inactive due to water damage to the sub-slab ventilation plenum and ducting for the housing HVAC system. Approximately 80 housing units were inactive due to the significant visual presence of mold growth. Approximately 10 of these units have either undergone or are in the process of mold remediation work in order to return the units to active status.

While this assessment that the housing units do not represent an extraordinary health risk may be true for the occupants as a whole, there could be individuals who, by virtue of their individual history or other factors, might have an increased risk of health problems related to building factors. These individual should continue to seek support from their Primary Care Manager or Healthcare Provider, as appropriate.

The primary recommendation is to repair all sources of water intrusion in the housing units. This may be challenging given the on-going postponement of housing privatization initiatives and the lack of funds to perform necessary repairs. Beale AFB leadership is actively working with the Air Combat Command staff to secure funding necessary to adequately maintain housing units pending success of a housing privatization initiative.

The existing Mold Working Group should be formally chartered and the program formalized through the establishment of a specific plan to capture the process used at Beale AFB to evaluate water incursion, prevent conditions favorable for mold growth, assessment of mold presence, and ultimately mold remediation if necessary. Some of these procedures are captured in meeting notes and written responsibilities which should be expanded to capture the entire mold prevention, assessment, and remediation approach at Beale AFB.

Existing risk communication efforts should be continued at set intervals to ensure new housing occupants are adequately informed on the housing issues and understand the procedures used to communicate water incursions so as to preclude the need for mold remediation. MFH occupants should also continue to be educated on the health risks associated with mold exposure and the

Beale AFB process to assess and remediate mold to ensure the safety and health of all family members.

2. INTRODUCTION

2.1. Purpose: The Headquarters Air Combat Command Bioenvironmental Engineer (HQ ACC/SGPB) requested that the Industrial Hygiene Branch of the Air Force Institute for Operational Health (AFIOH/RSHI) conduct an independent evaluation of Beale AFB mold assessment and remediation efforts in military family housing (MFH) units. Northrop Grumman Mission Systems was tasked to provide this assessment and participated in an on-site visit to Beale AFB, 13 Aug 06. The visit included meetings with base officials, a tour of representative housing designs and mold issues, and a presentation at a “town-hall” meeting to communicate risk and address the concerns of housing residents.

2.2. Survey Personnel:

Mr Kevin Gabos, CIH, Environmental, Safety, and Health System Engineer, Northrop Grumman Mission Systems

Mr. Michael Lazenby, Physical Scientist, AFIOH/RSHI

2.3. Personnel Contacted:

Col Polumbo, 9 WG/CC

Col Borland, 9 SPTG/CC

Col Salvatore, 9 MDG/CC

Lt Col Griffin, 9 CES/CC

Mr Ah Sam, 9 CES/CD

Lt Col West, 9 AMDS/SGP

Ms Patton, 9 CES/CEH

Ms Jodrey, 9 CES/CEH

Ms Vergara, 9 CES/CEC

Capt Macatumbas, 9 AMDS/SGPB

SSgt Franklin, 9 AMDS/SGPB

Mr La Bruzzo, Deputy Project Manager, Chugach Industries, Inc

Mr Noyer, President, Consolidated Western Contractors, Inc

3. BEALE MOLD REMEDIATION PROCEDURES

The Beale AFB Mold Assessment Team had established procedures for MFH occupants to communicate water incursion/damage and mold concerns to base officials. Water incursion/damage and mold concerns are first reported to the Chugach Industries, Inc., the current housing maintenance contractor. Chugach Industries, Inc. creates a work order and schedules a site visit to assess the scope of the problem. If problem appears to be a water leak or a “fixable” repair, Chugach Industries, Inc. completes the repair. If the person complains of

upper respiratory, breathing problems, or increased allergies, Chugach Industries, Inc. contacts the Public Health Flight who instructs the person to notify their Primary Care Manager at the base clinic. If extensive visible mold is discovered and remediation is required, Chugach Industries, Inc. contacts the Housing Office and the Bioenvironmental Engineering Flight. A separate assessment is then conducted by the Housing Office and Bioenvironmental Engineering Flight to determine appropriate course of action. In many cases, the housing occupants are relocated immediately while the base works to determine potential for remediation activities.

Mid to Large Scale Remediation Activities are performed by a sub-contractor, Consolidated Western Contractors, Inc. During sub-contracted remediation activities, the housing units are vacant. Containment and engineering control devices are required of the subcontractor and HVAC systems are sealed with 6 mil polyethylene plastic sheeting.

Currently, Mid to Large Scale Remediation Activities are limited to those housing units where the duct work can be cleaned. Although the National Air Duct Cleaners Association (NADCA) recommends specific procedures for the cleaning of fiberglass lined ducts, the configuration of the HVAC ducting for many of the Beale AFB housing units would result in damage to the ducting material, making cleaning not appropriate.

After completing Mid to Large Scale Remediation Activities, an independent sub-contractor, Indoor Environmental Consultants, Inc., performs a post-mitigation assessment. The post-mitigation assessment by an industrial hygienist includes visual inspection, air and surface sampling.

4. ASSESSMENT OF BEALE MOLD REMEDIATION PROCEDURES

4.1. Mold Assessment: Representatives of the Beale AFB Housing Office, the Bioenvironmental Engineering Flight, and Chugach Industries, Inc., have satisfactorily completed training in Mold Assessment and meet the intent of the IICRC S520 Standard for an Indoor Environmental Professional (IEP). Representatives of Consolidated Western Contractors, Inc. and Indoor Environmental Consultants, Inc also have an appropriate degree of training and experience for the work being performed.

There are various classification schemes that can be applied to the assessment of mold in residential structures. There is no specific regulatory criterion that identifies a preferred scheme and associated actions.

The Institute of Inspection, Cleaning and Restoration Certification (IICRC) Standard S520, Standard for Professional Mold Remediation, defines three conditions:

1. Condition 1 (normal ecology) - An indoor environment that may have settled spores, fungal fragments or traces of actual growth whose identity, location and quantity is reflective of a normal fungal ecology for an indoor environment.

2. Condition 2 (settled spores and trace growth) - An indoor environment, which is primarily contaminated with settled spores that were dispersed directly or indirectly from a Condition 3 area, and which may have traces of actual growth
3. Condition 3 (actual growth) - an indoor environment contaminated with the presence of actual mold growth and associated spores. Actual growth includes growth that is active or dormant, visible or hidden.

Other classification schemes have been used to define the magnitude of Condition 2 or 3 situations in which actual growth is visible. For instance, the New York City Guidelines on Assessment and Remediation of Fungi in Indoor Environments identifies the following three levels of contamination:

1. Level I: Small Isolated Areas (10 square feet or less) - e.g., ceiling tiles, small areas on walls
2. Level II: Mid-Sized Isolated Areas (10 - 30 square feet) - e.g., individual wallboard panels.
3. Level III: Large Isolated Areas (30 - 100 square feet) - e.g., several wallboard panels.

Similarly, HQ USAF/ILE/SGO Memo, Interim Policy and Guidance for the Prevention, Surveillance, and Remediation of Water Damage and Associated Mold Contamination in Air Force (AF) Facilities, 10 May 2005, divided the scope of remediation activities into the following categories:

1. Small – Total Surface Area Affected Less Than 10 square feet
2. Medium – Total Surface Area Affected Between 10 and 100 square feet
3. Large – Total Surface Area Affected Greater Than 100 square feet of Potential for Increase Occupant or Remediator Exposure During Remediation Estimated to be Significant.

Beale AFB relies upon the visual identification of mold growth by housing occupants or through inspection associated with normal maintenance and housing occupant turn-over inspections. Water incursion through roofs, windows, and exterior wall cracks creates the conditions for mold growth to occur. Mold that is contained to a small area, with trace growth is usually referred back to the housing occupant for cleaning. This would typically relate to the IICRC S520 *Condition 1 or 2*, the New York City Guideline *Level I*, or the Air Force Category *Small*. In many cases at Beale AFB, the small appearance on an interior wall is the first indication of extensive mold presence in the wall interior and behind the wall baseboards. In these instances, the level of mold present would be at the IICRC S520 *Condition 2 or 3*, the New York City Guideline *Level II or III*, or the Air Force Category *Medium or Large*. If the visual presence of mold is at the IICRC S520 *Condition 2 or 3*, the New York City Guideline *Level II or III*, or the Air Force Category *Medium or Large*, occupants are typically moved from the housing unit and

a remediation plan considered based upon overall assessment of the condition of the housing unit and available funds.

In other Beale AFB housing units, water incursion in HVAC mechanical rooms leads to a favorable environment for mold growth. At Beale AFB, the visual presence of mold in these areas is typically at the IICRC S520 *Condition 2 or 3*, the New York City Guideline *Level II or III*, or the Air Force Category *Medium or Large*. Given the proximity of visible mold to the HVAC system components, and the amount of mold visually present, an assessment of the entire HVAC is typically warranted, as well as the need to clean the HVAC system. The National Air Duct Cleaners Association (NADCA)'s Assessment, Cleaning, of HVAC Systems (ACR 2006) provides specific procedures for cleaning ducts lined with fiberglass. As stated previously, the configuration of certain HVAC ducting systems at Beale AFB is not conducive to cleaning due to the potential for damage to the fiberglass duct liner.

Lastly, water incursion into the sub-slab HVAC ducting at Beale AFB significantly damaged the fiberglass duct liner making replacement of this ducting the only option. The Environmental Protection Agency (EPA), the National Air Duct Cleaners Association (NADCA), and the North American Insulation Manufacturer's Association (NAIMA) all recommend the replacement of wet or moldy fiber glass duct material. Once fiberglass duct liner is contaminated with mold, cleaning is not sufficient to prevent re-growth and there are no EPA-registered biocides for the treatment of porous duct materials. Beale AFB is looking to fund a project to install new HVAC ducting above the ceiling and remediate/remove the damaged ducting in many of these housing units.

4.2. Other HVAC Considerations: IICRC S520 highly recommends HVAC system cleaning be performed when an HVAC cleanliness inspection indicates that the system is contaminated with a significant accumulation of particulate or if microbial contamination reaches either IICRC S520 *Condition 2 or Condition 3*.

As stated previously, it is highly recommended that porous materials with actual fungal growth (*Condition 3*) be removed. When there is evidence of damage, deterioration, delaminating, friable material, mold growth, biological reservoirs or excessive moisture accumulation such that cleaning or resurfacing cannot restore fiber glass materials, it is highly recommended that these materials be replaced.

The EPA suggests consider having the air ducts in a home cleaned if "there is substantial visible mold growth inside hard surface (e.g., sheet metal) ducts or on other components of your heating and cooling system." For mold originating in the mechanic rooms, it is highly likely that the ducts and other components of the HVAC system need to be cleaned.

The IICRC S520 indicates "if the system has been confirmed by an Indoor Environmental Professional to be at *Condition 2 or Condition 3* status then the system must be cleaned." Currently, the presence of settled spores is assumed in the HVAC ducting based upon the visual presence of mold elsewhere in the residence is at levels corresponding with the New York City Guidelines *Level II or III* or the Air Force *Medium or Large* category. This is a conservative approach that is subject to the judgment of the IEP based upon the extent and location of visible

mold, the location and configuration of the HVAC ducting, and other factors involving the potential disturbance of the visible mold prior to containment and remediation. It was recommended to the Beale AFB Housing office and Bioenvironmental Engineering Flight to consider a test to determine if a housing unit could pass a post-remediation assessment after remediating a New York City Guidelines *Level II* or an Air Force *Medium* category mold growth without cleaning the HVAC of settled spores. This would be based upon early identification of the presence of mold and conditions that are favorable to minimize the release mold spores for entry into the ventilation system.

4.3 Remediation Activities: The MFH residences are unoccupied during New York City Guidelines *Level II or III* or the Air Force *Medium or Large* category mold remediation and reconstruction activities, remain unoccupied until all restoration work is complete, and post-remediation sampling has documented that the restoration measures have been adequate. At present, this is based upon surface and air sampling to determine if indoor mold spore levels are acceptable to outside baseline levels.

During remediation, HVAC system cold-air return, ducting components, and registers are sealed to prevent further spread of airborne mold spores.

All major exposed surfaces throughout the residence are cleaned by High-Efficiency Particular Air (HEPA) vacuum capable of 99.97% capture. At least two rounds of HEPA-vacuuming and damp wipe cleaning of all surfaces are conducted. Housing contents are cleaned in accordance with procedures established by the EPA, IICRC S520, and HQ USAF/ILE/S GO Memo, Interim Policy and Guidance for the Prevention, Surveillance, and Remediation of Water Damage and Associated Mold Contamination in Air Force (AF) Facilities, 10 May 2005.

After all surfaces throughout the residence have been vacuumed and cleaned, the residence is sealed off with access restricted for a period of no less than 48 hours. During this 48 hour period, negative air scrubbers inside the residence are continuously operated to filter airborne material from the air.

After 48 hours of continuous air scrubbing, the negative air equipment is turned-off allowing any suspended dust and mold spores to settle. The negative air machines are then turned off and sealed with 6 mil polyethylene plastic at the intakes/exhausts and removed from the residence. All areas inside the residence should remain closed with access restricted for another 8 hour period allowing the remainder of mold spores through the residence to settle onto horizontal surfaces. After the 8 hour period, all the horizontal surfaces within the residence are HEPA-vacuumed and cleaned via damp wipe. Post remediation surface and air sampling is then conducted.

These remediation practices are consistent with industry benchmark recommendations.

4.4. Sample Collection Activities: Samples collected by the independent sub-contractor, Indoor Environmental Consultants, Inc. appear to be collected in accordance with sampling and analytical protocols established by the American Conference of Industrial Hygienists (ACGIH), published in *Bioaerosols Assessment and Control*, Chapter 5, *Developing a Sampling Plan*.

4.5. Laboratory Analysis: Collected samples have been sealed, labeled, and submitted under chain-of-custody protocol to Environmental Microbiology Laboratory, Inc. (EML) in Sacramento, CA for analysis by a registered mycologist. EML is an Environmental Microbiology Laboratory Accreditation Program (EMLAP) accredited laboratory with the American Industrial Hygiene Association.

5. CONCLUSIONS

Unacceptable mold growth will continue based on current condition of housing units. Remediation activities provide for safe occupancy but do not totally eliminate potential for further water incursion. The Beale AFB Mold Assessment Team has adequate procedures to ensure the health and safety of housing occupants once the presence of mold is identified.

6. REFERENCES

Institute of Inspection, Cleaning and Restoration Certification (IICRC) Standard S520, Standard for Professional Mold Remediation, First Edition, Published 2003, Reprinted with typographical corrections. September, 2004.

National Air Duct Cleaners Association (NADCA), Assessment, Cleaning, of HVAC Systems (ACR 2006), Washington, DC, 2006

HQ USAF/ILE/SGO Memo, Interim Policy and Guidance for the Prevention, Surveillance, and Remediation of Water Damage and Associated Mold Contamination in Air Force (AF) Facilities, 10 May 2005

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United States Environmental Protection Agency. Mold Remediation in Schools and Commercial Buildings, March 2001.

American Conference of Industrial Hygienists (ACGIH), Bioaerosols Assessment and Control, 1999