

# **INDOOR ENVIRONMENTAL QUALITY EVALUATION**

**BATTLE RESIDENCE  
448 PRECIOUS STREET, VILLAS AT FORTUNA  
SAN ANTONIO, TEXAS**

Prepared for

**SAN ANTONIO HOUSING AUTHORITY  
SAN ANTONIO, TEXAS**

by

**ETC INFORMATION SERVICES, LLC**

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Project No. 7A-020  
April 30, 2007

Mr. Timothy Alcott  
San Antonio Housing Authority  
1315 N. Elmendorf  
San Antonio, Texas 78207

**Re: Indoor Environmental Quality Evaluation  
Battle Residence, 448 Precious Street, San Antonio, Texas**

Dear Mr. Alcott:

A copy of the report for the investigation of the referenced property is being forwarded to you for your information and necessary action. This report is part of a more comprehensive report on eleven properties in the Villas at Fortuna and Blueridge subdivisions. The comprehensive report should be used for a full introduction, discussion of field operations, and discussion.

We will be happy to answer any questions concerning this report. It has been a pleasure working with you on this important assignment. We look forward to being of continuing service to you.

Sincerely,

**ETC INFORMATION SERVICES, LLC**

Donald J. Schaezler, Ph.D., P.E., CIH  
President

## **1.0 INTRODUCTION AND BACKGROUND**

### **1.1 Purpose of the Evaluation**

The subject residence was evaluated for indoor environmental quality conditions March 29, 2007. The purposes of the evaluation were as follows:

- To interview residents about their complaints with respect to water damage, mold, health symptoms, and other indoor environmental issues
- To collect indoor air samples for identification and enumeration of airborne fungal spores and culturable fungi
- To collect indoor air samples for enumeration of fiber glass and other mineral fibers, pollen, skin cell fragments, and other particles
- To measure indoor air quality with respect to common chemical and physical parameters
- To evaluate apparent sources of water damage and visible mold in the residences
- To document areas with excess moisture content in building materials
- To assess, in a preliminary manner, the condition and performance of the HVAC systems
- If necessary, to recommend remediation, including preparation of a Mold Remediation Protocol

The investigation was performed at a screening level and was designed to obtain information on the overall condition of the residence. It was not intended to be in-depth investigations of all potential conditions that affect the indoor environment.

The investigation was conducted by Donald J. Schaezler, Ph.D., P.E., CIH, with assistance from other ETC staff. Dr. Schaezler is a licensed Mold Assessment Consultant (MAC), a licensed professional engineer (P.E.), and a Certified Industrial Hygienist (CIH).

### **1.2 Subject Residence**

The subject residence was in the Villas at Fortuna subdivision. The residence was apparently built by KB Homes in about 2000. It was initially leased, but was later sold and currently belongs to the Battles. Over the past several years, the residents in this and similar homes had complained to SAHA and KB about a variety of structural and indoor environmental issues. These complaints have triggered investigations by several consultants, including this report.

## 2.0 FIELD OPERATIONS

### 2.1 Description of Residences

The subject residence is approximately seven years old and is a single-family dwelling located in west San Antonio, between West Commerce and Culebra Road, near St. Mary's University. It appears to have a reinforced concrete foundation, Hardiplank® siding external wall finish, conventional wood framing, and a complex hip ad gable roof with composition shingles. It is a one-story structure with three bedrooms, two bathrooms, Kitchen, Breakfast Room, Living Room, Utility Closet, and an attached one-car Garage. The layout of the subject residence is shown schematically in Figure 2.

The residence had carpeting in bedrooms, the Living Room, and hallways. It had vinyl flooring in the Entry, Kitchen, Breakfast Room, bathrooms, and the Utility Closet. Interior finishes were typically textured and painted gypsum board.

There is a single, central HVAC system of split design. The condenser unit (CU) is outside on a concrete pad. The air handler unit (AHU) is in a hallway closet. Return air is routed through a grille in the lower closet door and up through a supporting platform to the AHU. The AHU has a return air filter, evaporator coil, blower, and electric heating unit. Supply air is routed up to the Attic through a ductboard plenum. Flexible runouts are attached to that plenum. The return air plenum is shared by a low profile hot water heater. The ceiling penetration in the HVAC Closet is sealed with aluminum foil duct tape. There were small openings to a chase behind the AHU and to the attic behind the supply air plenum.

The Utility Closet included connections for a washer and a dryer. The dryer exhausted to a vent stack located in a wall cavity, and the vent stack continued through the roof.

For simplicity of discussion in this report, Precious Street is assumed to run north-south. Directional references, such as front, right, rear, and left will refer to an observer facing the front of the house from the street. Back door refers to the side door to a side yard rather than to the rear of the house.

### 2.2 Observations

1. Mold growth and/or water staining was observed at many of the window sills, especially in the Master Bedroom.
2. Physical damage was observed at the Master Bath shower just above the fiberglass enclosure. This could lead to water damage on the wall.
3. The home had excessive dust in the return air plenum, including at the entrance to the air handler unit (AHU).
4. The home was using a low efficiency return air filter.
5. The evaporator coils had moderate accumulations of dust.

Areas with water damage and mold growth are summarized in Table 2, along with other characterizations of investigation results.

## **2.3 Field Measurements**

### **2.3.1 Moisture Content**

Moisture measurements were made for wood, sheetrock, and concrete surfaces in areas with visible or potential water damage with Delmhorst and Tramex moisture instruments. Measurements were also taken in background areas for comparison. Wet or moist conditions were not found in the Battle residence.

### **2.3.2 Air Quality**

During the survey, the indoor area was investigated by measuring general indoor air quality parameters to determine the potential for chemical and physical problems. Temperature, relative humidity, carbon dioxide, and carbon monoxide were measured using a Vulcain Safety Palm field instrument. Results are summarized in Table 3. Key points are discussed below.

1. The indoor relative humidity was unsatisfactory, and the dew points were marginally high.
2. Carbon dioxide values were unsatisfactory. The high values do not represent a direct health threat, but high values are associated with poor ventilation with fresh outdoor air and can cause some discomfort.
3. Carbon monoxide values were satisfactory.

### **2.3.3 Thermal performance of Heating, Ventilation, and Air-Conditioning Systems (HVACs)**

During the survey, the thermal performance of the HVAC system was evaluated by measuring the temperature of supply air and return air in the system, using a laser-focused infrared thermometer. The results are summarized in Table 4. The Battle residence was found to have marginal thermal performance.

## **2.4 Sampling**

The emphasis of the sampling program was to evaluate indoor air quality. Samples were collected from two locations, at the return air grille with the blower in the AHU on and in the Master Bedroom near the Master Bathroom.

## **2.5 Photographs**

Photographs of the subject residence are available for review.

### 3.0 RESULTS AND DISCUSSION

All sample results are included in the comprehensive report. The results are summarized in the tables and are discussed in this section for comparison purposes.

#### 3.1 Fungi in Air

Two sets of indoor air samples and two outdoor air samples were collected for each house. One set of indoor air samples was collected from near the return air grille, and one set was collected from a rear bedroom. Indoor air samples were collected for indirect evidence of water damage and mold amplification and to evaluate potential exposures to occupants of the house.

Outdoor air samples from the neighborhood were used for all houses in that neighborhood on that day.

Samples were collected for total bioaerosols, using Allergenco D cassettes, which are slit impaction samplers. Sampling was at 15 liters per minute for five minutes. The slides in the cassettes were interpreted microscopically by Aerotech and were analyzed for total bioaerosols. Results of analyses are summarized in Table 5.

Samples were also collected for culturable fungi, using a single stage Anderson-type impactor with potato dextrose agar plates. Sampling was at 28.3 liters per minute for three minutes. The plates were then reassembled, sealed with tape, and shipped to Aerotech for incubation and interpretation. Results of analyses are summarized in Table 6.

1. One sample for total bioaerosols was determined to be a bad sample, because of sampling or laboratory errors.
2. Based on the remaining samples, the Battle residence had low levels of total fungal spores and culturable fungi.
3. One set of samples had an elevated proportion of *Bipolaris/Drechlsera* spores and of culturable *Bipolaris* species. The levels of these fungal types were very low, and *Bipolaris* is not a primary indicator of water damage. Therefore, the results were not determined to be important with respect to water damage and the indoor environment.

#### 3.2 Fibers and Other Particles in Air Samples

The Allergenco D slides were evaluated by Aerotech for the presence of fibers and particles of potential interest other than fungal spores and mycelial fragments. The fibers found were compared specifically to attic insulation. The results are summarized

in Table 5. There were high concentrations of fibers in the one valid aerosol sample. There were low levels of skin cell fragments, pollen, insect parts, and fiberglass.

The fibers reported were found not to be from the attic insulation. The fibers were also not fiberglass.

### **3.3 Sources of Water Damage**

Based on field observations and measurements, apparent sources of water causing damages at the subject residences include the following:

1. Condensation at windows

## 4.0 CONCLUSIONS

1. The Battle residence had marginal thermal performance of the air-conditioning system. This may contribute to the high relative humidities found in the house.
2. The residence had high relative humidity during the preliminary investigation. High relative humidity is conducive to mold growth, dust mite proliferation, and other indoor environmental problems.
3. The house had inadequate filtration within the air handler unit (AHU). This condition will contribute to problems with excess dust in the house.
4. The residence appeared to have excess dust accumulated within the interior environment.
5. The Battle residence had symptoms of inadequate ventilation with fresh, outdoor air (High carbon dioxide concentration). This condition, at high occupancy levels, may exacerbate problems with high humidity.
6. The residence had conditions that are conducive to indoor environment complaints from residents, including the possible presence of pets and the existence of soiled carpeting.
7. The residence had some water damage and mold growth at many window sills. This damage is consistent with condensation that would occur during cold weather.
8. There were only low levels of total fungal spores and culturable fungi in the indoor air of the Battle residence.
9. There were elevated levels of *Bipolaris* in one set of indoor air samples. The levels were very low, and *Bipolaris* is not a primary indicator of water damage. Therefore, the results were not determined to be important with respect to water damage and the indoor environment.
10. High levels of fibers and moderate levels of skin cell fragments were found in the air samples. The fibers were not from the attic insulation and not fiberglass.

## 5.0 RECOMMENDATIONS

1. A technically competent HVAC contractor should evaluate the Battle residence for the size of the HVAC equipment, the capacity of the blower, the size of the plenums, the size and orientation of the ductwork, the size of the registers, the connections of all supply air components, the sealing of the HVAC Closet and return air plenum, the cleanliness of the system and the need for cleaning, the thermal performance of the system, the balance of the supply air system, the operation of the thermostat, the level of refrigerant in the system, and other aspects of the design and operation of the system.
2. The Battle residence should use high performance pleated return air filters, rated as MERV 8 or better.
3. Deficiencies in installation of doors and windows should be investigated and corrected as necessary. This should start with representative houses where problems have been observed and extended to other locations as appropriate.
4. During the evaluation of the HVAC systems and investigation of door and window installations, the Mold Assessment Consultant should evaluate the condition of the systems with respect to mold contamination.
5. *Bipolaris*, which was found at very low but elevated levels in two air samples, can have health implications with respect to allergic sinusitis and certain infections. Personal physicians for the Battles should be made aware of the presence of *Bipolaris* in the residence
6. The residence should be thoroughly cleaned. HEPA-vacuuming of all surfaces and HEPA-vacuuming plus hot water extraction of upholstery and carpeting by a professional cleaning company may be very useful to reduce the inventory of dust in the house. Together with use of high performance return air filters, this should help to correct the dust problems.
7. All penetrations of the ceilings (such as the peripheral edges of supply air ducts and vents and exhaust fans) and chases (such as at the HVAC closet) should be sealed.
8. All improperly finished sheetrock/shower-surround junctions should be properly repaired.

**TABLE 1 – SUMMARY OF RESIDENCES INVESTIGATED**

No.	Street	Occupant	Owner	Yr. Built	SF	Stories	Garage	Neighborhood	Subdivision	Date Investigated
448	Precious	Battle	Battle	2000	1283	One	1-car	Rosedale Park	Villas at Fortuna	3/29/07

**TABLE 2 – SUMMARY OF MOLD GROWTH, WATER DAMAGE AND MOISTURE CONTENT**

No.	Street	Occupant	Visible Mold Growth	Visible Water Damage	High Moisture Content
448	Precious	Battle	Window sills (slight)	Window sills (slight)	None

**Table 3 - Summary of Air Quality Measurements**

Location	Temp °F	RH %	CO <sub>2</sub> ppmv	CO ppmv	Dew Point °F
March 29, 2007					
Outside Air	70.9	84	448	0	65
Battle in LR	68.9	72	1885	0	59

Yellow-highlighted boxes indicate conditions that may be significant in evaluation of indoor environmental issues.

**TABLE 4 – SUMMARY OF HVAC SYSTEM OPERATION AND SPECIAL CONDITONS**

No.	Street	Occupant	AC Operation	AHU Cleanliness	Dew Point	IAQ CO <sub>2</sub> /CO	No. Occupants	Pets	Comments
448	Precious	Battle	Marginal	Poor	59	1885/0	Ca. 4	1 dog	Dog in Garage? Soiled carpets

Yellow-highlighted boxes indicate conditions that may be significant in evaluation of indoor environmental issues.

**TABLE 5 – SUMMARY OF AIRBORNE AND AHU PARTICLES**

No.	Street	Occupant	Sample Location	Total Fungal Spores	Unusual Spore Counts	Mycelial Fragments	Fiber Count	Skin Cell Fragments	Fiber-glass	
<b>3/29/07</b>										
Outdoor Air Samples – Villas at Fortuna										
402	Precious	O'Campo	Outside Air	5,973	No	40	<13	<13	<13	
Indoor Air Samples – Villas at Fortuna										
448	Precious	Battle	Return Air	320	<i>Bipolaris/Drech-slera</i>	133	1,040	1,867	<13	
448	Precious	Battle	MBR	Bad Sample						

Yellow-highlighted boxes indicate conditions that may be significant in evaluation of indoor environmental issues.

**TABLE 6 – SUMMARY OF AIRBORNE CULTURABLE FUNGI AND AHU SAMPLES**

No.	Street	Occupant	Sample Location	Total Fungi	Unusual Counts	Return Air Filter	Supply Air Plenum
<b>March 29, 2007</b>							
<b>Outdoor Air Sample – Villas at Fortuna</b>							
402	Precious	O'Campo	Outdoor Air	82	No CI; this may not be representative of the outdoor air that has affected the indoor air in the subject residences.		
<b>Indoor Air Samples – Villas at Fortuna</b>							
448	Precious	Battle	Return Air	153	No		
448	Precious	Battle	MBR	129	Bipolaris		

