

INDOOR ENVIRONMENTAL QUALITY EVALUATION

**ZARAGOSA RESIDENCE
1607 NW 26th, BLUERIDGE
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
Zaragosa Residence, 1607 NW 26th, 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. A remediation protocol is included in the report. 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 residence
- To document areas with excess moisture content in building materials
- To assess, in a preliminary manner, the condition and performance of the HVAC system
- 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 an in-depth investigation 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 Blueridge subdivision. The residence was apparently built by KB Homes in about 2000. It is owned by Randy and Carol Zaragosa. 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 Residence

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 and gable roof with composition shingles. It is a one-story structure with three bedrooms, two bathrooms, Kitchen, Breakfast Room, Living Room, Utility Room, and an attached one-car Garage. The layout of the subject residence is shown schematically in Figure 1.

The residence had ceramic tile in the Entry, Living Room, and Hall. It had carpeting in the bedrooms and vinyl flooring in the Entry, Kitchen, Breakfast Room, bathrooms, and the Utility Room. 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 Room 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, NW 26th 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 and Living Room. The growth was on the lower returns as well as the sills.
2. The home had dust in the return air plenum, including at the entrance to the air handler unit (AHU).
3. The home was using a low efficiency return air filter.
4. The carpet was clean in appearance but was stained.

5. The Attic was clean in overall appearance. There was no evidence of roof leaks or water stains on the framing.
6. There was an area in the right rear of the Attic where ceiling insulation had been removed and piled onto other areas. According to Mr. Zaragosa this must have been when alarm wiring was installed.
7. The supply air plenum, viewed from an access cut at the Attic, had dark debris on the ductboard liner.
8. The attempts to seal the Attic from the HVAC closet were not fully successful. Gaps were evident in the Attic.

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. No locations with moist or wet conditions were found in the Zaragosa 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. The house was not occupied at the time of the survey.

1. The indoor relative humidity was unsatisfactory. The dew points were marginally high.
2. Carbon dioxide values were marginally high. 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 zero.

2.3.3 Thermal performance of Heating, Ventilation, and Air-Conditioning System (HVAC)

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 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.

Samples were also collected from the return air filter and the supply air plenum to evaluate mold levels in the return and supply sides of the AHU system.

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 the Master 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. The Zaragosa residence had low levels of total fungal spores and culturable fungi.
2. The diversity of fungal spores in the sample at the return air grille was somewhat abnormal. The proportion of *Aspergillus/Penicillium*-like spores in that sample was somewhat elevated.
3. Mycelial fragments were somewhat elevated in that same sample.

3.2 Swab and Bulk Samples

A surface sample was taken from the return air filter with a sterile swab, and a bulk sample was collected from the supply air plenum by cutting a thin slice of material from the inside of the plenum at the Attic level. The samples were analyzed by microscopic examination and by culturing. Results of the analyses are summarized in Tables 5 and 6.

1. The return air filter in the Zaragosa residence had a very low level of total fungal spores and a moderate level of culturable fungi. There was a predominance of *Penicillium* species Variant 1. This finding is consistent with the possibly elevated levels of *Aspergillus/Penicillium*-like spores found in one air sample and may also be indicative of growth occurring on the filter itself.
2. The supply air plenum in the Salazar residence had low levels of total fungal spores and culturable fungi.

3.3 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. Compared to samples collected from other houses, there were high concentrations of fibers, but low levels of skin cell fragments and fiberglass in the samples.

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

3.4 Sources of Water Damage

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

1. Condensation at windows
2. Possible water intrusion at some windows

4.0 CONCLUSIONS

1. The Zaragosa residence had marginal performance of the air-conditioning system.
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). The residence appeared to have excess dust accumulated within the interior environment.
4. The residence appeared to have excess dust accumulated within the interior environment.
5. The residence had symptoms of inadequate ventilation with fresh, outdoor air (high carbon dioxide concentrations). Inadequate ventilation, at high occupancy levels, may exacerbate problems with high humidity.
6. The residence had some water damage and mold growth at several window sills. This damage is consistent with condensation that would occur during cold weather. Rain water intrusion may also be occurring at some windows.
7. The cleanliness of the AHU Closet and system was poor, and the thermal performance of the AHU system was marginal.
8. There were somewhat elevated proportions of *Aspergillus/Penicillium*-like spores in the indoor air sample from near the return air grille.
9. High levels of fibers were found in both air samples. The particles identified as “fibers” were not from the attic insulation and not fiberglass.

5.0 RECOMMENDATIONS

1. A technically competent HVAC contractor should evaluate the Zaragosa 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 Zaragosa 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 corrected as necessary.
4. During the evaluation of the HVAC system and investigation of door and window installations, the Mold Assessment Consultant should evaluate the condition of the system with respect to mold contamination.
5. Because of the elevated proportions of *Aspergillus/Penicillium*-like spores, the Zaragosa residence should be evaluated further.
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 houses. Badly soiled carpet should be discarded. 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 peripheral edges of supply air ducts and vents and exhaust fans) and chases (such as at the HVAC closet) should be sealed.
8. Improperly finished sheetrock/shower-surround junctions should be properly repaired.

Indoor Environmental Evaluation – Zaragosa Residence – 1607 NW 26th

TABLE 1 – SUMMARY OF RESIDENCE CHARACTERISTICS

No.	Street	Occupant	Owner	Yr. Built	SF	Stories	Garage	Neighborhood	Subdivision	Date Investigated
1607	NW 26th Street	Zaragosa	Zaragosa	2000	1269	One	1-car	Cenizo Park	Blueridge	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
1607	NW 26th Street	Zaragosa	Window sills/returns	Window sills (slight)	

**Table 3
Summary of Air Quality Measurements**

Location	Temp °F	RH %	CO ₂ Ppmv	CO Ppmv	Dew Point °F
March 29, 2007					
Outside Air	70.9	84	448	0	65
Zaragosa at return air grille	70.9	75	1168	0	62
Zaragosa in MBR	71.7	72	1224	0	62

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

Indoor Environmental Evaluation – Zaragosa Residence – 1607 NW 26th

TABLE 4 – SUMMARY OF HVAC SYSTEM OPERATION AND SPECIAL CONDITONS

No.	Street	Occupant	AC Operation	AHU Cleanliness	Dew Point	IAQ CO ₂ /CO	No. Occupants	Pets	Comments
1607	NW 26th Street	Zaragosa	Marginal	Poor	62	1224/0	Ca. 4		Living Room and Hall carpeting has been replaced with ceramic tile

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	Pollen	AHU
3/29/07											
Outdoor Air Samples – Blueridge											
1607	NW 26 th	Zaragosa	Outside Air	5,293	No	40	<13	13	<13	187	
Indoor Air Samples – Blueridge											
1607	NW 26 th	Zaragosa	Return Air	560	Possibly As/Pn*	293	1,253	2,133	<13	120	Low spores
1607	NW 26 th	Zaragosa	MBR	93	No	27	1,267	2,547	<13	<13	

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
March 29, 2007							
Outdoor Samples – Blueridge							
1607	NW 26 th St.	Zaragosa	Outdoor Air	35	No CI; this may not be representative of the outdoor air that has affected the indoor air in the subject residences.		
Indoor Samples – Blueridge							
1607	NW 26th St.	Zaragosa	Return Air	59	No	Moderate counts, high <i>Penicillium</i>	Mod. counts, <i>Cladosporium</i>
1607	NW 26th St.	Zaragosa	MBR	24	No		

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

