

INDOOR ENVIRONMENTAL QUALITY EVALUATION

**ARISPE RESIDENCE
1615 NW 26TH STREET, 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
May 17, 2007

Mr. Timothy Alcott
San Antonio Housing Authority
818 South Flores
San Antonio, Texas 78204

**Re: Indoor Environmental Quality Evaluation
Arispe Residence, 1615 NW 26th 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 ten properties in the Villas at Fortuna, Blueridge, and Sunflower 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 April 18, 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 investigations were performed at a screening level and were designed to obtain information on the overall condition of the residence. They were not intended to be in-depth investigations of all potential conditions that affect the indoor environment.

The investigations were 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 was purchased by the Arispe family. Over the past several years, the residents in 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 carpeting in the bedrooms, the Living Room, and the hallways. It had vinyl flooring in the Entry, Kitchen, 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 near the living room. 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, probably, to the attic behind the supply air plenum.

The Utility Room included connections for a washer and a dryer.

For simplicity of discussion in this report, NW 26th Street is assumed to run north-south. The subject residence is on the west side of the street, and the house is assumed to face east. Directional references, such as front, right, rear, and left will refer to an observer facing the front of the house from the street.

2.2 Observations

1. The resident was present during the investigation.
2. There was significant water damage and mold growth at many of the window sills in the residence. At some windows, the mold growth extended from the sill to about six inches above the sill.
3. There was minor water damage and mold growth in small areas under the showerhead and at the head of the tub in the Master Bathroom.
4. There was water damage and mold growth near the back door on trim materials. The visible damage was minor, but the homeowner indicated the door had been repaired and recaulked.

5. The home had significant dust in the return air plenum, including at the entrance to the air handler unit (AHU), and on the evaporator coils.
6. The coils had been cleaned, and some of the fins had been damaged. There was significant accumulation of dry scum at the periphery of the coils that had not been removed by cleaning.
7. There were indications that the indoor environment has excessive dust levels.
8. The home was using a pleated return air filter, but the efficiency of the filter could not be determined.

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. There was excess moisture on the lower wall and trim near the head of the tub in the Master Bathroom, on the wall under the showerhead in the Master Bathroom, and on trim near the back door.

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 occupied at the time of the survey.

1. The indoor relative humidity was marginally satisfactory.
2. Carbon dioxide values were satisfactory, but there was low occupancy when the measurements were taken.
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 Arispe Residence had marginal thermal performance. The results are summarized in Table 4.

2.4 Sampling

The emphasis of the sampling program was to evaluate indoor air quality. The blower in the AHU was turned on before sampling. Samples were collected from two locations, at the return air grille 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

Three sets of indoor air samples and one outdoor air sample were collected for the house. One set of indoor air samples was collected from near the return air grille, one set was collected from the Master Bedroom near the Master Bathroom, and a third was collected from the third 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 Arispe front yard and the front yard at 111 Villa Arboles were used for comparison.

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. Outdoor air had typical levels of total fungal spores, dominated by *Cladosporium* and with significant proportions of Basidiospores and Ascospores.
2. Indoor air had moderate to high levels of total fungal spores.
3. At the return air grille, total fungal spores were at high levels, dominated by *Cladosporium* and *Aspergillus/Penicillium*-like spores. There were also relatively high levels of *Alternaria* compared to outdoor air.
4. In the Master Bedroom, there were moderate levels of total fungal spores, dominated by *Cladosporium* and *Alternaria* and with a significant proportion of *Aspergillus/Penicillium*-like spores.

5. Outdoor air had moderate to high levels of culturable fungi, dominated by *Cladosporium*.
6. Indoor air had somewhat high levels of culturable fungi, but lower than outdoor air, also dominated by *Cladosporium*. There were moderate levels and significant proportions of culturable *Penicillium*. There were no culturable *Alternaria* in these samples.
7. These results indicate that there are likely to be significant sources of growth of *Penicillium* in the Arispe residence.

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. Compared to samples collected from other houses, there were low to moderate concentrations of fibers in the two samples. There were high to very high levels of skin cell fragments in the two indoor air samples.

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 residence include the following:

1. Condensation at windows
2. Possible rain water intrusion at windows
3. Rain water intrusion at the back door
4. Overspray from showers onto nearby walls and floors, including the upper wall for the Master shower

4.0 CONCLUSIONS

1. The Arispe Residence had marginal thermal performance of the air-conditioning system.
2. The residence had marginally satisfactory relative humidity during the preliminary investigation, but the dew point was satisfactory.
3. The house may have had adequate filtration within the air handler unit (AHU), but that could not be determined. Inadequate filtration will contribute to accumulation of debris on the evaporator coils and contribute to problems with excess dust in the house.
4. The residence appeared to have excess dust accumulated within the interior environment.
5. The residence had significant water damage and mold growth at many of the window sills, including mold growth at least six inches above the sill in some places. This damage is consistent with condensation that would occur during cold weather, exacerbated by rain water intrusion.
6. There was minor water damage and mold growth on the trim at the back door. The trim had an elevated moisture content. The damage is consistent with a history of rain water intrusion and repairs.
7. There was water damage and mold growth in a small area of the lower wall and base trim at the head of the tub in the Master Bathroom. The damage is consistent with overspray from the shower.
8. There was minor water damage in a small area of sheetrock wall below the shower head in the Master Bathroom. The damage is consistent with overspray or drips from the showerhead.
9. The cleanliness of the AHU system was unsatisfactory. The thermal performance of the air-conditioning system was marginal.
10. There were significantly elevated levels of total fungal spores, *Aspergillus/Penicillium*-like spores, and culturable *Penicillium* in the indoor air.
11. The indoor air results indicate that there are likely sources of *Penicillium* growth in the Arispe residence.
12. There were low concentrations of fibers in the two samples. There were high to very high levels of skin cell fragments in the two indoor air samples.

5.0 RECOMMENDATIONS

1. A technically competent HVAC contractor should evaluate the Arispe 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. All deficiencies should be corrected, including cleaning of the evaporator coils outside of the house.
2. The Arispe 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. All windows with visible damage, and the back door, should be remediated from the inside and repaired from the outside as necessary. This work should be done with source and/or local containment, air-scrubbing, and with a HEPA-vacuum for collection of dust as it is generated.
4. Mold contamination likely affects areas with less than 25 contiguous square feet. Therefore, the mold assessment and the remediation work may not be required to follow the Texas Mold Assessment and Remediation Rules (TMARR). A mold Remediation Protocol is not being prepared for the work recommended above. If during remediation it is determined that the TMARR must be followed, work should cease, and work should then be completed in full compliance with the TMARR.
5. During the evaluation of the HVAC system and investigation/remediation of door and window installations, the Mold Assessment Consultant should evaluate the condition of the system with respect to mold contamination.
6. Following remediation procedures, the residence should be thoroughly cleaned. HEPA-vacuums of all surfaces and HEPA-vacuums 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.

9. The damaged areas around the tub in the Master Bedroom should be remediated using source containment, air scrubbing, and normal remodeling procedures.
10. Because of the multiple areas of remediation and the need to clean the residence after remediation, it would be practical for the residents to move from the home during the remediation and cleaning procedures.

TABLE 1 – SUMMARY OF RESIDENCE CHARACTERISTICS

No.	Street	Resident	Owner	Yr. Built	SF	Stories	Garage	Floor Plan	Subdivision	Date Investigated
1615	NW 26 th Street	Arispe	Arispe	2000	1283	1	1-car	I	Blueridge	18-Apr

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

No.	Street	Resident	Visible Mold Growth	Visible Water Damage	High Moisture Content
1615	NW 26 th Street	Arispe	Most window sill corners, well above sill level Master Bath lower wall and trim at head of tub (minor) Trim near back door (minor)	Most window sill corners, well above sill level Master Bath lower wall and trim at head of tub (minor) Master Bath wall below shower head Trim near back door (minor)	Moist on trim near back door Moist on wall below shower head Wet on lower wall and trim at head of tub

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

**Table 3
Summary of Air Quality Measurements**

Location	Temp °F	RH %	CO ₂ Ppmv	CO Ppmv	Dew Point °F
April 18, 2007					
Outside Air	67.4	51	438	0	48
Inside Air					
1615 NW 26 th (Arispe) K	70.6	54	605	0	52.5
1615 NW 26 th (Arispe) RA	69.2	58	858	0	53
1615 NW 26 th (Arispe) MBR	69.5	61	955	0	54.5

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

Indoor Environmental Evaluation – Arispe Residence – 1615 NW 26th Street

TABLE 4 – SUMMARY OF HVAC SYSTEM OPERATION AND SPECIAL CONDITONS

No.	Street	Resident	AC Operation	AHU Cleanliness	Dew Point	IAQ CO ₂ /CO	No. Occupants	Pets	Comments
111	Villa Arboles	None	Marginal ΔT= 12°	Dusty return air plenum Excessive dry debris on coils	54.5	955/0	4	0	

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	Resident	Sample Location	Total Fungal Spores	Unusual Spore Counts	Mycelial Fragments	Fiber Count	Skin Cell Fragments	Fiber-glass	Pollen	AHU
April 18, 2007											
Outdoor Air Samples –Blueridge											
111	Villa Arboles	None	OA-front	2920	Cl>Bas>Asc	<13	27	67	<13	80	
1615	NW 26 th St	Arispe	OA-front	2440	Cl>Bas, Asc	67	13	67	<13	80	
Indoor Air Samples – Blueridge											
1615	NW 26 th St	Arispe	Return Air	3,293	Cl>As/Pn>Alt 1,320 As/Pn	93	987	4,387	<13	27	
1615	NW 26 th St	Arispe	MBR	867	Cl>Alt>As/Pn	147	587	7,093	<13	67	

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

Alt denotes *Alternaria*. As/Pn denotes *Aspergillus/Penicillium*-like spores. Asc denotes Ascospores. Bas denotes Basidiospores. Bi denotes *Bipolaris/Drechslera*. Cl denotes *Cladosporium*. Sm denotes Smuts/Myxomycetes/*Periconia*
A>B, C denotes that type A is more numerous than type B, which in turn has the same numbers as type C.

TABLE 6 – SUMMARY OF AIRBORNE CULTURABLE FUNGI AND AHU SAMPLES

No.	Street	Resident	Sample Location	Total Fungi	Unusual Counts	Return Air Filter	Supply Air Plenum
April 18, 2007							
Outdoor Air Samples – Blueridge							
111	Villa Arboles	None	OA – front	1,000	Cl>>StH		
1615	NW 26 th St	Arispe	OA - front	4,824	Cl>>StH		
Indoor Air Samples – Blueridge							
1615	NW 26 th St	Arispe	Return Air	1,988	Cl>Pn Pn 365		
1615	NW 26 th St	Arispe	MBR	1,882	Cl>Pn Pn 518		

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

As denotes *Aspergillus*, Aur denotes *Aureobasidium*, Bi denotes *Bipolaris*, Cl denotes *Cladosporium*, Pn denotes *Penicillium*, Spo denotes *Sporotrichum*, Y denotes yeast, and StH denotes sterile Hyphae.

