

INDOOR ENVIRONMENTAL QUALITY EVALUATION

**SALAZAR RESIDENCE
139 VILLA GRANDE, BLUERIDGE
SAN ANTONIO, TEXAS**

Prepared for

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

by

ETC INFORMATION SERVICES, LLC

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

April 2007

ETC INFORMATION SERVICES, LLC
19349 Old Wiederstein Road • Cibolo, Texas 78108-1916
210/659-4747 • 210/659-8199 fax • donald@schaezler.net
engineering, technology, consulting

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
Salazar Residence, 139 Villa Grande, 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 April 5, 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 Mary Salazar. 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 Closet, and an attached one-car Garage. The layout of the subject residence is shown schematically in Figure 2.

The residence had carpeting in the Living Room, Hall, and in the bedrooms and 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, Villa Grande 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. The home had dust in the return air plenum, including at the entrance to the air handler unit (AHU) and also on carpets at doorways and on horizontal surfaces.
3. The home was using a low efficiency return air filter.
4. The carpet was clean in appearance, but dark dust had accumulated under the doors of the bedrooms, where return air flows on its way to the return air grille.

5. In Bathroom 2 there was some water damage on the sheetrock wall and some mold growth on the shower surround.
6. The Attic was clean in overall appearance. There was no evidence of roof leaks or water stains on the framing.
7. The supply air plenum, viewed from an access cut at the Attic, had dark debris on the ductboard liner.

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. Locations with moist or wet conditions are summarized in Table 2.

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 marginally high. The dew points were satisfactory.
2. Carbon dioxide values were 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 between zero and one ppmv.

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

The thermal performance of the HVAC system was not evaluated because of cool outside conditions.

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.

A bulk sample was collected from the supply air plenum to evaluate mold levels in the supply side 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

In general, two sets of indoor air samples and two outdoor air samples were collected from 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. The Salazar residence had low to moderate 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. Total fungal spores in that sample were significantly greater than in the other indoor air sample.
3. Mycelial fragments were somewhat elevated in that same sample.

3.2 Swab and Bulk Samples

A bulk sample was collected from the supply air plenum. The sample was analyzed by microscopic examination and by culturing. Results of the analyses are summarized in Tables 5 and 6. Supply air plenums and ductwork often experience moist conditions, because condensation is often taking place at the evaporator coils just upstream. Supply side samples may indicate if the supply air distribution system is a source or pathway for microbial matter in the indoor environment.

1. The supply air plenum in the Salazar residence had very 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 skin cell fragments, marginally high levels of fibers, and low levels of 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. Drip or overspray from the shower head onto nearby walls

4.0 CONCLUSIONS

1. The residence had marginally high relative humidity during the preliminary investigation.
2. The house had inadequate filtration within the air handler unit (AHU). This condition will contribute to problems with excess dust in the house.
3. The residence appeared to have excess dust accumulated within the interior environment.
4. 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.
5. 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.
6. The cleanliness of the AHU Closet and system was poor. The thermal performance of the AHU system was not checked.
7. There were somewhat elevated proportions of *Aspergillus/Penicillium*-like spores in the indoor air sample from near the return air grille.
8. High concentrations of skin cell fragments and marginally 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 Salazar 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 Salazar 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 Salazar 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 – Salazar Residence – 139 Villa Grande

TABLE 1 – SUMMARY OF RESIDENCE CHARACTERISTICS

No.	Street	Occupant	Owner	Yr. Built	SF	Stories	Garage	Neighborhood	Subdivision	Date Investigated
139	Villa Grande	Salazar	Salazar	2000	1283	One	1-car	Cenizo Park	Blueridge	4/5/07

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

No.	Street	Occupant	Visible Mold Growth	Visible Water Damage	High Moisture Content
139	Villa Grande	Salazar	Window sills (slight); Bathroom 2 shower surround	Window sills (slight); sheetrock wall under shower head in Bathroom 2	

**Table 3
Summary of Air Quality Measurements**

Location	Temp °F	RH %	CO ₂ Ppmv	CO Ppmv	Dew Point °F
April 5, 2007					
Outside Air	62.1	43	428	0	39
Salazar at return air grille	71.1	65	1640	0	58
Salazar in MBR	73.8	61	1671	0-1	59

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

Indoor Environmental Evaluation – Salazar Residence – 139 Villa Grande

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
139	Villa Grande	Salazar	Not checked	Poor	59	1671/0	3		

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
4/5/07											
Outdoor Air Samples – Blueridge											
139	Villa Grande	Salazar	Outside Air	2,173	No	173	80	27	13	520	
139	Villa Grande	Salazar	Outside Air	1,853	No	67	53	733	<13	333	
Indoor Air Samples – Blueridge											
139	Villa Grande	Salazar	Return Air	1,360	Possibly As/Pn*	173	1,093	4,573	53	213	v. low spores
139	Villa Grande	Salazar	MBR	520	No	53	827	4,880	<13	67	

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
April 5, 2007							
Outdoor Air Sample – Blueridge							
139	Villa Grande	Salazar	Outdoor Air	1,000	<i>Cladosporium</i> dominant		
Indoor Air Samples – Blueridge							
139	Villa Grande	Salazar	Return Air	447	No		Very low counts, all <i>Cladosporium</i>
139	Villa Grande	Salazar	MBR	376	No		

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

