

INDOOR ENVIRONMENTAL QUALITY EVALUATION

**LUCIO RESIDENCE
1507 VILLA FLORES, SUNFLOWER
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

May 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
May 17, 2007

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

**Re: Indoor Environmental Quality Evaluation
Lucio Residence, 1507 Villa Flores, 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 17, 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 Sunflower subdivision. The residence was apparently built by KB Homes in about 2000. It has been purchased the Lucio 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 southwest San Antonio, near Castrovilla Road and S. San Joaquin. 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 bedrooms, the Living Room, and the hallways. It had vinyl flooring in the Entry, Kitchen, 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 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 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 Flores is assumed to run north-south. The subject residence is at the north end of a cul-de-sac, and the house is assumed to face south. 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. According to the homeowner, her Grandmother can smell mold in Bedroom 3 when she stays there.
2. The homeowner related that past plumbing leaks have been repaired in the Kitchen, Master Bathroom, and Bathroom 2.
3. The sink cabinet in the Master Bathroom was visibly damaged from the old leak.
4. Significant mold growth was present on the Master Bedroom rear window. This is a north-facing window.

5. The carpeting appeared to be very clean.
6. The home had dust in the return air plenum, including at the entrance to the air handler unit (AHU).
7. The home was using a high efficiency, pleated return air filter.
8. There was a significant accumulation of debris on the evaporator coils, mostly in the form of dry scum at the periphery of the coils.

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. Excess moisture was found on base trim near the head of both tubs.

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 high, but the dew point was satisfactory.
2. Carbon dioxide values were high.
3. Carbon monoxide values were zero to one ppmv.

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 Lucio Residence had good 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 three locations, at the return air grille, in the Master Bedroom near the Master Bathroom, and in the third bedroom.

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 Lucio front yard 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 low but typical levels of total fungal spores, dominated by *Cladosporium* and with significant proportions of Ascospores and Basidiospores.
2. Indoor air had low to very low levels of total fungal spores. *Cladosporium* and Basidiospores were the predominant spore types. *Aspergillus/Penicillium*-like spores were present at trace levels.
3. Outdoor air had moderate levels of culturable fungi, dominated by *Cladosporium* and yeast and with a trace level of *Aspergillus* species.
4. Indoor air had low levels of culturable fungi, in comparison to outdoor air, also dominated by *Cladosporium*. There were trace levels of culturable *Aspergillus*.
5. These results indicate that there are not likely to be significant sources of mold growth in the Lucio 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 concentrations of fibers in the three samples. There were high levels of skin cell fragments in the two of the three 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. Overspray from showers onto nearby walls and floors, including the upper wall for the Master shower
3. Past plumbing leaks that have been repaired

4.0 CONCLUSIONS

1. The Lucio Residence had good thermal performance of the air-conditioning system.
2. The residence had unsatisfactory relative humidity during the preliminary investigation.
3. The house had adequate filtration within the air handler unit (AHU). Based on the condition of the evaporator coils, this may not always have been the case. Poor filtration will contribute to accumulation of debris on the evaporator coils and contribute to problems with excess dust in the house.
4. The evaporator coils had excessive debris.
5. The residence appeared to have excess dust accumulated within the interior environment.
6. The residence had inadequate ventilation with fresh, outdoor air (high carbon dioxide concentrations).
7. The residence had some water damage and mold growth at the rear window sills in the Master Bedroom. This damage is consistent with condensation that would occur during cold weather.
8. The cleanliness of the AHU system was poor. The thermal performance of the air-conditioning system was good.
9. There were normal levels of total fungal spores and culturable fungi in the indoor air.
10. There were low concentrations of fibers in the three samples. There were high levels of skin fragments and fiberglass in the two of the three indoor air samples.

5.0 RECOMMENDATIONS

1. A technically competent HVAC contractor should evaluate the Lucio 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 Lucio Residence should continue to 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. This appears to be minor in nature at this house.
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. 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.
6. Improperly finished sheetrock/shower-surround junctions should be properly repaired.
7. The cabinet in the Master Bathroom should be replaced, and the cavity under the cabinet should be cleaned.
8. The work recommended above is not considered to be mold remediation and will 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 the work it is determined that the TMARR must be followed, work should cease, and work should then be completed in full compliance with the TMARR.
9. Following the work recommended above, 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 continued use of high performance return air filters, this should help to correct the dust problems

TABLE 1 – SUMMARY OF RESIDENCE CHARACTERISTICS

| No. | Street | Resident | Owner | Yr. Built | SF | Stories | Garage | Floor Plan | Subdivision | Date Investigated |
|------|--------------|----------|-------|-----------|------|---------|--------|------------|-------------|-------------------|
| 1507 | Villa Flores | Lucio | Lucio | 2000 | 1283 | 1 | 1-car | II | Sunflower | 17-Apr |

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

| No. | Street | Resident | Visible Mold Growth | Visible Water Damage | High Moisture Content |
|------|--------------|----------|----------------------------|-------------------------|--------------------------------------|
| 1507 | Villa Flores | Lucio | Master Bedroom rear window | Master Bathroom cabinet | Base trim near the head of both tubs |

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 17, 2007 | | | | | |
| Outside Air | 65.1 | 94 | 459 | 0 | 62.5 |
| Inside Air | | | | | |
| 1507 Villa Flores (Lucio) K | 70.9 | 66 | 2023 | 0 | 58 |
| 1507 Villa Flores (Lucio)RA | 69.9 | 63 | 2023 | 0 | 56 |
| 1507 Villa Flores (Lucio)BR3 | 71.9 | 60 | 2012 | 1 | 56.5 |

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

Indoor Environmental Evaluation – Lucio Residence – 1507 Villa Flores

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 |
|------|--------------|----------|--------------|--|-----------|-------------------------|---------------|------|---|
| 1507 | Villa Flores | Lucio | Good | Dusty return air plenum Excessive dry debris on coils | 58 | 2023/0 | 4 | 0 | Old water damage was not fully cleaned. |

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 17, 2007 | | | | | | | | | | | |
| Outdoor Air Samples – Sunflower | | | | | | | | | | | |
| 1507 | Villa Flores | Lucio | OA-front | 1067 | Cl>Asc>Bas | 27 | 147 | 347 | 13 | 27 | |
| Indoor Air Samples – Sunflower | | | | | | | | | | | |
| 1507 | Villa Flores | Lucio | MBR | 213 | Cl>Bas | <13 | 560 | 4,417 | 13 | 53 | |
| 1507 | Villa Flores | Lucio | Return Air | 267 | Cl>Bas>As/Pn, Sm | 27 | 707 | 5,653 | <13 | 40 | |
| 1507 | Villa Flores | Lucio | BR3 | 67 | Bas, As/Pn | <13 | 400 | 1,013 | <13 | <13 | |

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

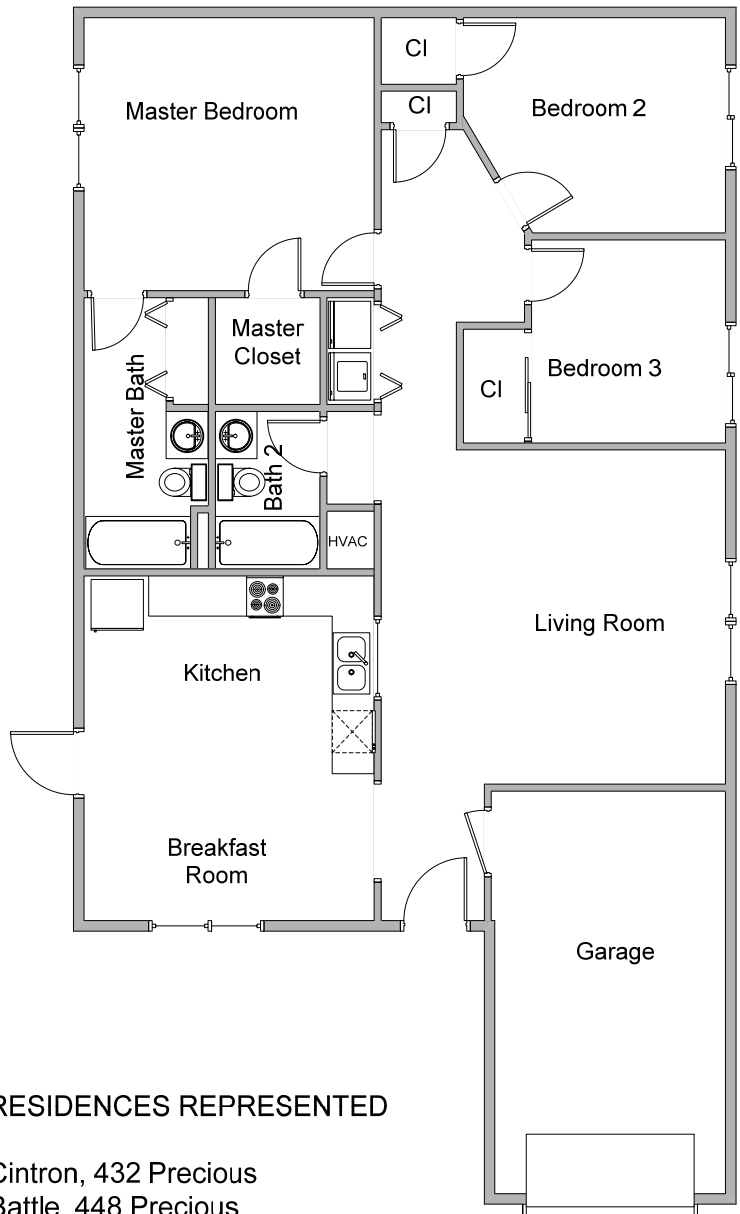
Alt denotes *Alternaria*. As/Pn denotes *Aspergillus/Penicillium*-like spores. Asc denotes Ascospores. Bas denotes Basidiospores. Bi denotes *Bipolaris/Drechslera*. Cl denotes *Cladosporium*. Sm denotes Smuts/Myxomycetes/*Periconia*. A>B, C denotes that type A is more numerous than type B, which in turn 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 17, 2007 | | | | | | | |
| Outdoor Samples – Sunflower | | | | | | | |
| 1507 | Villa Flores | Lucio | OA-front | 365 | Cl>Y>Spo | | |
| Indoor Air Samples – Sunflower | | | | | | | |
| 1507 | Villa Flores | Lucio | MBR | 176 | Cl>As | | |
| 1507 | Villa Flores | Lucio | Return Air | 235 | Cl>Y>StH | | |

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.



RESIDENCES REPRESENTED

- Cintron, 432 Precious
- Battle, 448 Precious
- De Los Santos, 506 Precious
- Rojas, 126 Villa Grande
- Salazar, 139 Villa Grande
- Lucio, 1507 Villa Flores

| | | |
|--------------------------------------|---------------------------|-----------------------------|
| ETC Information Services, LLC | MIRASOL RESIDENCES | FIGURE 2 |
| | LAYOUT 2 | Scale: Approx. 1/8" = 1' |
| | | Drawn By: DJS 041007 |