

# **INDOOR ENVIRONMENTAL QUALITY EVALUATION**

**ROJAS RESIDENCE  
126 VILLA GRANDE, 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  
Rojas Residence, 126 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 March 29, 2007, and April 23, 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).

On April 23, 2007, Dr. Schaezler observed and assisted a structural investigation of water intrusion through the building envelope by Rimkus Consulting Group, Inc. This investigation included some deconstruction of suspect areas.

### **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 Jose and Mary Rojas. 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 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, 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 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 evaporator coils were being cleaned by a foaming coil cleaner. The label for this cleaner said that it should not be used indoors and should not be used for evaporator coils. The gas released from the foam was interfering with the indoor air quality meter, and readings for carbon monoxide could not be obtained.
3. The home had some 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. There were water stains on the tackboard and carpet in the hallway to the AHU and to Bathroom 2.
6. There were some water stains on the floor of the return air plenum and at the base of the hot water heater.
7. There was a small amount of mold growth on one wall of the return air plenum.
8. The shelf for the Kitchen sink cabinet had either been replaced or covered with a  $\frac{3}{4}$ -inch thick piece of plywood. According to the homeowner, there had been several leaks under the sink, the shelf had collapsed, and, after several repairs, the new shelf had been installed.

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. See Table 2 for areas with excess moisture.

### 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 and dew point were unsatisfactory. The HVAC system was not operating, because the evaporator coils were being cleaned.
2. Carbon dioxide values were satisfactory. This was partially due to windows and doors being open during the cleaning of the evaporator coils.
3. Carbon monoxide values could not be determined because of interferences from the cleaning chemical for the evaporator coils.

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

The thermal performance of the HVAC system could not be evaluated, because the evaporator coils were being cleaned.

## **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 the 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 Rojas residence had elevated levels of total fungal spores, dominated by *Cladosporium* and *Aspergillus/Penicillium*-like spores, in both indoor air samples. There were also elevated levels of culturable fungi, dominated by *Cladosporium* and *Penicillium* and with some *Aspergillus* in one sample.

#### 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 moderate concentrations of fibers in both samples. There were high concentrations of skin cell fragments in both samples. There were high concentrations of fiberglass in the sample from the Living Room.

The particles reported as “fibers” 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. Multiple, past water leaks at the Kitchen sink.
2. Condensation at windows
3. Possible water intrusion at the Master Bedroom window
4. Rain water intrusion at the back door
5. Overspray from showers onto nearby walls and floors

## 4.0 CONCLUSIONS

1. 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. The air-conditioning system was not operating because the coils were being cleaned.
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 conditions that are conducive to indoor environment complaints from occupants, including the presence of at least one smoker and the burning of candles.
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 damage at the Master Bedroom window sill may be exacerbated by rainwater intrusion through improper installation of the window.
7. There had been a history of plumbing leaks under the Kitchen sink. These leaks were finally repaired, but the cavity under the shelf and other cavities and areas may have been impacted. The damage may have extended to the return air plenum and the hall at the plenum.
8. There were elevated levels of total fungal spores in both indoor air samples. The spores were dominated by *Cladosporium* and *Aspergillus/Penicillium*-like spores. One of two samples had elevated levels of culturable fungi, dominated by *Cladosporium* and *Penicillium* species.
9. Moderate levels of fibers and high levels of skin cell fragments and fiberglass were found in the air samples. The particles identified as “fibers” were not from the attic insulation and not fiberglass.
10. An investigation by Rimkus Consulting Group on April 23, 2007, found deficiencies in the installation of the back door and the Master Bedroom window. There was evidence of water intrusion and water damage at those locations.
11. Residents should be moved from the house, and the house should be remediated in accordance with the attached Remediation Protocol.

## 5.0 RECOMMENDATIONS

1. A technically competent HVAC contractor should evaluate the Rojas 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 Rojas 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 health complaints of occupants and the elevated levels of *Aspergillus/Penicillium*-like spores and *Penicillium* species, the Rojas residence should be remediated. Following mold remediation, including post remediation verification (clearance), the residents should be able to reoccupy their home.
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. The back door and threshold should be replaced, and the moisture barriers in the adjacent walls should be extended to protect the installation.
8. The window at the Master Bedroom should be removed and reinstalled properly.
9. 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.
10. Improperly finished sheetrock/shower-surround junctions should be properly repaired.

Indoor Environmental Evaluation – Rojas Residence – 126 Villa Grande

**TABLE 1 – SUMMARY OF RESIDENCE CHARACTERISTICS**

| No. | Street       | Occupant | Owner | Yr. Built | SF   | Stories | Garage | Neighborhood | Subdivision | Date Investigated   |
|-----|--------------|----------|-------|-----------|------|---------|--------|--------------|-------------|---------------------|
| 126 | Villa Grande | Rojas    | Rojas | 2000      | 1283 | One     | 1-car  | Cenizo Park  | Blueridge   | 3/29/07,<br>4/23/07 |

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

| No. | Street       | Occupant | Visible Mold Growth  | Visible Water Damage  | High Moisture Content  |
|-----|--------------|----------|--|---|--|
| 126 | Villa Grande | Rojas    | Window sills (slight, except at Master Bedroom); <b>rotted shelf under K sink (repaired)</b> ; return air plenum (slight growth on wall surface); back door near threshold | Window sills (slight), except at Master Bedroom, where some damage was noted from the exterior; <b>rotted shelf under K sink-shelf replaced</b> ; water stains on carpet and tackboard near return air plenum; back door near threshold | Lower wall and trim near head of MBR tub; wall under shower head; wall under Master Bedroom window sill; exterior materials near Master Bedroom window and back door |

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 <sub>2</sub> ppmv | CO Ppmv      | Dew Point °F |
|----------------|---------|-----------|----------------------|--------------|--------------|
| March 29, 2007 |         |           |                      |              |              |
| Outside Air    | 70.9    | 84        | 448                  | 0            | 65           |
| Rojas in MBR   | 73.0    | <b>68</b> | 1099                 | interference | 61           |
| Rojas in BR 2  | 72.9    | <b>68</b> | 976                  | Interference | 61           |
| Rojas in K     | 73.2    | <b>80</b> | 778                  | Interference | 66           |
| Rojas in LR    | 73.3    | <b>78</b> | 770                  | interference | 65           |

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

Indoor Environmental Evaluation – Rojas Residence – 126 Villa Grande

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

| No. | Street       | Occupant | AC Operation | AHU Cleanliness                     | Dew Point | IAQ CO <sub>2</sub> /CO | No. Occupants | Pets | Comments  |
|-----|--------------|----------|--------------|-------------------------------------|-----------|-------------------------|---------------|------|---|
| 126 | Villa Grande | Rojas    | Not checked  | Coils being cleaned; RAF very dirty | 66        | 1099/interference       | Ca. 5         |      | Smoker in house; candles burning; improper water damage repair to Kitchen cabinet, water stains and slight mold growth near return air plenum |

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 |
|---------------------------------|---------------------|----------|-----------------|---------------------|----------------------|--------------------|-------------|---------------------|-------------|--------|-----|
| <b>3/29/07</b>                  |                     |          |                 |                     |                      |                    |             |                     |             |        |     |
| Outdoor Air Samples – Blueridge |                     |          |                 |                     |                      |                    |             |                     |             |        |     |
| 1607                            | NW 26 <sup>th</sup> | Zaragosa | Outside Air     | 5,293               | No                   | 40                 | <13         | 13                  | <13         | 187    |     |
| Indoor Air Samples – Blueridge  |                     |          |                 |                     |                      |                    |             |                     |             |        |     |
| 126                             | Villa Grande        | Rojas    | MBR             | 1,120               | As/Pn                | 173                | 920         | 3,080               | 133         | 40     |     |
| 126                             | Villa Grande        | Rojas    | LR              | 2,267               | As/Pn                | 293                | 920         | 3,920               | 1,067       | 120    |     |

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 – Blueridge</b> |                         |          |                 |             |   |                   |                   |
| 1607                                  | NW 26 <sup>th</sup> St. | Zaragosa | Outdoor Air     | 35          | No Cl; this may not be representative of the outdoor air that has affected the indoor air in the subject residence. |                   |                   |
| <b>Indoor Air Samples – Blueridge</b> |                         |          |                 |             |   |                   |                   |
| 126                                   | Villa Grande            | Rojas    | MBR             | 1,106       | <i>Aspergillus, Cladosporium, Penicillium</i>   |                   |                   |
| 126                                   | Villa Grande            | Rojas    | LR              | 59          | No  |                   |                   |

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

