INDOOR ENVIRONMENTAL QUALITY EVALUATION

GONAZALEZ RESIDENCE
467 PRECIOUS, VILLAS AT FORTUNA
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
Gonzalez Residence, 467 Precious, 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, 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 and some water testing of selected areas.

1.2 Subject Residence

The subject residence was in the Villas at Fortuna subdivision. The residence was apparently built by KB Homes in about 2000. It has been leased to the Gonzalez family but is owned by SAHA. 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 two-story structure with four bedrooms, two bathrooms, Kitchen, Dining Room, Living Room, Utility Room, and an attached one-car Garage. The layout of the subject residence is shown schematically in Figure 3.

The residence had carpeting in the bedrooms, the Living Room, the Dining 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 top of the stairway. 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. There are chases for ductwork to reach the first floor ceilings. 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, Precious 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.

2.2 Observations

1. Minor mold and/or water staining was observed at many of the window sills.
2. Excess moisture was found by Rimkus Consulting Group in the wall just under the sill in the Bedroom 4 window. When the interior and exterior walls were deconstructed, no water damage was discovered, but significant construction

defects were documented at the window and at the flashing for the shed roof for the porch.
3. Serious water damage was observed on the base trim at the back door. The damage extended to and included the left side of the base cabinet in the Kitchen.
4. There was excess moisture in the trim along the rear wall of the Dining Room near the back door.
5. Rimkus deconstructed the exterior trim for the back door and documented construction defects, including defects in the installation of the moisture barrier.
6. Isolated spots of mold growth were present on the upper wall and ceiling in Bathroom 2. No sources of water were observed in the Attic above this bathroom.
7. In each bathroom there was water damage and some mold growth on the lower wall and trim near the head of the tub.
8. In the Master Bathroom, there was mold growth at the juncture of the upper sheetrock wall and the shower surround.
9. There was a large ant bed outside the left wall of the Dining Room. The ant bed mounded over the lower siding. In the Dining Room, dirt from ant activity was seen along the base of the wall.
10. The home had dust in the return air plenum, including at the entrance to the air handler unit (AHU).
11. The home was using a low efficiency return air filter.

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. Excess moisture was found near the back door, near the head of both tubs, and under the window in Bedroom 4.

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 and the dew point were satisfactory.

2. Carbon dioxide values were satisfactory. Because of mild conditions, the doors were often open during the investigation.

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 Gonzalez 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. Samples were collected from three locations, at the return air grille with the blower in the AHU on, in the Master Bedroom near the Master Bathroom, and in the Kitchen near the back door.

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 two outdoor air samples 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 Kitchen rear the back door. 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. There were elevated levels of total fungal spores and culturable fungi in the indoor air in the Kitchen/Dining Room area.
2. There were elevated proportions of *Aspergillus/Penicillium*-like spores and culturable *Aspergillus niger*, *Cladosporium*, and *Penicillium* in the indoor air samples.

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 marginally high concentrations of fibers in the two samples. There were high levels of skin fragments and fiberglass 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. Rain water intrusion at the back door
2. Condensation at windows
3. Water intrusion at windows
4. Overspray from showers onto nearby walls and floors, including the upper wall for the Master shower
5. Condensation in both bathrooms

4.0 CONCLUSIONS

1. The Gonzalez residence had good thermal performance of the air-conditioning system.
2. The residence had normal relative humidity during the preliminary investigation.
3. The house had inadequate filtration within the air handler unit (AHU). This condition will 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 adequate ventilation with fresh, outdoor air (moderate carbon dioxide concentrations).
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.
7. Water intrusion has apparently occurred at the window in Bedroom 4 and may be occurring at other windows.
8. Construction deficiencies related to water intrusion were documented at the window in Bedroom 4 and the roof flashing for the porch.
9. The residence had serious water damage at the floor level of the rear wall and Kitchen cabinet near the back door. This damage is consistent with rain water intrusion.
10. Construction deficiencies related to water intrusion were documented at the back door.
11. The cleanliness of the AHU system was poor. The thermal performance of the air-conditioning system was good.
12. There were elevated levels of total fungal spores and culturable fungi in the indoor air in the Kitchen/Dining Room area. There were elevated levels of *Aspergillus/Penicillium*-like spores and culturable *Aspergillus*, *Cladosporium*, and *Penicillium* in the indoor air samples at that location.
13. There were low to marginally high concentrations of fibers in the two samples. There were high levels of skin fragments and fiberglass in the two indoor air samples.

5.0 RECOMMENDATIONS

1. A technically competent HVAC contractor should evaluate the Gonzalez 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 Gonzalez 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 levels of airborne fungal spores and culturable fungi, the Gonzalez residence should be remediated. A mold remediation protocol has been prepared. 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 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.

TABLE 1 – SUMMARY OF RESIDENCE CHARACTERISTICS

No.	Street	Occupant	Owner	Yr. Built	SF	Stories	Garage	Neighborhood	Subdivision	Date Investigated
467	Precious	Gonzalez	SAHA	2000	2239	Two	1-car	Rosedale Park	Villas at Fortuna	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
467	Precious	Gonzalez	Window sills (slight); Bath 2 on upper walls and ceiling; Master Bath above shower surround; trim and tackboard at back door	Trim at back door, Kitchen cabinet near back door; both baths at head of tub; window sills (slight)	Trim at back door; lower walls and trim at head of both tubs; lower wall under windows and at flashing in Bedroom 4

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

Table 3
Summary of Air Quality Measurements

Location	Temp ºF	RH %	CO_2 Ppmv	CO Ppmv	Dew Point ºF
April 5, 2007					
Outside Air	62.1	43	428	0	39
Gonzalez at return air grille (after operation of AC)	64.5	49	708	0	45
Gonzalez in Kitchen (after operation of AC)	68.8	42	596	0	44

TABLE 4 – SUMMARY OF HVAC SYSTEM OPERATION AND SPECIAL CONDTIONS

No.	Street	Occupant	AC Operation	AHU Cleanliness	Dew Point	IAQ CO_2/CO	No. Occupants	Pets	Comments
467	Precious	Gonzalez	Good	Poor	45	708/0	Ca. 5		Possible ant infestation; significant visible water damage

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
April 5, 2007											
Outdoor Air Samples – Villas at Fortuna											
467	Precious	Gonzales	Outside Air	1,787	No	107	200	160	13	200	
Indoor Air Samples – Villas at Fortuna											
467	Precious	Gonzalez	Return Air	867	No	160	480	6,667	507	67	
467	Precious	Gonzalez	Kitchen	2,707	As/Pn, *Cladosporium*	200	1,173	6,667	520	187	
467	Precious	Gonzalez	MBR	1,160	No	200	813	6,667	520	27	

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

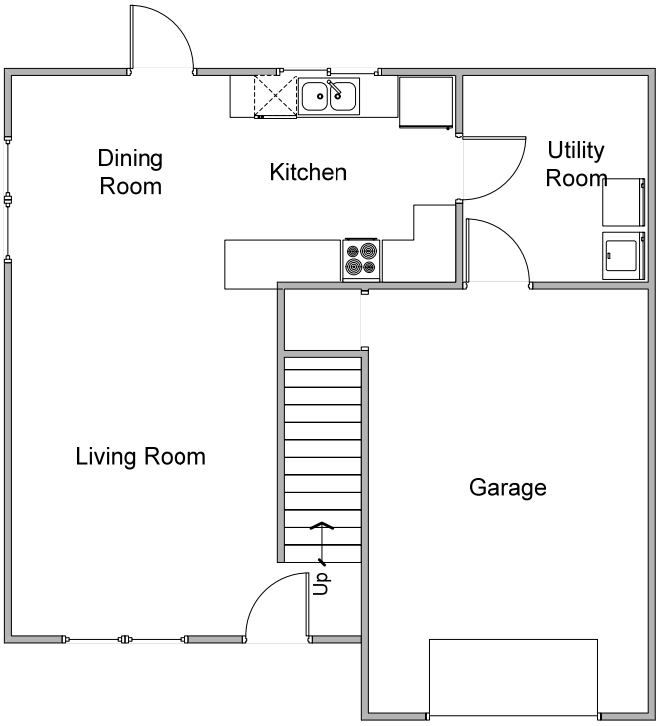
As/Pn denotes *Aspergillus/Penicillium*-like spores.

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 Samples – Villas at Fortuna							
467	Precious	Gonzalez	Outdoor Air	565	*Cladosporium* dominant		
Indoor Air Samples – Villa at Fortuna							
467	Precious	Gonzalez	Return Air	424	Possibly Aspergillus niger		
467	Precious	Gonzalez	Kitchen	1,929	*Cladosporium*; possibly *Aspergillus niger*, *Penicillium*		

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

FIRST FLOOR



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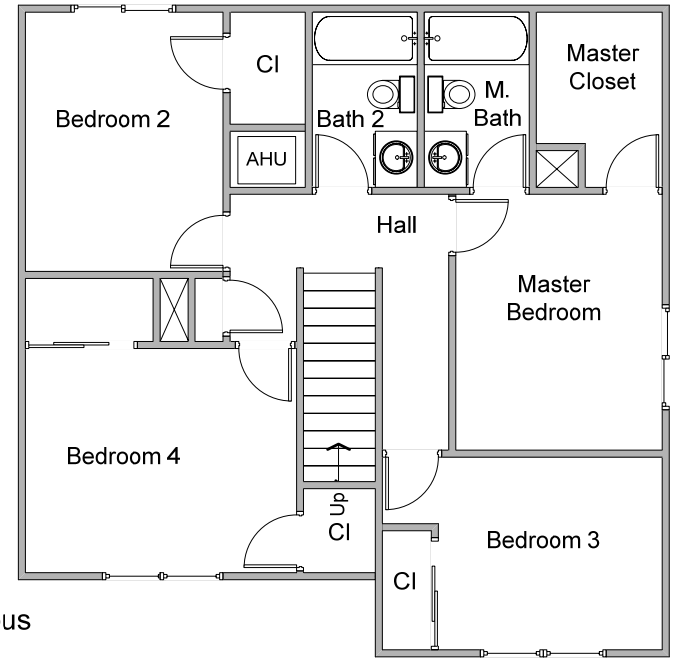

RESIDENCES REPRESENTED

Gonzalez, 467 Precious

ETC Information Services, LLC	**MIRASOL RESIDENCES**	**FIGURE 3**
		Scale: Approx. 1/8" = 1'
	LAYOUT 3	Drawn By: DJS 042807