

INDOOR ENVIRONMENTAL QUALITY EVALUATION

**DE LOS SANTOS RESIDENCE
506 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
De Los Santos Residence, 506 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 2, 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 Villas at Fortuna subdivision. The residence was apparently built by KB Homes in about 2000. It is owned by Pedro and Cristal De Los Santos. 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, 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. Back door refers to the side door to a side yard rather than to the rear of the house.

2.2 Observations

1. Slight mold growth and/or water staining was observed at many of the window sills. There was excess moisture in building materials at the Master Bedroom window sill.
2. The trim at the back door had high moisture content.
3. The lower walls and base trim at the head of both bathtubs had high moisture content.
4. The sheetrock wall below the shower head in the Master Bathroom had evidence of prior water damage that had been repaired.

5. The home had some dust in the return air plenum, including at the entrance to the air handler unit (AHU).
6. 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. 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 unsatisfactory. The dew point was marginally high until the air-conditioning system was operated.
2. Carbon dioxide and carbon monoxide values were satisfactory. .

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 results are summarized in Table 4. The residence was found to have good thermal performance.

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 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 De Los Santos residence had low levels of total fungal spores and culturable fungi.
2. The diversity of fungal spores and culturable fungi were somewhat abnormal. The proportion of *Aspergillus/Penicillium*-like spores was somewhat elevated, and the proportions of culturable *Alternaria* and *Penicillium* were somewhat elevated.

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 low concentrations of fibers, skin fragments, and fiberglass in both samples. This is probably due to the house not being occupied for some time.

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. Possible rain water intrusion at the Master Bedroom window
4. Overspray from showers onto nearby walls and floors

4.0 CONCLUSIONS

1. The De Los Santos residence had good thermal performance of the air-conditioning system.
2. 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.
3. The house had inadequate filtration within the air handler unit (AHU). This condition will contribute to problems with excess dust in the houses.
4. The residence appeared to have excess dust accumulated within the interior environment.
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.
7. There were somewhat elevated proportions of *Aspergillus/Penicillium*-like spores in both indoor air samples. The two locations also had elevated proportions of culturable *Alternaria* and *Penicillium* species.
8. Low levels of fibers, skin cell fragments, and fiberglass were found in the air samples. The low levels may be partly because the house had not been occupied for some time. 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 De Los Santos 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 De Los Santos 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 and *Alternaria* and *Penicillium* species, the De Los Santos 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. 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 – De Los Santos Residence – 506 Precious

TABLE 1 – SUMMARY OF RESIDENCE CHARACTERISTICS

No.	Street	Occupant	Owner	Yr. Built	SF	Stories	Garage	Neighborhood	Subdivision	Date Investigated
506	Precious	De Los Santos	De Los Santos	2000	1269	one	1-car	Rosedale Park	Villas at Fortuna	4/2/07

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

No.	Street	Occupant	Visible Mold Growth	Visible Water Damage	High Moisture Content
506	Precious	De Los Santos	Window sills (slight)	Window sills (slight); trim at back door; trim near head of both tubs; sheetrock wall under shower head in Master Bathroom	Trim at back door; lower wall and trim near head of both tubs; MBR window sill

**Table 3
Summary of Air Quality Measurements**

Location	Temp °F	RH %	CO ₂ ppmv	CO Ppmv	Dew Point °F
April 2, 2007					
Outside Air	70.3	84	422	0	64
De Los Santos in MBR	73.0	68	503	0	61
De Los Santos at return air grille	72.2	68	501	0-1	60
De Los Santos in BR 2	73.6	69	576	0	62
De Los Santos at return air grille after operation of AC	70.5	65	715	0	57

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

Indoor Environmental Evaluation – De Los Santos Residence – 506 Precious

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
506	Precious	De Los Santos	Good	Poor	62-57	503/0	None		

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

TABLE 5 – SUMMARY OF AIRBORNE AND AHU PARTICLES

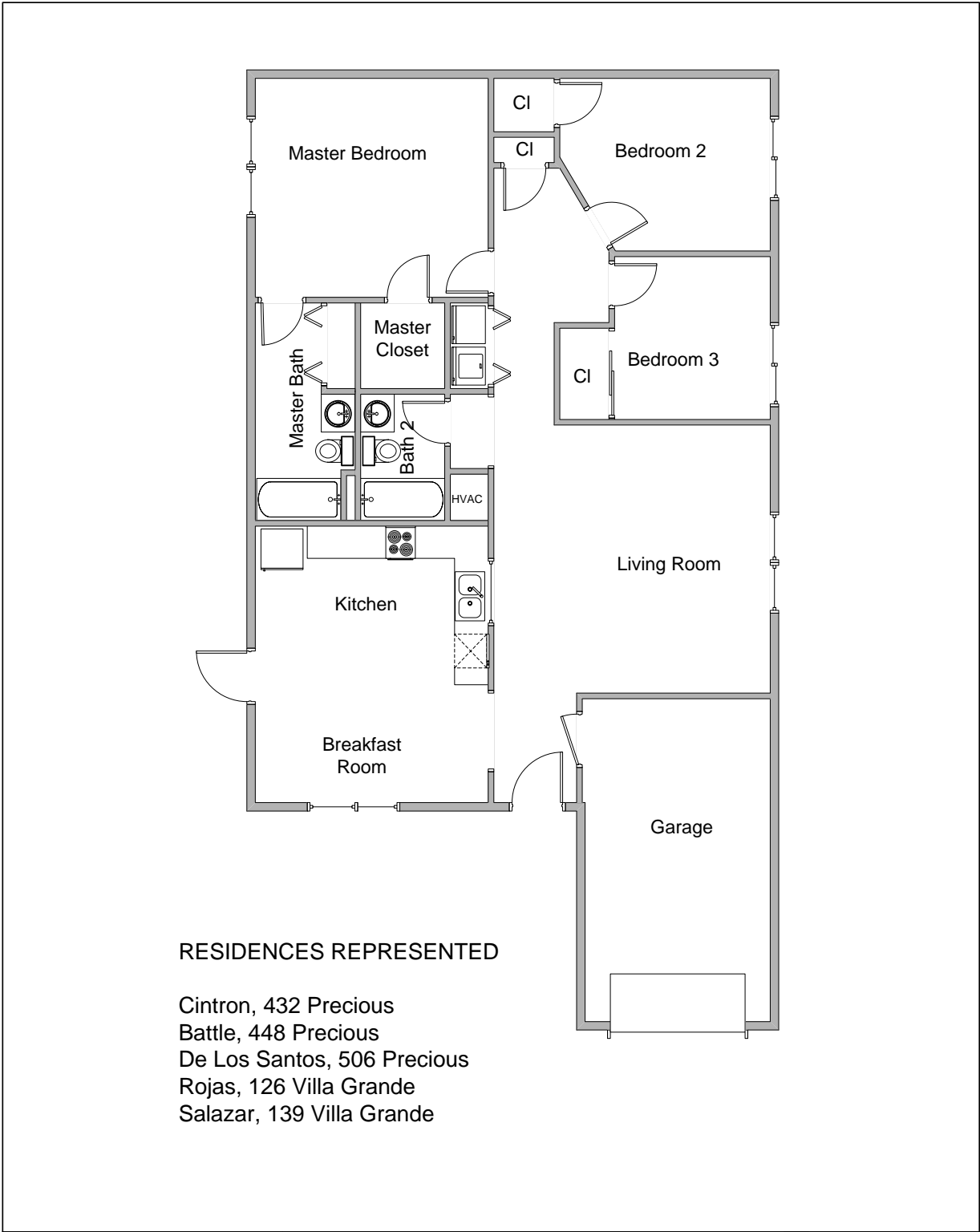
No.	Street	Occupant	Sample Location	Total Fungal Spores	Unusual Spore Counts	Mycelial Fragments	Fiber Count	Skin Cell Fragments	Fiber-glass	Pollen	AHU
4/2/07											
Outdoor Air Samples –Villas at Fortuna											
506	Precious	De Los Santos	Outside Air	6,813	No	13	27	<13	<13	13	
506	Precious	De Los Santos	Outside Air	3,053	No	<13	27	27	<13	13	
Indoor Air Samples – Villas at Fortuna											
506	Precious	De Los Santos	MBR	960	Possibly As/Pn*	80	480	600	<13	107	
506	Precious	De Los Santos	Return Air	547	Possibly As/Pn*	27	547	387	40	93	Moderate spores, As/Pn

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 2, 2007							
Outdoor Air Samples – Villas at Fortuna							
506	Precious	De Los Santos	Outdoor Air	929	Cladosporium dominant; Sporotrichum significant		
506	Precious	De Los Santos	Outdoor Air	882	Cladosporium dominant; Sporotrichum and yeast significant		
Indoor Air Samples – Villas at Fortuna							
506	Precious	De Los Santos	MBR	647	Alternaria , Penicillium		
506	Precious	De Los Santos	Return Air	329	Alternaria, Penicillium	High counts, Penicillium, Paecilomyces	

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



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