INDOOR ENVIRONMENTAL QUALITY EVALUATION

YNMAN RESIDENCE
463 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
May 17, 2007

Mr. Timothy Alcott
San Antonio Housing Authority
818 South Flores
San Antonio, Texas 78204

Re: Indoor Environmental Quality Evaluation
Ynman Residence, 463 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. 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 18, 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 has been leased to the Ynman family, but it is owned by SAHA. 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 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 Room, and an attached one-car Garage. The layout of the subject residence is shown schematically in Figure 1.

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 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 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 Room included connections for a washer and a dryer.

For simplicity of discussion in this report, Precious is assumed to run north-south. The subject residence is on the west side of the street, and the house is assumed to face east. 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. The resident reported previous water intrusion at the back door, at the Kitchen, Master Bedroom, and Living Room windows, and a leak that affected the Kitchen sink cabinet. Repairs were apparently made at the back door and sink cabinet.
2. The resident also reported what she believed are mite bites that guests suffer when they use Bedroom 2.
3. According to the resident, the return air filter is wet when it is changed once per month.
4. A low efficiency return air filter was being used. There was some dust in the return air plenum and significant dust and debris on the evaporator coils.

5. Supply air vents were closed in the Kitchen and the Utility Room.
6. The Utility Room seemed to be very humid.
7. There was excess dust clogging the exhaust grille in the Utility Room.
8. Inspection of the HVAC closet revealed a small puddle of water standing on the floor of the closet. Water was seen dripping from above, and the platform supporting the AHU was wet. Further inspection revealed water not draining through the primary drain and water leaking through the capped secondary drain outlet.
9. There was some mold growth along with water stains on the platform.
10. Moisture from the HVAC closet had apparently reached the Kitchen. The trim under the left rear corner of the base cabinet was wet.
11. There was minor water damage at several windows. There was no elevated moisture at the window sills or under the sills.
12. There were water damage and mold growth on the lower door jamb and base trim at the back door. The trim was saturated on one side and moist on the other side of the door.

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. There was standing water in the HVAC closet and significant excess moisture was found on the AHU platform and on the trim at the nearby Kitchen cabinet. There was also significant excess moisture on the trim at the back door.

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 satisfactory, but the dew point was high.
2. Carbon dioxide values were satisfactory.
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 not evaluated because of the backup and overflow in the condensate drain system.

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 two locations, at the return air grille 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 sets of 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 near the Master Bathroom. 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 Ynman front yard and the Smith 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 typical levels of total fungal spores, dominated by *Cladosporium* and with low but significant proportions of *Alternaria*, Ascospores, Basidiospores, *Bipolaris*, and *Curvularia*.

2. There were slightly elevated levels of total fungal spores in the indoor air, and the diversity of airborne spores and fungi was somewhat different than for outdoor air.
3. *Aspergillus/Penicillium*-like spores were slightly elevated in numbers and proportions in the two indoor air samples.
4. Outdoor air had typical levels of culturable fungi, dominated by sterile Hyphae in one sample and *Cladosporium* in the other.
5. Indoor air had slightly elevated levels of culturable fungi. The diversity of culturable fungi was similar to the one sample dominated by *Cladosporium*, but there were minor differences.
6. Culturable *Aspergillus* species were present at trace levels in indoor air but were not present in outdoor air.
7. These results indicate that there are likely to be significant sources of mold growth in the Ynman 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 two samples. There were high levels of skin cell fragments 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. Condensation at windows
2. Water intrusion at the back door
3. Condensate overflow at the AHU

4.0 CONCLUSIONS

1. The thermal performance of the Ynman Residence could not be measured because of an active condensate leak.
2. The residence had satisfactory relative humidity and dew point during the preliminary investigation.
3. The house had inadequate filtration within the air handler unit (AHU). This condition will contribute to accumulation of debris on the evaporator coils and contribute to problems with excess dust in the house.
4. The residence appeared to have excess dust accumulated within the interior environment.
5. There was an active condensate backup and leak at the AHU and HVAC closet. The primary drain was clogged, and condensate was dripping through the platform onto the hot water heater and then the floor of the closet.
6. The adjacent Kitchen cabinet had wet base trim.
7. There was water damage and mold growth on the door jambs and trim at the back door. The base trim on one side was wet.
8. There was minor water damage to some of the window sills. The damage was consistent with condensation that would occur during cold weather.
9. The cleanliness of the AHU system was somewhat unsatisfactory. The return air plenum and evaporator coils had noticeable dust present.
10. There were slightly elevated levels of total fungal spores and culturable fungi in the indoor air, and the diversity of airborne spores and fungi was somewhat different than for outdoor air.
11. *Aspergillus/Penicillium*-like spores were slightly elevated in numbers and proportions in the two indoor air samples.
12. Culturable *Aspergillus* species were present at trace levels in indoor air but were not present in outdoor air.
13. There were marginally high concentrations of fibers in one of the two samples. There were high levels of skin cell fragments in both of the indoor air samples.
14. There was no evidence of significant levels of dust mites in the house generally and in Bedroom 2 specifically.
15. The impact on the HVAC closet and Kitchen from the condensate leak should be investigated further by partial deconstruction of the closet front wall and the cabinetry lower shelves to determine if mold contamination is present.

5.0 RECOMMENDATIONS

1. A technically competent HVAC contractor should evaluate the Ynman 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 Ynman 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 active condensate leak, the wet Kitchen cabinet, and the slightly elevated levels of *Aspergillus/Penicillium*-like spores in the indoor air, the Ynman residence should be investigated further using partial deconstruction of the HVAC closet front wall and the Kitchen cabinetry bottom shelves. This work should be done with source and/or local containment with a HEPA-vacuum for collection of dust as it is generated. If minor remediation is required, it should be completed during this investigation. Exposed wall and cabinet cavities should have critical barriers placed as soon as possible. The requirements for remediation will be determined during or after this investigation.
6. Mold contamination may affect areas with less than 25 contiguous square feet. Therefore, the mold assessment and the remediation work may 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 remediation it is determined that the TMARR must be followed, work should cease, and work should then be completed in full compliance with the TMARR.
7. 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.

8. 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.
9. Improperly finished sheetrock/shower-surround junctions should be properly repaired.

TABLE 1 – SUMMARY OF RESIDENCE CHARACTERISTICS

No.	Street	Resident	Owner	Yr. Built	SF	Stories	Garage	Floor Plan	Subdivision	Date Investigated
452	Precious	Ynman	SAHA	2000	1283	1	1-car	I	Villas at Fortuna	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
452	Precious	Ynman	Door jamb and door trim at back door AHU platform	HVAC closet platform, plenum Several window sills (minor) Trim at back door (minor)	HVAC closet floor, plenum, platform Kitchen base cabinet near HVAC closet Base trim at 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 ºF	RH %	CO_2 Ppmv	CO Ppmv	Dew Point ºF
April 18, 2007					
Outside Air	67.4	51	438	0	48
Inside Air					
463 Precious (Ynman) MBR	69.1	57	689	0	52.5
463 Precious (Ynman) RA	69.7	55	573	0	52
463 Precious (Ynman) BR2	67.1	55	750	0	49.5

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

TABLE 4 – SUMMARY OF HVAC SYSTEM OPERATION AND SPECIAL CONDTIONS

No.	Street	Resident	AC Operation	AHU Cleanliness	Dew Point	IAQ CO_2/CO	No. Occupants	Pets	Comments
463	Precious	Ynman	Not tested	Some dust in plenum and on coils	52.5	750/0	3		Active condensate leak in HVAC closet affecting Kitchen cabinets Supply air vents closed in Kitchen and Utility Room; excess dust in exhaust grille, humid in UR

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 18, 2007											
Outdoor Air Samples – Villas at Fortuna											
463	Precious	Ynman	OA-front	1,413	Cl>Asc>Bas	27	27	40	<13	520	
514	Precious	Smith	OA-front	2,840	Cl>Bi>Alt>Cur	133	27	227	<13	360	
Indoor Air Samples – Villas at Fortuna											
463	Precious	Ynman	Return Air	1,467	Cl>As/Pn>Bi 173 As/Pn	107	907	5,027	13	67	
463	Precious	Ynman	BR2	1,253	Cl>Bi>Alt, As/Pn 107 As/Pn	107	1,213	5,493	<13	107	

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 18, 2007							
Outdoor Air Sample – Villas at Fortuna							
463	Precious	Ynman	OA-front	776	StH		
514	Precious	Smith	OA-front	1,024	Cl>Bi>StH>Alt		
Indoor Air Samples – Villas at Fortuna							
463	Precious	Ynman	Return Air	1,188	Cl>Alt>StH		
463	Precious	Ynman	MBR	1,341	Cl>Alt, StH		

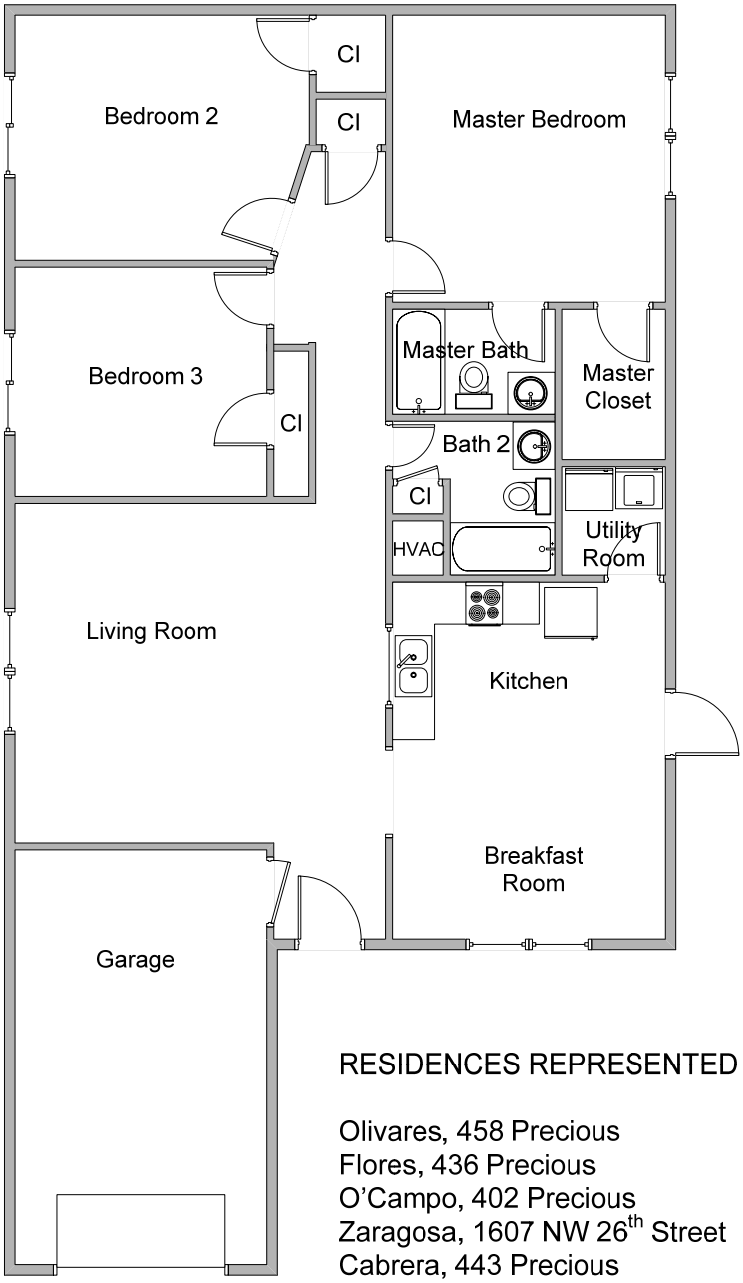
Yellow-highlighted boxes indicate conditions that may be significant in evaluation of indoor environmental issues.

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.

Table 9
Analyses of Dust Samples for Dust Mite Allergens

Ref. No.	Description of Bulk Samples	Allergen Analysis – Dust, µg/gram	
		Dust Mite (Der p1)	Dust Mite (Der f1)
B-4-S	Vacuum Cleaner dust, Ynman	Present	Present
B-5-S	Bedroom 2 Carpet Dust, Ynman	<1.56	Present

Note: threshold vales 2.0 µg/gram



RESIDENCES REPRESENTED

Olivares, 458 Precious
Flores, 436 Precious
O'Campo, 402 Precious
Zaragosa, 1607 NW 26th Street
Cabrera, 443 Precious
Martinez, 452 Precious
Arispe, 1615 NW 26th Street
Ynman, 463 Precious
466 Precious

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