

**MOLD REMEDIATION
POST – REMEDIATION/CLEANING VERIFICATION (CLEARANCE) REPORT**

**SMITH RESIDENCE
514 PRECIOUS
SAN ANTONIO, TEXAS**

Prepared for

**SAN ANTONIO HOUSING AUTHORITY
SAN ANTONIO, TEXAS**

by

**ETC INFORMATION SERVICES, LLC
ALADDIN ENVIRONMENTAL SERVICES**

Donald J. Schaezler, Ph.D., P.E., CIH, MAC

John Spalten, MAC

July 2008

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
July 31, 2008

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

**Re: Post - Remediation Verification (Clearance) Report, Revision 1
Smith Residence, 514 Precious, San Antonio, Texas**

Dear Mr. Alcott:

A copy of the revised report for the Post - Remediation Verification (Clearance) investigation of the referenced property is being forwarded to you for your information and necessary action. This revision includes the results of sampling for viable fungi in dust. Several recent sampling events and inspections have been done for this house. These reports should be consulted for a full review of the context of this investigation.

The sources of water intrusion in this house and garage have been corrected, and the results of this investigation indicated that remediation was successful, but that carpeting needs to be removed and replaced.

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

ALADDIN ENVIRONMENTAL SERVICES

Donald J. Schaezler, Ph.D., P.E., CIH
Licensed Mold Assessment Consultant
President

John Spalten
Licensed Mold Assessment Consultant

1.0 INTRODUCTION

The subject residence has been recently inspected and sampled for remediation of water damage and mold contamination from direct and indirect sources. The inspections and sampling were performed by ETC Information Services, LLC, and Aladdin Environmental Services jointly. The purpose of the inspection was to determine the status of remediation and mold contamination by visual inspection and collection of air, dust, and surface samples. The purpose of this letter is to summarize the results of the inspection and to document why the remediation and mold contamination removal has been successfully demonstrated.

2.0 Background

Refer to previous reports

3.0 Observations

3.1 July 17, 2008

1. Contents were being unloaded by the moving company and then cleaned by the remediation contractor. Appliances were cleaned, but the process was aborted, and all contents were reloaded for additional storage.
2. The occupants were concerned about an old leak from the drain system upstairs. Shortly after they originally moved into the house, the ceiling in the Living Room collapsed near the foot of the stairs. The drain system from the tub was reportedly not connected. The ceiling was repaired, but the occupants did not know if mold contamination was present then or now.
3. The carpet was visibly soiled at the corner of the upstairs hallway. It was damaged by bleach spots near the Utility Closet.
4. Subfloor surrounding the Hall Bathroom was examined and found to be free of any water stains.
5. Some dust was present on ceiling fan blades and on some other surfaces.
6. Toilet bowls were not clean, and microbial growth was present in one bowl.
7. The Garage floor had not been completely cleaned. Some dust was still present on and behind the hot water heater.
8. Miscellaneous contents had been cleaned and left in the house in several areas. These were discarded at the occupants' request.

3.2 July 21, 2008

1. All surfaces previously noted to have dust accumulations were now visibly clean.
2. A small amount of dust was found firmly attached to the inlet areas of ventilation fans in the second floor bathrooms and the utility closet, as well as in the return air plenum. These areas were rigorously cleaned with a small vacuum pump using a dust sampling cassette. This provided a sample of the dust as well as providing reasonably clean surfaces.
3. The toilets had been cleaned.
4. The garage floor had been cleaned.
5. The dust on and behind the hot water heater in the garage had been cleaned.
6. The ceiling/subfloor cavities under the Hall Bathroom upstairs were exposed and inspected. The cavities included one directly under the tub drain and two more downstream, along the pathway of the drain pipe. There was no visible water staining, water damage, or mold growth on the materials observed in these cavities.
7. Two small spots of black staining were present on the caulk above the top shelf of the Master Bedroom closet. The caulk and staining were photographed, sampled, and removed.
8. Indoor air quality in the residence was as indicated in the table below.

Location	Temperature °F	Relative Humidity %	Dew Point °F	Carbon Dioxide ppmv	Carbon Monoxide Ppmv
Outside - front	81.9	55	63.5	361	0
Outside – front	86	53	66		
Living Room	74.6	26	37	442	0
Kitchen	73.2	30	39.5	434	0
Kitchen	72	31	39		
Living Room	74	30	40		
Master Bathroom	65.9	38	39	501	0
Master Bedroom	63.7	39	37.5	491	0
Master Bedroom	67	29	33		
Bedroom 2	68.4	35	39	513	0

Bedroom 2	67	32	35.5		
Bedroom 3	68	30	35		
Bedroom 4	68.0	36	39.5	536	0
Bedroom 4	66	31	34		
Bedroom 5	66	32	35		
Garage	96	20	48		

The results indicated that the parameters were all within satisfactory ranges. Temperatures indoors were low because of the setting on the HVAC system. The temperature in the Garage was high because an air scrubber and a dehumidifier were operating, and the Garage is not well-ventilated.

4.0 Sampling and Discussion

4.1 July 21, 2008

4.1.1 Air Samples

Ten air samples were collected. Eight samples were collected from the main rooms upstairs and downstairs. Two samples were collected from outdoor air for reference. The results are summarized in the tables at the end of this memo. The results and their significance are summarized below:

1. Outdoor air had typical levels of total fungal spores, dominated by *Cladosporium* and *Bipolaris*. There were significant proportions of *Alternaria*, Ascospores, Smuts/*Periconia*/Myxomycetes, *Curvularia*, and Basidiospores.
2. Garage air had very low levels of total fungal spores with significant proportions of *Cladosporium*, Ascospores, *Alternaria*, and Basidiospores.
3. Indoor air had low levels of total fungal spores. The diversity of spore types was very similar to that in outdoor air.
4. There was a very low level of *Penicillium/Aspergillus* type spores in one indoor sample. There were no *Chaetomium* spores and no *Stachybotrys* spores.
5. The results for the Garage and indoor areas **were consistent with successful remediation.**

4.1.2 Surface Samples

One tape lift sample was taken of very small area of dark staining on the top shelf of the Master Bedroom closet. The results and their significance are summarized below:

1. The sample had only one total spore observed at a detection level of 17 Cts/cm². This is considered to be a trace level of normal fungal spores found in the indoor environment. The results **were satisfactory**.

4.1.3 Dust Samples

Dust samples were collected from two carpet areas and from the inlet side of several ventilation blowers and from the return air plenum. The results and their significance are summarized below. Interpretation of dust samples is based on literature references.

Fungal Concentration per Unit Mass

The concentration of fungi per unit mass of dust collected can be used to evaluate the dust itself. Several studies in the literature have recommended criteria for evaluation of environmental and/or carpet dust. Hodgson and Scott¹ concluded the following:

- >10⁵ CFU/g most likely associated with buildings contaminated with fungi
- >10⁶ CFU/g certainly associated with buildings contaminated with fungi

It was suggested that the dominant fungi present in the dust can also be an indicator of buildings contaminated with fungi. They stated, as an example, that dominance of *Penicillium sp*, or *Aspergillus sp*, is generally associated with problem buildings.

The OSHA Technical Manual published in 1992² lists contamination indicator limits for fungi in dust as 1,000,000 fungi/g of dust or material. They do not specify if this refers to spores or CFU.

Fungal Concentration per Unit Area

The fungal exposure potential is considered to be better indicated by fungal concentration per unit area and the total area involved.

¹ "Prevalence of Fungi in Carpet Dust Samples, Hodgson, M. and R. Scott, In: **Bioaerosols, Fungi, and Mycotoxins. Health Effects Assessment, Prevention, and Control. Updated and Revised Reprint**, Ed. by E. Johannig, Mount Sinai School of Medicine, New York, New York, pp. 268-274, 2001.

² **OSHA Technical Manual**, Occupational Health and Safety Administration, Washington, D.C., 1992.

A recent, comprehensive review and independent study by Bridge et al. in 2004³ provided the following guidelines for dust recovered from carpets.

- ≤ 0.85 CFU/cm² (Condition 1, normal fungal ecology)
- >0.85 to <6.0 CFU/cm² (Condition 2, settled spores)
- ≥ 6.0 CFU/cm² (Condition 3, actual fungal growth)

Discussion of Sample Results

Culturable results are pending. Assuming a 5:1 ratio of spores to CFU, the guidelines for spore counts become:

- ≤ 4.2 Cts/cm² (Condition 1, normal fungal ecology)
- >4.2 to <30 Cts/cm² (Condition 2, settled spores)
- ≥ 30 Cts/cm² (Condition 3, actual fungal growth)

These criteria are used in Table 2B. Based on these guidelines, and on our experience with many similar samples, the following comments can be made:

1. The distribution of spore types for all samples is representative of normal fungal ecology. Specific, water-damage-indicating fungi do not predominate.
2. Environmental dust had acceptable levels of spores. Most of the dust from the intakes of ventilation blowers was removed as a result of sampling.
3. The carpets in the Master Bedroom and the Hall reflect an elevated accumulation of settled spores and hyphal fragments.

4.1.3 Photographs

Photographs of the Master Bedroom closet and the ceiling/floor cavities under the Hall Bathroom are available.

³ "Literature Review and Suggested Quantitative Limits for Fungi in Carpet Dust, Related to IICRC S520 Conditions 1-3," D. W. Bridge, September 2004.

5.0 Conclusions

1. There was no evidence of water damage or mold contamination in the ceiling cavities under the upstairs Hall Bathroom.
2. Carpeting in the upstairs areas needs to be recleaned, as a minimum. Based on the occupants' sensitivity to mold, previous unsuccessful cleaning of the carpeting, and the visible condition of the carpet, the carpeting should be replaced.
3. All surfaces other than carpets are reasonably clean.
4. Indoor air quality in the residence and in the Garage was satisfactory with respect to chemical, physical, and fungal parameters.
5. The causes of the water damage and mold contamination that were identified have been remediated.

6.0 Recommendations

1. Remove and replace carpeting in upstairs rooms.
2. Replace and finish the ceiling sheetrock that was removed for inspection in the Living Room.
3. Leave air scrubbers in place until clean or new contents have been moved into place.
4. Re-clean areas affected by reconstruction activity, including horizontal surfaces that collect dust.
5. The house should be retested after all contents are in place.

**TABLE 1 - BIOAEROSOL SAMPLING RESULTS
MAJOR GENERA/TYPES – JULY 21, 2008 - Method A001**

Ref. No.	Description-Air Samples	Concentration, Counts/M ³ (%)									
		Asc	Al	Bas	Bi	Cl	Cur	Pn/As	Sm/Myx	Total Fungal Spores	HyF
Outside											
A1	Outdoor air – front 1	420 (4)	1180 (12)	168 (2)	3280 (33)	3780 (38)	588 (6)	0	462 (5)	10,000	0
A10	Outdoor air - front 2	462 (11)	0	336 (8)	0	2940 (73)	0	0	294 (7)	4,030	42
Outdoor Average		441 (6)	590 (8)	252 (4)	1,640 (23)	3,360 (48)	294 (4)	0	378 (5)	7,015	21
Garage											
A2	Garage	42 (16)	42 (16)	42 (16)	0	84 (32)	13 (5)	0	0	265	0
Inside											
A3	Kitchen	42 (11)	84 (22)	0	42 (11)	210 (55)	0	0	0	378	0
A4	Living Room	126 (19)	0	84 (13)	0	336 (50)	0	0	42 (6)	672	0
A5	Master Bedroom	84 (10)	42 (5)	210 (30)	0	252 (35)	42 (5)	0	42 (6)	714	0
A6	Front Bedroom over	0	42 (3)	0	168 (14)	714 (58)	210 (17)	0	84 (7)	1,230	0
A7	Back Bedroom over	0	378 (18)	42 (2)	546 (26)	420 (20)	336 (16)	168 (8)	84 (4)	2,070	0
A8	Back Middle BR	0	126 (9)	0	294 (21)	672 (48)	168 (12)	0	84 (6)	1,390	0
A9	Back Left BR	0	210 (24)	84 (10)	210 (24)	252 (29)	84 (10)	0	0	882	0
Indoor Average		36 (3)	126 (12)	60 (6)	180 (17)	408 (39)	120 (11)	24 (2)	48 (5)	1,048	0
See Table 5 for abbreviations.											

**TABLE 2A - DUST SAMPLES - FUNGAL IDENTIFICATION
MAJOR GENERA/TYPES – JULY 21, 2008**

Ref. No.	Description - Dust Samples	Concentration, Counts/gram (%)										
		Asc	Al	Bas	Bi/Dr	Cl	Cur	Pn/As	Pi	Sm/Myx	Total Fungal Spores	HyF
CC-1	Environmental dust from air mover intakes	0	26,000 (26)	0	10,000 (10)	26,000 (26)	2,600 (3)	13,000 (13)	0	15,000 (15)	100,300	49,000
CC-2	Master Bedroom carpet	2,600 (1)	64,000 (29)	0	38,000 (17)	56,000 (26)	0	13,000 (5)	15,000 (7)	10,000 (5)	218,700	62,000
CC-3	Hall carpet at corner	0	120,000 (25)	5,300 (1)	150,000 (31)	75,000 (16)	37,000 (8)	0	37,000 (8)	43,000 (9)	483,600	200,000
CC-4	Kitchen wall cabinets (top)	0	10,000 (36)	0	5,100 (18)	13,000 (46)	0	0	0	0	28,100	26,000

See Table 5 for abbreviations.

**TABLE 2B - DUST SAMPLES - FUNGAL IDENTIFICATION
MAJOR GENERA/TYPES – JULY 21, 2008**

Ref. No.	Description - Dust Samples	Area Sampled cm ²	Concentration		Criterion	Action
			Counts/sample	Counts/cm ²	Counts/cm ²	
CC-1	Environmental dust from air mover intakes	930	2994	3.2	<4.2	Condition 1, None
CC-2	Master Bedroom carpet	930	6637	7.1	>4.2, <30	Condition 2, Clean or replace
CC-3	Hall carpet at corner	930	7104	7.6	>4.2, <30	Condition 2, Clean or replace
CC-4	Environmental dust from top of Kitchen wall cabinets	3,720	840	0.90	<4.2	Condition 1, None

See Table 5 for abbreviations.

**TABLE 3A - DUST SAMPLES – CULTURABLE FUNGI
MAJOR GENERA/TYPES – JULY 21, 2008**

Ref. No.	Description - Dust Samples	Concentration, CFU/gram (%)						
		Alt	Total Asp	Cl	Epi	NSF	Pn	Total
CC-1	Environmental dust from air mover intakes	6,700 (4)	13,000 (7)	110,000 (61)	3,300 (2)	20,000 (11)	10,000 (6)	179,300
CC-2	Master Bedroom carpet	6,700 (4)	0	90,000 (55)	17,000 (10)	20,000 (12)	10,000 (6)	163,600
CC-3	Hall carpet at corner	210,000 (25)	0	140,000 (17)	0	490,000 (58)	0	840,000
CC-4	Kitchen wall cabinets (top)	33,000 (14)	0	170,000 (72)	0	33,000 (14)	0	236,000

See Table 5 for abbreviations.

**TABLE 3B - DUST SAMPLES – CULTURALBLE FUNGI
MAJOR GENERA/TYPES – JULY 21, 2008**

Ref. No.	Description - Dust Samples	Area Sampled cm ²	Concentration		Criterion CFU/cm ²	Action
			CFU/sample	CFU/cm ²		
CC-1	Environmental dust from air mover intakes	930	5,500	5.9	≤6.0	High Condition 2, clean (cleaned by sampling)
CC-2	Master Bedroom carpet	930	4,900	5.3	<6.0	High Condition 2, clean or replace
CC-3	Hall carpet at corner	930	12,000	13	>6.0	Condition 3, fungal growth, replace
CC-4	Environmental dust from top of Kitchen wall cabinets	3,720	7,000	1.9	<6.0	Low Condition 2, non-porous, none (most cleaned by sampling)

See Table 5 for abbreviations.

**TABLE 4 – TAPE LIFT SAMPLE - FUNGAL IDENTIFICATION
MAJOR GENERA/TYPES – JULY 21, 2008**

Ref. No.	Description - Tape Samples	Concentration, Counts/cm ² (%)										
		Asc	Al	Bas	Bi/Dr	Cl	Cur	Pn/As	Pi	Sm/Myx	Total Fungal Spores	HyF
T-1	MBR closet – black stain on top of closet shelf	0	0	0	0	17 (100)	0	0	0	0	17	<17

See Table 5 for abbreviations.

TABLE 5 - ABBREVIATIONS FOR GENERA, SPECIES, AND TYPES OF FUNGI

Abbreviation	Description
Acremonium	<i>Acremonium</i> sp.
Al	<i>Alternaria</i> sp.
An	<i>Aspergillus niger</i>
As	<i>Aspergillus</i> sp.
Asc	Ascocarps or Ascospores, the fruiting bodies of Ascomycetes
Aur	<i>Aureobasidium</i> sp.
Bas	Basidiospores
Bi/Dr	<i>Bipolaris</i> sp. and/or <i>Drechslera</i> sp.
Bo	<i>Botrytis</i> sp.
Chae	<i>Chaetomium</i> sp.
Cl	<i>Cladosporium</i> sp.
Cur	<i>Curvularia</i> sp.
Epicoccum	<i>Epicoccum</i> sp.
Fusarium	<i>Fusarium</i> sp.
HyF	Hyphal fragments
Mem	<i>Memnoniella</i> sp.
Muc	<i>Mucor</i> sp.
Nig	<i>Nigrospora</i> sp.
Pn	<i>Penicillium</i> sp.
Phia	<i>Phialophora</i> sp.
Pi/Ulo	<i>Pithomyces</i> sp. and/or <i>Ulocladium</i> sp.
Pn/As	<i>Penicillium/Aspergillus</i> type spores
Sm/Myx	Smuts, Myxomycetes, or <i>Periconia</i> spores
Spo	<i>Sporotrichum</i> sp.
Sta	<i>Stachybotrys</i> sp.
Syn	<i>Syncephalastrum</i> sp.
Tae	<i>Taeniolella</i> sp.
Tri	<i>Trichoderma</i> sp.
UC	Unclassified conidia
Y	Yeast