UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
ENVIRONMENTAL RESPONSE TEAM
Edison, NJ – Cincinnati, OH – Las Vegas, NV – Research Triangle Park, NC

August 27, 2009

MEMORANDUM

SUBJECT: Drywall Investigations: Additional Five Drywall Sample Analysis Summary Results

FROM: Raj Singhvi, Chemist
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TO: Arnold E. Layne, Director
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1.0 INTRODUCTION

A total of five drywall samples from Florida, Louisiana, and Virginia were analyzed for various parameters. The purpose of this study was to obtain additional information on the composition of the drywall and confirm the presence or absence of two organic compounds detected in the previous drywall gypsum sample study (May 7, 2009). Parameters were chosen based on: (1) residential odor complaints from the homeowners to the States; (2) available methods to obtain information about the chemical composition and the structure of the material; and (3) available field methods that may be useful in identifying whether imported drywall was used during the construction of homes.

EPA/ERT extracted three painted drywall samples from two homes in Florida and one in Louisiana during the preliminary visit to those States in preparation for conducting air testing efforts. The three drywall samples were imported from China. Samples of the paint used on the drywall were also collected from the same two homes in Florida and the home in Louisiana. In addition one imported drywall sample was collected by EPA/ERT from a warehouse in New Orleans and one drywall sample was received from a warehouse in Virginia. The results from the analysis of these drywall samples will assist EPA in preparing drywall investigation protocols for the U.S. Consumer Product Safety Commission (CPSC) and various States.

2.0 SAMPLE PREPARATION

Three painted imported drywall samples were prepared for analysis as follows: First, the thin layer of paint was scraped off of the three imported drywall samples for metals and semivolatile organic compound (SVOC) analyses. For all five drywall samples (three painted and two unpainted), the top and bottom layers of paper were then separated from the solid material (gypsum) and placed into separate glass jars. The paper portion of the drywall samples was analyzed for metals and SVOCs. The gypsum portion of drywall samples was analyzed for metals, SVOCs, volatile organic compounds (VOCs), total acid soluble sulfides, total organic carbon (TOC), sulfate, elemental sulfur, pH, and loss on ignition (LOI). The liquid paint samples were analyzed for strontium and SVOCs, including the

tentatively identified compounds of interest (i.e., propanoic acid, 2-methyl-, 2, 2-dimethyl-1-(2-hydroxy-1-methylethyl) propyl ester, and propanoic acid, 2-methyl-, 3-hydroxy-2,4,4-trimethylpentyl ester.

3.0 ANALYTICAL RESULTS

3.1 Strontium and Elemental Sulfur

The analysis shows the presence of elemental sulfur and strontium in four out of five imported drywall samples (gypsum portions) ranging from 71.4 parts per million (ppm) to 419 ppm, and from 3,030 ppm to 4,110 ppm, respectively. No elemental sulfur was detected in the gypsum sample from the New Orleans warehouse, but strontium was detected at a concentration of 401 ppm, approximately 10 times less than that found in the other gypsum samples. Elemental sulfur was also detected in the paper portion of the four imported drywall samples ranging from 41.7 ppm to 454 ppm. The presence of elemental sulfur in the paper could be attributed to the sulfur leaching out of the gypsum, or it may have been added in some form of sulfur compound during the manufacturing process.

3.2 Organic Compounds of Primary Interest

Analytical results show the presence of two organic compounds in the three paint samples collected from the two homes in Florida and the home in Louisiana, and from the painted gypsum portion of the drywall samples. The two compounds tentatively identified by the mass spectrometry library search were propanoic acid, 2-methyl-, 2,2-dimethyl-1-(2-hydroxy-1-methylethyl) propyl ester (CAS # 74367-33-2) at estimated concentrations ranging from 1.78 to 10.6 ppm, and propanoic acid, 2-methyl-, 3-hydroxy-2,4,4-trimethylpentyl ester (CAS # 74367-34-3) at estimated concentrations ranging from 2.04 to 10.7 ppm in the gypsum samples. These compounds were also detected in the paper portion of the drywall sample collected from the Louisiana home. These two compounds were detected in the liquid paint samples collected from the two homes in Florida and the home in Louisiana at a much higher concentration than that found in the gypsum portion of the drywall (see Table 1). The results of the investigation show that these two compounds are components of the paint and not necessarily from the gypsum portion of the drywall sample**.** The presence of these two compounds in the gypsum portion is attributed to diffusion from the paint to the gypsum core.

3.3 Reduced Sulfur Off-Gases from Gypsum-Headspace Analysis

The five gypsum core (without paper or paint) samples were qualitatively analyzed for sulfur compounds using a recently acquired gas chromatograph equipped with a sulfur chemiluminescence detector (GC/SCD) using a headspace technique. The experiments were performed to determine the presence of sulfur containing compounds in the drywall gypsum samples under dry and wet conditions. Due to the limited amount of sample, available paper and paint from the drywall were not included in these experiments. Five grams of each gypsum sample were sealed in 40-milliliter (mL) VOA vials for two days to simulate dry conditions; the headspace in each 40-mL vial was analyzed for sulfur gases using GC/SCD. Hydrogen sulfide, carbonyl sulfide and carbon disulfide were detected in the headspace in four drywall samples collected from the Florida and Louisiana homes, and a Virginia warehouse. Low levels of carbonyl sulfide and carbon disulfide were detected for a drywall sample collected from a warehouse in New Orleans. Next, 15-20 mL of water was added to each of the 40-mL vials to submerge each sample. These samples were placed in a room for two days to simulate wet conditions. After two days, the headspaces in these vials were analyzed. An increase in the carbonyl sulfide and carbon disulfide concentrations was noted, whereas hydrogen sulfide concentrations decreased upon the addition of water to the drywall gypsum samples. Hydrogen sulfide has a greater solubility in water than carbonyl sulfide and carbon disulfide; water solutions of hydrogen sulfide are

not stable, adsorbed oxygen causes the formation of elemental sulfur. Additional work is necessary to better characterize and understand the relationship of the headspace vapor concentrations of hydrogen sulfide, carbonyl sulfide, and carbon disulfide under dry and wet conditions.

3.4 Analytical Results Summary

The results of these experiments showed that elemental sulfur and strontium were found in the gypsum core of many of the drywall samples. Two organic compounds were attributable to the paint on the drywall. Hydrogen sulfide, carbonyl sulfide and carbon disulfide were produced from the gypsum core under dry conditions; the carbonyl sulfide and carbon disulfide concentrations increased dramatically when the gypsum core was submerged in water. Conversely, hydrogen sulfide was detected at higher concentration from dry samples of the gypsum core.

A summary of the analytical results for the five drywall samples (gypsum, paper and paint chip portions) and the liquid paint samples is presented in Table 1. The qualitative XRD and XRF results for the gypsum portion of the drywall samples are presented in Table 2. Tentatively identified compounds detected by a GC/MS library search for the SVOC and VOC fractions are presented with estimated concentrations in Tables 3 and 4 for the drywall (gypsum, paper and paint chips) samples, and the liquid paint samples. A summary of qualitative headspace reduced sulfur compound off-gases results is presented in Table 5.

4.0 RELATED WORK IN PROGRESS

ERT is now analyzing 15 drywall samples (imported and domestic) received from the U.S. CPSC on July 8 and 20, 2009. A recommended procedure for identifying imported drywall in the field will be developed based on all the drywall composition analyses that ERT has performed.

If there are any questions, please call me at 732-321-6761.

Attachments

Table 1. Target Compound Analysis Results of Imported Drywall
Table 2. XRD & XRF Analysis Results of Imported Drywall
Table 3. SVOC Tentatively Identified Compounds (mg/kg)
Table 4. VOC Tentatively Identified Compounds (mg/kg)
Table 5. Headspace Screening Results for Reduced Sulfur Compounds in Gypsum by GC/SCD (ppbv)

cc: Barnes Johnson, OSRTI
Jeff Heimerman, OSRTI/TIFSD
Dave Wright, ERT
Harry Compton, ERT

Table 1. Target Compounds Analysis Results of Imported Drywall																	
Sample Location		193 FL				233 FL				701 LA				Warehouse, VA		Warehouse, LA	
%LOI at 750C		25				23				23				25		20	
pH (5% w/v)		7.24				7.37				7.45				7.32		6.71	
Sample	Matrix	Gypsum	Paper	Paint Chips	Paint	Gypsum	Paper	Paint Chips	Paint	Gypsum	Paper	Paint Chips	Paint	Gypsum	Paper	Gypsum	Paper
Target Analytes (Units)	Method	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Aluminum	REAC SOP 1811	737 J	5500	11900	NA	695 J	1810	4430	NA	578 J	1870	2640	NA	888 J	6000	678 J	5870
Arsenic	REAC SOP 1811	<2.33	<2.00	<1.96 J	NA	<2.50	<1.92	<2.08 J	NA	<2.33	<1.85	<2.00 J	NA	<2.42	<1.72	3.37	<1.82
Barium	REAC SOP 1811	69.6	31.1	13.3	NA	44.6	27.4	42.8	NA	39.0	30.5	27.9	NA	82.5	23.8	258	28.6
Cadmium	REAC SOP 1811	<0.233	0.215	<0.196	NA	<0.250	<0.192	<0.208	NA	<0.233	<0.185	<0.200	NA	<0.242	<0.172	<0.228	<0.182
Calcium	REAC SOP 1811	245000	13500	227000	NA	256000	15500	210000	NA	250000	21000	232000	NA	247000	10700	228000	10500
Chromium	REAC SOP 1811	1.48	4.48 J	17.2 J	NA	1.84	3.13 J	3.72 J	NA	1.74	3.06 J	5.28 J	NA	1.46	3.38 J	2.47	4.06 J
Cobalt	REAC SOP 1811	0.847	<0.400	1.61	NA	0.620	<0.385	0.597	NA	<0.467	<0.370	0.526	NA	0.904	<0.345	0.511	0.427
Copper	REAC SOP 1811	2.72	26.8	3.98	NA	2.08	21.6	1.67	NA	1.57	20.0	1.29	NA	2.44	20.9	6.16	18.8
Iron	REAC SOP 1811	2010	625	2210	NA	1620	340	1800	NA	1100	333	693	NA	1990	445	1650	486
Lead	REAC SOP 1811	1.90	5.40	2.96	NA	4.54	4.02	3.11	NA	<1.40	3.97	3.55	NA	<1.45	3.28	21.3	3.86
Magnesium	REAC SOP 1811	17400	1040	8670	NA	8740	878	5080	NA	4100	890	4180	NA	20100	830	158	1110
Manganese	REAC SOP 1811	96.7	19.5	82.5 J	NA	77.7	30.9	61.6 J	NA	57.5	30.8	51.0 J	NA	93.3	17.1	8.61	36.1
Mercury	REAC SOP 1832	0.0873	NA	NA	NA	0.0603	NA	NA	NA	<0.0486	NA	NA	NA	<0.0506	NA	1.55	NA
Nickel	REAC SOP 1811	1.50	2.06	6.52	NA	1.48	1.10	0.971	NA	1.17	1.02	1.73	NA	1.50	0.914	1.06	1.32
Potassium	REAC SOP 1811	269 J	168	421 J	NA	251 J	98.7	625 J	NA	141 J	97.9	665 J	NA	302 J	104	206 J	346
Selenium	REAC SOP 1811	<2.09	2.00	<1.76	NA	<2.25	1.95	<1.88	NA	<2.10	<1.67	<1.80	NA	<2.18	<1.55	<2.05	<1.64
Silver	REAC SOP 1811	<0.581	<0.500	<0.490	NA	<0.626	0.767	<0.521	NA	<0.584	<0.46	<0.500	NA	<0.606	<0.431	<0.570	<0.455
Sodium	REAC SOP 1811	592	2840	2150	NA	642	3670	1040	NA	414	2320	1040	NA	666	2170	316	1880
Strontium	REAC SOP 1811	3640	81.6	653	15	3030	70.5	454	26	3190	111	169	4.65 J	4110	95.0	401	24.2
Vanadium	REAC SOP 1811	2.37	2.95	8.19	NA	1.97	1.78	5.62	NA	1.62	1.57	2.38	NA	2.61	2.97	1.38	2.99
Zinc	REAC SOP 1811	3.07	37.4 J	91.2 J	NA	2.53	39.5 J	167 J	NA	0.945	30.5 J	11.6 J	NA	2.40	20.9 J	4.56	22.9 J
Total Sulfate $(SO_4)^{-2}$	EPA Method 375.4	444000	NA	NA	NA	514000	NA	NA	NA	542000	NA	NA	NA	482000	NA	563000	NA
Total acid soluble sulfide	SW 846 9030/9034	<12.6	NA	NA	NA	<12.8	NA	NA	NA	<12.9	NA	NA	NA	<12.6	NA	<12.9	NA
Elemental sulfur	Mod. REAC SOP 1805	254	223	**	NA	71.4	41.7	**	NA	419	58.3	**	NA	379	454	<7.75	<40.0
TOC	EPA C-88	6900	NA	NA	NA	4500	NA	NA	NA	4700	NA	NA	NA	6600	NA	4200	NA
Units		µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg
Trichlorofluoromethane	REAC SOP 1807	7.51 J	NA	NA	<25.0	5.58 J	NA	NA	<25.0	<11.9	NA	NA	<62.5	7.81 J	NA	<11.6	NA
Acetone	REAC SOP 1807	21700 J	NA	NA	11800 J	163 J	NA	NA	60.2 J	<47.6	NA	NA	45200 J	76.0 J	NA	<46.5	NA
Methylene Chloride	REAC SOP 1807	23.7	NA	NA	1890	7.69	NA	NA	4460 J	<11.9	NA	NA	<62.5	<11.6	NA	<11.6	NA
Carbon Disulfide	REAC SOP 1807	<11.6	NA	NA	<25.0	<11.8	NA	NA	<25.0	<11.9	NA	NA	<62.5	9.81 J	NA	<11.6	NA
2-Butanone	REAC SOP 1807	<11.6	NA	NA	7150	<11.8	NA	NA	<25.0	<11.9	NA	NA	367	<11.6	NA	<11.6	NA
Trichloroethene	REAC SOP 1807	<11.6	NA	NA	<25.0	<11.8	NA	NA	<25.0	<11.9	NA	NA	<62.5	8.65 J	NA	<11.6	NA
Bromodichloromethane	REAC SOP 1807	<11.6	NA	NA	<25.0	<11.8	NA	NA	<25.0	<11.9	NA	NA	<62.5	<11.6	NA	<11.6	NA
4-Methyl-2-Pentanone	REAC SOP 1807	<11.6	NA	NA	149	<11.8	NA	NA	19.9 J	<11.9	NA	NA	36.5 J	<11.6	NA	<11.6	NA
Toluene	REAC SOP 1807	<11.6	NA	NA	91.6	<11.8	NA	NA	13.1 J	<11.9	NA	NA	58.0 J	68.2	NA	<11.6	NA
Ethylbenzene	REAC SOP 1807	11.0 J	NA	NA	53.8	6.66 J	NA	NA	<25.0	<11.9	NA	NA	<62.5	3.14 J	NA	<11.6	NA
p&m-Xylene	REAC SOP 1807	47.5	NA	NA	91.8	33.9	NA	NA	8.20 J	<23.8	NA	NA	<125	9.79 J	NA	<23.3	NA
o-Xylene	REAC SOP 1807	13.9	NA	NA	34.4	6.47 J	NA	NA	<25.0	<11.9	NA	NA	<62.5	4.16 J	NA	<11.6	NA
Styrene	REAC SOP 1807	<11.6	NA	NA	226	<11.8	NA	NA	<25.0	<11.9	NA	NA	<62.5	3.95 J	NA	<11.6	NA
Isopropylbenzene	REAC SOP 1807	<11.6	NA	NA	68.4	<11.8	NA	NA	<25.0	<11.9	NA	NA	<62.5	<11.6	NA	<11.6	NA
1,2,3-Trichloropropane	REAC SOP 1807	<11.6	NA	NA	<25.0	<11.8	NA	NA	<25.0	<11.9	NA	NA	<62.5	<11.6	NA	<11.6	NA
n-Propylbenzene	REAC SOP 1807	5.95 J	NA	NA	47.7	3.34 J	NA	NA	<25.0	<11.9	NA	NA	<62.5	<11.6	NA	<11.6	NA
1,3,5-Trimethylbenzene	REAC SOP 1807	8.51 J	NA	NA	<25.0	<11.8	NA	NA	<25.0	<11.9	NA	NA	<62.5	<11.6	NA	<11.6	NA
1,2,4-Trimethylbenzene	REAC SOP 1807	35.8	NA	NA	15.6 J	15.6	NA	NA	<25.0	<11.9	NA	NA	<62.5	<11.6	NA	<11.6	NA
sec-Butylbenzene	REAC SOP 1807	<11.6	NA	NA	9.8	<11.8	NA	NA	<25.0	<11.9	NA	NA	<62.5	<11.6	NA	<11.6	NA
1,4-Dichlorobenzene	REAC SOP 1807	<11.6	NA	NA	<25.0	<11.8	NA	NA	<25.0	<11.9	NA	NA	<62.5	3.88 J	NA	<11.6	NA
Diethylphthalate	REAC SOP 1805	247 J	<2000	<10000	NA	128 J	<2000	<10000	NA	338 J	<2000	<20000	NA	<388	<2000	<388	<2000
Di-n-butylphthalate	REAC SOP 1805	379 J	2210	4070 J	NA	874	3470	5940 J	NA	1790	6010	9320	NA	125 J	1670 J	122 J	1310 J
3,3'-Dichlorobenzidine	REAC SOP 1805	<388	<2000	<10000	NA	<392	<2000	<10000	NA	<397	<2000	<20000	NA	<388	890 J	<388	<2000
Bis-(2-ethylhexyl) phthalate	REAC SOP 1805	499	3710	4370 J	NA	429	2040	6730 J	NA	769	1270	10300	NA	358 J	1930	223 J	1780 J
TIC'S of interest from Previous Analysis Report		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Propanoic acid ester $	REAC SOP 1805	1.78	ND	ND	1860	3.98	ND	ND	3020	10.6	4.77	ND	3600	ND	ND	ND	ND
Propanoic acid ester $$	REAC SOP 1805	2.04	ND	ND	2680	4.24	ND	ND	4190	10.7	9.33	ND	5600	ND	ND	ND	ND

NA: Not Analyzed or Not reported due to sample size

$: Propanoic acid, 2-methyl-, 2,2-dimethyl-1-(2-hydroxy-1-methylethyl)propyl ester

$$:Propanoic acid, 2-methyl-, 3-hydroxy-2,4,4-trimethylpentyl ester

ND: Not detected

J: Concentration estimated

**Elemental sulfur detection level is higher in case of paint chip due to insufficient sample

All drywall samples analyzed are imported.

Raj 8/10/2009

Table 2. XRD & XRF Analysis Results of Imported Drywall (Gypsum)					
XRD Quantitative Phase Analysis (Wt %)					
Sample Location	193 FL	233 FL	701 LA	Warehouse, VA	Warehouse, LA
$Ca(SO_4)(H2O)_2$ (Gypsum)	77.5 (6)	80.7(6)	81.6(6)	77.2(7)	89.4(6)
CaCO3 (Calcite)	5.2(1)	6.2(1)	7.4(1)	4.7(1)	0.2(1)
$CaMg(CO_{3)}$ (Dolomite)	12.5(2)	6.1(1)	3.7(2)	11.9(2)	0.6(1)
SiO_2 (Quartz)	1.1(1)	0.9(1)	1.2(1)	0.7(1)	2.9(1)
$CaSO_4$ (Anhydrite)	0.3(1)	2.0(1)	1.5(1)	1.6(1)	2.2(1)
$Ca(SO_4)(H2O)_{0.5}$ (Bassanite)	2.5(1)	2.9(1)	2.9(1)	2.0(1)	3.0(1)
$K(Al.Fe)(Al,Si_3O_{10})(OH)_2$ (Muscovite)	0.9(1)	1.2(2)	1.7(1)	1.9(1)	1.7(1)

Note: The number in parentheses is the estimated standard deviation. For example, 77.5(6) represents 77.5 ± 0.6%.

Note: Samples were analyzed by sub-contract laboratory

XRF Analysis (mg/kg)					
Sample Location	193 FL	233 FL	701 LA	Warehouse, VA	Warehouse, LA
Strontium (Sr)	3200	2500	2750	3600	340
Calcium (Ca)	240000	240000	245000	240000	220000
Iron (Fe)	1400	1200	785	1500	935

Table 3. SVOC Tentatively Identified Compounds (mg/kg)

	Sample Location	193 FL				233 FL				701 LA				Warehouse , VA		Warehouse, LA	
	Matrix	Gypsum	Paper	Paint Chips	Paint	Gypsum	Paper	Paint Chips	Paint	Gypsum	Paper	Paint Chips	Paint	Gypsum	Paper	Gypsum	Paper
RT	Tentatively Identified Compounds																
3.2	Ethylene Glycol		3.72										1700				
3.4	Unknown				630				762								
3.5	C5 Organic Acid							0.400									
3.9	Propylene glycol	0.497			3680				139								
4.1	2-Methyl-propanoic Acid				144				140								
4.6	Unknown				130												
5.1	C6 Organic Acid/ester			0.660													
5.2	Unknown disulfide compound													0.598			
5.2	Unknown	0.503	2.51														
5.3	2-Furancarboxaldehyde															0.0486	
5.6	Unknown													0.448			
5.8	Diethylene glycol												5710				
6.2	Styrene			2.02													
6.8	Unknown disulfide compound													0.601			
6.8	Diethyl Disulfide	0.517															
7.2	Diethylene Glycol	0.377			592	2.12	31.3			1.18	7.55						
7.2	C4 Alcohol		4.03														
7.3	C7 Aldehyde/Unknown			0.951													
7.4	C6 Organic Acid\Unknown					0.559				0.638							
7.4	C6 Organic Acid	0.807														0.0807	0.763
7.6	Aniline						0.648				1.82				2.69		1.12
7.7	Alkyl-benzene isomer C9H12																
7.7	Ethanol, 2-(2-butoxyethoxy)-												3490				
7.8	Ethanol, 2-(ethoxyethoxy)									0.989	1.49						
8.1	Ethyl hexanol isomer				62.4			1.16	106								
8.2	Unknown disulfide compound	0.271		0.813										0.367			
8.4	Tripropylene glycol monomethyl ether (C10H22O4 isomer)												306				
8.2	Unknown									0.508							
8.4	C5 Organic Acid															0.0793	
8.6	2-Furancarboxylic acid															0.306	3.05
8.4	1-Propanol, 2,2'-oxybis-					0.400											
8.7	C8 Alcohol																1.15
8.7	C7 Organic Acid									0.323							
8.7	Unknown	0.252						0.670						0.236		0.0850	
8.8	Acetophenone			0.919													
8.8	Acetophenone+unknown		1.27														
8.9	o-Toluidine						0.486								0.876		
8.9	2,5-Furancarboxylic acid															0.0416	
9.2	C9 Aldehyde		1.64														
9.6	Unknown disulfide compound													0.343			
9.6	C8 Organic Acid/ester			1.15													
9.6	Unknown	0.192						1.13									
9.8	Trimethyl Pentanediol				1340				961								
10.0	C8 Organic Acid/ester					0.543				1.25							
10.0	2-Decyne-4,7-diol, 2,4,7,9-tetramethyl					0.509											
10.0	Phthalic anhydride/Unknown			0.547													
10.3	2-Dodecene, (Z)-											4.19				0.0267	
10.4	Ethanol, 1-(2-butoxyethoxy)-	2.36	2.07			0.281				0.508	7.43		148				
10.7	Hydroxy Methyl Furan Carboxaldehyde																2.22
10.9	Unknown													0.213			
11.0	Benzothiazole\Unknown						0.453										
11.0	2-(2-butoxyisopropoxy)-2-isopropanol isomer					1.83											
11.0	Dipropylene glycol, monomethylether isomer					1.90											
11.3	C10 Alcohol																0.880
11.1	Caprolactum + unknown					2.15											
11.1	Unknown						0.377										
11.1	1-Phenoxy-2-propanol		5.81		1170												
11.2	C9 Organic Acid						0.624			2.04	2.98						
11.2	Quinoline	0.296															
11.3	1,4- Dimethylcyclooctane													0.205			
11.3	Propanediol ethyl isomer				82.8												
11.3	Caprolactum	0.267					0.589										

Table 3. SVOC Tentatively Identified Compounds (mg/kg)

	Sample Location	193 FL				233 FL				701 LA				Warehouse , VA		Warehouse, LA	
	Matrix	Gypsum	Paper	Paint Chips	Paint	Gypsum	Paper	Paint Chips	Paint	Gypsum	Paper	Paint Chips	Paint	Gypsum	Paper	Gypsum	Paper
RT	Tentatively Identified Compounds																
12.1	1-Decanethiol	0.103												0.217			
12.4	4-Hydroxybenzaldehyde						0.355								0.782		
12.5	Propanoic acid, 2-methyl-, 2,2-dimethyl-1-(2-hydroxy-1-methylethyl)propyl ester	1.78			1860	3.98	0.982		3020	10.6	4.77		3600				
12.8	Propanoic acid, 2-methyl-, 3-hydroxy-2,4,4-trimethylpentyl ester	2.04			2680	4.24			4190	10.7	9.33		5600				
12.8	Unknown							0.380						0.448			
13.0	Unknown			1.05		0.509		0.530									
13.0	Vanillin	0.286	2.78				0.835			0.444	2.37				6.04	0.117	3.49
13.3	1,4-Methanoazulene, decahydro-4,8,8-trimethyl-9-methylene-														0.847		
13.6	Unknown																7.67
13.6	Dodecanol				42.0						2.04			2.38	4.51		
13.7	C12 Alcohol																
13.6	C12 Chlorinated Alkane											3.20				0.394	
13.7	Dodecenol	2.81	9.88														
13.8	Unknown (column bleed?)				91.6				55.6								
14.0	2,6-Di(t-butyl)-4-hydroxy-4-methyl-2,5-cyclohexadiene-1-one									0.242							
14.4	1-Dodecanethiol	0.896	1.07											2.42	4.16		
14.9	Unknown			0.680				0.350				0.962					
14.9	Unknown Organic Acid								57.2								
14.9	C12 Organic Acid ester/phthalate			0.758	37.6												
15.0	Hydroxy methoxy phenyl ketone														0.740		
15.1	Unknown							0.790									
15.1	Phenol, 4-octyl			1.15													
15.4	Cedran-8-ol									0.713							
15.4	Unknown			0.702													2.74
16.0	Unknown							0.420			2.02						
16.2	C10 Organic Acid										2.34						
16.3	Unknown											1.37					
16.3	Unknown			0.729				0.570		1.33	3.44				0.981		
16.4	2-Tetradecene/Cyclotetradecane	0.304															
16.4	C14 Organic Acid/Benzoic acid, propy; ester isomer									0.736							0.785
16.4	C14 Organic Acid/Unknown		1.75				0.428										
16.4	Tetradecanethiol													1.04	2.87		
16.8	Alkane/Unknown															0.0346	
16.7	Bis Phenyl ether							0.390				0.949					
16.8	Benzenesulfonamide, n-butyl-							0.980									
16.9	C20 Alkane													0.186			
16.7	Benzyl Benzoate			0.617													
16.9	Fyrol PCF							0.390									
17.1	Unknown			1.06				0.380				1.62					
17.1	Unknown			2.20													
17.1	Unknown							0.590									
17.4	C16 Organic Acid ester/phthalate			1.80				2.23		0.579							
17.6	1,2-Benzenedicarboxylic acid, butyl decyl ether	0.196				0.557	0.439									0.0336	
17.8	Unknown							0.430									1.36
18.2	C16 Organic Acid	0.738	14.6	0.855		0.788	3.90	0.510		1.36	12.6			0.770	13.6	1.57	16.0
18.8	Unknown														1.31		
18.9	Dibutylisophthalate							0.510									
19.1	Unknown				190							0.931					
19.4	Unknown			4.40				1.66				1.10		0.361			
19.3	Unknown Alkane						0.601			1.20						0.0345	
19.6	Octadecenoic Acid		1.78				4.38				9.67				17.5	0.248	9.88
19.6	Unknown			0.987													
19.7	Alkyl maleate			5.17													9.20
19.8	Benzoic Acid alkylester		9.72			0.249				1.14	2.14	16.2			9.10	0.199	
19.9	Bis (2-ethylhexyl) maleate							16.0									
19.9	Unknown			0.767													
20.1	Unknown			1.21													
20.1	Unknown			0.607				0.350									
20.1	Fumaric Acid C6 ester								375								
20.0	Unknown Alkane									0.712						0.0923	

Table 3. SVOC Tentatively Identified Compounds (mg/kg)

	Sample Location	193 FL				233 FL				701 LA				Warehouse , VA		Warehouse, LA	
	Matrix	Gypsum	Paper	Paint Chips	Paint	Gypsum	Paper	Paint Chips	Paint	Gypsum	Paper	Paint Chips	Paint	Gypsum	Paper	Gypsum	Paper
RT	Tentatively Identified Compounds																
20.1	C22 Alkane					0.319	1.27				2.29				0.954		0.840
20.8	Unknown Alkane															0.233	
20.7	C23 Alkane																2.16
20.8	C21 Alkane	0.315															
20.5	Unknown														1.09		
20.6	Fumaric Acid, bis (2-ethylhexyl) ester							183									
20.6	Unknown Alkane					0.247					5.31						
20.8	Unknown Alkane		2.03			0.935	2.71			1.47				0.534	2.45		
21.0	Unknown														0.766		
21.0	Unknown Alkane					0.242											
21.3	Unknown							0.410									
21.3	Benzyl butyl phthalate			0.573				1.11				2.27					
21.5	Unknown Alkane	0.383	3.59			1.48	4.25			2.33	8.96			0.808	5.55	0.396	5.18
21.8	Phosphoric Acid, 2-ethylhexyldiphenyl ester			1.14								3.62					
21.8	C20 Alkane							0.430									
21.9	Unknown					0.253											
22.2	Unknown Alkane	0.579				1.98								1.05		0.560	7.61
22.1	4-Phenyl Morpholine						9.18	1.75				631					
22.2	4-Phenyl Morpholine											840					
22.1	Unknown		6.80					20.4		17.4	59.0				8.15		
22.2	Unknown			12.4		0.360				16.8	98.7					0.123	
22.4	Unknown Alkane					0.290											
22.3	Diethylene glycol dibenzoate		6.45				19.9	63.2		2.59	9.71				7.75		4.55
22.3	Dipropylene glycol dibenzoate											121					
22.7	Unknown			1.56						2.88							
22.8	Unknown Alkane	0.455	4.69			1.74	6.51				15.8			0.971	6.61	0.606	5.82
23.2	Unknown Alkane					0.287											
23.2	Unknown			2.36													
23.4	Unknown Alkane	0.636	6.39			1.95	8.41			3.12	21.8			1.19	7.88	0.578	7.01
23.8	Unknown													0.293		0.0643	
24.0	Unknown Alkane	0.387	7.08			1.09	4.06			1.28	5.49			0.685	3.81	0.415	4.11
24.7	Unknown Alkane	0.580	4.63			1.06	4.86			1.15	6.37			0.878	5.18	0.359	4.44
25.1	Disulfide, didodecyl													0.637			
25.2	Unknown	0.230						2.64									
26.2	Unknown Alkane	0.403	5.65			0.592	5.58			0.456	6.10			0.583	5.75	0.147	4.23
26.9	C28 Alkane										5.03						
26.8	Unknown													0.408			
27.1	Unknown Alkane		4.26			0.221	4.74			0.238					4.18	0.0853	
27.2	Binaphthylsulfone isomer	0.377												0.273		0.225	
28.0	Unknown Alkane																2.78
28.0	Unknown															0.211	
28.1	Binapthyl sulfone	0.169															
28.1	Unknown Alkane		4.20				4.23				4.06				3.74		
29.4	Unknown Alkane		3.26				3.20				3.01				2.45		1.86
29.9	Unknown Alkane																3.39
30.8	Unknown Organic Acid/ester		1.02														2.25
32.3	Unknown Alkane						1.70				1.81						
32.8	C28 Alkane		1.99														
33.5	Unknown		3.58														2.43
	Total TIC Concentration mg/Kg	**19.9**	**128**	**49.8**	**12700**	**32.9**	**127**	**304**	**9810**	**86.4**	**325**	**1630**	**20900**	**19.1**	**132**	**7.39**	**119**
	Total SVOC mg/Kg	**1.84**	**5.92**	**8.44**	**NA**	**1.43**	**5.51**	**12.7**	**NA**	**2.90**	**7.28**	**19.6**	**NA**	**0.483**	**4.49**	**0.345**	**3.09**
	Total mg/Kg	**22**	**134**	**58**	**12700**	**34**	**133**	**317**	**9810**	**89**	**332**	**1650**	**20900**	**20**	**136**	**8**	**122**

Table 4. VOC Tentatively Identified Compounds (mg/kg)									
	Sample Location	**193 FL**		**233 FL**		**701 LA**		**Warehouse, VA**	**Warehouse, LA**
	Matrix	**Gypsum**	**Paint**	**Gypsum**	**Paint**	**Gypsum**	**Paint**	**Gypsum**	**Gypsum**
RT	**Tentatively Identified Compounds**								
	Isopropanol						4.04		
4.8	2-Propanol, 2-methyl-		1.02		1.46		4.61		
7.2	Propanal, 2,2-dimethyl-		0.088						
10.4	Pentanal+TCE			0.00357		0.00357			
12.6	2-Pentanone,4,4-dimethyl		0.00831						
12.8	C7 Ketone (2,4,dimethyl,3-pentanone)		0.00726				0.00699		
13.2	Hexanal			0.00464		0.00464		0.00713	0.00186
13.3	Acetic acid, butyl ester						0.0407		
14	C7 Ketone (4-heptanone)		0.00285				0.00879		
14.3	Benzene, 1-chloro-4-(trifluoromethyl)-		0.0314						
14.6	n-Butyl ether		0.25		0.25		0.625		
14.8	4-Heptanone				0.0164		0.0272		
15.5	Propanoic acid, butyl ester		0.00718				0.249		
15.6	Heptanal			0.00419		0.00419		0.00168	
17.1	Ethyl Methyl Benzene Isomer	0.0437		0.0404		0.0404			
17.3	Butanoic acid butyl ester isomer						0.0118		
17.6	Ethyl Methyl Benzene Isomer			0.00244		0.00244		0.00203	
17.7	Benzaldehyde		0.00582				0.0183		
17.7	Unknown							0.00459	0.00179
17.8	Ethyl Methyl Benzene Isomer								
17.8	Octanal			0.00425		0.00425			
17.9	Butanoic acid butyl ester isomer						0.0067		
18.1	Unknown aldehyde			0.00245		0.00245			
18.1	1-Hexanol, 2-ethyl-		0.149		1.14			0.00488	
18.2	C10 Alkene\Cycloalkane						0.00909		
18.4	Limonene							0.00251	
18.6	2-Butenoic acid, butyl ester						0.0334		
19	C8 alcohol							0.0065	0.0043
20.1	Unknown			0.00547		0.00547		0.00973	0.00349
20.8	Unknown aldehyde							0.00219	
23.3	Unknown								0.00191
23.4	Unknown							0.00221	
24.5	Unknown			0.00134		0.00134			
25.5	Propanoic acid, 2-methyl-, 2,2-dimethyl-1-(2-hydroxy-1-methylethyl)propyl ester		0.0469		0.216		0.0937		0.00793
25.7	Propanoic acid, 2-methyl-, 3-hydroxy-2,4,4-trimethylpentyl ester		0.0266		0.125		0.0854		0.00735
26.9	Unknown								0.0
	Total VOC Concentration (mg/Kg)	**21.9**	**21.6**	**0.242**	**4.56**	**0.242**	**45.7**	**0.195**	**0**
	Total VOC TIC Concentration (mg/Kg)	**0.0437**	**1.64**	**0.0688**	**3.21**	**0.0688**	**9.87**	**0.0435**	**0.0286**
	Total mg/Kg	**21.9**	**23.3**	**0.311**	**7.77**	**0.311**	**55.5**	**0.238**	**0.0286**

Table 5. Headspace Screening Results for Reduced Sulfur Compounds in Gypsum by GC/SCD (PPBV)												
Sample Location	Method Blank		193 FL		233 FL		701 LA		Warehouse, VA		Warehouse, LA	
Target Analytes	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet
Hydrogen SUlfide	<2.0	<2.0	130	76	72	4.3	45	6.9	130	35	<2.0	2.8
Carbonyl Sulfide	<2.0	<2.0	270	640E	130	700E	160	1100 E	270	2100 E	9.5	29
Methyl Mercaptan	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Ethyl Mercaptan	<2.0	<2.0	<2.0	7.0	<2.0	3.8	<2.0	<2.0	7.1	7.1	<2.0	<2.0
Dimethyl Sulfide	<2.0	<2.0	<2.0	<2.0	<2.0	3.6	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Carbon Disulfide	<2.0	<2.0	72	400E	50	420E	63	570E	81	1100E	8.2	24
Isopropyl Mercaptan	<2.0	<2.0	8.9	44	7.8	15	<2.0	18	7.7	36	<2.0	3.1
t-Butyl Mercaptan	<2.0	<2.0	<2.0	4.3	<2.0	<2.0	<2.0	<2.0	<2.0	6.7	<2.0	<2.0
n-Propyl Mercaptan	<2.0	<2.0	<2.0	3.7	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Ethyl Methyl Sulfide	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Thiophene/2-Methyl-Propanethiol	<4.0	<4.0	<4.0	25	<4.0	7.4	<4.0	7.2	11	17	<4.0	<4.0
Methyl Isopropyl Sulfide	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
1-Methyl-Propanethiol	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
n-Butyl Mercaptan	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0

E: estimated, above calibration range