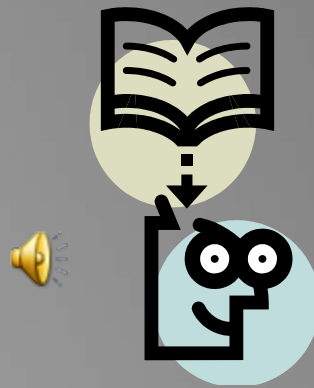


Analytical Considerations in
Emissions Testing Related to Chinese
Drywall

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Thought for the Day

- Wouldn't it be nice to remember everything we ever learned?



- As we look at the vast amount of data being collected & reported, it's important to discern what's important and what's not – what's good & useful and what's not.



If it's corrosive to copper...

Brief Timeline of Events

June 2008 – FDOH receives first complaint from homeowner

September 2008 – A consultant contacts FDOH regarding its investigations on behalf of a commercial home builder

January 2009 – DOH receives consultant's report and conducts its own initial assessment of 12 homes

February 2009 – Lakeland Labs contacted by this same consultant regarding development of analytical method

March 2009 – FDOH drafts case definition



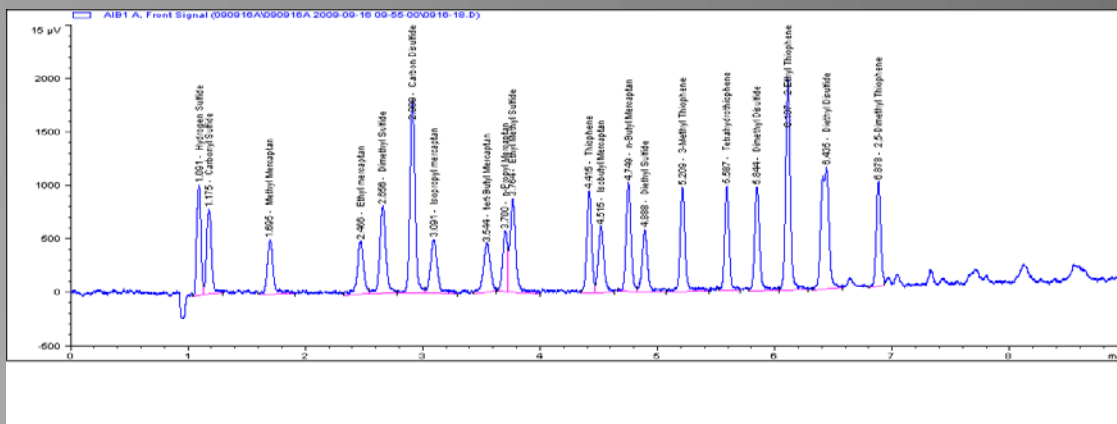
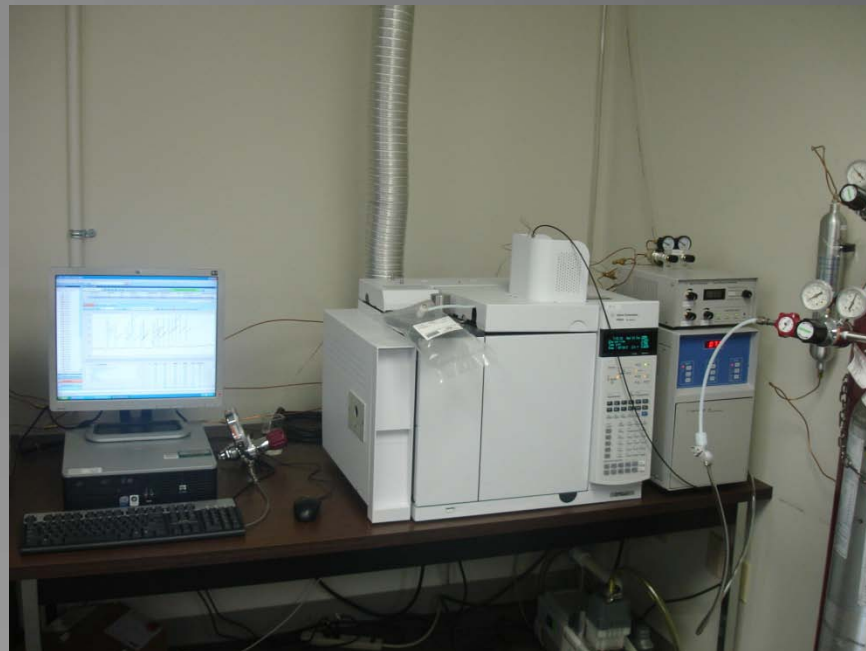
Brief Timeline of Events

April 2009 – Lakeland Labs commits to method development – Contacted by EPA to participate in additional assessment efforts

May 2009 – FDOH initiates contract laboratory testing to determine if Chinese drywall poses health risks to occupants – Lakeland Labs finalizes method development

June 2009 – Lakeland Labs begins analyzing “real” samples from FDOH, EPA, and a private consultant

November 2009 – Lakeland Labs analyzing samples collected by consultants based in all regions of US – Participating in research aimed at defining the mechanisms involved



Analysis of Trace Sulfur Compounds in Air (ASTM D5504-08)

- Samples collected into Tedlar™ bags
- Samples collected by personal sampling pump or lung-type sampler
- Analysis by GC-SCD within 24 hours



Method Detection & Practical Quantitation Limits



Initial MDLs/PQLs in ppbv

	MDL	PQL
• Hydrogen Sulfide	3.35	5.00
• Carbonyl Sulfide	3.96	5.00
• Methyl Mercaptan	4.65	5.00
• Ethyl Mercaptan	4.59	5.00
• Dimethyl Sulfide	3.41	5.00
• Carbon Disulfide	1.29	5.00
• Isopropyl Mercaptan	5.00	7.00
• tert-Butyl Mercaptan	5.64	7.00
• n-Propyl Mercaptan	4.36	5.00
• Ethyl Methyl Sulfide	3.36	5.00
• Thiophene	3.50	5.00
• Isobutyl Mercaptan	4.00	5.00
• n-Butyl Mercaptan	3.39	5.00
• Diethyl Sulfide	4.29	5.00
• 3-Methyl Thiophene	2.70	5.00
• Tetrahydrothiophene	2.07	5.00
• Dimethyl Disulfide	3.25	5.00
• 2-Ethyl Thiophene	1.97	5.00
• Diethyl Disulfide	1.26	5.00
• 2,5-Dimethyl Thiophene	3.62	5.00

Current MDLs/PQLs in ppbv

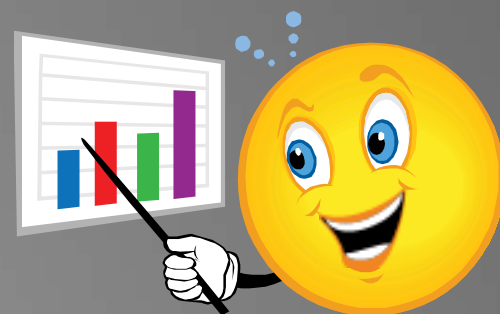
	MDL	PQL
• Hydrogen Sulfide	1.25	5.00
• Carbonyl Sulfide	0.900	5.00
• Methyl Mercaptan	1.80	5.00
• Ethyl Mercaptan	1.89	5.00
• Dimethyl Sulfide	0.750	5.00
• Carbon Disulfide	0.560	5.00
• Isopropyl Mercaptan	1.55	5.00
• tert-Butyl Mercaptan	1.67	5.00
• n-Propyl Mercaptan	1.96	5.00
• Ethyl Methyl Sulfide	0.790	5.00
• Thiophene	0.360	5.00
• Isobutyl Mercaptan	1.62	5.00
• n-Butyl Mercaptan	0.910	5.00
• Diethyl Sulfide	1.80	5.00
• 3-Methyl Thiophene	1.21	5.00
• Tetrahydrothiophene	1.06	5.00
• Dimethyl Disulfide	1.05	5.00
• 2-Ethyl Thiophene	0.450	5.00
• Diethyl Disulfide	0.960	5.00
• 2,5-Dimethyl Thiophene	0.880	5.00



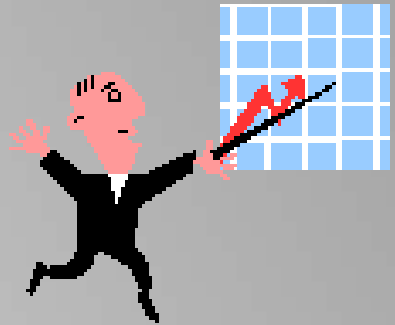
Analytical Warning & Control Limits

Lab Control Sample – Lab Control Sample Duplicate

Analyte	LCL	LWL	UWL	UCL
• Hydrogen Sulfide	74	80	103	109
• Carbonyl Sulfide	75	82	111	118
• Methyl Mercaptan	80	84	103	107
• Ethyl Mercaptan	61	72	120	132
• Dimethyl Sulfide	78	84	109	115
• Carbon Disulfide	73	81	115	123
• Isopropyl Mercaptan	61	72	116	127
• tert-Butyl Mercaptan	71	80	113	121
• n-Propyl Mercaptan	59	71	118	129
• Ethyl Methyl Sulfide	79	85	111	118
• Thiophene	80	86	111	118
• Isobutyl Mercaptan	70	79	116	126
• n-Butyl Mercaptan	83	88	106	110
• Diethyl Sulfide	64	74	116	126
• 3-Methyl Thiophene	75	83	115	123
• Tetrahydrothiophene	66	76	117	127
• Dimethyl Disulfide	80	86	108	114
• 2-Ethyl Thiophene	75	83	113	121
• Diethyl Disulfide	67	78	121	131
• 2,5-Dimethyl Thiophene	58	73	132	147



Analytical Warning & Control Limits – Matrix Spike – Matrix Spike Duplicate



Analyte	LCL	LWL	UWL	UCL
• Hydrogen Sulfide	62	73	117	128
• Carbonyl Sulfide	77	97	176	196
• Methyl Mercaptan	58	70	119	131
• Ethyl Mercaptan	52	66	124	139
• Dimethyl Sulfide	74	82	111	119
• Carbon Disulfide	71	90	168	187
• Isopropyl Mercaptan	66	74	109	118
• tert-Butyl Mercaptan	51	66	124	139
• n-Propyl Mercaptan	61	72	117	129
• Ethyl Methyl Sulfide	70	79	114	123
• Thiophene	68	77	114	124
• Isobutyl Mercaptan	57	68	115	127
• n-Butyl Mercaptan	73	82	116	125
• Diethyl Sulfide	62	71	108	117
• 3-Methyl Thiophene	71	80	113	122
• Tetrahydrothiophene	60	71	117	129
• Dimethyl Disulfide	67	76	114	124
• 2-Ethyl Thiophene	63	74	120	131
• Diethyl Disulfide	57	70	123	136
• 2,5-Dimethyl Thiophene	58	71	124	137



Observations and Comments on Initial Sample Sets

- Background contamination issues observed by others in some manufacturers' Tedlar™ bags.
- Some samples submitted to us were solely for the purpose of confirming this phenomena.
- Tedlar™ bag manufacturers may have modified manufacturing process to meet demand, resulting in failure of almost 10% of all bags.



Observations and Comments on Initial Sample Sets

- Hydrogen sulfide identified in outdoor samples collected near active irrigation systems.
- Trace carbonyl sulfide detected in occasional outdoor samples.



Observations and Comments on Current Sample Sets

- All Tedlar™ bags now checked prior to use to identify defective bags *before* samples are collected.
- Mean LCS-LCSD recoveries for compounds range from 91% to 103%. Mean MS-MSD recoveries range from 89% to 99% for all compounds except carbonyl sulfide and carbon disulfide.
- Mean LCS-LCSD recoveries for carbonyl sulfide and carbon disulfide are 97% and 98%, respectively.
- Mean MS-MSD recoveries for these two compounds are 137% and 129%, respectively. Why? Humidity? Reactivity with other known or unknown compounds in matrix?
- Effects of environmental variables (e.g., RH, exposure to light, holding times, etc.)



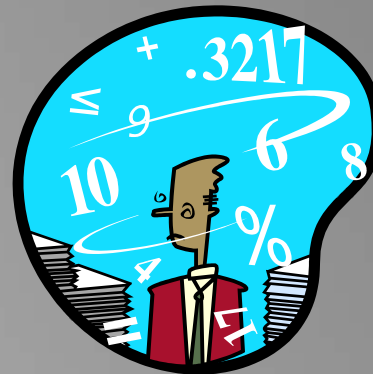
Distribution of Positive Detections

- As of November 1, 2009, analysis of 841 samples has been completed.
- Positive detections of all but 5 compounds.
- Of these positive detections, we suspect “real hits” of only hydrogen sulfide, carbonyl sulfide, and carbon disulfide distributed as follows –
 - H₂S in 3.21% of all samples
 - COS in 4.76% of all samples
 - CS₂ in 8.44 % of all samples



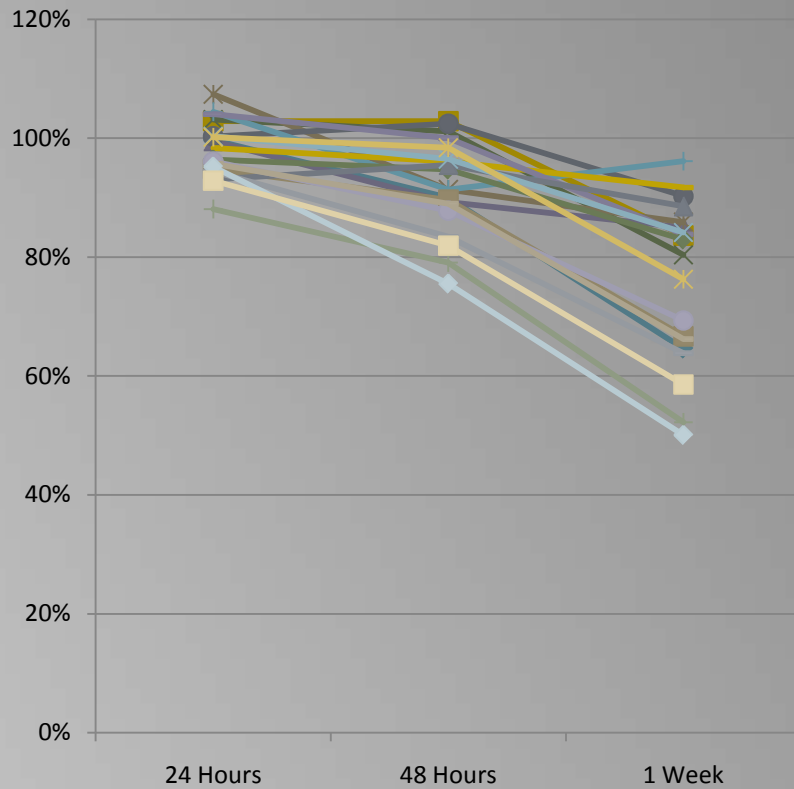
Distribution of Positive Detections

- Of the samples analyzed, we infer 58 instances of positive detections of at least one of these three compounds in indoor environments.
- This represents 6.90% of all samples tested.
- Most of these hits are qualified as being between the MDL and the PQL.

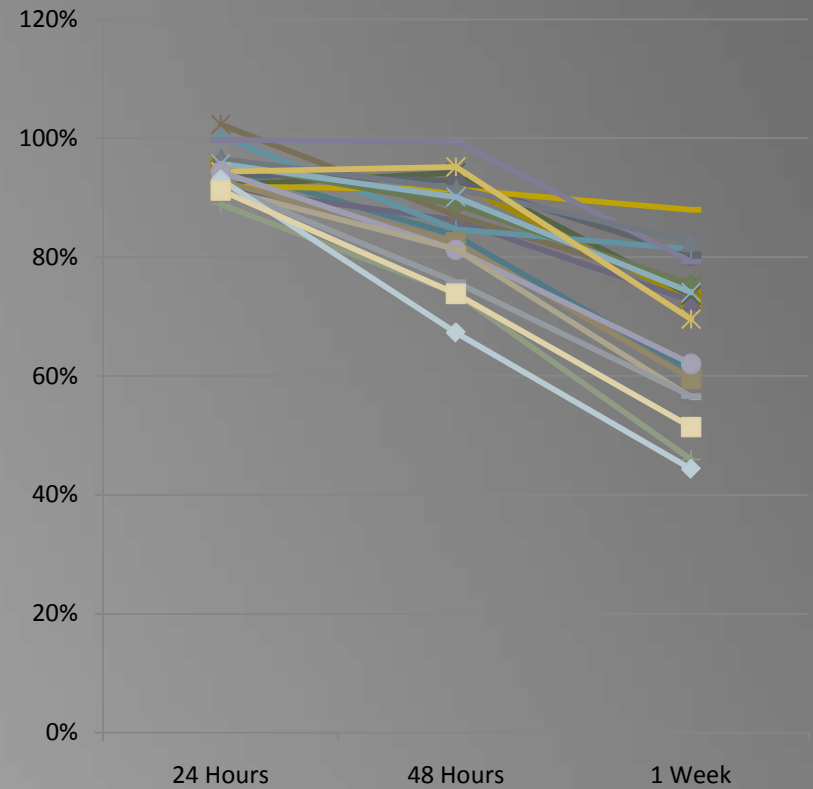


Degradations with Holding Time

Samples Stored Away from Light

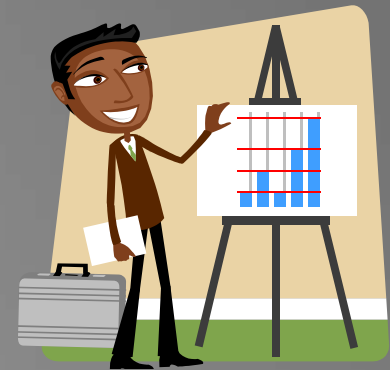


Samples Stored at Normal Room Lighting



Where do we go from here?

- Reviewing details of assessments from FDOH, EPA, and CPSC
- Currently reviewing results of chamber studies in an attempt to confirm mechanisms
- Participating in studies aimed at assessing effectiveness of various remedial techniques
- Look for results of studies & assessments in *peer-reviewed* studies and publications



Analytical Considerations in Emissions Testing Related to Chinese Drywall

Presented at the Technical Symposium on Corrosive
Imported Drywall (November 5-6, 2009)

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