

# **6th Specialty Conference on Vapor Intrusion 2012**

**Denver, Colorado, USA  
3-4 October 2012**

**ISBN: 978-1-62276-828-8**

**Printed from e-media with permission by:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571



**Some format issues inherent in the e-media version may also appear in this print version.**

The opinions expressed in these papers are solely of the authors and should not be considered as having the endorsement or support of the Association.

Compilation Copyright © 2012 by the Air & Waste Management Association.  
Copyright of the individual papers are retained by the authors. Published in July 2012

Printed by Curran Associates, Inc. (2013)

For permission requests, please contact the Air and Waste Management Association at the address below.

Air and Waste Management Association  
One Gateway Center, 3rd Floor  
420 Fort Duzuesne Blvd.  
Pittsburgh, Pennsylvania 15222-1435

Phone: 800 270 3444  
Fax: 412 232 3450

[www.awma.org](http://www.awma.org)

**Additional copies of this publication are available from:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571 USA  
Phone: 845-758-0400  
Fax: 845-758-2634  
Email: [curran@proceedings.com](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

# TABLE OF CONTENTS

## **KEYNOTE**

<b>The Vapor Intrusion Pathway - Twenty Years After the J&amp;E Model</b> .....	1
<i>Robert Ettinger</i>	

## **SESSION I: REGULATORY RESEARCH AND POLICY**

<b>Summary of State Approaches to Vapor Intrusion – 2012 Update</b> .....	7
<i>Bart Eklund, Tom McHugh</i>	
<b>Quantitative Review of EPA’s Proposed Vapor Intrusion Attenuation Factor for Exterior Soil Gas, and the Potential Impact on Brownfield Development</b> .....	8
<i>Michael J. Moes, Michelle K. King, Claudia Cuadrado, Thomas W. Kalinowski</i>	
<b>Monitored-Natural or Engineered - Vapor Attenuation?</b> .....	24
<i>Henry J. Schuver, Lenny M. Siegel</i>	
<b>Typical Indoor Air Concentrations of Volatile Organic Compounds in Non-Smoking Montana Residences Not Impacted by Vapor Intrusion</b> .....	30
<i>Christopher A. Cote, Benjamin J. Martich</i>	
<b>Developing Groundwater Clean-Up Levels Based on the Vapor Intrusion Pathway</b> .....	49
<i>Susan B. Welt, Franklyn Legall, Miguel F. Singer</i>	
<b>Uncertainty Over Potential Vapor Intrusion Complicates Closing Transactions</b> .....	63
<i>Thomas P. Wilczak, Todd C. Fracassi</i>	

## **SESSION II: SYSTEMATIC DECISION MAKING FOR VAPOR INTRUSION**

<b>Use of VOC Mass Flux to Estimate Vapor Intrusion Impacts</b> .....	76
<i>Bradley A. Green, David Shea, Andrew E. Ashton</i>	
<b>Analysis and Interpretation of Time-Variable Vapor Intrusion Data: Pressure-Driven Flow Across Building Foundations</b> .....	93
<i>George E. DeVauil</i>	
<b>Long-Term Detailed Study of Variability in Attenuation Factors – Separating Building from Subsurface Factors</b> .....	107
<i>Christopher C. Lutes, Brian Cosky, Brian Schumacher, John Zimmerman, Robert Truesdale, Shu-yi Lin, Blayne Hartman</i>	
<b>Evaluation of Vapor Intrusion Sampling Strategies Using Simulated Distributions of Indoor Air Concentrations</b> .....	120
<i>John Lowe, Michael Novak, Loren Lund</i>	

## **SESSION III: PRESSING VI ISSUES**

<b>AWMA VI Panel Discussion: Your Questions Answered</b> .....	134
<i>Matthew Lahvis, Donna Caldwell, Rich Kapuscinski, Lawrence Kirsch</i>	
<b>Navy Vapor Intrusion Challenges</b> .....	139
<i>Donna Caldwell</i>	
<b>Pressing Vapor Intrusion Issues - Your Questions Answered</b> .....	145
<i>Laurence S. Kirsch</i>	

## **SESSION IV: PETROLEUM HYDROCARBONS AND VAPOR INTRUSION**

<b>Effects of Ethanol Blended Gasoline Release on Soil Vapor Transport: Preliminary Results of Biogas Generation Experiments and Numerical Modeling</b> .....	155
<i>Parisa Jourabchi, Natasha Sihota, Ian Hers, K. Ulrich Mayer, George DeVauil, Ravi Kolhatkar, Bruce Bauman</i>	
<b>The Relationship Between Petroleum Hydrocarbon Vapors and Oxygen Concentrations Beneath Slabs</b> .....	185
<i>Nivari S. Jayasinghe, Adrian C. Heggie</i>	
<b>High Bias and Analytical Uncertainty of the Massachusetts APH Method for Indoor Air and Sub-Slab Soil Gas Samples</b> .....	195
<i>Sara Goshorn, Danielle Bailey, Lila Beckley, William Elcoate, Stephanie Fiorenza, Thomas McHugh</i>	

## **SESSION V: DATA VALIDATION, LABORATORY AND ANALYTICAL CONCERNS**

<b>Evaluation of an Automated Air Sampling System: LESS™</b> .....	204
<i>Kyle C. Hunt</i>	
<b>Evaluation of the Potential Influences of Modeling Clay on Sub-slab Sampling Results</b> .....	209
<i>Nadine Weinberg, Abby Wolford, Andrew Korik, Alyson Fortune, Samantha Henningsen, Sasha Sommer</i>	

## **SESSION VI: INDOOR SAMPLING ISSUES**

<b>The Utilization of C, Cl and H Isotopes in Vapor Intrusion Studies as a Tool for Determining Sources of Indoor VOCs</b> .....	225
<i>Tomasz Kuder, Monika Klisch, Thomas McHugh, R. Paul Philp</i>	
<b>Definitive Vapor Intrusion Investigations Using On-site GC/MS Analysis and Building Pressure Control</b> .....	237
<i>Lila Beckley, Erik Dettenmaier, Kyle Gorder, Ignacio Rivera-Duarte, Thomas McHugh</i>	

## **SESSION VII: SUSTAINABLE MITIGATION AND OTHER CASE STUDIES**

<b>Performance of Aerated Floor Systems in the Passive Venting Mode</b> .....	248
<i>David Folkes, Theodore Kuehster, Eric Lovenduski</i>	
<b>Sustainable Approaches for Soil Gas Mitigation Systems</b> .....	249
<i>Ian Hers, Eric Hood</i>	
<b>Case Histories in Vadose Zone Profiling: Value of Exterior Explorations to Assess Vapor Intrusion Potential</b> .....	267
<i>Erica Bradstreet, Lisa Jacob, Daniel Carr</i>	
<b>Innovative Method for Depressurizing the Slab of a Large Industrial Building</b> .....	279
<i>Eric M. Alongi, James M. Cavotta, Clare F. Leary, M. Brendan Mullen, Trevor M. Staniec, Matthew Traister</i>	
<b>Engineering Evaluation of Including Sub-Slab Liners in Active Vapor Intrusion Mitigation Systems</b> .....	293
<i>Michael J. Moes, Michelle K. King, Thomas W. Kalinowski</i>	
<b>Case Study: Isotope Analysis to Support Differentiation between Vapor Intrusion and Background Indoor Air Sources</b> .....	307
<i>Charles (Chip) P. Halbert, Lauren K. McIntire</i>	
<b>Applying Dynamic Controls to Vapor Intrusion Mitigation Systems to Manage Pressure Differentials, Effluent Concentrations and Energy Conservation</b> .....	322
<i>Thomas E. Hatton, Michael D. Salcone</i>	
<b>A Case Study Using Traditional and Non-Traditional Lines of Evidence for a Vapor Intrusion Pathway Evaluation in a Fractured Bedrock Setting</b> .....	337
<i>Shannon L. Thompson, Paul E. Michalski, Charles P. DeWolf, Justin G. Pruis</i>	

## **POSTERS**

<b>Analytical Quantification of Soil Gas Entry Into Basement Through Permeable Basement Wall to Study the Impact of Soil Gas Pollutant on Indoor Air Quality</b> .....	354
<i>Thierno M.O. Diallo, Bernard Collignan, Francis Allard</i>	
<b>Determination of Polychlorinated Biphenyls in Soil Vapor using EPA Compendium Method TO-17</b> .....	355
<i>Heidi C. Hayes, Jason S. Arnold</i>	
<b>Organochlorine Pesticide Measurements in Residential Indoor Air</b> .....	356
<i>Richard J. Rago, Gina Plantz</i>	
<b>Advancements in Contaminant Vapor Mitigation Technologies</b> .....	357
<i>Peter Grant</i>	
<b>Benefits of Using Passive Diffusion Samplers for Vapor Intrusion Assessment at a Large Site</b> .....	358
<i>Monica K. Williams, Benjamin J. Martich</i>	
<b>Can your Vapor Intrusion CSM Change During Remediation? Lessons Learned from a Manufacturing Site in New Hampshire</b> .....	359
<i>Russell Abell, Carl Elder, Mary DeFlaun, Frank Simmons</i>	
<b>The Effects of Groundwater Level on Vapor Intrusion</b> .....	360
<i>Rui Shen, Kelly G. Pennell, Eric M. Suuberg</i>	
<b>The Value of Open Communication</b> .....	361
<i>Susan Welt, Lisa Sigler</i>	
<b>The Potential Formation and Off-Gassing of Trihalomethanes (THMs) and other VOCs into Soil Vapor and Ambient Air</b> .....	362
<i>Andrew P. Rezendes, William Elcoate</i>	
<b>Author Index</b>	