

**RADISAV D. VIDIC, Ph.D., P.E.**  
William Kepler Whiteford Professor and Chair  
Department of Civil and Environmental Engineering  
University of Pittsburgh, Pittsburgh, PA 15261-2294

EDUCATION

Ph.D. Environmental Engineering, University of Cincinnati, 1992  
M.S. Environmental Engineering, University of Illinois, Urbana, 1989  
B.S. Civil Engineering, University of Belgrade, 1987

TEACHING AND RESEARCH EXPERIENCE

2007 - present	Chair, Department of Civil and Environmental Engineering, University of Pittsburgh, Pittsburgh, PA
2016 – 2021	Visiting Professor, Department of Civil Engineering, University of Belgrade, Serbia
2006 - present	Professor of Chemical and Petroleum Engineering, University of Pittsburgh, Pittsburgh, PA
2003 - present	Professor of Environmental Engineering, University of Pittsburgh, Pittsburgh, PA
2003 - 2004	Fulbright Scholar, University of Belgrade, Serbia
1998 - 2003	Associate Professor of Environmental Engineering, University of Pittsburgh, Pittsburgh, PA
1999 - 2000	Visiting Scientist, Institute Chemische Technologie, Fraunhofer Gesellschaft, Karlsruhe, Germany
1992 - 1998	Assistant Professor of Environmental Engineering, University of Pittsburgh, Pittsburgh, PA
1990 - 1992	Research and Teaching Assistant, Department of Civil and Environmental Engineering, University of Cincinnati, Cincinnati, OH
1988 - 1989	Research and Teaching Assistant, Department of Civil Engineering, University of Illinois, Urbana, IL
1987 - 1988	Lecturer, Department of Civil Engineering, University of Belgrade, Serbia
1986 - 1987	Visiting Scholar, University of Lund, Sweden

PROFESSIONAL SOCIETIES AND RECOGNITION

2014 Board of Visitors Faculty Award, Swanson School of Engineering, University of Pittsburgh  
2014 Who's Who in Energy, Business Times  
2014 Finalist, Shale Gas Innovation Contest (Ben Franklin Technology Partners)  
2013 Who's Who in Energy, Business Times  
2013 Member, Board of Directors, Shale Alliance for Energy Research (SAFER)

2013 Water Environment Federation Student Paper Competition, Graduate Division, awarded to my graduate student Xuan Zheng  
 2013 University Research Grand Prize for Excellence in Environmental Engineering and Science, American Academy of Environmental Engineers and Scientists  
 2013 PennTec Student Research Award, awarded to my graduate student Xuan Zheng  
 2011 Appointed to the US EPA Science Advisory Board Panel for the Review of Hydraulic Fracturing Study  
 2009 ACS Graduate Student Award in Environmental Chemistry, awarded to my graduate student Heng Li  
 2008 Professor of the Year, American Society of Civil Engineers, Pittsburgh Section  
 2003 Fulbright Scholarship, University of Belgrade, Serbia  
 2001 ASHRAE Poster Presentation Award  
 2000 Professional Research Award from the Pennsylvania Water Environment Association  
 2000 Third Place Award in AWWA Poster Session, American Water Works Association  
 1993 Outstanding Doctoral Thesis Award, Association of Environmental Engineering Professors  
 1991 Water Pollution Control Federation Award for Best Student Research Paper in the Ph.D. Category  
 William Kepler Whiteford Faculty Fellowship, University of Pittsburgh, 1994, 1996 and 1998  
 William Kepler Whiteford Professor, University of Pittsburgh, 2008, 2012  
 Scientific Committee, Second Conference on The Systems for Management of Environmental Protection, Novi Sad, Serbia and Montenegro, May 20-22, 2004  
 Chair, International Program Committee, First International Conference on Environmental Recovery of Yugoslavia 2001, Belgrade, Yugoslavia, September 27-30, 2001  
 Editorial Board, International Journal of Water and Waste Water Treatment, SciForschen, 2014.  
 Associate Editor - Water Research, 1996-2004  
 Associate Editor – ASCE Journal of Environmental Engineering, 2004-2012  
 Association of Environmental Engineering and Science Professors, 1992 – present  
 Member, Fred Pohland Award, 2005-2007  
 Membership Committee (Chair), 1995-2000  
 American Society of Civil Engineers, 1989 - present  
 Technical Committee Chair - 1995 ASCE National Environmental Engineering Conference  
 Water Environment Federation, 1989 - present  
 Program Committee, 1992-1999  
 Hazardous Waste and Ground Water Committee, 1993 - 2000  
 Program Committee, Pennsylvania Water Environment Association, 1993 - 2002  
 Research Committee (Chair), Pennsylvania Water Environment Association, 1994 - 2000  
 American Water Works Association, 1989 - present  
 Student Activities Committee (Chair) - Pennsylvania Section, 1992 - 1999  
 Strategic Planning Committee - Pennsylvania Section, 1994 - 2000  
 Program Committee - Pennsylvania Section, 1993 - present  
 American Institute of Chemical Engineers, 1998 – present  
 Chairman of the Mercury Control Session, AIChE Spring National Meeting, March 14-18, 1999, Houston, TX  
 American Chemical Society, 1995 – present

Symposium Organizer “Mercury and Other Trace Elements in Fuel: Emissions and Control”  
 ACS Division of Fuel Chemistry, 235th American Chemical Society National Meeting,  
 April 6-10, 2008, New Orleans, LA  
 International Water Association, 1989 – present

	Google Scholar	Scopus
h-index:	50	41
Citations:	10,108	6,787

## PUBLICATIONS

### A. Journal Articles

1. Chang, H., Liu, B., Zhang, Z., Pawar, R., Yan, Z., Crittenden, J.C. and **Vidic, R.D.** “A Critical Review of Membrane Wettability for Membrane Distillation from the Perspective of Interfacial Interactions” *Environmental Science & Technology*, 55(3), 1395-1418, 2021. <https://doi.org/10.1021/acs.est.0c05454>
2. Chang, H., Liu, S., Tong, T., He, Q., Crittenden, J.C., **Vidic, R.D.** and Liu, B. “On-site Treatment of Shale Gas Flowback and Produced Water in Sichuan Basin by Fertilizer Drawn Forward Osmosis for Irrigation” *Environmental Science & Technology*, 54(17):10926-10935, 2020. <https://pubs.acs.org/doi/10.1021/acs.est.0c03243>
3. Tian L., Chang H., Tang P., Li T., Zhang X., Liu S., He Q., Wang T., Yang J., Bai Y., **Vidic, R.D.**, Crittenden, J.C., and Baicang, L. "Rare Earth Elements Occurrence and Economical Recovery Strategy from Shale Gas Wastewater in the Sichuan Basin, China" accepted for publication in *ACS Sustainable Chemistry & Engineering*, 8(32):11914-11920, 2020. <https://doi.org/10.1021/acssuschemeng.0c04971>
4. Gusa, A.V., Tomani, A., Zhang, Z. and **Vidic, R.D.** “Sulfate precipitation in produced water from Marcellus Shale for the control of naturally occurring radioactive material” *Water Research*, 177, 115765, 2020, <https://doi.org/10.1016/j.watres.2020.115765>
5. Tavakkoli, S., Lokare, O., **Vidic, R.D.** and Khanna, V. “Shale gas produced water management using membrane distillation: An optimization-based approach” *Resources, Conservation & Recycling*, 158, 104803, 2020. <https://doi.org/10.1016/j.resconrec.2020.104803>
6. Chang, H., Liu, B., Crittenden, J.S., **Vidic, R.D.** “Resource Recovery and Reuse for Hydraulic Fracturing Wastewater in Unconventional Shale Gas and Oil Extraction” *Environmental Science & Technology*, 53, 13547-13548, 2019. <https://doi.org/10.1021/acs.est.9b06240>
7. Lokare, O. and **Vidic, R.D.** “Impact of operating conditions on measured and predicted concentration polarization in membrane distillation” *Environmental Science & Technology*, 2019, 53, 11869-11876, 2019. <https://doi.org/10.1021/acs.est.9b04182>
8. Wadekar, S., Wang, Y., Lokare, O. and **Vidic, R.D.** “Influence of chemical cleaning on physicochemical characteristics and ion rejection by thin film composite nanofiltration membranes” *Environmental Science & Technology*, 53, 10166-10176, 2019. <https://doi.org/10.1021/acs.est.9b02738>

9. Lokare, O., Ji, P., Wadekar, S., Dutt., G. and **Vidic, R.D.** "Concentration polarization in membrane distillation: I. Development of laser-based spectrophotometric method for in-situ characterization" *J. Membrane Science*, 581, 462-471, 2019. <https://doi.org/10.1016/j.memsci.2019.03.080>
10. Chang, H., Li, T., Liu, B., **Vidic, R.D.**, Elimelech, M., Crittenden, J.C. "Potential and implemented membrane-based technologies for the treatment and reuse of flowback and produced water from shale gas and oil plays: A review" *Desalination*, 455, 34-57, 2019. <https://doi.org/10.1016/j.desal.2019.01.001>
11. Gusa, A.V. and **Vidic, R.D.** "Development of Functionalized Proppant for the Control of NORM in Marcellus Shale Produced Water" *Environmental Science & Technology*, 53, 373-382, 2019. <https://doi.org/10.1021/acs.est.8b05710>
12. Tasker, T., Burgos, W., Ajemigbitse, M., Lauer, N., Gusa, A., Khatbek, M., May, D., Landis, J., Alessi, D., Johnsen, A., Kaste, J., Headrick, K., Wilke, F.D.H., McNeal, M., Engle, M., Jubb, A., **Vidic, R.D.**, Vengosh, A., Warner, N. "Accuracy of methods for reporting inorganic element concentrations and radioactivity in oil and gas wastewaters from the Appalachian Basin, U.S. based on an inter-laboratory comparison" submitted for publication, *Environmental Science: Processes & Impacts*, 21, 224-241, 2019 (DOI: 10.1039/c8em00359a).
13. Thomas, L., Tang, H., Kalyon, D.M., Seda Aktas, S. Arthur, J.D., Blotvogel, J., Carey, J.W., Filshill, A., Fu, P., Hsuan, G., Hu, T., Soeder, D., Shah, S., **Vidic, R.D.**, Young, M.H. "Toward better hydraulic fracturing fluids and their application in energy production: A review of sustainable technologies and reduction of potential environmental impacts" *Journal of Petroleum Science and Engineering*, 173, 793-803, 2019. <https://doi.org/10.1016/j.petrol.2018.09.056>
14. Wang, Y., Tavakkoli, S., Khanna, V., **Vidic, R.D.**, Gilbertson, L.M. "Life cycle impact and benefit trade-offs of a produced water and abandoned mine drainage cotreatment process" *Environmental Science & Technology*, 52, 13995-14005, 2018. DOI: 10.1021/acs.est.8b03773
15. Wadekar, S.S. and **Vidic, R.D.** "Insights into the rejection of barium and strontium by nanofiltration membrane from experimental and modeling analysis" *Journal of Membrane Science*, 564, 742-752, 2018
16. Wadekar, S.S. and **Vidic, R.D.** "Comparison of ceramic and polymeric nanofiltration membranes for treatment of abandoned coal mine drainage" *Desalination*, 440, 135-145, 2018.
17. Brantley, S.L., **Vidic, R.D.**, Brasier, K., Yoxtheimer, D., Pollak, J., Wilderman, C. and Wen, T. "Engaging over data on fracking and water quality", *Science*, 359:6374, 395-397, 2018.
18. Lokare, O., Tavakkoli, S., Khanna, V. and **Vidic, R.D.** "Importance of feed recirculation for the overall energy consumption in membrane distillation systems", *Desalination*, 428, 250-254, 2018.
19. Wadekar, S., Mittal, D., Hayes, T., Lokare, O. and **Vidic, R.D.** "Optimization of nanofiltration membranes for treatment of abandoned mine drainage: Laboratory- and pilot-scale studies" *Industrial & Engineering Chemistry Research*, 56, 7355-7364, 2017.
20. Tavakkoli, S., Lokare, O., **Vidic, R.D.** and Khanna, V. "A techno-economic assessment of membrane distillation for treatment of Marcellus shale produced water" *Desalination*, 416, 24-34, 2017.

21. Wadekar, S. and **Vidic, R.D.** "Influence of active layer chemistry on physicochemical properties and performance of commercially available polyamide nanofiltration membranes" *Environmental Science & Technology*, 51, 5658-5665, 2017.
22. Lokare, O., Tavakkoli, S., Rodriguez, G., Khanna, V. and **Vidic, R.D.** "Integrating membrane distillation with waste heat from natural gas compressor stations for produced water treatment in Pennsylvania", *Desalination*, 413, 144-153, 2017.
23. Lokare, O., Tavakkoli, S., Khanna, V. and **Vidic, R.D.** "Fouling in direct contact membrane distillation of produced water from unconventional gas extraction", *J. Membrane Science*, 524, 493-501, 2017.
24. Lu, C., **Vidic, R.D.**, Liu, Q. and Monnell, J.D. "Using abandoned mine drainage (AMD) precipitate to remove mercury in flue gas from coal-fired power plants." *Fresenius Environmental Bulletin*, 26(1A), 989-994, 2017
25. Tavakkoli, S., Lokare, O., **Vidic, R.D.** and Khanna, V. "A Systems-level analysis of waste heat recovery opportunities from natural gas compressor stations in the U.S." *ACS Sustainable Chemistry & Engineering*, 4(7), 3618-3626, 2016.
26. He, C. and **Vidic, R.D.** "Impact of antiscalants on the fate of barite in the unconventional gas wells" *Environmental Engineering Science*, 33:10, 2016.
27. He, C., Zhang, T. and **Vidic, R.D.** "Co-treatment of abandoned mine drainage and Marcellus Shale flowback water for use in hydraulic fracturing" *Water Research*, 104, 425-431, 2016.
28. He, C. and **Vidic, R.D.** "Application of microfiltration for the treatment of Marcellus Shale flowback water: Influence of floc breakage on membrane fouling" *Journal of Membrane Science*, 510, 348-354, 2016.
29. Theregowda, R., **Vidic, R.D.**, Landis, A.E., Dzombak, D.A. and Matthews, H.S. "Integrating external costs with life cycle costs of emissions from tertiary treatment of municipal wastewater for reuse in cooling systems" *Journal of Cleaner Production*, 112, 4733-4740, 2016.
30. Zhang, T., Hammack, R. and **Vidic, R.D.** "Fate of Radium in Marcellus Shale flowback water impoundments and assessment of associated health risks" *Environmental Science & Technology*, 49, 9347-9354, 2015.
31. Duda, S., Baron, J.L., Wagener, M.M., **Vidic, R.D.** and Stout, J.E. "Lack of correlation between Legionella colonization and microbial population quantification using heterotrophic plate count and adenosine triphosphate bioluminescence measurement" *Environmental Monitoring and Assessment*, 187:393, 2015
32. Sanchez, D., Jacobs, D., Gregory, K., Huang, J., Hu, Y., **Vidic, R.D.**, Yun, M. "Changes in carbon electrode morphology affect microbial fuel cell performance with *Shewanella oneidensis* MR-1" *Energies*, 8, 1817-1829, 2015.
33. Zhang, T., Bain, D., Hammack, R. and **Vidic, R.D.** "Analysis of radium-226 in high salinity wastewater from unconventional gas extraction by inductively coupled plasma-mass spectrometry" *Environmental Science & Technology*, 49, 2969-2976, 2015.
34. Liu, W., Chien, S.H., Dzombak, D.A. and **Vidic, R.D.** "Scaling control for heat exchangers in recirculating cooling systems using tertiary-treated municipal wastewater", *Industrial & Engineering Chemistry Research*, 53, 16366-16373, 2014.
35. He, C., Zhang, T., Zheng, X., Li, Y. and **Vidic, R.D.** "Management of Marcellus Shale produced water in Pennsylvania: A review of current strategies and perspectives" *Energy Technology*, 2, 968-976, 2014.

36. Theregowda, R., **Vidic, R.D.**, Dzombak, D.A. and Landis, A. E. "Life cycle impact analysis of tertiary treatment alternatives to treat secondary municipal wastewater for reuse in cooling systems" *Environmental Progress & Sustainable Energy*, 34, 178-187, 2015.
37. Choudhury, M.R., **Vidic, R.D.**, Dzombak, D.A. "Inhibition of copper corrosion by Tolyltriazole in cooling systems using treated municipal wastewater as makeup water" *Arabian Journal for Science and Engineering*, 39, 7741-7749, 2014.
38. Zhang, T., Gregory, K.B., Hammack, R. and **Vidic, R.D.** "Co-Precipitation of radium with barium and strontium sulfate and its impact on the fate of Radium in treatment facilities for produced water from unconventional gas extraction" *Environmental Science & Technology*, 48:8, 4596-4603, 2014.
39. Safari, I., Hsieh, M-K., Chien, S-H., Walker, M., Dzombak, D., **Vidic, R.D.**, Abbasian, J. "Effect of CO<sub>2</sub> stripping on pH in open-recirculating cooling water systems" *Environmental Progress and Sustainable Energy*, 33(1), 275-282, 2014.
40. He, C., Wang, X., Barbot, E. and **Vidic, R.D.** "Membrane filtration of Marcellus Shale flowback water" *Journal of Membrane Science*, 462, 88-95, 2014.
41. Chien, S.H., Liu, W., Dzombak, D.A. and **Vidic, R.D.** "Impact of tertiary treatment processes on the effectiveness of chloramination for biological growth control in recirculating cooling systems using treated municipal wastewater" *Journal of Environmental Engineering*, 140:2, 04013003-1-8, 2014.
42. Brantley, S.L., Yoxtheimer, D., Arjmand, S., Grieve, P., **Vidic, R.D.**, Pollak, J., Llewellyn, G., Abad, J., and Simon, C. "Water resource impacts during unconventional shale gas development: the Pennsylvania experience" *International Journal of Coal Geology*, 126, 14-156, 2014.
43. He, C., Li, M., Liu, W., Barbot, E. and **Vidic, R.D.** "Kinetics and equilibrium of barium and strontium sulfate formation in Marcellus Shale flowback water" *Journal of Environmental Engineering*, 140(5), B4014001-1-9, 2014.
44. Brantley, S.L., Pollak, J., and **Vidic, R.D.** "Project asks what's in the water after fracking at depth" *EOS, Transactions of the American Geophysical Union*, 94, 409-411, 2013,
45. Murali Mohan, A., Hartsock, A., Bibby, K.J., Hammack, R.C., **Vidic, R.D.** and Gregory, K.B. "Microbial community changes in hydraulic fracturing fluids and produced water from shale gas extraction" *Environmental Science & Technology*, 47:22, 13141-1350, 2013.
46. Bibby, K.J., Brantley, S.L., Reible, D.D., Linden, K.G., Mouser, P.J., Gregory, K.B., Ellis, B.R. and **Vidic, R.D.** "Suggested reporting parameters for investigations of wastewater from unconventional shale gas extraction" *Environmental Science & Technology*, 47:23, 13220-13221, 2013.
47. He, C., Zhang, T. and **Vidic, R.D.** "Use of abandoned mine drainage for the development of natural gas resources" *Disruptive Science and Technology*, 1:4, 169-176, 2013. DOI: 10.1089/dst.2013.0014.
48. Murali Mohan, A., Hartsock, A., Hammack, R.C., **Vidic, R.D.** and Gregory, K.B. "Microbial communities in flowback water impoundments from hydraulic fracturing for recovery of shale gas" *FEMS Microbial Ecology*, 86, 567-580, 2013.
49. Theregowda, R., Hsieh, M-K., Walker, M.E., Landis, A. E., Abbasian, J., **Vidic, R.D.** and Dzombak, D.A. "Life cycle costs to treat secondary municipal wastewater for reuse in cooling systems" *Journal of Water Reuse and Desalination*, 3:3, 224-238, 2013.

50. Chien, S.H., Dzombak, D.A. and **Vidic, R.D.** "Comprehensive evaluation of biological growth control by chlorine-based biocides in power plant cooling systems using tertiary effluent" *Environmental Engineering Science*, 30:6, 324-332, 2013.
51. Dale, A., **Vidic, R.D.**, Khanna, V., Bilec, M. "Process based life-cycle assessment of natural gas from the Marcellus Shale" *Environmental Science & Technology*, 47:10, 5459-5466, 2013.
52. Safari, I., Walker, M.E., Hsieh, M.K., Dzombak, D.A., Liu, W., **Vidic, R.D.**, Miller, D.C. and Abbasian, J. "Utilization of municipal wastewater for cooling in thermoelectric power plants" *Fuel*, 111, 103-113, 2013.
53. **Vidic, R.D.**, Brantley, S.L., Vandenbossche, J.M., Yoxtheimer, D. and Abad, J.D. "Impact of shale gas development on regional water quality" *Science*, 340:6134, 1235009, 2013.
54. Barbot, E., Vidic, N., Gregory, K. and **Vidic, R.D.** "Spatial and Temporal Correlation of Water Quality Parameters of Produced Waters from Devonian-age Shale following Hydraulic Fracturing" *Environmental Science & Technology*, 47, 2562-2569, 2013.
55. Hsieh, M.K., Walker, M.E., Safari, I., Chien, S.H. Abbasian, J., **Vidic, R.D.** and Dzombak, D.A. "Ammonia stripping in open-recirculating cooling water systems," *Environmental Progress & Sustainable Energy*, 32:3, 489-495, 2013.
56. Choudhury, M.R., Hsieh, M.K., **Vidic, R.D.** and Dzombak, D.A. "Corrosion management in power plant cooling water systems using tertiary treated municipal wastewater as makeup water", *Corrosion Science*, 61, 231-241, 2012.
57. Chien, S.H., Chowdhury, I., Hsieh, M.K., Dzombak, D.A. and **Vidic, R.D.** "Control of biological growth in recirculating cooling systems using treated secondary effluent as makeup water with monochloramine", *Water Research*, 46(19), 6508-6518, 2012.
58. Liu, W., Chien, S-H., Dzombak, D.A. and **Vidic., R.D.** "Mineral scaling mitigation in cooling systems using tertiary-treated municipal wastewater" *Water Research*, 46(14), 4488-4498, 2012.
59. Chien, S.H., Hsieh, M.K., Li, H., Monnell, J., Dzombak, D.A. and **Vidic, R.D.** "Pilot-scale cooling tower to evaluate corrosion, scaling, and biofouling control strategy for cooling system makeup water," *Review of Scientific Instruments* 83(2), 024101, 2012.
60. Li, H., Dzombak, D.A. and **Vidic, R.D.** "Electrochemical impedance spectroscopy (EIS) based characterization of mineral deposition from precipitation reactions" *Industrial & Engineering Chemistry Research*, 51(7), 2821-2829, 2012.
61. Choudhury, M.R., Hsieh, M-K., **Vidic, R.D.**, Dzombak, D.A. "Development of an instantaneous corrosion rate monitoring system for metal and metal alloys in recirculating cooling systems" *Industrial & Engineering Chemistry Research*, 51:11, 4230-4239, 2012.
62. Hsieh, M.K., Chien, S.H., Li, H., Monnell, J.D., Dzombak, D.A. and **Vidic, R.D.** "Corrosion control when using passively treated abandoned mine drainage as alternative makeup water for cooling systems" *Water Environment Research*, 83:9, 807-814, 2011.
63. Duda, S., Stout, J.E. and **Vidic, R.D.** "Biological control in cooling towers using nonchemical treatment devices" *HVAC&R Research*, 17:5, 872-890, 2011.
64. Gregory, K.B, **Vidic, R.D.** and Dzombak, D.A. "Water management challenges associated with the production of shale gas by hydraulic fracturing" *Elements*, 7, 181-186, 2011.
65. Li, H., Chien, S.H., Hsieh, M.K., Dzombak, D.A. and **Vidic, R.D.** "Escalating water demand for energy production and the potential for use of treated municipal wastewater", *Environmental Science & Technology*, 45, 4195-4200, 2011.

66. Li, H., Hsieh, M.K., Chien, S.H., Monnell, J.D., Dzombak, D.A. and **Vidic, R.D.** "Control of mineral scale deposition in cooling systems using secondary-treated municipal wastewater", *Water Research*, 45 (2), 748-760, 2011.
67. Hsieh, M.K, Dzombak, D.A. and **Vidic, R.D.** "Bridging gravimetric and electrochemical approaches to determine corrosion rate of metals and metal alloys in cooling systems: Bench scale evaluation method" *Industrial & Engineering Chemistry Research*, 49 (19), 9117-9123, 2010.
68. Hsieh, M.K., Li, H., Chien, S.H., Monnell, J.D., Chowdhury, I., Dzombak, D.A. and **Vidic, R.D.** "Corrosion control when using secondary treated municipal wastewater as alternative makeup water for cooling tower systems", *Water Environment Research*, 82 (12), 2346-2356, 2010.
69. Kazachkin, D., Nishimura, Y., Irle, S., Feng, X., **Vidic, R.D.** and Borguet, E. "Temperature and pressure dependence of solvent molecule adsorption on single wall carbon nanotubes and the existence of a 'pressure gap'" *Carbon*, 48:7, 1867-1875, 2010.
70. Sanchez, D.V.P., Huynh, P., Kozlov, M.E., Baughman, R.H., **Vidic, R.D.**, Yun, M. "Carbon nanotube/platinum (Pt) sheet as an improved cathode for microbial fuel cells" *Energy & Fuels*, 24, 5897-5902, 2010.
71. Hsieh, M.-K, Dzombak, D.A. and **Vidic, R.D.** "Effect of tolyltriazole on the corrosion protection of copper against ammonia and disinfectants in cooling systems" *Industrial & Engineering Chemistry Research*, 49 (16), 7313-7322, 2010.
72. Bhardwaj, R., Chen, X. and **Vidic, R.D.** "Impact of fly ash composition on mercury speciation in simulated flue gas" *J. Air and Waste Management Association*, 59, 1331-1338, 2009.
73. Li, H., Monnell, J.D., Alvin, M., **Vidic, R.D.** "Factors affecting activated carbon-based catalysts for selective hydrogen sulfide oxidation," *Main Group Chemistry*, 7:3, 239-250, 2008.
74. Kazachkin, D., Nishimura, Y., Irle, S., Morokuma, K., **Vidic, R.D.**, Borguet, E. "Interaction of acetone with single wall carbon nanotubes at cryogenic temperatures: A combined temperature programmed desorption and theoretical study," *Langmuir*, 24:15, 7848-7856, 2008.
75. Zhang, Z., Stout, J.E., Yu, V.L. and **Vidic, R.D.** "Effect of pipe corrosion scales on chlorine dioxide consumption in drinking water distribution systems", *Water Research*, 42:1, 129-136, 2008.
76. Zhang, Z., McCann, C., Stout, J.E., Pieszczynski, S., Hawks, R., **Vidic, R.** and Yu, V.L. "Safety and efficacy of chlorine dioxide for *Legionella* control in a hospital water System," *Infection Control and Hospital Epidemiology*, 28:8, 1009-1012, 2007.
77. Feng, W., Borguet, E., **Vidic, R.D.** "Sulfurization of carbon surface for vapor phase mercury removal – I: Effect of temperature and sulfurization protocol", *Carbon*, 44, 2990-2997, 2006.
78. Feng, W., Borguet, E., **Vidic, R.D.** "Sulfurization of carbon surface for vapor phase mercury removal – II: Sulfur forms and mercury uptake", *Carbon*, 44, 2998-3004, 2006
79. Liu, Z., Lin, Y.E., Stout, J.E., **Vidic, R.D.**, and Yu, V.L. "Effect of flow regimes on the presence of *Legionella* within the biofilm of a model plumbing system" *J. Applied Microbiology*, 101, 437-442, 2006.
80. Modise, C. M., Bendick, J. A., Miller, C.J., Neufeld, R. D., **Vidic, R. D.** "Use of hydrophilic and hydrophobic microfiltration membranes to remove microorganisms and



organic pollutants from primary effluents" *Water Environment Research*, 78:6, 557-564, 2006.

81. Feng, X., Dementev, N., Feng, W., **Vidic, R.D.** and Borguet, E. "Detection of low concentration oxygen containing functional groups on activated carbon fiber surfaces through fluorescent labeling." *Carbon*, 44, 1203-1209, 2006.
82. Flora, J.R.V., Hargis, R.A., O'Dowd, W.J., Karash, A. and **Vidic, R.D.** "The role of pressure drop and flow redistribution on modeling mercury control using sorbent injection in baghouse filters." *J. Air and Waste Management Association*, 56, 343-349, 2006.
83. Feng, W., Kwon, S., Feng, X., Borguet, E., **Vidic, R.D.** "Sulfur impregnation of activated carbon fibers through H<sub>2</sub>S oxidation for vapor-phase mercury removal," *J. Environmental Engineering*, 132:3, 292-300, 2006.
84. Lin Y.E., **Vidic R.D.** "Possible phosphate interference with copper-silver ionization for Legionella control". *J. Hospital Infection*, 62:1, 119, 2006.
85. Feng, W., Kwon, S., Borguet, E., **Vidic, R.D.** "Adsorption of hydrogen sulfide onto activated carbon fibers: Effect of pore structure and surface chemistry," *Environmental Science and Technology*, 39:24, 9744-9749, 2005.
86. Bendick, J.A., Miller, C.J., Kindle, B.J., Shan, H., **Vidic, R.D.** and Neufeld, R.N. "Pilot scale demonstration of cross-flow ceramic membrane microfiltration for treatment of combined and sanitary sewer overflows" *J. Environmental Engineering, ASCE*, 131:11, 1532-1539, 2005.
87. Williams, J.E., Goel, R., Flora, J.R.V. and **Vidic, R.D.** "Investigating role of growing adsorbent bed in a dead-End PAC/UF process." *J. Environmental Engineering, ASCE*, 131:11, 1583-1588, 2005.
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#### B. Books and Book Chapters

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#### C. Refereed Conference Proceedings

1. Zhang, Z., Pawar, R.D. and Vidic, R.D. "Predicting the Conductivity Increase By Volatile Salts Penetration in Direct Contact Membrane Distillation (DCMD) Permeate Water" 2020 AIChE Annual Meeting, Houston, TX, August 16-20, 2020.
2. Pawar, R.D., Zhang, Z. and Vidic, R.D. "Impact of organic compounds in produced water on desalination by membrane distillation" 2020 AIChE Annual Meeting, Houston, TX, August 16-20, 2020.

3. Shamlou, E.M., Vidic, R.D. and Vikas Khanna Optimization Based Design and Analysis of Osmotically Assisted Reverse Osmosis for Application in Shale Oil and Gas Produced Water Treatment” 2020 AIChE Annual Meeting, Houston, TX, August 16-20, 2020.
4. Sengupta, D. El-Halwagi, M.M., Kwon, J.S., Camacho, L.M., Freeman, B.D., Brennecke, J.F., Carlberg, P., Swogger, K., Khanna, V. and Vidic, R.D. “Deploying Intensified, Automated, Mobile, Operable, and Novel Designs “Diamond” for Treating Shale Gas Wastewater (SGWW)” 2019 AIChE Annual Meeting, Orlando, FL, November 10-15, 2019.
5. Shamlou, E.M., Vidic, R.D. and Khanna, V. “Geospatial Assessment of Waste Heat from Unconventional Oil and Gas Production” 2019 AIChE Annual Meeting, Orlando, FL, November 10-15, 2019.
6. Shamlou, E.M., Vidic, R.D. and Khanna, V. “Modeling and Techno-Economic Optimization of Desalination Technologies for Produced Water Treatment” 2019 AIChE Annual Meeting, Orlando, FL, November 10-15, 2019.
7. Pawar, R.D. and Vidic, R.D.” In Situ Measurement of Concentration Polarization in Pressure Driven Membrane Systems Using Laser-Based Spectrophotometric Method” 2019 AIChE Annual Meeting, Orlando, FL, November 10-15, 2019.
8. Zhang, Z. and Vidic, R.D. “Membrane Distillation for Enhanced Water Recovery by Inland Brackish Water Desalination Plants” 28<sup>th</sup> Annual Meeting, North American Membrane Society, Pittsburgh, PA, May 11-15, 2019.
9. Gusa, A., Alkhashab, H., Flora, J.R.V. and Vidic, R.D. “Radium removal from dilute and high ionic strength solution using barium sulfate ( $\text{BaSO}_4$ ): Comparison of experimental results and molecular simulations” ACS National Meeting & Exposition, Orlando, FL, March 31-April 4, 2019.
10. Shamlou, E.M., Mashayekhi, A., Vidic, R.D., Khanna, V. “Thermo-Economic Optimization Based Comparison of Membrane Distillation Vs Mechanical Vapor Recompression for Shale Gas Produced Water Treatment” 2018 AIChE Annual Meeting, 304g, Pittsburgh, PA, October 29-November 1, 2018.
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12. Lokare, O.R., Ji, P., Dutt, G., and Vidic, R.D. “Optical Technique for In-Situ Measurement of Concentration Polarization in Direct Contact Membrane Distillation” 27<sup>th</sup> Annual Meeting, North American Membrane Society, Lexington, KY, June 9-13, 2018.
13. Wadekar, S.S. and Vidic, R.D. “Effect of repetitive chemical cleaning on the performance of polymeric nanofiltration membranes.” American Water Works Association (AWWA) – American Membrane Technology Association (AMTA), Membrane Technology Conference, West Palm Beach, FL, Mar 12-16, 2018.
14. Tavakkoli, S., Lokare, O. R., Vidic, R.D. and Khanna, V. “Shale Gas Wastewater Management Using Membrane Distillation” 8<sup>th</sup> Annual Cost-Effective Produced Water Management Marcellus and Utica, Pittsburgh, PA, Mar. 27-28, 2018.
15. Tavakkoli, S., Lokare, O.R., Vidic, R.D. and Khanna, V. “Shale Gas Wastewater Management Using Membrane Distillation: An Optimization Based Approach,” American Institute of Chemical Engineers (AIChE) Annual Conference, Minneapolis, MN, Oct 29. – November 3, 2017.

16. Lokare, O.R., Liu S., Tavakkoli, S., Khanna, V. and Vidic, R.D. "Comparison of DCMD and VMD for treatment of produced water from unconventional gas extraction" American Water Works Association (AWWA) – American Membrane Technology Association (AMTA), Membrane Technology Conference, Long Beach, CA, Feb 13-17, 2017.
17. Lokare, O.R. and Vidic, R.D. "Pretreatment for the Control of Membrane Fouling in Direct Contact Membrane Distillation of High Salinity Produced Water from Shale Gas Extraction" American Water Works Association (AWWA) – American Membrane Technology Association (AMTA), Membrane Technology Conference, Long Beach, CA, Feb 13-17, 2017.
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26. Lokare, O.R., Tavakkoli, S., Khanna, V. and Vidic, R.D. "Use of Membrane Distillation for Treatment of Produced Water from Unconventional Onshore Gas Extraction". Presented at DesalTech, San Diego, CA, August 28-29, 2015.
27. Tavakkoli, S.; Vidic, R. D.; Khanna, V., Exploiting Industrial Ecology for Managing Wastewaters from Shale Gas Operations, International Society for Industrial Ecology (ISIE), Surrey, England, Jul. 7 – 10, 2015.
28. He, C. and Vidic, R.D. "Application of AMD for produced water reuse: Equilibrium and kinetics of solid precipitation and solid waste management" 249th ACS National Meeting & Exposition, Denver, CO, March 22-26, 2015.
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  36. Zhang, T. and Vidic, R. "Health and Environmental Impacts of Naturally Occurring Radioactive Materials (NORM) Produced by Unconventional Gas Extraction From Marcellus Shale." International Pittsburgh Coal Conference (PCC), Pittsburgh, PA, Oct. 6-9, 2014.
  37. He, C., Zhang, T. and Vidic, R. “Use acid mine drainage for development of unconventional shale gas resources" International Pittsburgh Coal Conference (PCC), Pittsburgh, PA, Oct. 6-9, 2014.
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  40. Zhang, T. and Vidic, R.D. “Fate of radium from flowback/produced water in centralized impoundments, treatment facilities, and solid waste disposal options” 246th ACS National Meeting and Exposition, Indianapolis, IN, September 8-12, 2013.
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45. Zhang, T., Barbot, E., Gregory, K.B. and Vidic, R.D. "Fate of Radium in Marcellus Shale Flowback Water", 2012 American Institute of Chemical Engineers Annual Meeting, Pittsburgh, PA, October 28 – November 2, 2012.
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47. Chien, S.H., Dzombak, D. A. and Vidic, R. D. "Impacts of advanced municipal wastewater treatment processes on monochloramine effectiveness in recirculating cooling systems", WEFTEC 2012, Session 63, New Orleans, LA, September 29 - October 3, 2012.
48. Niblick, B., Theregowda, R., Dzombak, D., Vidic, R. and Landis, A. "Evaluating Sustainability Tools and Metrics for Application to Reuse of Treated Municipal Wastewater in Power Plant Cooling Systems" Proceedings from the LCA XII International Conference, September 25-27, 2012, Tacoma, WA.
49. Murali Mohan, A., Hartsock, A., Hammack, R.W., Vidic, R.D. and Gregory, K.B. "Microbial ecology and geochemistry of hydraulic fracturing fluid and flowback water from Devonian-aged shale", American Chemical Society National Meeting, Philadelphia, PA, August 19-23, 2012.
50. Barbot, E., Vidic, N., Gregory, K., Vidic, R.D. "Chemical characteristics of Marcellus Shale flowback water in Pennsylvania", American Chemical Society National Meeting, Philadelphia, PA, August 19-23, 2012.
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52. Liu, W., Dzombak, D.A. and Vidic, R.D. "Scaling control when using secondary-and tertiary-treated municipal wastewater as cooling water in thermoelectric power plants," PennTec 2012, State College, PA, June 3-6, 2012.
53. Chien, S.H., Dzombak, D.A. and Vidic, R.D. "Impact of TOC level in treated municipal wastewater on biofouling control and biocidal effectiveness of common chemical disinfectants" PennTec 2012, June 3-6, 2012.
54. Chien, S.H., Dzombak, D.A. and Vidic, R.D. "Can monochloramine be used to control biofouling in recirculating power plant cooling system using treated municipal wastewater?", Proceeding of American Institute of Chemical Engineers Conference 2012, Houston, TX, April 1-4, 2012.
55. Liu, W., Dzombak, D.A., Vidic, R.D. "Feasibility study on scaling prediction with MINEQL+ when using secondary-treated municipal wastewater in cooling systems", American Chemical Society 243<sup>rd</sup> National meeting 2012, San Diego, CA, March 25-29, 2012.
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  59. Murali Mohan, A., Gregory, K.B., Vidic, R.D., Miller, P. and Hammack, R.W. “Characterization of Microbial Diversity in Treated and Untreated Flowback Water Impoundments From Gas Fracturing Operations,” Paper No. SPESPE-147414-PP, 2011 SPE Annual Technical Conference and Exhibition, October 30 – November 2, 2011, Denver, CO.
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  10. Vidic, R.D., Flora, J.R.V. "Modeling of Sorbent Injection for Mercury Control" Final Report for the US Department of Energy - NETL, Contract No. DE-AM26-99FT40463, Subtask No. FT10241, January, 2002.
  11. Vidic, R.D. "Permeable Reactive Barriers – Case Study Review" Technology Evaluation Report No. TE-01-01, Ground-Water Remediation Technologies Analysis Center, November, 2001.
  12. Vidic, R. D., Liu, W. "Development of Novel Activated Carbon-Based Adsorbents for the Control of Mercury Emissions from Coal-Fired Power Plants" Final Report for the US Department of Energy, Project Number DE-FG2-96PC96212, March, 1999.
  13. Vidic, R.D., Chang, M.T. "Kinetics of Vapor-Phase Mercury Uptake by Virgin and Sulfur Impregnated Activated Carbons." Final Report for the US Environmental Protection Agency, Project Number CR 822617-01-0, November, 1996.
  14. Vidic, R.D., Pohland, F.G. "Treatment Walls" Technology Evaluation Report, TE-96-01, Prepared for the Ground-Water Remediation Technologies Analysis Center, October, 1996.
  15. Vidic, R.D. "Activated Carbon Adsorption for the Removal of Mercury from Flue Gas Emissions." Final Report for the Pennsylvania Energy Development Authority RD&D Project Number 9303-4007, June, 1996.
  16. Vidic, R.D. and Bourdeau, J.A. "Effect of Surface Metals on the Catalytic Properties of Activated Carbon for Oxidative Coupling of Phenolic Compounds." Final Report for the University of Cincinnati Engineering Research Center Contract No. PC94B-03223, April, 1996.
  17. Suidan, M.T., Pfeffer, J.T., Nakhla, G.F., Traegner, U.K., and Vidic, R.D. "Anaerobic Fluid-Bed Treatment of Coal Conversion Wastewater." Final Report for US Department of Energy, Project Number DE-FG22-86PC-90614, 1989.

#### E. Conference Presentations

1. Vidic, R.D. and Khanna, V. "What to do With Shale Gas Brines if Recycling for Hydraulic Fracturing is not Feasible?" 2019 Shale Network Workshop, State College, PA, May 19, 2019.
2. Tavakkoli, S.; Lokare, O. R.; Vidic, R. D.; Khanna, V., A Systems-level Approach for Integrated Shale Gas Produced Water Management, 9<sup>th</sup> Annual Sustainability Conference, Pittsburgh, PA, November 16, 2017.
3. Lokare, O. R., Tavakkoli, S., Rodriguez G., Khanna, V., Vidic R. D. "Waste Heat Driven Membrane Distillation for Cost-Effective Produced Water Treatment in

- Pennsylvania.” Society of Environmental Journalists National Conference , Pittsburgh, PA, Oct 4, 2017.
4. Lokare, O. R., & Vidic, R. D. “Changes in the Quantity and Quality of Produced Water from Appalachian Shale Energy Development and their Implications for Water Reuse” US DOE Water Working Group Annual Meeting, Pittsburgh, PA, August 2, 2017.
  5. Vidic, R.D. and Yoxtheimer, D. “Changes in the Quantity and Quality of Produced Water from Appalachian Shale Energy Development and their Implications for Water Reuse” Shale Network Workshop, State College, May 18-19, 2017.
  6. Lokare, O. R., Beck, A., Khanna, V., Vidic R. D. “Development of Membrane Distillation Technology Utilizing Waste Heat for Treatment of High Salinity Wastewaters” 2017 Project Review Meeting for Crosscutting Research, Gasification Systems, and Rare Earth Elements Research Portfolios, Pittsburgh, PA, March 20-23, 2017.
  7. Lokare, O.R., Tavakkoli, S., Khanna, V. and Vidic R.D. “Development of Membrane Distillation for Pure Water Recovery from Produced Water” 2016 Shale Gas Innovation Contest, Pittsburgh, PA, May 18, 2016.
  8. Tavakkoli, S., Lokare, O.R., Khanna, V. and Vidic, R.D., “Integrating Membrane Distillation with Waste Heat Sources for Affordable Produced Water Treatment in Pennsylvania”, 2016 Annual Shale Gas Innovation Contest, Pittsburgh, PA, May 18, 2016.
  9. Lokare, O.R., Tavakkoli, S., Khanna, V. and Vidic R.D. “Development of Membrane Distillation Technology Utilizing Waste Heat for Treatment of High Salinity Wastewaters”. Crosscutting Research and Rare Earth Elements, Pittsburgh, PA, April 18-22, 2016.
  10. Brantley, S.L., Wendt, A.K., Yoxtheimer, D. and Vidic, R.D. “Shale-gas Impacts in Pennsylvania Surface Waters” Geologic Society of America, Denver, CO, September, 25-28, 2016.
  11. Wadekar, S.S. and Vidic R.D. “Role of active layer in the performance of aromatic and semi-aromatic nanofiltration membranes for water purification.” Engineering Conferences International (ECI), Advanced Membrane Technology VII, Cork, Ireland, September 13-17, 2016.
  12. Brantley, S.L., Li, Z., Yoxtheimer, D. and Vidic, R.D. “The Pennsylvania Experience with Hydraulic Fracturing for Shale Gas Development: Relatively Infrequent Water Quality Problems with Lots of Public Attention”, AGU Fall Meeting, San Francisco, CA, December 14-18, 2015.
  13. Vidic, R.D. and He, C. “Colloids in Produced Water and Their Impact on Membrane Filtration”, SPE Produced Water Handling and Management Symposium, Galveston, TX, May 21-22, 2015.
  14. Lokare, O.R., Tavakkoli, S., Khanna, V. and Vidic, R.D. “Development of Membrane Distillation Technology Utilizing Waste Heat for Treatment of High Salinity Wastewaters”. Presented at Crosscutting Technology Research Review Meeting, Pittsburgh, PA, April 28, 2015.
  15. Arjmand, S., Simon, C.A., Frias, C., Abad, J.D., Paul, B., Vidic, R.D. and Doran, M. “Pitt Teen Shale Network - Little Connoquenessing Creek Watershed” Shale Network Workshop, State College, May 12-13, 2014.
  16. Yue, H., Arjmand, S., Simon, C.A., Abad, J.D., Vidic, R.D., Brantley, S.L., Vastine, J. and Wilderman, C. “Evaluation of Potential Overland Flow and Pathway of Accidental Spills from Unconventional Drilling Sites to Nearby Streams” Shale Network Workshop, State College, May 12-13, 2014.

17. Vidic, R.D., Brantley, S.L., Abad, J.D., Vastine, J., Yoxtheimer, D., Wilderman, C. and Pollak, J. "Water Quality Challenges Associated with Energy Resource Extraction from Marcellus Shale" Keynote presentation at 247<sup>th</sup> ACS National Meeting, Dallas, TX, March 16-20, 2014.
18. Arjmand, S., Abad, J. D., Brantley, S.L. and Vidic, R.D. "Spatiotemporal Impacts of Shale Gas in Pennsylvania & Monitoring Network Evaluation", Water Science Forum of the Susquehanna River Basin Commission, Harrisburg, PA, October 7-8, 2013.
19. Simon, C.A., Arjmand, S., Abad, J.D., Vidic, R.D., Brantley, S.L. and Yoxtheimer, D. "Optimal Water Quality Sensor Placement in Watersheds of Pennsylvania Potentially Affected by Marcellus Shale Gas Extraction" Water Science Forum of the Susquehanna River Basin Commission, Harrisburg, PA, October 7-8, 2013.
20. Gregory, K.B., Murali Mohan, A., and Vidic, R.D. "Produced water management: Importance of microbial ecology for the fate of naturally occurring radioactivity" Overcoming the Environmental and Community Challenges of Hydraulic Fracturing for Shale Gas, Boulder, CO, August 4-8, 2013.
21. He, C. and Vidic, R.D. "Formation and Transport of Barite in Unconventional Gas Wells" Overcoming the Environmental and Community Challenges of Hydraulic Fracturing for Shale Gas, Boulder, CO, August 4-8, 2013.
22. Zhang, T., Bain, D. and Vidic, R.D. "An Expedited Method for Ra-226 Measurement and Fate of Ra-226 from Flowback/Produced Water in Centralized Impoundments and Treatment Facilities" Overcoming the Environmental and Community Challenges of Hydraulic Fracturing for Shale Gas, Boulder, CO, August 4-8, 2013.
23. Arjmand, S., Cesar, S.A., Abad, J. D. and Vidic, R.D. "Shale gas contamination - water quality monitoring network", Shale Network Workshop, State College, May 19-20, 2013.
24. Neal, A., Mendoza, A., Simon, C.A., Abad, J.D., Vidic, R.D., Yoxtheimer, D. and Brantley, S.L. "Using the NSF funded Shale Network Database and Critical Zone Observatories to Assess Water Quality Concerns in Areas of Shale Gas Development" Shale Network Workshop, State College, May 19-20, 2013.
25. Simon, C.A., Arjmand, S., Abad, J.D., Vidic, R.D. and Brantley, S.L. "Surface Water Transport Contaminant Modeling and Water Quality Sensor Density, Ten Mile Creek" Shale Network Workshop, State College, May 19-20, 2013.
26. Murali Mohan, A., Hartsock, A., Hammack, R.W., Vidic, R.D. and Gregory, K.B. "Microbial Community Changes with Time in Flowback Water Produced from Hydraulic Fracturing of Devonian Black Shale for Natural Gas Production," American Society of Microbiology General Meeting, San Francisco, California June 16-19, 2012.
27. Murali Mohan, A., Hartsock, A., Hammack, R.W., Vidic, R.D. and Gregory, K.B. "Microbial Ecology and Geochemistry of Hydraulic Fracturing Fluid and Flowback Water from Devonian-aged Shale", Environmental Research and Poster Session organized by Steinbrenner Institute, Pittsburgh, PA, 8 May, 2012.
28. Zhang, T., Barbot, E., Gregory, K.B. and Vidic, R.D. "Equilibrium and kinetics of Radium co-precipitation in Ba-Sr-SO<sub>4</sub> system", American Institute of professional Geologists (AIPG), Pittsburgh, PA, April 13-14, 2012.
29. Choudhury M., Hsieh, M.K., Vidic, R.D. and Dzombak, D.A. "Corrosiveness of Different Treated Municipal Wastewaters Used as Power Plant Cooling System Makeup Water: A Bench-Scale Evaluation" 220th ECS Meeting & Electrochemical Energy Summit, Boston, MA, October 9-14, 2011.

30. Gregory, K.B., Vidic, R.D. and Dzombak, D.A. "Addressing Diverse Water Management Challenges During Hydraulic Fracturing of Shale for Natural Gas Production" GSA Annual Meeting and Exposition, Minneapolis, MN, October 9-12, 2011.
31. Murali Mohan, A., Vidic, R.D. and Gregory, K.B. "Microbial Communities in Flowback Water Impoundments from Hydraulic Fracturing of Shale for Natural Gas Recovery", 2011 Association of Environmental Engineering and Science Professors (AEESP) Education and Research Conference, Tampa, FL, July 10-12, 2011
32. Murali Mohan, A., Hammack, R.W., Vidic, R.D. and Gregory, K.B. "Characterization of Microbial Populations in Flowback Water Impoundments from Hydraulic Fracturing Operations in Pennsylvania", American Institute of professional Geologists (AIPG), Pittsburgh, PA, April 13-14, 2011.
33. Dale, A., Vidic, R.D. and Bilec, M. "Preliminary life cycle impacts of treatment of Marcellus shale waters." Engineering Sustainability 2011, Pittsburgh, PA, April 10-12, 2011.
34. Murali Mohan, A., Vidic, R.D. and Gregory, K.B. "Impact of Treatment on Depth-dependent Microbial Communities in Flowback Water Impoundments from Hydraulic Fracturing Operations", Environmental Research and Poster Session organized by Steinbrenner Institute, Pittsburgh, PA, 6 April, 2011.
35. Gregory, K., Barbot, E. and Vidic, R.D. "Sustainable Water Management During Hydraulic Fracturing of Shale for Natural Gas Production" International Conference on Environmental Challenges: A Global Concern (ICEC-10), Kanya Maha Vidyalaya (College), Janandhar, Punjab, India, October 15-17, 2010.
36. Li, H. and Vidic, R.D. "Mineral deposit formation, measurement, and control in wastewater reuse" (session keynote), the 6<sup>th</sup> International Conference on Interfaces against Pollution (IAP 2010), Beijing, China, May 16-19, 2010.
37. Vidic, R.D. Frack Water Management - panel discussion at Marcellus Shale Policy Conference, Pennsylvania Environmental Council and Duquesne University, Pittsburgh, PA, May 3-4, 2010.
38. Li, H.; Chien, S.-H.; and Vidic, R.D. "A solution to water crisis in energy production: feasibility of using impaired waters for coal-based power plant cooling" (oral), American Society of Engineering Education (ASEE) North Central Sectional Conference, University of Pittsburgh, Pittsburgh, PA, March 26-27, 2010.
39. Dzombak, D.A., Landis, A.E., Vidic, R.D., Chien, S.H., Feng, Y.H., Hsieh, M.K., Li, H., Monnell, J.D. and Niblick, B. "Reuse of treated municipal wastewater for power plant cooling," 2009 AEESP Conference, Iowa City, IA, July 26-29, 2009.
40. Chien S.H., Hsieh M.K., Dzombak D., Vidic R.D., "Water for Cooling in Thermoelectric Power Plants: The Impending Shortage and Alternative Sources", Engineering Sustainability 2009, Pittsburgh, PA, April 19-21, 2009.
41. Kazachkin, D.V., Nishimura, Y., Irle, S., Morokuma, K., Vidic, R.D. and Borguet, E. "Pressure gap in carbon nanomaterials? The effect of temperature and pressure on the binding of simple molecules to carbon nanotubes." Proceedings of the 2008 AIChE Annual Meeting, November 16-21, 2008, Philadelphia, PA.
42. Sun, W., Bhardwaj, R., Chen, X., Flora, J.R.V., Borguet, E., Vidic, R.D. "Mercury Speciation in Coal-Fired Power Plant Flue Gas – Experimental Studies and Model Development" University Coal research Contractors Review Conference, June 10-11, 2008, Pittsburgh, PA.

43. Li H., Vidic R.D., Chien S.H., Hsieh M.K., Chowdhury I., Dzombak D. "Reuse of treated internal or external wastewaters in the cooling systems of coal-based thermoelectric power plants" Poster Session, University of Pittsburgh Energy Center, Pittsburgh, PA, April 15, 2008.
44. Monnell, J., Li, H., Alvin, M., Vidic, R.D. "Activated Carbon-Based Catalysts for Selective Hydrogen Sulfide Oxidation", Poster Session, University of Pittsburgh Energy Center, Pittsburgh, PA, April 15, 2008.
45. Li, H. and Vidic, R.D. "Reducing water footprint: internal water reuse for coal-based thermoelectric power generation" 3<sup>rd</sup> annual Student Industrial Ecology Conference (SIEC), International Society of Industrial Ecology (ISIE, Pittsburgh student chapter), Pittsburgh, PA, April 12, 2008.
46. Chien, S.H. and Vidic, R.D. "Alternative water sources: feasibility of using secondary treated municipal wastewater in power industry" 3<sup>rd</sup> annual Student Industrial Ecology Conference (SIEC), International Society of Industrial Ecology (ISIE, Pittsburgh student chapter), Pittsburgh, PA, April 12, 2008.
47. Kazachkin, D.V., Nishimura, Y., Dementev, N.N., Irle, S., Morokuma, K., Vidic, R.D. and Borguet, E. "The interaction of simple molecules with CNT" 235<sup>th</sup> American Chemical Society National Meeting, April 6-10, 2008, New Orleans, LA.
48. Li H., Chien S.H., Hsieh M.K., Dzombak D., Vidic R.D. "Predicting deposit formation from impaired water use in power plant cooling systems" 11<sup>th</sup> annual Environmental Chemistry Student Symposium (ECSS), Center of Environmental Chemistry and Geochemistry, Pennsylvania State University, State College, PA, March 28-29, 2008.
49. Hsieh M.K., Li H., Dzombak D., Vidic R.D. "Corrosion and corrosion inhibition in power plant cooling systems using impaired waters as alternative makeup sources" 11<sup>th</sup> annual Environmental Chemistry Student Symposium (ECSS), Center of Environmental Chemistry and Geochemistry, Pennsylvania State University, State College, PA, March 28-29, 2008.
50. Kazachkin, D.V., Feng, X., Kwon, S., Dementev, N.N., Vidic, R.D. and Borguet, E. "Interaction of acetone with single wall carbon nanotubes: FTIR and TPD study" ACS Middle Atlantic Regional Meeting, Collegeville, PA, May 16 - 18, 2007
51. Vidic, R.D. "Control of Mercury Emissions from Thermoelectric Power Plants" 2006 American Filtration Society Conference, Pittsburgh, PA, October 16-18, 2006.
52. Borguet, E., Feng, X., Vidic, R.D. and Dementev, N. "Sonication Induced Chemisorption of Solvents on Single Walled Carbon Nanotubes: Infrared Spectroscopy and Temperature Programmed Desorption Study" The 229<sup>th</sup> ACS National Meeting, in San Diego, CA, March 13-17, 2005.
53. Feng, W. and Vidic, R.D. "Novel Mercury Sorbents through Industrial Ecology" Energy Event, University of Pittsburgh, Pittsburgh, PA, December 9, 2004.
54. Feng, X., Vidic, R.D., Borguet, E. "Study of Ammonia Adsorption on Single Walled Carbon Nanotubes (SWNTs) by Infrared Spectroscopy" 2004 Annual AIChE Meeting, San Antonio, TX, November 7-12, 2004.
55. Feng, X., Matranga, C., Vidic, R.D., Borguet, E. "Infrared Spectroscopy Study of Functionalities on Single Walled Carbon Nanotubes (SWNTs)" 2004 Annual AIChE Meeting, San Antonio, TX, November 7-12, 2004
56. Vidic, R.D., Feng, W., Borguet, E. "Adsorption of hydrogen sulfide on activated carbon fibers" International Activated Carbon Conference, Pittsburgh, PA, October 7-8, 2004.

57. Neufeld, R.D., Vidic, R.D, Kindle, B., Bendick, J., Modise, C., "Ceramic Membrane Filtration of Combined Sewer Overflow" presented at the Sixth Annual 3 Rivers Wet Weather Sewer Rehabilitation Conference, Pittsburgh, PA, September 29-30, 2004.
58. Feng, X., Matranga, C., Vidic, R.D. and Borguet, E. "Vibrational Spectroscopy of Oxygen Containing Functional Groups and Their Influence on the Adsorption of Small Molecules on Single Walled Carbon Nanotubes" 228th ACS National Meeting, Philadelphia, PA, August 22-26, 2004.
59. Feng, W., Kwon, S., Feng, X., Borguet, E., Vidic, R.D. "Sulfur impregnation on activated carbon fibers through H<sub>2</sub>S oxidation for vapor phase mercury removal" 228th ACS National Meeting, Philadelphia, PA, August 22-26, 2004.
60. Feng, X., Vidic, R.D. and Borguet, E. "A Vibrational Spectroscopy Study of the Fate of Oxygen Containing Functional Groups on Carbon Single Walled Nanotube Surfaces during Thermal Treatment" Vibrations at Surfaces 11, Bangor, Maine, June, 2004.
61. Vidic, R.D., Lauzon, C., Fontan, J-C, Tosovic, S., Adjanski-Spasic, Lj., Pantelic, Z. "Management options for hazardous and medical waste in Serbia" Keynote presentation at the Second International Conference on Rural Health and First International Conference on Occupational and Environmental Health in Mediterranean, South East and Central European Countries, Belgrade, Serbia and Montenegro, May 26-29, 2004.
62. Feng, W., Vidic, R.D., Feng, X. and Borguet, E. "Adsorption of Hydrogen Sulfide on Activated Carbon Fibers: Effect of Pore Structure and Surface Treatment" 35th Central Regional Meeting of the American Chemical Society, Pittsburgh, PA, October 19-22, 2003.
63. Feng, X., Vidic, R.D. and Borguet, E. "How Do Surface Functional Groups On Single Walled Carbon Nanotubes (SWNTs) Affect Molecular Adsorption?" 35th Central Regional Meeting of the American Chemical Society, Pittsburgh, PA, October 19-22, 2003.
64. Neufeld, R. D., Vidic, R. D., Bendick, J., Miller, C. J. "Water Conservation using Ceramic Membrane Filtration: An Innovative Technology for the Combined Sewer Overflow Problem" Poster Presentation, Science 2003 Symposium, University of Pittsburgh September 24, 2003
65. Bendick, J., Neufeld, R. D., Vidic, R. D., "Membrane Ultra Filtration of Primary Sewage Effluents", invited presentation Allegheny County Sanitary Authority, June 11, 2003.
66. Kwon, S., Borguet, E. and Vidic, R.D. "Role of surface chemical and topological heterogeneity on adsorption on carbonaceous surfaces" The 225th ACS National Meeting, New Orleans, LA, March 23-27, 2003.
67. Vidic, R.D., Kwon, S., Xue, F., Newsome, T., and Borguet, E. "Effects of surface-chemical heterogeneity on molecular adsorption in and on single-walled carbon nanotubes" The 225th ACS National Meeting, New Orleans, LA, March 23-27, 2003.
68. Kwon, S., Vidic, R.D., and Borguet, E. "Impact of Chemical and Topological Heterogeneity of Single Walled Carbon Nanotubes (SWNT) on Uptake and Binding of Simple Molecules" Annual Meeting for the University/NETL Student Partnership Program, Pittsburgh, PA, October 22, 2002.
69. Neufeld, R.D., Vidic, R.D, Bendick, J., Modise, C., Miller, C., "Ceramic Membrane Filtration for Wet Weather Flow Management" presented at the Fourth Annual 3 Rivers Wet Weather Sewer Rehabilitation Conference, September 16-17, 2002.
70. Kwon, S., Borguet, E. and Vidic, R.D. "Understanding the Impact of Chemical and Morphological Heterogeneity of Carbonaceous Surfaces on Mercury Adsorption" AEESP/AAEE Education and Research Conference, Toronto, Canada, August 10-14, 2002.

71. Zhao, X., Johnson J. K., Kwon S., Vidic R. D., Borguet E., Adsorption of polar organics on graphite from experiment and molecular simulation., AIChE 2001 Annual Meeting: Interfacial phenomena in environmental systems, Reno, Nevada, November 4-9, 2001.
72. Kwon, S.J., Russell, J., Vidic, R.D., and Borguet, E.U. "Probing Chemical and Topological Heterogeneity of Carbonaceous Surfaces via Temperature Programmed Desorption of Simple Molecules from Model Carbonaceous Surfaces" IUVESTA 15th International Vacuum Congress, AVS 48th International Symposium, 11th International Conference on Solid Surfaces, San Francisco, CA, October 28 - November 2, 2001.
73. Kwon, S., Vidic, R.D., and Borguet, E. "Probing Carbonaceous Surface Chemical and Topological Heterogeneity by Temperature Programmed Propane Adsorption/Desorption" University of Pittsburgh, Science Fair 2001, September 13, 2001.
74. You, X. and Vidic, R.D. "Sulfur Impregnation of Activated Carbon through H<sub>2</sub>S Oxidation" 25<sup>th</sup> Biennial Conference on Carbon, Lexington, KY, July 14-19, 2001.
75. Chen, A., Kwon, S.J., Borguet, E.U. and Vidic, R.D. "Impact of Pore Structure and Surface Oxygen on Elemental Mercury Uptake by Virgin Activated Carbon" 25<sup>th</sup> Biennial Conference on Carbon, Lexington, KY, July 14-19, 2001.
76. Kwon, S.J., Russell, J., Vidic, R.D. and Borguet, E.U. "Investigation of Polar Organic Adsorption/Desorption from a Model Carbonaceous Surface: Acetone on Graphite" 25<sup>th</sup> Biennial Conference on Carbon, Lexington, KY, July 14-19, 2001.
77. Kwon, S.J., Vidic, R.D. and Borguet, E.U. "'Probing Carbonaceous Surface Chemical and Topological Heterogeneity by Temperature Programmed Propane Adsorption/Desorption" 25<sup>th</sup> Biennial Conference on Carbon, Lexington, KY, July 14-19, 2001.
78. You, X. and Vidic, R.D. "An Industrial Ecology Approach for Reducing Mercury in the Environment" 2001 Symposium on Sustainability, Clarkson University, Potsdam, NY, June 16-19, 2001.
79. Zhao, X., Johnson, K.J., Kwon, S., Vidic, R.D., and Borguet, E.U. "Propane adsorption on graphite wall: Experiment and Simulation" 2001 Midwest Thermodynamics and Statistical Mechanics Conference, East Lansing, MI, May 7-8, 2001.
80. Kwon, S.J., Russell, J., Vidic, R.D., and Borguet, E.U. "Phase Separation in Two Dimensions on Carbonaceous Surfaces: Implications for Atmospheric Chemistry", Annual Chemistry Conference - Duquesne University, Pittsburgh, PA, July, 2000.
81. Kwon, S.J., Russell, J., Vidic, R.D., and Borguet, E.U. "Investigation of Adsorption/Desorption Kinetics on Carbonaceous Surfaces using Optical Differential Reflectivity and Temperature Programmed Desorption", 65th Birthday Symposium Honoring John T. Yates, Jr., R.K. Mellon Professor of Chemistry and Director, Pittsburgh, PA, July, 2000.
82. Lin, Y.E., Stout J.E., Yu, V.L., Vidic, R.D. and States, S.J. "Legionnaires' Disease in An Apartment Building: Disinfection Methods and Recommendations" 1<sup>st</sup> International Water Congress, International Water Association (Session A, No. 7), Paris, France, July 3 – 7, 2000.
83. Kwon, S.J., Vidic, R.D., and Borguet, E.U. "Combined Theoretical and Experimental Investigation of Mechanisms and Kinetics of Vapor-Phase Mercury Uptake by Carbonaceous Surface Adsorption of Mercury in Gas-Phase" DOE Contractors Meeting, Pittsburgh, PA, June 6-8, 2000.
84. Lin, Y.E., Stout, J.E., Vidic, R.D., and Yu, V.L. "Impact of pH, Alkalinity, Hardness, and Dissolved Organic Carbon on Efficacy of Copper-Silver Ionization for Legionella

- Eradication" 99th General Meeting, American Society for Microbiology, Chicago, IL, May 30 - June 3, 1999.
85. Liu, W., Vidic, R.D., and Brown, T.D. "Impact of Gas Constituents on Mercury Uptake by Sulfur-Impregnated Activated Carbons." 1999 AIChE Spring National Meeting, Houston, TX, March 14-18, 1999.
  86. Vidic, R.D., Wei, L. "Application of Sulfur Impregnated Activated Carbons for the Control of Mercury Emissions from Coal Fired Power Plants" Air Quality Conference, McLean Virginia, December 1-4, 1998.
  87. Liu, W. and Vidic, R.D. "Selecting a Proper Impregnate to Improve the Performance of Mercury Control by Different Adsorbents" Fifth International Activated Carbon Conference, Pittsburgh, PA, September 17-18, 1997.
  88. Vidic, R. D. and Korpiel, J.A. "Impact of Sulfur Impregnation Method on Mercury Uptake by Activated Carbons" Emerging Technologies in Hazardous Waste Management VIII, I&EC Division - ACS, Birmingham, AL, September 9-11, 1996.
  89. Vidic, R.D., Tessmer, C.H., and Uranowski, L.J. "Impact of Surface Properties of Activated Carbons on Oxidative Coupling of Phenolic Compounds." American Carbon Society Workshop, Charleston, SC, June 9-12, 1996.
  90. Lin, Y.E., Stout, J.E., Vidic, R.D., McCartney, C., and Yu, V.L. "In Vitro Efficacy of Copper/Silver Ions in Killing Mycobacterium avium: A New Method for Disinfection of Hospital Water Distribution Systems." 96th General Meeting, American Society for Microbiology, New Orleans, May 19-23, 1996.
  91. Vidic, R.D. "Control of Mercury Emission in Flue Gas by Activated Carbon Adsorption." Third International Activated Carbon Conference, Pittsburgh, PA, September 11-14, 1995.
  92. Petrosky, C.J. and Vidic, R.D. "Pretreatment of Industrial Wastewater Containing Phthalate Esters by Centrifugation." 67th Annual Conference of Pennsylvania Water Environment Association, Champion, PA, June 12-15, 1995.
  93. Lin, Y.S., Vidic, R.D., Stout, J.E., and Yu, V.L. "In Vitro Synergy of Copper and Silver Ions in Killing *Legionella*." 95th General Meeting, American Society for Microbiology, Washington, D.C., May 21-25, 1995.
  94. Vidic, R.D. "Control of Disinfection By-Products in Drinking Water: Case Studies of Alternative Disinfection Technologies." NATO Advanced Studies Institute, Varna, Bulgaria, October 24 - November 4, 1994.
  95. Vidic, R.D. "Control of Disinfection By-Products in Drinking Water: Regulations and Costs." NATO Advanced Studies Institute, Varna, Bulgaria, October 24 - November 4, 1994.
  96. Vidic, R.D. "Polymerization of Phenolic Compounds Catalyzed by Activated Carbon Surface." Second International Activated Carbon Conference, Pittsburgh, PA, September 19-23, 1994.
  97. Vidic, R.D., Suidan, M.T., and Brenner, R.C. "Effect of Dissolved Oxygen on Phenols Breakthrough from GAC Adsorbents." 16th Biennial IAWPRC Conference, Washington, D.C., May 24-30, 1992. Vidic, R.D., Suidan, M.T., and Brenner, R.C. "Prediction of GAC Adsorptive Capacity With and Without Molecular Oxygen." Symposium on Bioremediation of Hazardous Waste, EPA's Biosystems Technology Development Program, Chicago, IL, May 5-6, 1992.



98. Sorial, G.A., Suidan, M.T., Vidic, R.D., and Brenner, R.C. "Effect of GAC Characteristics on Adsorption of Organic Pollutants" 64th WPCF Annual Meeting, Toronto, Canada, October 7-10, 1991.
99. Vidic, R.D., Sorial, G.A., and Suidan, M.T. "Molecular Oxygen and the Adsorption of Phenols - Effect of Functional Groups." 64th WPCF Annual Conference, Toronto, Canada, October 7-10, 1991.
100. Sorial, G.A., Suidan, M.T., and Vidic, R.D. "Evaluation of Multicomponent Adsorption in Fixed Beds." National AIChE Meeting, Pittsburgh, PA, August 18-21, 1991.
101. Vidic, R.D. and Suidan, M.T. "The True Adsorptive Capacity of GAC." AIChE 1990 Annual Meeting, Chicago, IL, November 11-16, 1990.
102. Vidic, R.D. and Suidan, M.T. "Enhanced Removal of Organic Compounds in GAC Adsorbers." 63rd WPCF Annual Conference, Washington, D.C., October 7-11, 1990.
103. Vidic, R.D., Suidan, M.T., Traegner, U.K., and Nakhla, G.F. "Adsorption Isotherms: Helpful or Misleading." 62nd WPCF Annual Conference, San Francisco, CA, October 16-19, 1989.

#### F. Invited Presentations

1. "Membrane distillation for Inland Brackish Water Desalination" Keynote presentation at Renewable Energy and Water Sustainability - 5<sup>th</sup> International Conference on Scientific Research (ISR-2019), Sharm El Sheikh, Egypt, March 26-29, 2019.
2. "Management of Produced Water from Unconventional (Shale) Gas Extraction" Tanta University, Tanta, Egypt, March 25, 2019.
3. "Produced Water: Opportunities and Challenges" Workshop on Environmental Legacies and Produced Water Related to Unconventional Gas Production, The National Academies of Science, Engineering and Medicine, Pittsburgh, PA, November 15, 2018.
4. "Impact of operating conditions in membrane-based separation processes on the characteristics of inorganic scales on membrane surface" Colloidal and Interfacial Science in Separation Processes, Division of Colloid and Surface Chemistry, 256th ACS National Meeting & Exposition, Boston, August 19-23, 2018.
5. "Management of Produced Water from Unconventional (Shale) Gas Extraction", Department of Petroleum Engineering, Louisiana State University, Baton Rouge, March 17, 2017.
6. "Health risks and management strategies for NORM generated by shale gas extraction" 2017 Geochemistry Division Medal Symposium, 253th ACS National Meeting & Exposition, San Francisco, CA, April 2-6, 2017.
7. "Regional Similarities and Differences: Environmental and Regulatory Context for Potential Use of Flowback and Produced Water" Roundtable on Unconventional Hydrocarbon Development, National Academies, Washington, DC, May 25-26, 2016.
8. "U.S. Experience on Wastewater Treatment, Disposal and Reuse" Joint US-UK Workshop on improving Understanding of Potential Environmental Impacts Associated with Unconventional Hydrocarbons, Arlington, VA, November 5-6, 2015.
9. "Use of Abandoned Mine Drainage for the Recovery of Barite from Marcellus Shale Produced Water" The Chemical Sciences Roundtable, National Research Council of the National Academies, Washington, DC, May 18-19, 2015.
10. "Sustainable Water Management for Unconventional Gas Extraction in Marcellus Shale" Keynote Presentation, NSF Workshop: Development of Green Fracturing Fluids and

Sustainable Remediation and Containment Technologies, University of Arkansas at Little Rock, April 20-21, 2015.

11. “Environmental Challenges and Opportunities in Unconventional (Shale) Gas Extraction” Department of Chemical and Environmental Engineering, University of Arizona, Tucson, February 17, 2015.
12. “Water Quality Challenges Associated with Energy Resource Extraction from Marcellus Shale - NORM Issues” ASA, CSSA, & SSSA Annual Meetings, Long Beach, CA, November 2-5, 2014.
13. “Sustainable Water Management for Natural Gas Extraction From Marcellus Shale” North American Oil and Gas Conference, Calgary, AB, Canada, October 21-22, 2014.
14. “Abandoned Mine Drainage (AMD) as an Alternative Water Source for Hydraulic Fracturing” Shale Gas Insight, Pittsburgh, PA, September 24-25, 2014.
15. “Wastewater Reuse in Electric Power Production and Unconventional Gas Extraction” Roundtable on Science and Technology for Sustainability, The National Academies, Washington, DC, May 20-21, 2014.
16. “Abandoned Mine Drainage (AMD) as Alternative Water Source for Hydraulic Fracturing” Produced Water Disposal & Reuse Initiative 2014: Utica and Marcellus, Canonsburg, PA, March 26-27, 2014.
17. “Opportunities and Challenges in Unconventional (Shale) Gas Extraction” Illinois Institute of Technology, March 26, 2014.
18. “Environmental Challenges of Unconventional Gas Extraction” Plenary lecture at XIII Seminario Internacional del Medio Ambiente y Desarrollo Sostenible – XIII Simads, November 6-9, 2013, Bucaramanga, Colombia.
19. “Applying Innovative Techniques to Reduce the Amount of Water Used in Unconventional Operation” North Africa Oil & Gas Summit, October 23-25, Tunis, Tunisia.
20. “Environmental Challenges and Opportunities in Shale Gas Extraction” Keynote Presentation at 2013 Mid-Atlantic Conference of the American Water Resources Association, West Windsor, NJ, September 26, 2013.
21. “Treatment Options for Reuse of Flowback and Produced Water” Shale Insight 2013, Philadelphia, PA, September 25, 2013.
22. “Use of Abandoned Mine Drainage for Hydraulic Fracturing in Marcellus Shale” Innovative Water Management Workshop, Petroleum Technology Transfer Council, Morgantown, WV, August 22, 2013.
23. “Reuse of Produced Water for Hydraulic Fracturing” 3<sup>rd</sup> Annual Shale Play Water Management: Marcellus & Utica 2013, Pittsburgh, PA, March 26-27, 2013.
24. “Challenges and Opportunities for the Use of Abandoned Mine Drainage in Hydraulic Fracturing” SPE Workshop: Water Treatment for Unconventional Production, Fort Worth, TX, March 4-6, 2013.
25. “Wastewater Management for Unconventional Gas Extraction” 22<sup>nd</sup> Annual Southwest Florida Water Resources Conference” Ft. Myers, FL, January 25, 2013.
26. “Water Quality, Quantity, and Management: Lessons from the Marcellus Shale Region” Top engineering technologies for gas industry, Ostrava, Czech Republic, October 24-25, 2012.
27. “Water Management for Unconventional Gas Resource Extraction” 2012 Annual Conference of the Pennsylvania Society of Professional Engineers, Pittsburgh, PA, September 14, 2012.

28. "Flowback and Produced Water in Shale Gas Extraction: Water Quality and Management Options" Identification of Fundamental Interfacial and Transport Phenomena for the Sustainable Deployment of Hydraulic Shale Fracturing – Role of Chemicals Used, NSF Workshop, Arlington, VA, May 14-15, 2012.
29. "Water Quality, Quantity and Management Strategies for Unconventional Shale Plays" Produced Water Management: Strategies for Compliance, Cost Reduction, and Efficiencies, EUCI, Pittsburgh, PA, May 8-9, 2012.
30. "Water Quality, Quantity and Management: Lessons from the Marcellus Shale Region" Hydrofracking in Focus – What Every Citizen Needs to Know, A Science and Management Forum, Cary Institute of Ecosystem Studies, Millbrook, NY, May 5, 2012.
31. "Environmental Challenges for Unconventional Shale Gas Extraction" University of Cincinnati, Cincinnati, OH, May 4, 2012.
32. "Use of Abandoned Mine Drainage for Hydraulic Fracturing" SPE Workshop: Reducing Environmental Impact of Unconventional Resource Development, San Antonio, TX, April 23-25, 2012.
33. "Recycling and Reuse of Wastewater in Marcellus Shale" Shale Gas Water Management Initiative 2012, Pittsburgh, PA, March 28-29, 2012.
34. "Use of AMD in the Development of Marcellus Shale: Technical Uncertainties and Challenges" in *Feasibility and Challenges of Using Coal Mine Drainage for Marcellus Shale Natural Gas Extraction*, RAND Corporation, Pittsburgh, PA, December 14, 2011.
35. "Examining Limitations of Recycling Technologies And Potential Improvements to These Methods to Reduce the Amount of Water Needed for Hydraulic Fracturing" Shale Gas Water Management Initiative 2011, Dallas, TX, November 30 – December 1, 2011.
36. "Water Management for Sustainable Development of Marcellus Industry" Science 2011, Pittsburgh, PA, October 6, 2011.
37. "Strategies for Effective Water and Waste Water Management in Shale Plays" Marcellus Infrastructure Finance and Development Summit 2011, Pittsburgh, PA, October 5, 2011.
38. "Marcellus Shale Impacts and Opportunities: Sustainable Water Management in Marcellus Shale Industry" Annual ASCE/EWRI/CS4 Sustainability Conference, Pittsburgh, PA, September 22, 2011.
39. "Techno-Economic Assessment of Water Management Solutions: Assessing The Economics Of Technologies, And Emerging Solutions For Shale Gas Water Management" Shale Gas Water Management Initiative – Marcellus Initiative 2011, Pittsburgh, PA, April 13-14, 2011.
40. "Should Pittsburgh Permit Marcellus Drilling" Marcella L. Finegold Memorial Public Debate (discussion), William Pitt Debating Team, Pittsburgh, PA, April 6, 2011.
41. "Developing the Law of Marcellus Shale" The University of Pittsburgh Law Review and the Innovation Practice Institute (Expert panel discussion), Pittsburgh, PA, April 5, 2011.
42. "The Water-Shale Nexus: Exploring Strategies and Technologies for Water Treatment, Reuse and Disposal", Eagle Ford E&P Efficiency & Expansion Forum, San Antonio, TX, March 14-15, 2011
43. Vidic, R.D. "Water management options for Marcellus shale development" Global Shale Gas Water Management Initiative 2010, Dallas, TX, October 27-29, 2010.
44. "Global Challenges to Sustainable Water Management" Global Issues Lecture Series, Global Studies Program of the University Center for International Studies, Pittsburgh, PA, October 19, 2010.

45. "Looking Towards the Future of Marcellus Shale Exploration" ASCE/EWRI/CS4 Pittsburgh Regional Water Conference: Protecting and Utilizing our Greatest Asset, Pittsburgh, PA, September 9, 2010.
46. "Phytoremediation of Arsenic Contaminated Groundwaters: The Role of Rhizosphere Microbiota" School of Environmental Studies, China University of Geosciences, Wuhan, China, May 12, 2010.
47. "Reuse of Impaired Waters for Cooling in Coal-Fired Power Plants" School of Resource and Environmental Science, Wuhan University, Wuhan, China, May 13, 2010.
48. Frack Water Management panel discussion at Marcellus Shale Policy Conference, Pennsylvania Environmental Council and Duquesne University, Pittsburgh, PA, May 3-4, 2010
49. "Sustainable Water Management for Marcellus Shale Development" Marcellus Shale Natural Gas Stewardship: Understanding the Environmental Impact, Temple University Summit, Philadelphia, March 18, 2010.
50. "Control of Mercury Emissions from Coal-Fired Power Plants in the US: Regulations and Technology Status", Vinca Institute of Nuclear Sciences, July 27, 2009.
51. "Reuse of Treated Municipal Wastewater in Power Plant Cooling Systems" Faculty of Civil Engineering, University of Belgrade, July 16, 2009.
52. "Control of Mercury Emissions from Coal-Fired Power Plants: Regulations and Technology Status" Department of Civil and Environmental Engineering, University of Cincinnati, February 25, 2008.
53. "Phytoremediation of Arsenic Contaminated Groundwaters: The Role of Rhizosphere Microbiota" Department of Civil and Environmental Engineering, Temple University, November 2, 2007.
54. "Mercury Speciation in Coal-Fired Power Plant Flue Gas: Role of Fly Ash in Catalyzing Mercury Transformations" Department of Civil and Environmental Engineering, University of South Carolina, September 20, 2007.
55. "Phytoremediation for Environmental Cleanup" Department of Civil Engineering, University of Belgrade, July 16, 2007.
56. "Use of Membranes for Treatment of Municipal Wastewater" Faculty of Natural and Mathematical Sciences of the University of Kragujevac and Serbian Chemical Society, February 26, 2004.
57. "Future of Higher Education in Serbia" workshop organized by the Student Union of Belgrade University and GEPS, December 16, 2003.
58. "Engineering Studies in the US – Civil Engineering Program" Faculty of Technical Sciences, University of Novi Sad, October 31, 2003.
59. "Higher Education in The US – Example of Engineering Studies" Plenary lecture at the Second GEPS Conference, Novi Sad, Serbia and Montenegro, 11, 2003.
60. "Phytoremediation: Using plants for environmental cleanup" Plenary lecture at the 5th Regional Conference on Environment and Food Quality, Novi Sad, Serbia and Montenegro, September 4-5, 2003.
61. "Bridging the pressure gap from UHV to atmospheric conditions: Adsorption of mercury by graphite and activated carbon" Presented at Environmental Engineering Science and Management Seminar Series, Carnegie Mellon University, Pittsburgh, PA, April 4, 2003.

62. Discussion of "An Effective Biocide Combination Treatment Program for Colling Water Systems", 63<sup>rd</sup> Annual International Water Conference, Pittsburgh, PA, October 20-24, 2002 (published in Conference proceedings).
63. "Impact of Surface Heterogeneity of Carbonaceous Sorbents on Mercury Uptake" Plenary lecture at the 2002 International Activated Carbon Conference, Pittsburgh, PA, September 26-27, 2002.
64. "Sulfur Impregnation Approach for the Production of Economical Mercury Adsorbents" Department of Chemistry, University of Kentucky, Lexington, KY, October 12, 2001.
65. "Development of Novel Sorbents for the Control of Mercury Emissions from Coal-Fired Power Plants" Department of Chemical and Petroleum Engineering, University of Pittsburgh, Pittsburgh, PA, September 21, 2001.
66. "Applied Industrial Ecology – Reducing Mercury in the Environment" University of Pittsburgh, Science Fair 2001, September 13, 2001.
67. "Disinfection Modalities for the Control of Legionella in Water Distribution Systems" NSF Workshop, Holiday In, Pittsburgh, October 30-31, 2000.
68. "Uptake of Elemental Mercury Vapors by Sulfur Impregnated Activated Carbons" Institute for Technical Chemistry, Forschungszentrum Karlsruhe, Karlsruhe, Germany, March 9, 2000.
69. "Novel Technologies for the Control of Legionella in Institutional Water Distribution Systems", WAREM – Water Resources Institute, University of Stuttgart, Stuttgart, Germany, January 25, 2000.
70. "Chemical Compatibility of Organic Polymers with Polar and Non-Polar Solvents: Membrane Filtration of Industrial Wastewater" Dow Chemicals, Stade, Germany, December 14, 1999.
71. "Impact of Surface Functional Groups on Activated Carbon Uptake of Phenolic Compounds." Institute for Chemical Technology, University of Karlsruhe, Karlsruhe, Germany, November 11, 1999.
72. "Application of Impregnated Activated Carbons for the Control of Elemental Mercury Emissions from Coal Fired Power Plants" National Technical Workgroup Mercury Workshop, Atlanta, GA, November 18-20, 1998.
73. "Development of Economical Sorbents for Mercury Emissions Control from Coal-Fired Power Plants" Plenary lecture at the 1998 International Activated Carbon Conference, Pittsburgh, PA, September 18, 1998.
74. "Control of Mercury Emissions from Coal-Fired Power Plants" Plenary lecture at the 1997 International Activated Carbon Conference, Pittsburgh, PA, September 17, 1997.
75. "Remediation Technology Status Report: Treatment Walls" Emerging Technologies in Hazardous Waste Management VIII, I&EC Division - ACS, Birmingham, AL, September 9-11, 1996. "Adsorption Technology for the Control of Mercury Emissions from Combustion Processes." Presented at Environmental Science and Engineering Seminar Series, Carnegie Mellon University, Pittsburgh, PA, March 1, 1996.
76. "Control of Disinfection By-Products in Drinking Water: Regulations and Costs." NATO Advanced Studies Institute, Varna, Bulgaria, October 24 - November 4, 1994.
77. "Control of Disinfection By-Products in Drinking Water: Case Studies of Alternative Disinfection Technologies." NATO Advanced Studies Institute, Varna, Bulgaria, October 24 - November 4, 1994.

## GRADUATE STUDENT ADVISING

### MS Students

Name	Year	Source of Support	Dissertation Title
Curtis J. Petrosky	1994	Part-time	Pretreatment of Industrial Wastewater Containing Phthalate Esters by Centrifugation
J. Brendan McLaughlin	1995	American Industrial Recycling	Activated Carbon Adsorption for the Removal of Mercury from Flue Gas Emissions
Yu-sen Eason Lin	1995	VA Medical Center	Disinfection of <i>L. pneumophila</i> with Cu/Ag ionization
Jacob A. Bourdeau	1996	Pitt CRDF	Effect of Ash and Metal Content of the Catalytic Properties of Activated Carbon for Oxidative Coupling of Phenolic Compounds
Charles H. Tessmer	1996	PEDA	The Effect of Oxygen-Containing Surface Functional Groups on the Catalytic Behavior of Granular Activated Carbon
Lois J. Uranowski	1996	Self	The Effect of Surface Metal Oxides on Activated Carbon Adsorption of Phenolics
George S. Sarapa	1996	Allegheny County Health Department	Use of GIS in groundwater monitoring
Min-Tsang Chang	1996	U.S. EPA	Kinetics of vapor-phase mercury uptake by different adsorbents
John A. Korpiel	1996	PEDA	Effect of sulfur impregnation method on activated carbon adsorption of vapor-phase mercury
Edward C. McCall	1998	VA Medical Center	Efficacy of biocides against Legionella in the biofilm of a model plumbing system
Douglas P. Siler	1999	Teaching Assistantship	Effect of chloride salt impregnation on activated carbon adsorption of vapor-phase mercury
Thomas J. O'Toole	1999	Part-time	Sanitary wastewater treatment plant evaluation
Seokjoon Kwon	1999	U.S. DOE	Evaluation of sulfur impregnation processes on different substrates for the production of elemental mercury sorbents
Joe M. Klinvex	2000	Part-time	Iron and manganese removal from drinking water
Yang Gao	2000	VA Medical Center	Inactivation of Legionella by monochloramine, chlorine dioxide and DBNPA in a pilot-scale water plumbing system
Xiaozhou You	2002	Dominion Center	Sulfur impregnation on activated carbon through hydrogen sulfide oxidation
John L. Stuart	2002	Chester fellowship	Evaluation of mercury uptake by activated carbons under simulated flue gas conditions
John A. Bendick	2003	Allegheny County Health Department	Feasibility of cross-flow microfiltration for combined sewer overflows
Claude Modise	2003	Fraunhofer Center	Use of polymeric microfiltration membranes to remove microorganisms and organic pollutants from primary sewage effluent

Sevil Caniyilmaz	2005	Mascaro Sustainability Initiative	Removal of arsenic during Fe-Mn oxidation and microfiltration
Chantal Blake	2006	Mascaro Sustainability Initiative	Optimizing the use of arsenic hyper-accumulating ferns for treatment of arsenic contaminated water
Ana Maria Benvides	2007	Mascaro Sustainability Initiative	The effect of arsenic speciation on arsenic uptake and fate in the presence of the hyper-accumulating species <i>Pteris Cretica</i>
Xihua Chen	2007	U.S. DOE	Impact of fly ash composition and flue gas components on mercury speciation
Ravi Bhardwaj	2007	Corning, Inc.	Development of novel sorbents for mercury control
Huixing Li	2008	US DOE	Selective catalytic oxidation of hydrogen sulfide from syngas
Wei Sun	2009	US DOE	Use of abandoned mine drainage solids for the control of mercury emissions from coal-fired power plants
Yinghua Feng	2009	US DOE	Management of blowdown from closed loop cooling systems using impaired waters
Shih-Hsiang Chien	2009	US DOE	Regulatory assessment of wastewater use for cooling in thermoelectric power plants
Scott Duda	2010	ASHRAE	Use of non-chemical devices to control biofouling in cooling towers
Meng Li	2011	US DOE	Removal of divalent cations from Marcellus Shale flowback water through chemical precipitation
Xihun Wang	2012	US DOE	Membrane filtration of Marcellus Shale flowback water
Xuan (Katie) Zhang	2013	Self support	Solids removal from a mixture of flowback and AMD
Liang Tang	2014	US DOE	Thermodynamic model for membrane distillation
Emily Wolff	2015	US DOE	Use of acrylic co-polymer membrane for membrane distillation
Zhewei Zhang	2018	Self support	Use of membrane distillation for water recovery from brackish water RO concentrate

*Ph.D. Students*

Name	Year	Source of Support	Dissertation Title
Wei Liu	1998	U.S. DOE	Development of novel adsorbents for the control of vapor-phase mercury emissions
Yu-Sen E. Lin	1999	VA Medical Center	Use of copper/silver ions for disinfection of <i>Legionella</i> and <i>Mycobacterium</i> in water distribution systems
Seokjoon Kwon	2002	U.S. DOE	Environmentally relevant adsorption on carbonaceous surfaces studied by optical differential reflectance and temperature programmed desorption

Xue Feng	2005	NSF	<b>Application of single walled carbon nanotubes in environmental engineering: Adsorption and desorption of environmentally relevant species studied by infrared spectroscopy and temperature programmed desorption</b>
Wenguo Feng	2005	NSF	Hydrogen sulfide adsorption/oxidation on carbonaceous surfaces and its application in vapor phase mercury control
Zhe Zhang	2007	VA Medical Center	Use of chlorine dioxide for Legionella control in hospital water systems
Heng Li	2010	US DOE	Mineral deposition in recirculating cooling systems using treated municipal wastewater: Kinetics, mechanism and modeling
Shih (Sean) Chien	2012	US DOE	Use of chlorine, chloramine, and chlorine dioxide to control biological growth in power plant recirculating cooling system using treated municipal wastewater
Wenshi Liu	2013	US DOE	Control of chemical precipitation in recirculating cooling system using treated municipal wastewater
David Sanchez	2013	IGERT/NSF	Understanding the influence of the electrode material on microbial fuel cell performance
Tieyuan Zhang	2015	US DOE	Origin and fate of Radium in flowback and produced water from Marcellus Shale
Can He	2016	US DOE	Fate of sulfate during hydraulic fracturing in Marcellus shale
Shardul Wadekar	2018	SAFER	Separation potential characterization and its role in selecting nanofiltration for the removal of inorganic ions
Omkar Lokare	2018	US DOE	Development of direct contact membrane distillation for Marcellus shale produced water treatment
Alen Gusa	2019	NSF	Management of TENORM waste generated by unconventional gas extraction
Zhewei Zhang	ongoing	US DOE	Membrane distillation for brackish water RO concentrate
Ritesh Pawar	ongoing	US DOE	Concentration polarization in membrane processes

*Post-Doctoral Scientists*

Aiguo Chen, 1999-2000

Hui Liu, 2007-2008

Elise Barbot, 2009-2012

Theodore Novitsky, 2010 - 2011

Shiyun Zhu, 2011-2012



Yoshihiko Inagaki, 2018-2019  
Haiqing Chang, 2019-2020

## COURSES TAUGHT

### CEE 1503 *Introduction to Environmental Engineering*

This is an undergraduate level course that covers fundamentals of environmental science and engineering as applied to water and wastewater treatment, air quality control, and solid and hazardous waste management.

### CEE 2501 *Environmental Engineering Chemistry*

This course is offered to both undergraduate and graduate level students and is designed to assist students in developing and understanding fundamentals of water chemistry as applied to the description and evaluation of natural environments and environmental quality control systems.

### CEE 2502 *Physical/Chemical Principles of Environmental Engineering*

This course is predominantly a graduate level course that is designed to assist students in understanding basic principles and applications of thermodynamics, fluid mechanics, reaction equilibria and kinetics, diffusion, and mass transfer to natural environments and environmental quality control systems.

### CEE 2508 *Atmospheric Pollution Control*

The course is designed to assist students in understanding sources and transport of air pollutants and design of control technologies for particulate and gaseous emissions with emphasis on stationary sources of air pollutants.

### CEE 3501 *Environmental Engineering Processes I*

This graduate level course is designed to assist students in understanding theory and applications of physical and chemical principles to water and wastewater treatment and disposal including mixing, equalization, coagulation, sedimentation, filtration, disinfection, adsorption, chemical precipitation, gas transfer, and solids handling.

### CEE 3503 *Environmental Engineering Process Laboratory*

The course is designed to assist students in understanding and designing laboratory simulations for developing design and control parameters for unit operations and processes applicable to environmental quality control systems.

## SPONSORED RESEARCH PROJECTS

(Principal Investigator)

### *Deploying Intensified, Automated, Mobile, Operable, and Novel Designs "DIAMOND" for Treating Shale Gas Wastewater*

Agency: U.S. DOE

Amount: \$5.3 million (Pitt share: \$1.7 million)

Duration: 01/19 – 12/21

### *Scale up and Demonstration of Membrane Distillation*

Agency: U.S. DOE

Amount: \$750,000 (Pitt share: \$445,000)

Duration: 01/19 – 06/21

### *Fate and Control of Naturally Occurring Radioactive Material (NORM) Produced by Unconventional Gas Industry*

Agency: NSF

Amount: \$270,178

Duration: 04/15 – 03/18

### *Development of Membrane Distillation Technology Utilizing Waste Heat for Treatment of High Salinity Wastewaters (Co-PI: V. Khanna)*

Agency: U.S. DOE

Amount: \$654,183

Duration: 10/14 – 09/17

### *Technical and Logistical Feasibility of Abandoned Mine Drainage Treatment and Use in Unconventional Shale Gas Well Treatments*

PI: R. Vidic

Agency: SAFER

Amount: \$98,684

Duration: 03/15 – 02/16

### *Fate of Radium During Lime-Soda Ash Softening of Water Produced During Unconventional Gas Extraction*

PI: R. Vidic

Agency: Shell

Amount: \$96,805

Duration: 10/14 – 09/15

### *Sustainable Management of Flowback Water during Hydraulic Fracturing of Marcellus Shale for Natural Gas Production*

Agency: U.S. DOE

Amount: \$794,226

Duration: 10/10 – 1/15

*Fate of Naturally Occurring Radioactive Material (NORM) in Flowback and Produced Waters from Natural Gas Development*

Agency: U.S. DOE  
Amount: \$275,000  
Duration: 10/10 – 11/14

*Use of Treated Municipal Wastewater as Power Plant Cooling System Makeup Water: Tertiary Treatment versus Expanded Chemical Regimen for Recirculating Water Quality Management*

Agency: U.S. DOE  
Amount: \$740,550  
Duration: 10/08 – 6/12

*Biological Control in Cooling Water Systems using Non-Chemical Water Treatment Devices*

Agency: ASHRAE  
Amount: \$179,715  
Duration: 07/08 – 4/10

*Reuse of Treated Internal or External Wastewaters in the Cooling Systems of Coal-based Thermoelectric Power Plants*

Agency: U.S. DOE  
Amount: \$617,703  
Duration: 7/06 – 6/09

*Evaluation of Biofilm Monitoring and Control Using BioGeorge and VMP for Cooling Tower Applications*

Agency: Veolia Water Solutions  
Amount: \$27,142  
Duration: 05/09 – 09/09

*Catalysts for Selective Hydrogen Sulfide Oxidation*

Agency: U.S. DOE – NETL  
Amount: \$196,857  
Duration: 9/06 – 5/08

*Evaluation of a Novel Carbon Material (Carbon Honeycomb) for Mercury Control*

Agency: Corning, Inc.  
Amount: \$84,000  
Duration: 6/06 – 9/08

*Mercury Speciation in Coal-Fired Power Plant Flue Gas*

Agency: U.S. DOE – University Coal Research  
Amount: \$400,000  
Duration: 8/05 – 7/08

*Development of Novel Mercury Adsorbents through Applied Industrial Ecology (Co-PI: Dr. E. Borguet)*

Agency: National Science Foundation

Amount: \$376,180  
Duration: 8/02 – 7/06

*Application of Ceramic Membrane Module to Combined Sewer Overflows (Co-PI with Dr. R.D. Neufeld)*

Agency: Three Rivers Wet Weather Demonstration Program – ACHD  
Amount: \$293,494  
Duration: 1/02 – 12/03

*Modeling In-Duct Mercury Control by Powdered Sorbent Injection*

Agency: U.S. DOE - NETL  
Amount: \$35,551  
Duration: 8/02 – 9/03

*Adsorption on Nanotubes (Co-PI with Dr. E. Borguet)*

Agency: National Energy Technology Laboratory (NETL); Student Partnership Program  
Amount: \$35,000  
Duration: 01/02-01/03

*Environmental and Public Health Recovery and Protection in Yugoslavia*

Agency: University Center for International Studies  
Amount: \$24,800  
Duration: 5/02 – 4/03

*Catalytic Oxidation of Hydrogen Sulfide on Activated Carbon for Simultaneously Upgrading Low Quality Natural Gas and Producing Effective Elemental Mercury Sorbents*

Agency: DOMINION Center for Environment and Energy  
Amount: \$15,000  
Duration: 9/01 – 12/02

*Modeling Sorbent Injection for Mercury Control*

Agency: U.S. DOE - NETL  
Amount: \$33,510  
Duration: 2/01 – 10/01

*Combined Theoretical and Experimental Investigation of Mechanisms and Kinetics of Vapor-Phase Mercury Uptake by Carbonaceous Surfaces (Co-PIs: Dr. E.U. Borguet and Dr. J.K. Johnson)*

Agency: U.S. DOE - FETC (University Coal Research Program)  
Amount: \$360,931  
Duration: 9/98 – 3/01

*Experimental Investigation of Mercury Capture by Novel Sulfur Impregnated Activated Carbons Under Simulated Flue Gas Conditions*

Agency: U.S. DOE - FETC  
Amount: \$50,102

Duration: 9/98 - 2/99

*Development of Novel Activated Carbon-Based Adsorbents for the Control of Mercury Emissions from Coal-Fired Power Plants*

Agency: U.S. DOE - FETC (University Coal Research Program)

Amount: \$261,055

Duration: 9/96 - 8/98

*Uptake of Mercury Vapor by Activated Carbon*

Agency: U.S. Environmental Protection Agency

Amount: \$88,556

Duration: 10/94 - 9/96

*Groundwater Quality Database for Allegheny County*

Agency: Allegheny County Health Department

Amount: \$24,000

Duration: 9/94 - 8/96

*Mercury Control in Coal-Fired Power Plant Flue-Gas*

Agency: Pennsylvania Energy Development Authority

Amount: \$101,103

Duration: 9/94 - 6/96

*Effect of Activated Carbon Characteristics on the Adsorption of Phenolic Compounds*

Agency: University of Cincinnati Engineering Research Center

Amount: \$10,000

Duration: 5/94 - 4/95

*Control of Mercury Concentration in Gaseous Emissions*

Agency: American Industrial Recycling, Pittsburgh, PA

Amount: \$15,300

Duration: 1/94 - 9/94

*Catalytic Properties of Activated Carbon*

Agency: University of Pittsburgh Central Research Development Fund

Amount: \$13,000

Duration: 1/93 - 1/94

*Educational Grant for Equipment Purchase*

Agency: N-Con Systems, Inc., Larchmont, NY

Amount: \$15,750

Duration: One-time grant - 1993

## CONSULTING EXPERIENCE

Veolia Water Technologies - Assessment of the produced water treatment plant in WV, 2019  
Shell Exploration and Production - Downhole risks for mineral scaling, 2011-2015  
RAND Corporation - Feasibility and challenges of using acid mine drainage for Marcellus Shale natural gas extraction activities, 2011.  
Rice Energy - Use of acid mine drainage for hydrofracturing operations, 2011  
DTE Energy Services - Water treatment needs and opportunities in Marcellus shale play, 2011  
Range Resources - Management of water impoundments for water quality, 2010-2011  
Gas Technology Institute – Techno-Economic Assessment of Water Management Solutions, 2010-2011  
NA Water Solutions - ceramic membranes for flowback water treatment, 2010  
BG Group – Water risks for shale gas operations in the US, 2010  
Stericycle (Lake Forest, IL) - implementation of chlorine dioxide disinfection practice in US hospitals, 2005-2006.  
European Agency for Reconstruction - Key expert for “Feasibility Study for Hazardous and Medical Waste Management in Serbia”, Belgrade, Serbia and Montenegro, 2003-2004.  
Public Health Institute of Belgrade - Update of hazard indicators for the city of Belgrade, Serbia and Montenegro, 2003-2005  
REC CO SCG - Key expert for “Regional Strategy for Hazardous Waste Management in Serbia” funded by the Stability Pact for Southeastern Europe, 2003.  
REC CO SCG - Expert for hazardous and industrial waste generation and treatment for "SWAMAP Municipal Solid Waste Management Plan", 2002-2003  
Allegheny County Wet Weather Demonstration Program - Comprehensive assessment of CSO/SSO management requirements in the county, 2000-2002.  
Energy and Resource Technology, Inc., Taiwan - Design of air pollution control system for thermal soil treatment plant, 2000-2001.  
Halox, Inc. (Bridgeport, CT) - Use of novel chlorine dioxide generating system for the control of biofilms in institutional water distribution systems, 2000.  
NUCON International, Inc. (Columbus, OH) - Mercury sorbent manufacturing and testing program, 1999.  
Nemacolin Woodlands Resort (Farmington, PA) - Critical evaluation of the drinking water treatment plant process with emphasis on process optimization and safety, 1999.  
ICF Consulting Group (Fairfax, VA) - Development of Drinking Water Criteria Document for Legionella, 1998.  
Nichols & Slagle Engineering, Inc. (Pittsburgh, PA) - Expansion of the Leetsdale Borough wastewater treatment plant, PA, 1998.  
Metcalf & Eddy, Inc. (San Diego, CA) - Development of membrane bioreactors for water reclamation in San Diego, CA, 1998.  
Institute for Water Resources “Jaroslav Černi” - Membrane filtration technology in the City of Zrenjanin water treatment plant, Serbia and Montenegro, 1997-1998.  
Vencon Management, Inc. (New York, NY) - Alanco Flue Gas Desulfurization technology demonstration program, 1997.  
Advanced Technology Systems, Inc. (Pittsburgh, PA) - Continuous emission monitoring program for mercury in Allegheny County, 1996.  
Allegheny County Health Department (Pennsylvania) - Integrated Groundwater Monitoring Program and Wellhead Protection Program for the County, 1994-1995.