

BIOGRAPHICAL RESUME

Albert J. Heber, Ph.D., P.E., Professor

Agricultural and Biological Engineering, Purdue University
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EDUCATION

Ph.D., Engineering, University of Nebraska-Lincoln, 5/84
M.S., Agricultural Engineering, South Dakota State University, 12/79
B.S., Agricultural Engineering, South Dakota State University, 8/78

PROFESSIONAL POSITIONS AND EXPERIENCE

6/02- *Professor*, Agricultural and Biological Engineering, Purdue University, W. Lafayette, IN
7/85- *President*, Heber Consulting, LLC, Delphi, IN
4/15-5/15/14 *Visiting Scientist*, Uludag University, Bursa, Nilufer, Turkey
9/22-10/22/11 *Visiting Scientist*, Zhejiang University, Hangzhou, Zhejiang Province, P.R. China
6/93-6/02 *Associate Professor*, Agricultural Engineering, Purdue University, W. Lafayette, IN
8/1/90-7/25/91, 6/17-9/15/93, 9/5/00-3/1/01 *Visiting Scientist*, Silsoe Research Institute, Silsoe, UK
7/89-6/93 *Associate Professor*, Agricultural Engg., Kansas State University, Manhattan, KS
5/84-6/89 *Assistant Professor*, Agricultural Engg., Kansas State University, Manhattan, KS
6/81-5/84 *Research Engineer II*, Agricultural Engineering, Univ. Nebraska, Lincoln, NE
1/80-6/81 *Instructor*, Agricultural Engineering, South Dakota State Univ., Brookings, SD
7/78-12/79 *Graduate Research Assistant*, Agricultural Engineering, SDSU, Brookings, SD

HONORARY AND PROFESSIONAL SOCIETIES

Alpha Epsilon Honorary Member, 1986
Air and Waste Management Association, 2002-present
American Association of Aerosol Science, 1987-1988
American Society of Agricultural and Biological Engineers, 1980-present
American Society of Engineering Education, 1985-1987
American Society of Heating, Refrigeration and Air Conditioning Engineers, 1992-2011
Gamma Sigma Delta, Honor Society of Agriculture, 1978
Phi Kappa Phi, Honor Society, 1978
Sigma Xi, Scientific Research Society, 1980
The Aerosol Society, 1990-1996
Tau Beta Pi, Engineering Honor Society, 1977

PROFESSIONAL RECOGNITION AND AWARDS

Member of College of Ag CAFO Group who received Dean's Team Award, 2010
Millionaires Club Award, College of Agriculture, Purdue University, 2008
Seed-for-Success Award, Provost Office, Purdue University, 2007
Tony and Mary Hulman Health Achievement Award in Environmental Health, IPHF, 2005
Heber's Agricultural Air Quality Group at Purdue received Dean's Team Award, 2005
Selected Research Leader of National Air Emissions Monitoring Study, 2005
Selected to United Egg Producers Scientific Panel Concerning Environmental Issues, 2004
Article featured in ASAE Resource magazine, 2003
Selected Reviewer and Review Coordinator for NRC Report on Air Emissions, 2002
Transactions of ASAE Article Honorable Mentions, 1993, 1995, 2005
Member of the Year, ASAE Kansas Section, 1992
Advisor of the Year, Agricultural Engineering Department, KSU, 1992
Blue Ribbon in ASAE Educational Aids Competition for MWPS-33, 1990
Outstanding Reviewer, ASAE Structures and Environment Division, 1987

Journal paper selected for feature article in Agricultural Engineering magazine, 1986
New Engineering Educator Delegate to National ASEE meeting, 1985
Ralston-Purina Scholarship, 1977, 3M Engineering Scholarship, 1976

SUMMARY OF EXPERTISE

Dr. Heber has over 33 years of experience in livestock facility research, education, and consulting with emphasis on air quality including the assessment and mitigation of particulate matter, pathogens, odor and gas emissions and concentrations at livestock buildings and waste facilities. He directs Purdue's Agricultural Air Quality Laboratory, which utilizes state-of-the-art instruments for meteorology, olfactometry, gas chromatography, mass and FTIR spectrometry, and viable particle sampling, along with multiple continuous analyzers for NH₃, H₂S, CO₂, CH₄, N₂O, TSP, PM₁₀, and PM_{2.5} concentrations. In the mid-1990's, he introduced the use of continuous analyzers and mobile air quality labs to monitor livestock air emissions and to evaluate odor and air pollution mitigation strategies. Since 1996, he has directed several comprehensive air emission measurement campaigns in collaboration with 12 other universities and cooperation of milk, pork, poultry and egg producers, including the benchmark National Air Emissions Monitoring Study that was required by the U.S. EPA Air Consent Agreement.

Over 1,400 "barn-months" of emission data have been collected under his direction. Since 2000, Dr. Heber has published 78 journal articles, given 80 invited papers and lectures, and provided scientific expertise and information on air emission measurements, estimation methods, and emission controls at livestock facilities to state and federal agencies and the livestock industry.

Other research has involved manure additive testing, development of a science-based setback model for U.S. pork, dairy and poultry farms, air biofiltration, testing of odor measurement protocols, pathogen emission and dispersion from swine barns, greenhouse gas emissions from dairy farms, and odor emission from swine, dairy and layer housing, outdoor manure treatment, manure land application, and industrial composting. Dr. Heber has received \$33.6M in awards and gifts with direct responsibility of more than \$14.3M.

Other areas of expertise are atmospheric dispersion modeling using AERMOD, commercial oven design, air systems for confined spaces, electric power and control, manure treatment and land application, odor emission from food and feed processing, and building ventilation and indoor air quality.

CITATIONS IN BIOGRAPHICAL WORKS

PROFESSIONAL ACTIVITIES

National Committees

United Egg Producers Environmental Scientific Panel, 2004-present.

USDA-NRCS Air Quality Group, 2003-04 (Developed protocol for nationwide emission monitoring).

National Research Council Report on Air Emissions from Livestock Facilities, 2002

Reviewer, Interim Report; Review Coordinator, Final Report

American Society of Agricultural and Biological Engineers

SE-02 Steering Committee of Structures and Environment Division, Member, 1998-00

SE-06 Program Committee of Structures and Environment Division, Member, 1998-00

SE-30 Structures and Environment Division Environment Group Chair, 1998-00

SE-305 Environmental Air Quality Committee, 1986-13; Nominating Subcommittee Chair, 1992; Structures Subcommittee Chair, 1993-95

SE-302 Environment of Animal Structures Committee Member, 1989-present

Sec., 1993-94, Vice-Chair, '94-95, Chair, '95-96, Past-Chair, '96-97; Assoc. Editor, '93-9

PAFS-50 Environmental Air Quality, 2013-present, Secretary 2014-present.

American Society of Heating, Refrigeration and Air Conditioning Engineers, '93-'11

TC 2.2 Plant & Animal Environment Committee, 1993-04; Res. Subcommittee Chair, '93-03

Regional and State Committees

Indiana Department of Environmental Management CAFO Air Quality Committee, 2002-2009.

NCR 189: Air Quality Issues Associated with Animal Facilities, '96-02, Sec., '97-98, Chair, '98-99

International Conference on Air Pollution from Agricultural Operations, Conference Chairman

and Chair of Program Subcommittee, 1995-96
Mid-Central Conference of American Society of Agricultural Engineers
Program Committee Member, 1986-1988, and Chairman, 1988-1990
Kansas Committee on the Relation of Electricity to Agriculture
Chair, 1988-89, Sec.-Treas., 1985-89; Exec. Committee, 1985-90; Ad-Hoc Member, 1991-93
Kansas Section of American Society of Agricultural Engineers
Nominating Committee: Member, 1985; Chairman, 1986, Awards Committee Member, 1992-93
NCR-9 Midwest Plan Service
Agricultural Experiment Station Rep., 1985-93; Executive Committee Member, 1988-90
NCS-3 Integrated Health Management for Confined Swine; Task Force Member, 1986-1987

FACULTY RESPONSIBILITIES

Purdue University

Purdue NASA-NSCORT Resource Recovery Focus Area Lead, 2005-06.
Purdue Cooperative Extension Specialists Assoc., Dept Rep., 1993-97, Prof. Improvement Committee, 1993-94, Chair
1994-95; Pres.-Elect, 1996-97; Pres., 1997-98; Past-Pres., 1998-99.
College of Agriculture Grievance Committee, 1995-1996; Acting Chair, Jan., 1996
College of Agriculture Extension Education Committee, 1995-97
College of Agriculture Agenda and Policy Committee, 1995-98, 2013-16
College of Agriculture Area Promotions Committee, 2016-present.
College of Engineering Grade Appeals Committee, Chair, 1996-98
University Grade Appeals Committee, 1998-present, Chair, 2002-2003

Department

Graduate Committee, 1994-1996
Awards Committee, 1995-2004, Chair, 2002-2004
Extension Committee, 1993-present, Chair, 2012-present
Family Day Committee Chair, 1996-2005

Kansas State University

Research Assoc. of the KS Technology Enterprise Corp. Adv. Man. Inst. 1988-93
College of Agriculture Honors Advisory Committee, 1988-1990
Agricultural Experiment Station Conference Committee, 1992-93
Graduate Faculty Member, 1985-93
Engineering Academic Reinstatement Committee, 1984-1990
Kansas Electric Utilities Research Program Advisory Committee, 1988-93

Department

Structures and Environment Technical Committee Chairman, 1989-93; Graduate Committee, 1988-93; Honors
Committee, 1988-89; Room Scheduling Committee Chair, 1988-89; Scholarship Committee, 1988-89; Course and
Curriculum, 1987-93; Facilities and Space Committee, 1985-89; Engineering Open House, Co-advisor, 1985-86;
Advisor, 1987-89

TEACHING

Student Advising

Kansas State University: Agricultural Mechanization Undergraduate Students, 1984-90; Agricultural Engg.
Undergraduate Students, 1986-93; Major Professor: 2 M.S. Agricultural Mechanization Students, 1985-93; 6 M.S.
Agricultural Engg. Students, 1986-93; 1 Ph.D. Engg. Student, 1988-93; Advisor to 2-Postdoctoral Researchers, 1989,
1991-92.

Purdue University: Major Professor to: 1 M.S. Agricultural Systems Management Student; 1 M.S. Extension Education
Student; 3 M.S. Agricultural Engg. Students; 1 M.S. Mechanical Engg. Student; 4 Ph.D. Agricultural Engg. Students; 14
Postdoctoral researchers; 10 Visiting Scholars.

Undergraduate Courses

South Dakota State University

Ag Eng 444 “Electric Power and Processing.” 1981
Mech Ag 342 “Electricity for the Farm and Home.” 1980-81
Mech Ag 443 “Processing of Agricultural Products.” 1981

University of Nebraska

Ag Eng 460 “Agricultural Instrumentation and Controls” (50%), 1983

Kansas State University

Ag Eng 500 “Physical Properties of Biological Materials.” 1990
Ag Eng 510 “Environmental Design of Agric. Buildings.” 1984-89, 91-92 (taught via satellite one year)
Ag Eng 566 “Design of Agricultural Structures.” 1985-93
AgTechM 511 “Agricultural Building Systems.” 1985-88, 90(labs), 92-93

Purdue University

ASM 103 “Animal Systems Management (environmental module: 3 weeks)” 2017 (7 students)
ASM 420 “Electric Power and Controls.” 2012-present (12 to 35 students)
ABE 490 “Professional Practices in Agricultural and Biological Engineering”, 2013-present – 93 students in 2017.
ABE 590 “Air Biofiltration.” 2003 (four graduate students)
ASM 570 “Agricultural Structures.” 1995-04 (one month on building environment)
AGEN 556 “Food Plant Design.” 1994-96 (one week of ventilation)

Zhejiang University, Hangzhou, China

“Bio-Environmental Engineering (Environmental Control of Animal Buildings)” 31 lectures, Dec. 9-23, 2016, 43 lectures and a field trip, Dec. 10-26, 2017 (60 to 66 seniors).

Graduate Course

Kansas State University

Ag Eng 811 “Particle Technology.” 1988-89, 92

PATENTS

Heber, A.J., L. Vasan, J.T. Cole. 2005. Dual Conveyor Jet Impingement Oven. U.S. #6,880,545. Filed 8/28/03.
Assignee: National Gas Institute, Des Plaines, IL, 4/19.
Heber, A.J. 1995. Conveyor Oven with Improved Air Flow. U.S. Pat. No. 5,421,316. Filed 1/31/94. Assignee: G.S. Blodgett Corporation, Burlington, VT, 6/6.
Heber, A.J. 1992. Variable Speed Control of Livestock Ventilation Fans using Discrete Feedback of Motor Spd. U.S. #5,125,571. Filed 5/21/90. Assignee: KSU Research Foundation, Manhattan, KS, 6/30.

PEER-REVIEWED JOURNAL ARTICLES (total= 112)

1. Ni, J.-Q., A.J. Heber, T.-T. Lim, S.M. Hanni, and C.A. Diehl. 2017. Effect of a manure additive for mitigating gas and odor releases from layer hen manure. *Aerosol and Air Quality Research* doi:10.4209/aaqr.2016.07.0327.
2. Liu, S., J.-Q. Ni, A.J. Heber, and W.-Z. Liang. 2017. Modeling dynamic ammonia concentrations in layer houses using a distributed lag non-linear model. *J. Env. Informatics* <http://dx.doi.org/10.3808/jei.201700360>.
3. Ni, J.Q., S. Liu, C.A. Diehl, T.T. Lim, B.W. Bogan, L. Chen, L. Chai, K. Wang, and A.J. Heber. 2017. Emission factors and characteristics of ammonia, hydrogen sulfide, carbon dioxide, and particulate matter emissions from two high-rise layer houses. *Atmospheric Environment* 154:260-273.
4. Ni, J.-Q., C.A. Diehl, L. Chai, Y. Chen, A.J. Heber, T.T. Lim, and B.W. Bogan. 2017. Factors and characteristics of ammonia, hydrogen sulfide, carbon dioxide, and particulate matter emissions from two manure-belt layer hen houses. *Atmospheric Environment* 156:113-124.
5. Dai, X., J.-Q. Ni, Q. Pan, K. Wang, and A.J. Heber. 2016. Thermal environment and pollutant gas concentrations inside pig weaner barns in eastern China. *Trans. Chinese Soc. Agric. Machinery* 47(7) 315-322.
6. Zhao, L.Y., R.B. Manuzon, L.S. Hadlocon, M.J. Darr, H.M. Keener, A.J. Heber, and J.Q. Ni. 2016. Ammonia concentrations and emissions at a commercial poultry manure composting facility. *Biosys. Engg.* 150:69-78.

7. Grant, R.H., M.T. Boehm, and A.J. Heber. 2016. Ammonia emissions from anaerobic waste lagoons at pork production operations: influence of climate. *Agricultural and Forest Meteorology* 228:73-84.
8. Wang, K., Q.F. Li, L. Wang-Li, E.L. Cortus, B.W. Bogan, I. Kilic, W.-Z. Liang, C.H. Xiao, L.L. Chai, J.Q. Ni, and A.J. Heber. 2016. National air emissions monitoring study - Southeast layer site: Part V: Hydrogen sulfide and volatile organic compounds. *Trans. ASABE* 59(2):681-693.
9. Joo, H.S., P.M. Ndegwa, A.J. Heber, J.Q. Ni, B.W. Bogan, J.C. Ramirez-Dorronsoro, and E.L. Cortus. 2015. Ammonia and hydrogen sulfide concentrations and emissions for naturally-ventilated freestall dairy barns. *Trans. ASABE* 58(5):1321-1331.
10. Cai, L., J.A. Koziel, S. Zhang, A.J. Heber, E.L. Cortus, D.B. Parker, S.J. Hoff, G. Sun, K.Y. Heathcote, L.D. Jacobson, N. Akdeniz, B.P. Hetchler, S.D. Bereznicki, E.A. Caraway, T.T. Lim. 2015. Odor and odorous chem. emissions from dairy & swine facilities: Pt 3 – Chem. Emiss. *Trans. ASABE* 58(5):1333-1347 (**Superior Paper**).
11. Zhang, S., L. Cai, J.A. Koziel, S.J. Hoff, K.Y. Heathcote, L. Chen, L.D. Jacobson, N. Akdeniz, B.P. Hetchler, D.B. Parker, E.A. Caraway, A.J. Heber, S.D. Bereznicki. 2015. Odor & odorous chem. emissions from animal buildings: Part 5 – Correlations between odor intensities & chem. concentrations (GC-MS/O). *Trans. ASABE* 58(5):1349-1359.
12. Neerackal, G.M., P.M. Ndegwa, H.S. Joo, X. Wang, J.H. Harrison, A.J. Heber, J.-Q. Ni, C. Frear, M. Beutel. 2015. Effects of anaerobic digestion and solids separation on emissions from stored and land applied dairy manure. *Water, Air & Soil Pollution* 226(1):226-301.
13. Dai, X.R., C.K. Saha, J.Q. Ni, A.J. Heber, V. Blanes-Vidal, and J.L. Dunn. 2015. Characteristics of pollutant gas releases from swine, dairy, beef, and layer manure, and municipal wastewater. *Water Res.* 76:110-119.
14. Cortus, E.L., L.D. Jacobson, B.P. Hetchler, A.J. Heber, and B.W. Bogan. 2015. Methane and nitrous oxide analyzer comparison and emissions from dairy freestall barns with manure flushing and scraping. *Atmos. Env.* 100:57-65.
15. Page, L.H., J.Q. Ni, H. Zhang, A.J. Heber, N.S. Mosier, X.Liu, H.S. Joo, P.M. Ndegwa, and J.H. Harrison. 2015. Reduction of volatile fatty acids and odor offensiveness by anaerobic digestion and solid separation of dairy manure during manure storage. *J. Env. Man.* 152:91-98.
16. Joo, H.S., P.M. Ndegwa, A.J. Heber, J.Q. Ni, B.W. Bogan, J.C. Ramirez-Dorronsoro, and E.L. Cortus. 2014. Greenhouse gas emissions from naturally-ventilated freestall dairy barns. *Atmos. Env.* 102:384-392.
17. Schauburger, G., M. Piringger, and A.J. Heber. 2014. Odour emission scenarios for fattening pigs as input for dispersion models: a step from an annual mean value to time series. *Agriculture, Ecosystems and Environment* 193:108-116.
18. Chen, L., T.T. Lim, Y. Jin, A.J. Heber, J.Q. Ni, E.L. Cortus, and I. Kilic. 2014. Ventilation rate measurements at a mechanically-ventilated swine finishing quad barn. *Biosys. Engg.* 121(May):96-104.
19. Joo, H.S., Ndegwa, P.M., A.J. Heber, B.W. Bogan, J.Q. Ni, E.L. Cortus, and J.C. Ramirez-Dorronsoro. 2014. A direct method of measuring gaseous emissions from naturally ventilated dairy barns. *Atmos. Env.* 86:176-186.
20. Page, L.H., J.Q. Ni, A.J. Heber, N.S. Mosier, X. Liu, H.S. Joo, P.M. Ndegwa, and J.H. Harrison. 2014. Characteristics of volatile fatty acids in stored dairy manure before and after anaerobic digestion. *Biosys. Engg.* 118:16-28.
21. Rotz, C.A., F. Montes, S.D. Hafner, A.J. Heber, and R.H. Grant. 2013. Ammonia emission model for whole farm evaluation of dairy production systems. *J. Env. Quality* 43(4):1143-1158.
22. Grant, R.H., M.T. Boehm, A.J. Lawrence, and A.J. Heber. 2013. Hydrogen sulfide emissions from sow farm lagoon across climate zones. *J. Env. Quality* 42(6):1674-1683.
23. Grant, R.H., M.T. Boehm, A.J. Lawrence, and A.J. Heber. 2013. Ammonia emissions from anaerobic treatment lagoons at sow and finishing farms in Oklahoma. *Agric. Forest Meteor.* 180(15):203-210.
24. Wang-Li, L., Q.F. Li, K. Wang, B.W. Bogan, J.Q. Ni, E.L. Cortus, and A.J. Heber. 2013. The National Air Emissions Monitoring Study's southeast layer site: Part I-site characteristics and monitoring methodology. *Trans. ASABE* 56(3):1157-1171.
25. Li, Q.F., L. Wang-Li, K. Wang, L. Chai, E.L. Cortus, I. Kilic, B.W. Bogan, J.Q. Ni, and A.J. Heber. 2013. The National Air Emissions Monitoring Study's southeast layer site: Part II. Particulate matter. *Trans. ASABE* 56(3):1173-1184.
26. Wang-Li, L., Q.F. Li, L. Chai, E.L. Cortus, K. Wang, I. Kilic, B.W. Bogan, J.Q. Ni, and A.J. Heber. 2013. The National Air Emissions Monitoring Study's southeast layer site: Part III. Ammonia concentrations and emissions. *Trans. ASABE* 56(3):1185-1197.
27. Li, Q.F., L. Wang-Li, B.W. Bogan, K. Wang, L. Chai, J.Q. Ni, and A.J. Heber. 2013. The National Air Emissions Monitoring Study's southeast layer site: Part IV. Effects of farm management. *Trans. ASABE* 56(3):1199-1209.

28. Joo, H.S., P.M. Ndegwa, A.J. Heber, J.Q. Ni, B.W. Bogan, J.C. Ramirez-Dorransoro, E.L. Cortus. 2013. Particulate matter emissions from naturally-ventilated freestall dairy barns. *Atmos. Env.* 69:182-190.
29. Schauburger, G., T.T. Lim, J.Q. Ni, D.S. Bundy, B.L. Haymore, C.A. Diehl, R.K. Duggirala, and A.J. Heber. 2013. Empirical model of odor emission from deep-pit swine finishing barns to derive a standardized odor emission factor. *Atmos. Env.* 66:84-90.
30. Bereznicki, S.D., A.J. Heber, N. Akdeniz, L.D. Jacobson, B.P. Hetchler, K.Y. Heathcote, S.J. Hoff, J.A. Koziel, L. Cai, S. Zhang, D.B. Parker, E.A. Caraway, T.T. Lim, E.L. Cortus, and R.B. Jacko. 2012. Odor and odorous chemical emissions from animal buildings: Part 1 – Project overview, collection methods, and quality control. *Trans. ASABE* 55(6):2325-2334.
31. Akdeniz, N., L.D. Jacobson, B.P. Hetchler, S.D. Bereznicki, A.J. Heber, J.A. Koziel, L. Cai, S. Zhang, and D.B. Parker. 2012. Odor and odorous chemical emissions from animal buildings: Part 2 – Odor emissions. *Trans. ASABE* 55(6):2335-2345.
32. Akdeniz, N., L.D. Jacobson, B.P. Hetchler, S.D. Bereznicki, A.J. Heber, J.A. Koziel, L. Cai, S. Zhang, and D.B. Parker. 2012. Odor and odorous chemical emissions from animal buildings: Part 4 – Correlations between sensory and chemical emissions. *Trans. ASABE* 55(6):2347-2356.
33. Parker, B.P., L. Cai, J.A. Koziel, L.D. Jacobson, N. Akdeniz, S.D. Bereznicki, T.T. Lim, E.A. Caraway, S. Zhang, S.J. Hoff, A.J. Heber, K.Y. Heathcote, and B.P. Hetchler. 2012. Odor and odorous chemical emissions from animal buildings: Part 6 – Odor activity value. *Trans. ASABE* 55(6):2357-2368.
34. Lee, S.H., C. Li, and A.J. Heber. 2012. The effect of nitrate on ethylene biofiltration. *J. Hazardous Materials* 241-242:331-339.
35. Jin, Y., T.T. Lim, J.Q. Ni, J.H. Ha, and A.J. Heber. 2012. Emissions monitoring at a deep-pit swine finishing facility: Research methods and system performance. *J. Air and Waste Management Association* 62(11):1264-1276.
36. Lim, T.T., Y. Jin, J.Q. Ni, and A.J. Heber. 2012. Field evaluation of biofilters in reducing aerial pollutant emissions from a commercial pig finishing barn. *Biosys. Engg.* 112(3): 192-201.
37. Lin, X.J., E.L. Cortus, R. Zhang, S. Jiang, A.J. Heber and I. Kilic. 2012. Thermal environmental control of high-rise layer houses in California. *Trans. ASABE* 55(5):1909-1920.
38. Lin, X.J., E.L. Cortus, R. Zhang, S. Jiang, and A.J. Heber. 2012. Air emissions from broiler buildings in California. *Trans. ASABE* 55(5):1895-1908.
39. Ni, J.Q., A.J. Heber, E.L. Cortus, T.T. Lim, B.W. Bogan, R.H. Grant, and M.T. Boehm. 2012. Assessment of ammonia emissions from swine facilities in the US: Application of knowledge from experimental research. *Env. Science and Policy* 22:25-35.
40. Ni, J.Q., W.P. Robarge, C. Xiao, and A.J. Heber. 2012. Volatile organic compounds at swine facilities: A critical review. *Chemosphere* 89:769-788.
41. Lee, S.H., C. Li, A.J. Heber, J.Q. Ni, and H. Huang. 2012. Biofiltration of a mixture of ethylene, ammonia, n-butanol and acetone gases. *Bioresource Tech.* 127:366-377.
42. Ni, J.Q., L. Chai, L. Chen, B.W. Bogan, K. Wang, E.L. Cortus, A.J. Heber, T.T. Lim and C.A. Diehl. 2012. Characteristics of ammonia, hydrogen sulfide, carbon dioxide, and particulate matter concentrations in high-rise and manure-belt layer hen houses. *Atmos. Env.* 57:165-174.
43. Chai, L., J.Q. Ni, C.A. Diehl, I. Kilic, A.J. Heber, Y. Chen, E.L. Cortus, B.W. Bogan, T.T. Lim, J.C. Ramirez-Dorransoro, and L. Chen. 2012. Ventilation rates at large commercial layer houses with two-year continuous monitoring. *British Poultry Science* 53(1):19-31.
44. Li, Q., L. Wang-Li, Z. Liu and A.J. Heber. 2012. Field evaluation of particulate matter measurements using tapered element oscillating microbalance in a layer house. *J. AWMA* 62(3):322-335.
45. Lin, X.J., E.L. Cortus, R. Zhang, S. Jiang, and A.J. Heber. 2012. Ammonia, hydrogen sulfide, carbon dioxide, and particulate matter emissions from California high-rise layer houses. *Atmos. Env.* 46:81-91.
46. Lin, X.-J., E.L. Cortus, R. Zhang, S. Jiang, and A.J. Heber. 2011. Ventilation monitoring of broiler houses in California. *Trans. ASABE* 54(3):1059-1068.
47. Ni, J.Q., E.L. Cortus, and A.J. Heber. 2011. Improving ammonia emission modeling and inventories by data mining and intelligent interpretation of comprehensive agricultural air quality databases. *Atmosphere* 2(2):110-128.
48. Chen, Y., J.Q. Ni, C.A. Diehl, A.J. Heber, W.W. Bogan, L. Chai. 2011. Large scale application of vibration sensors for fan monitoring at commercial layer hen houses. *Sensors* 10(12):11590-11604.
49. Ni, J.Q., A.J. Heber, A.L. Sutton, D.T. Kelly, J.A. Patterson, and S.T. Kim. 2010. Effect of swine manure dilution on ammonia, hydrogen sulfide, carbon dioxide, and sulfur dioxide releases. *Science of the Total Environment* 408(23):5917-5923.

50. Ni, J.Q., A.J. Heber, S.M. Hanni, T.T. Lim, and C.A. Diehl. 2010. Characteristics of ammonia and carbon dioxide releases from layer hen manure. *British Poultry Science* 51(3):326-334.
51. Chai, C.A., J.Q. Ni, Y. Chen, C.A. Diehl, A.J. Heber, and T.T. Lim. 2010. Assessment of long-term gas sampling design at two commercial manure-belt layer barns. *J. AWMA* 60:702-710.
52. Lee, S.H., C. Li, A.J. Heber and C. Zheng. 2010. Ethylene removal using biotrickling filters: Part I. Experimental description. *Chemical Engineering J.* 158(2):79-88.
53. Lee, S.H., C. Li, A.J. Heber and C. Zheng. 2010. Ethylene removal using biotrickling filters: Part II. Parameter estimation and mathematical simulation. *Chemical Engineering J.* 158(2):89-99.
54. Ni, J.Q. and A.J. Heber. 2010. An on-site computer system for comprehensive agricultural air quality research. *Computers and Electronics in Agriculture* 71(1):38-49.
55. Zhang, S., L. Cai, J.A. Koziel, S.J. Hoff, D.R. Schmidt, C.J. Clanton, L.D. Jacobson, D.B. Parker, A.J. Heber. 2010. Field air sampling and simultaneous chemical and sensory analysis of livestock odorants with sorbent tubes and GC-MS/Olfactometry. *Sensors & Actuators: B. Chemical* 146:427-432.
56. Lawrence, A.F., R.H. Grant, M.T. Boehm, A.J. Heber, J.M. Wolf, S.D. Cortus, B.W. Bogan, J.C. Ramirez-Dorransoro and C.A. Diehl. 2009. Measurements of air quality around various open area sources in USA. *International J. Civil and Env. Engineering* 1(4):195-198.
57. Ni, J.Q., A.J. Heber, A.L. Sutton, and D.T. Kelly. 2009. Mechanisms of gas releases from swine wastes. *Trans. ASABE* 52(6):2013-2025.
58. Ni, J.Q., A.J. Heber, M.J. Darr, T.T. Lim, C.A. Diehl, and B.W. Bogan. 2009. Air quality monitoring and on-site computer systems for livestock and poultry environment studies. *Trans. ASABE* 52(3):937-947.
59. Hoff, S.J., D.S. Bundy, M.A. Nelson, B.C. Zelle, L.D. Jacobson, A.J. Heber, J.Q. Ni, Y. Zhang, J.A. Koziel, and D.B. Beasley. 2009. Real-time airflow rate measurements from mechanically ventilated animal buildings. *J. AWMA* 59(6):683-694.
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21. Wang, K., I. Kilic, Q.F. Li, L. Wang, W.L. Bogan, and A.J. Heber. 2010. NAEMS: Emissions Data from Two Tunnel-Ventilated Layer Houses in North Carolina - Site NC2B. Purdue University, W. Lafayette, IN, 6/18.
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25. Heber, A.J. and T.T. Lim. 2004. Comparison of Method 17 with UIUC TSP Sampler at a Layer Barn. Final Report to Ohio Fresh Eggs, Croton, OH, 11/1.
26. Heber, A.J., J.Q. Ni, T.T. Lim, P.C. Tao, and A.M. Schmidt. 2004. Air Emissions from Swine Production Buildings. PSF and Multi State Consortium on Animal Waste, 8/ 9.
27. Heber, A.J., T.T. Lim, J.Q. Ni, B.T. Richert, and A.L. Sutton. 2001. Odor, Ammonia and Hydrogen Sulfide Emission Factors for Grow-Finish Buildings. NPPC, 2/26.
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38. Heber, A.J., M.W. Peugh, R.H. Linton, N.J. Zimmerman, and K. Lutgring. 1998. The Effect of Processing and Air Flow Parameters on Microbial Aerosol Dispersion in Poultry Plants. Project 834-RP, ASHRAE, 12/31.
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47. Heber, A.J. and B. Misra. 1993. Selection of Components for Mechanical Ventilation Systems. Kansas Committee on the Relation of Electricity to Agriculture, 3/1.
48. Heber, A.J., J. Li, and J.P. Harner. 1992. FANSYS: A Design Program for Single- and Variable- Speed Fans. Osborne Ind., Sept. 30.
49. Morcos, M.M., A.J. Heber, and J.A. Mowry. 1992. Solid-State Speed Controllers For Single-Phase Capacitor Motors. Project 2782-4, EPRI TR-100174, National Rural Electric Corporation Assoc. and Electric Power Research Institute, January.
50. Heber, A.J., B. Zhang, and J. Li. 1992. Microprocessor-Embedded Controller for Ventilation Fans. Advanced Manufacturing Institute, 8/20.
51. Pickrell, J.A., A.J. Heber, J.P. Murphy, F.W. Oehme, D. Schoneweis, J.R. Gillespie, S.C. Henry. 1992. Ammonia, Total & Respirable Dust and Endotoxins in Swine Confinement Bldgs. NPPC.
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54. Heber, A.J. and T.N. Bisping. 1989. Effect of Pelletized Fat and Soybean Oil on Aerodynamic Dust Segregation of Swine Feed. Balanced Energy Company, 6/26.
55. Heber, A.J., J.P. Murphy, and J.W. Slocombe. 1989. Variable-Speed Control for Direct-Drive Ventilation Fans. Osborne Ind. and KS Tech. Enterprise Corp., 2/17.

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58. Heber, A.J. and M. Stroik. 1987. Characteristics of Aerial Dust in Finishing Buildings. KSU Swine Day Report, p. 85-88.
59. Heber, A.J. 1983. Performance and Evaluation of Photovoltaic Power. Sandia Laboratories, June.

POSTERS

- Kang, J., W.P. Robarge, S.R. Lee, A.J. Heber, E.L. Cortus, L. Chai, and J.Q. Ni. 2009. National Air Emissions Monitoring Study (NAEMS) Sow Site NC4B: Observations of Farm Operation and Management. ASA-CSSA-SSSA Mtg., Pittsburgh, PA, Nov. 30 – Dec. 3.
- Robarge, W.P., J. Kang, S.R. Lee, A.J. Heber, E.L. Cortus, L. Chai, and J.Q. Ni. 2009. National Air Emissions Monitoring Study (NAEMS) Finisher Hog Site NC3B: 16 Months of Observations of Farm Operation and Management. ASA-CSSA-SSSA Mtg., Pittsburgh, PA, Nov. 30 – Dec. 3.
- Robarge, W.P., J. Kang, S.R. Lee, A.J. Heber, E.L. Cortus, L. Chai, K. Wang, and J.Q. Ni. 2009. National Air Emissions Monitoring Study (NAEMS) Finisher Hog Site NC3B: Observations of Farm Operation and Management. National Atmospheric Deposition Program (NADP) Annual Mtg. and Scientific Symp., Saratoga Springs, NY, Oct. 6-9.
- Kang, J., Robarge, W.P., S.R. Lee, A.J. Heber, E.L. Cortus, L. Chai, K. Wang, and J.Q. Ni. 2009. National Air Emissions Monitoring Study (NAEMS) Sow Site NC4B: Observations of Farm Operation and Management. NADP Annual Mtg. and Scientific Symp., Saratoga Springs, NY, Oct. 6-9.
- Kang, J., W.P. Robarge, A.J. Heber, E.L. Cortus, L. Chai, K. Wang, and J.Q. Ni. 2009. Hydrogen Sulfide Monitoring in a Farrowing Facility of Sow Site, NC4B. NADP Annual Mtg. and Scientific Symp., Saratoga Springs, NY, Oct. 6-9.
- Heber, A.J. 2005. National air emission monitoring study. University Science and Education Exhibition and Reception on Capitol Hill, Wash., D.C., Mar. 1, (2 min DVD by Joan Crowe).
- Heber, A.J. 2004. Guidelines for transferring emission data between regions. Regional Science Workshop on AFOs – Science & Technical Support Needs. College Park, MD, Dec. 6-9.
- Heber, A.J. 2004. National air emission monitoring study. Regional Science Workshop on Animal Feeding Operations (AFOs) – Science and Technical Support Needs. College Park, MD, Dec. 6-9.
- Heber, A.J., J.Q. Ni, and T.T. Lim. 2004. Ammonia and PM10 emissions from a high-rise layer barn. AgEng04, Leuven, Belgium, Sept. 12-16 (Abstract handout).
- Heber, A.J., S.H. Lee, H. Huang, J.Q. Ni, S. Sharvelle, M.K. Banks, and Y.S. Kim. 2004. Testing biofilters for advanced life support. Habitation Conf., Orlando, FL, Jan. 5-7.
- Li, C., A.J. Heber, S.H. Lee, J.Q. Ni. 2006. Biofiltration for Gaseous Trace Contaminant Removal from Spacecraft during Long-Term Space Missions" Habitation Conf., Orlando, FL, Feb. 4-7.
- Heber, A.J., T.T. Lim, J.Q. Ni. 2003. Air emissions from a laying hen house. Purdue Poultry, Oct. 8.
- Heber, A.J. 1998. Agricultural odor control methods. Purdue Annual Extension Conf., Nov. 17-19.
- Heber, A.J. 1998. Livestock odor control. American Farm Bureau Conf., Charlotte, NC, Jan. 11-13.
- Heber, A.J. and M. Stroik. 1987. Swine house dust. Annual Kansas AES/CES Conf., Oct. 12. Selected for AES poster session at the KS State Capitol, Feb. 2, 1988.

SOFTWARE (most recent first)

- Heber, A.J. 2015. PSM. Odor setback model. Excel Spreadsheet Model.
- Eisentratt, M., A.J. Heber, and J.Q. Ni. 2004. CAPECAB. Calculation of barn emissions.
- Heber, A.J. 1999. SETBACK. Odor setback guideline. Interactive on web.
- Heber, A.J. 1998. VENTROOM. Ventilation system design program.
- Li, J. and A.J. Heber. 1993. FANSYS. Fan system design program.
- Heber, A.J. and B. Misra. 1994. AGVENT. Ventilation system design program.
- Heber, A.J. 1994. MGOVEN. Oven design program for conveyor belt ovens - draws three views.

Heber, A.J. 1993. MTOVEN. Oven design program that predicts heat transfer coefficient.

OTHER PUBLICATIONS (most recent first)

Heber, A.J. 2003. Air emission measurements at livestock houses: a hide-and-seeK challenge to find the numbers. *Resource* 10(4):7-8.

Heber, A.J. 1998. Summertime air quality in swine grow-finish buildings. *Pork'98*. November.

Heber, A.J. 1998. Setting a setback. *National Hog Farmer* 43(1):62-64.

Heber, A.J. 1997. Protection distances for sufficient dispersion and dilution of odor from swine buildings. Swine Day, Purdue University, W. Lafayette, IN, Aug. 28.

Heber, A.J. 1995. Mismatched fans throw ventilation out of whack. *National Hog Farmer* 40(4):12-18.

Heber, A.J. 1993. Improving worker health in hog buildings. Short Course on Improving Swine Production Efficiency, Purdue University, W. Lafayette, IN, p. 29-42.

Heber, A.J. 1987. Dust in finishing houses. KPPC Pig Tales Magazine. Summer.

Heber, A.J., T.L. Thompson, and D.D. Schulte. 1984. Managing electrical loads. *Agricultural Engineering* 65(6):8-13.

Heber, A.J. 1984. Electrical load management system for the integrated energy farm: a user's manual. Department of Agricultural Engineering, University of Nebraska, Lincoln, NE.

INVITED PAPERS AND LECTURES (total=102)

1. "Environmental Control of Greenhouses", Aquaponics Forum, Kokomo, IN, 10/28/16.
2. "Building Environmental Control", Shrimp Academy on Using Technology to Improve Shrimp Production, NICC, Calmar, IA, 9/10/16.
3. "Environmental Controls", Marine Shrimp Workshop, Indianapolis, IN, 2/10/16
4. "Phase 3 of Purdue Odor Setback Model", IPPC, Purdue University, 6/17/15
5. "Test Your Nose", Youth Activities Webinar, LPELC, 12/12/14
6. "Is Science a Bad Word?". Panelist. Purdue Agriculture Issues Engagement Initiative, 10/7/14,
7. "National Air Emissions Monitoring Study of Livestock Buildings". National Atmospheric Deposition Scientific Symp., Indy, 10/22/14
8. "Research Rags to Riches", College of Engg Celebration of Faculty Careers Colloquium, Purdue Univ, 9/29/14.
9. "Quality Assurance of Research Data", Uludag University, Bursa, Turkey, 5/13/14.
10. "Livestock and Poultry Air Quality", Ag Waste Management Class, Biosystems Engineering, Uludag University, Bursa, Turkey, 4/17/14.
11. "Agricultural Air Quality Workshop", College of Agriculture, Uludag University, Turkey, 5/2/14.
12. "What does the NAEMS Data Mean for Dairy Producers?" Midwest Manure Summit, Green Bay, WI, 2/27/13.
13. "Livestock Production Emissions Modeling and Monitoring." China Agricultural Univ., Beijing, China, 10/16/11.
14. "Measurement Strategies and Results for National Study of Barn Air Quality in USA." Zhejiang University, Hangzhou, China, 10/12/11.
15. "National Air Emissions Monitoring Study (NAEMS) Selected Results and Discussion of Their Significance." eXtension Webcast, 9/16/11.
16. "Results of the NAEMS." Poultry Feeding and Nutrition Conference, Indianapolis, IN, 5/25/11.
17. "NAEMS: Barn Emissions." Western Dairy Air Quality Symp., Sacramento, CA, 4/21/11.
18. "National Air Emissions Study Report." NPB Environmental Committee, Des Moines, IA, 4/6/11.
19. "Air Emissions: What did the National Study Tell Us?" Conference on Worker Safety, Human Resources and Environment. Kansas City, MO, 3/9/11.
20. "Report on NAEMS Egg Portion Results." United Egg Producers, Atlanta, GA, 1/24/11.
21. "NAEMS Dairy Air Emission Data from the NAEMS." PDPW Dairy Policy Summit, Madison, WI, 10/31/10.
22. "What is Agriculture Facing on the Environmental Front?" IN Legislative Rural Caucus, Indianapolis, IN, 8/19/10.
23. "An Overview of the Agricultural Air Emissions Study." FPPC Farm Technology Summit, St. Petersburg, FL, 8/25/10.

24. "Agricultural Production to Food Consumption: Meeting the Challenges for Sustainable Success." FAB, Minneapolis, MN 7/28/10.
25. "NAEMS Update." National Pork Producers Council Environment Committee, Washington, DC, 1/13/10.
26. "Measurements of Greenhouse Gases." Testimony before the U.S. House Committee Hearing on Science and Technology, Washington, D.C., 4/22/09.
27. "NAEMS Update." Western Dairy Air Quality Symp., Albuquerque, NM, 4/15/09.
28. "NAEMS Update." Joint National Pork Board & National Pork Producers Council Env. Comm. Mtg., Chicago, IL, 12/10/08.
29. "National Air Emissions Monitoring Study: Swine Gestation and Farrowing site in Iowa." Presented by J. Koziel. L. Cai, J. Harmon, S.J. Hoff, A.J. Heber, J.Q. Ni, E.L. Cortus. Dutch Ministry of Agriculture, Hague, NL, 11/25/08.
30. "Air Quality." Livestock Siting Symp., Indianapolis, IN, 11/14/08.
31. "NAEMS." PDPW, Eau Claire, WI, 10/15/08.
32. "NAEMS." USDA Agricultural Air Quality Task Force Mtg., Salt Lake City, UT, 5/14/08.
33. "NAEMS Update" Joint National Pork Board & National Pork Producers Council Environment Committees Mtg., Omaha, NE, 12/6/07.
34. "NAEMS" USDA Agricultural Air Quality Task Force Mtg., San Diego, CA, 5/8/07.
35. "NAEMS" Western Dairy Air Quality Symp., Las Vegas, NV, 3/26/07.
36. "Air Emissions Monitoring – Status of the Consent Agreement with Regard to the Poultry Industry." Nat. Commission on Industrial Farm Animal Production, Fayetteville, AR, 2/13/07.
37. "Odors/Emissions." VMA Annual Mtg." Indianapolis, IN, 1/19/07.
38. "Study and Regulation of Agricultural Air Quality in the U.S." A.J. Heber and B.W. Bogan. Workshop on Agricultural Air Quality: State of the Science, Potomac, MD, 6/5/06.
39. "NAEMS Project" Western Dairy Air Quality Symp., Las Vegas, NV, 3/21/06.
40. "Air Consent Agreement: What's Next?" International Poultry Exposition, Atlanta, GA, 1/26/06.
41. "Odor and Air Quality." Indiana Pork Producers Board, W. Lafayette, IN, 11/30/05.
42. "National Consent Agreement Research." PDPW Dairy Policy Summit, Madison, WI, 11/3/05.
43. "Air Quality Agreement with Animal Feeding Operations" CAFO Roundtable: CAFO Regulations: Implementation through Collaboration, Columbus, OH, 9/29/05.
44. "What's Next After Signing the U. S. EPA's Air Quality Compliance Consent Agreement & How Will the Study Determine Air Emissions from Animal Facilities?" IN-OH Farm Bureau Livestock Trends & Issues Conference, Ft. Wayne, IN, 9/6/05.
45. "The NAEMS Protocol." EPA OAQPS and Environmental Groups, Raleigh, NC, 7/22/05.
46. "Review of Proposed Monitoring Study Protocols." US Dairy Env. Task Force Mtg., College Park, MD 6/1/05, and Chicago, IL, 8/25/05 and 5/10/06.
47. "Emissions Monitoring." Livestock Issues Mtg., IN Farm Bureau, Indianapolis, IN, 4/20/05.
48. "EPA Consent Agreement and Study." ISPA Board Mtg., W. Lafayette, IN, 3/8/05.
49. "Agricultural Air Quality." Industrial College of the Armed Forces Agriculture Study Group, National Defense University, W. Lafayette, IN, 3/3/05.
50. "National Air Emissions Monitoring Study." NE Dairy Producers Assoc., Syracuse, NY, 3/1/05.
51. "State of the Science." Regional Science Workshop on Animal Feeding Operations (AFOs) – Science and Technical Support Needs," College Park, MD, 12/6/04.
52. "Clean Air Act Enforcement Settlement with Buckeye Egg Farm (with C. Secret)." Regional Science Workshop on Animal Feeding Operations – Science and Technology Support Needs." College Park, MD, 12/6/04.
53. "Air Emissions from Swine Facilities." IN Pork Producers. Montmorenci, IN, 11/30/04.
54. "Research Progress and Regulatory Programs for Odor and Air Quality from Intensive Livestock and Feeding Operations in America." Civil & Env. Eng., Technion I.I.T., Haifa, Israel, 11/8/04.
55. "Summary of Air Emission Studies and Results for Laying Hen/Pullets Operations" and "Review and Update of National Air Emission Monitoring Study." UEP ESP, Chicago, IL, 9/2/04.

56. "Measurement and Control of Ammonia, Dust and Odor Emissions from Layer Houses." Multi-State Poultry Mtg., Indianapolis, IN, 5/25/04.
57. "Air Emissions from Layer Houses." Symp. on Air Emissions and Poultry Production, Poultry Science Assoc., St. Louis, MO, 7/25/04.
58. "Layer Facility Emissions." Texas Commercial Egg Clinic, Bryan, TX, 5/13/04.
59. "Current Progress in US Research and Regulatory Programs on Intensive Livestock Odour and Air Quality." Opening Keynote Presentation, Enviro 04 Conf. on Advances in Odour Management: Towards more Livable Communities, Sydney, NSW, AUS, 3/29/04.
60. "Update Regarding U.S. Air Quality Research & Regulations." Intensive Livestock Odours Workshop, Enviro 04 Conf. on Advances in Odour Management: Towards more Livable Communities, Sydney, AUS, 3/29/04.
61. "Micromet Methods for Measuring Ammonia and Hydrogen Sulfide Emissions from Livestock Lagoons." Sampling for Odour Measurement Workshop, Enviro 04 Conf. on Advances in Odour Management: Towards more Livable Communities, Sydney, NSW, AUS, 3/30/04.
62. "Measurement, Regulation and Control of Air Emissions from Swine and Poultry Operations." Air Quality Workshop, Pacific Air and Environment, Brisbane, Qld, AUS, 3/19/04.
63. "Impacts of Emissions from Swine Facilities & Methods & Practices for Mitigation." Pan Pacific Pork Exposition, Brisbane, Qld, AUS, 3/18/04. Pres. to ISA & IPPA 3/23/04 in absentia.
64. "Air Emission Rates from Laying Houses and the Proposed Nationwide Monitoring Study." Environmental Committee, United Egg Producers, Atlanta, GA, 1/26/04.
65. "Quality Assured Air Emission Measuring Technologies." Ohio Agricultural Air Quality Res. Symp., Plain City, OH, 1/15/04.
66. "Field and Laboratory Tests of Air Emission Abatement Strategies." Ohio Agricultural Air Quality Res. Symp., Plain City, OH, 1/15/04.
67. "Testing Biofilters for Advanced Life Support." NASA ALS Air Qual. Workshop, Univ. FL, Gainesville, 1/8/04.
68. "Methodology for Measuring Building Emissions." NRCS Air Quality Group, Beltsville, MD, 11/18/03.
69. "Building Emission Measurement Solutions." National Pork Board, Ames, IA, 4/7/03.
70. "Effect of Oil Sprinkling on Odor, Gas and Particulate Matter Emissions from Swine Houses." Technology Review Panel Mtg., Premium Standard Farms, Trenton, MO, 11/25/02.
71. "Studies of Livestock Odor Concentrations and Emissions." Odor Discussion Group Mtg., PBS&J, Beltsville, MD, 10/16/02.
72. "Managing Odor, Dust and Gas Emissions." GroMaster Seminar on Ventilation – Present and Future, World Pork Expo, Des Moines, IA, 6/8/02.
73. "N Loss Meas. in Swine & Poultry Facilities" & "Conf. Wrap-Up Comments." Discover Conf. on N Losses to the Atmosphere from Livestock & Poultry Operations, ASDA, Nashville, IN, 4/28/02.
74. "Odor Measurement." Symp. on Odour Measurement in Relation to Pig Production at Danske Slagterier, Copenhagen, DK, 3/13/02.
75. "Agricultural Air Quality and Aerial Pollutant Emissions Research." Danish Institute of Agricultural Sciences, Research Centre Bygholm, Horsens, DK, 3/11/02.
76. "Air Emissions Research at Purdue Univ." Env. Comm. Mtg., Nat. Pork Bd., Ames, IA, 1/24/02.
77. "Emission Rates from Animal Production Buildings." Air Qual. Sem., Manhattan, KS, 1/7/02.
78. "Measurements of Agricultural Air Quality and Aerial Pollutant Emissions." IMAG, Wageningen, NL, 12/7/01.
79. "Tests of Pit Additives." Swine Odor and Waste Management Field Day, Univ. of Illinois, Urbana, IL, 8/29/01.
80. "Dust Measurement Methods." Invited Technical Session, ASAE Annual Mtg., Sacramento, CA, 7/31/01.
81. "Measurement of Air Pollutant Emissions from Livestock Operations" Prairie Swine Centre, Saskatoon, Saskatchewan, CAN, 5/31/01.
82. "Air Emission Measurements at Livestock Production Facilities." Seminar, Institute for Grassland and Environmental Research, North Wyke, Devon, UK, 2/19/01.
83. "Measurement of Air Pollution from Livestock Production Facilities." Divisional Seminar, Silsoe Research Institute, Silsoe, Bedford, UK, 1/26/01.

84. "Abatement of Livestock Air and Water Pollution." Hannover, DE, 9/28/00, [<http://agriculture.de/acms1/conf6/ws4prop.htm>].
85. "Measurement of Odor Emissions from Lagoons." Senator Paul Muegge's Odor Reduction Seminar, Oklahoma State Capital, Oklahoma City, OK, 6/28/00.
86. "Ventilation Demonstration." Livestock Building Operations Workshop, Springfield, IL, 3/8/00.
87. "Electronic Controls Fundamentals and Control Strategies." Livestock Building Operations Workshop, Springfield, IL, 3/8/00.
88. "Overview of Nationwide Odor Research." IL Waste Management Conf., Urbana, IL, 3/9/99.
89. "Gas and Odor Emission Rates from Large Swine Houses." Univ. Vet. Med., Vienna, AT, 11/24/98.
90. "Odor Control Methods for Livestock Producers." Forum on waste and nutrient management at the Annual Conf. of American Farm Bureau, Charlotte, NC, 1/11/98.
91. "Air Quality & Nuisance Issues." Conf. on Livestock and Environment, UNL, Lincoln, NE, 12/10/97.
92. "Improving Air Quality in and Around Livestock Facilities." National Conf. of Institutional Agribusinesses, Indianapolis, IN, 9/28/97.
93. "Odor Protection Setbacks for Swine Buildings." Fifth Meeting of the National Environmental Dialogue on Pork Production. America's Clean Water Found., Raleigh, NC, 9/10/97.
94. "Troubleshooting Environmental Problems for Pigs." SAVMA Symp., W. Laf., IN, 3/15/97.
95. "Monitoring Agricultural Respiratory Hazards." National Institute for Farm Safety Summer Conf., Ind., IN, 6/21/97.
96. "How Can We Better Ventilate?" Maple Leaf Growers Mtg., Milford, IN, 4/29/97.
97. "Ventilation." National Frame Builders Conf., Nashville, TN, 2/13/97.
98. "It's Time to Ventilate." Maple Leaf Growers Mtg., Milford, IN, 1/11/96.
99. "Ventilation Applications Demonstration." Plyco Regional Mtg., Walkerton, IN, 8/3/96.
100. "Maintaining finish quality with low-VOC wood coatings." Purdue Waste Conf., W. Lafayette, IN, 5/6/96.
101. "Improving Worker Health in Hog Buildings." Part of IHETS Satellite Short Course "Improving Swine Production Efficiency." 460 requests for material plus 70 for video tapes. 1994.
102. "Principles of Energy Conservation in Fan Ventilated Livestock Buildings." Energy in Rural America: Profits & Opportunities in Agric., Fuels, & Utilities Issues. Des Moines, IA, 6/1/92.

GRANTS, GIFTS, AND PROJECTS (most recent first)

1. Heber, A.J. and R. Rode. 2016. Field assessment of design and operation of Midwestern aquaculture buildings. USDA NIFA North Central Regional Aquaculture Center, Iowa State University, \$34,998.
2. Heber, A.J. 2016. Tests of odor abatement of sewage odor. Atmosphere Global, Inc., \$5,680.
3. Heber, A.J. 2015. Teaching equipment grant for ASM 420. College of Agriculture, Purdue University, \$8500.
4. Heber, A.J. 2015. Tests of odor and gas abatement of a swine manure amendment. Drylet, Inc., \$15,000.
5. Heber, A.J. 2014. Effect of completeness criteria on livestock emission rates. Eastern Research Group. \$31,770.
6. Heber, A.J., R.H. Grant, B.W. Bogan, E. Cortus, T. Lim. 2010. Evaluation and Analysis of NAEMS Dairy Data. Dairy Research Institute. \$100,000.
7. Heber, A.J. 2010. Sustainable Reduction of Greenhouse Gas Emissions from Northeast Dairy Farms. Planning Grant. USDA-AFRI-NIFA. \$50,000.
8. Heber, A.J., J.Q. Ni. 2010. Impact of Anaerobic Digestion on Air Quality in a Community Anaerobic Digester. Washington State University/USDA CIG. \$132,034.
9. Heber, A.J., R.H. Grant, J.Q. Ni, W.W. Bogan, E.L. Cortus, T. Lim. 2010. Evaluation and Analysis of NAEMS Pork Data. National Pork Board. \$108,677.
10. Heber, A.J., J.Q. Ni, W.W. Bogan, E. Cortus. 2010. Evaluation and Analysis of NAEMS Layer House Emissions Data. United Egg Producers. \$54,549.
11. Ni, J.Q., A.J. Heber. 2010. Survey of Availability, Application, and Economic Values of Poultry Manure for Cropland in Indiana. Indiana Soybean Alliance. \$70,110.

12. Heber, A.J., S.D. Bereznicki. 2010. Improving the Purdue Odor-Based Setback Distance Model and Interactive Website: Ph. 3. Indiana Soybean Alliance. \$45,000.
13. Heber, A.J., S.D. Bereznicki. 2010. Improving Investigations of Odor from the Land Application of Manure, Ph. I. Indiana Soybean Alliance. \$45,000.
14. Heber, A.J., J. Crow. 2009. Air Quality Extension and Education: Enhanced Learning Opportunities for Addressing Air Quality Issues in Animal Agriculture. University of Nebraska/USDA. \$30,000.
15. Heber, A.J. 2009. Assessment of Carbon Footprint Contributions to Milk Products by US Dairies. Dairy Management, Inc. \$499,785.
16. Lim, T.T., A.J. Heber. 2009. Improving the Purdue Odor-Based Setback Distance Model and Interactive Website: Ph. 2. Indiana Soybean Alliance GINA Project. \$45,000.
17. Heber, A.J. 2008. Measurement and Control of Air Emissions from Laying Houses in Ohio, Ohio Fresh Eggs, LLC, Supplement 6. \$18,269.
18. Lim, T.T., A.J. Heber. 2008. Effectiveness of Biofilter in Reducing Aerial Pollutant Emissions. National Pork Board. \$39,968.
19. Heber, A.J. 2008. Measurement and Control of Air Emissions from Laying Houses in Ohio, Ohio Fresh Eggs, LLC, Supplement 5. \$73,074.
20. Ebner, P., A.J. Heber. 2007. Effect of CAFO Odors on Respiratory and Mental Health of Neighboring Residents. Purdue University CAFO Initiative. \$30,000/\$56,500.
21. A.J. Heber. 2007. Publications on CAFO Odor. Purdue University CAFO Initiative. \$25,000.
22. Heber, A.J. 2007. Measurement and Control of Air Emissions from Laying Houses in Ohio, Ohio Fresh Eggs, LLC, Supplement 4. \$102,705.
23. Richert, B.T., A.J. Heber. 2007. Test of Diet Modification. BASF Plant Sciences. \$37,000/\$117,000.
24. Heber, A.J., T.T. Lim. 2007. Improving the Purdue Odor-Based Setback Distance Model and Interactive Website: Ph. 1. Indiana Soybean Alliance GINA Project. \$40,000.
25. Heber, A.J., T.T. Lim. 2007. Development of Science-Based Odor Setbacks for Indiana Dairy Farms. Mission-Oriented, Internal Competitive Grant Program, Dean of Agriculture. \$25,000.
26. Heber, A.J. 2006. National Air Emissions Monitoring Study. Agricultural Air Research Council. \$12,903,832/\$7,706,181.
27. Lu, C., A.J. Heber, A. Weiguo. 2006. Nanoporous Silicon Based Sensors and Sensor Arrays for Detection of VOC in Air. Purdue Center for the Environment. \$18,010/\$75,000.
28. Heber, A.J. 2005. Trace Contaminant Laboratory. Purdue Center for the Environment. \$57,000.
29. Zhang, R., J.G. Fadel, J.A. Ogejo, H. Xin, A.J. Heber. 2005. Developing and validating a process-based ammonia emission model for confinement animal feeding operations. \$60,000/\$498,741.
30. Heber, A.J. 2005. Development and Implementation of Trace Contaminant Analysis for Advanced Life Support. Purdue NSCORT. \$177,500.
31. Heber, A.J. 2005. Measurement and Control of Air Emissions from Laying Houses in Ohio, Ohio Fresh Eggs, LLC, Supplement 3. \$130,268/\$172,368.
32. Heber, A.J. 2005. Measurement and Control of Air Emissions from Laying Houses in Ohio, Ohio Fresh Eggs, LLC, Supplement 2. \$27,186/\$36,468.
33. Heber, A.J. 2005. Measurement and Control of Air Emissions from Laying Houses in Ohio, Ohio Fresh Eggs, LLC, Supplement 1. \$33,692/\$49,359.
34. Heber, A.J. 2005. Odor Control for Deep Pit Swine Confinement Facilities: Evaluation of the Rapp Technology. Rapp Technologies. (Subcontract of USDA-SBIR grant). \$29,821/\$79,062.
35. Turco, R., M.K. Banks, A.J. Heber. 2004. Innovative Environmental Technologies: Control of Air Emissions from Egg Laying Facilities. NRCS-USDA. \$79,662/\$500,000.
36. Heber, A.J., L. Zhao, H.M. Keener. 2004. Characterization and Abatement of Ammonia, Particulate, Pathogen and Odor Emissions from Egg Prod. Facilities. USDA. \$243,421/\$482,499.
37. Jacobson, L.D., A.J. Heber, D. Parker, J. Koziel, S.J. Hoff. 2004. Odor Emissions and Chemical Analysis of Odorous Compounds from Animal Buildings. USDA-NRI. \$86,816/\$482,000.

38. Lahav, O., A.J. Heber, D. Broday. 2004. Elimination of Emissions of Ammonia and Hydrogen Sulfide from Confined Animal and Feeding Operations (CAFO) Using an Adsorption/Liquid-Redox Process with Biolog. Regen. Binational Ag. Res. and Dev. (BARD). \$163,000/\$330,000.
39. Sutton, A.J., A.J. Heber, J.S. Radcliffe, B.T. Richert. 2004. Quantification of Gas and Odor Emissions from Swine Wean-Finish Facilities, National Pork Board. \$18,000/\$40,000.
40. Heber, A.J. 2004. Tests of Layer Feed Additive in Laying House. Rose Acre Farms. \$28,000.
41. Heber, A.J. 2004. Air Quality Tests of Ag-D-Tox in Laying Houses, Ag-D-Tox. \$17,500.
42. Heber, A.J. 2004. Measurement and Control of Air Emissions from Laying Houses in Ohio, Ohio Fresh Eggs, LLC. \$422,367/\$515,350.
43. Heber, A.J. 2004. Test of an Odor Control Additive for Biosolids, and Beef and Dairy Manure. ADM Consolidated Nutrition. \$12,500.
44. Radcliffe, J.S., A.L. Sutton, B.T. Richert, A.J. Heber, G.M. Hill, W.J. Powers. 2003. Baseline and Reduced Gas, Odor and Dust Emission Rates from Swine Wean-Finish Facilities. USDA-NRI. \$194,019/\$460,000.
45. Heber, A.J. 2004. Odor Evaluations for External Clients in 1998-99, 2000, 2001, 2002, 2003, 2004, and 2005: \$13,650, \$19,022, \$30,814, \$10,545, \$7348, \$6602, and \$1676.
46. Heber, A.J. 2003. Effect of Essential Oils on Swine Odor. Premium Standard Farms. \$5930.
47. Heber, A.J. 2003. Donation of EPA Method 5 Sampling Train. Rose Acre Farms, Inc. \$5200.
48. Heber, A.J. 2003. Test of an Odor Control Additive for Biosolids, and Swine and Dairy Manure. ADM Consolidated Nutrition. \$15,800.
49. Heber, A.J. 2003. Control of Dust, Odor and Gas Emissions from Swine Houses in Missouri by Misting Essential Oils and Water. Premium Standard Farms. \$23,318.
50. Heber, A.J. 2003. Donation of Uninterruptible Power Supply. Baumgartner Environics. \$3000.
51. Heber, A.J. 2003. FTIR Gas Spectrometer. Purdue Agricultural Research Programs. \$11,414.
52. Heber, A.J. 2003. Control of Dust, Odor and Gas Emissions from Swine Houses in Missouri with Essential Oils. Premium Standard Farms. \$17,772.
53. Heber, A.J. 2003. Travel to DK. Purdue Research Foundation. \$1050.
54. Heber, A.J. 2002. Effect of Biocurtains on Aerial Pollutant Emissions from Swine and Poultry Buildings. National Center for Manure and Animal Waste Management. \$55,530.
55. Jacobson, L.D., A.J. Heber, J.M. Sweeten, Y. Zhang, J. Koziel, G.R. Baughman, D.B. Beasley, S.J. Hoff, D.S. Bundy. 2002. Improving Measurements of Dust and Ammonia Emissions from Confined Animal Buildings. National Center for Manure and Animal Waste Man. \$7746/\$65,000.
56. Heber, A.J. 2002. Used Instrumentation. Monsanto EnviroChem. \$32,000 (50% of new cost).
57. Heber, A.J. 2002. Gas Dilution System. Dean of Agriculture. \$8604.
58. Mitchell, C.A., J.A. Alleman, E. Blatchley, B. Applegate, C.A. Beyl, K. Banks, P. Brown, G. Chiu, C.C. Glass, K.L. Jones, A.J. Heber, B. Joern, M. Ladisch, L. Mauer, P. Pacambaba, J. Pekny, G. C. Sharma, J. Trimble, J. Volenec, L.T. Walker, L.L. Williams, B. Yao, Y. Yih. 2002. Center of Excellence in Advanced Life Support. Minimizing Equivalent Systems Mass for a Regenerative Life Support System by Optimizing Kinetics and Energetics of Major Biotransformations. NASA NSCORT Space Life Science. \$604,569/\$9,600,000.
59. Heber, A.J. 2001. Measurement and Control of Dust, Odor and Gas Emissions from Swine Houses in Missouri. Premium Standard Farms. \$107,169.
60. Heber, A.J., J.Q. Ni. 2001. Analysis of Air Quality Data Collected in a High-Rise Swine Farrowing House. Consolidated Nutrition. \$6289.
61. Jacobson, L.D., A.J. Heber, J.M. Sweeten, Y. Zhang, R. Bottcher, D. Bundy. 2001. Air Pollutant Emissions from Confined Animal Buildings. USDA Initiative for Future Agriculture and Food Systems. \$469,699/\$2,150,000.
62. Heber, A.J., H. Xin, R. Gates. 2001. Improving Measurement of Emissions from Poultry Houses. U.S. EPA: Multi-State Consortium on Animal Waste. \$90,125/\$131,200.
63. Heber, A.J. and A. Millmeir. 2001. Measurement and Control of Aerial Pollutant Emissions from Swine Finishing Houses. U.S. EPA: Multi-State Consortium on Animal Waste. \$147,845/\$234,463.

64. Tischmack, J.K., A.J. Heber. 2001. Use of Organic Compounds to Control Odors in Biosolids Composting. Purdue Research Foundation. \$15,616.
65. Sutton, A.L., G.L. Allee, G.M. Hill, B.T. Richert, A.J. Heber, D.D. Jones, K.A. Foster, D.W. Rozeboom. 2001. Diet Modifications to Reduce Nutrient Excretions and Enhance Air Quality in Swine Operations. USDA Initiative for Future Ag and Food Systems. \$80,000/\$1,250,000.
66. Heber, A.J. 2001. Real-time Dust Concentration Monitor. Purdue Ag. Alumni Found. \$12,000.
67. Heber, A.J., J.Q. Ni, R. Grant. 2001. Odor, Gas and Dust Emission Factors for Caged-Layers. Indiana Commissioner of Agriculture. \$34,681.
68. Heber, A.J. 2000. Ammonia Produced by Animal Operations. National Center on Animal Waste, Univ. of North Carolina. Subcontract to North Carolina State Univ. \$2000.
69. Heber, A.J. 2000. Site Selection of Animal Operations Using Air Quality Criteria. National Center on Animal Waste, Univ. of North Carolina. Subcontract to Univ. of MN. \$1000.
70. Heber, A.J. 2000. Particulate Matter Emissions from Confined Animal Feeding Operations: Management and Control Measures. National Center on Animal Waste, Univ. of North Carolina. Subcontract to Texas A&M Univ. \$2000.
71. Heber, A.J. 2000. Odor Mitigation for Concentrated Animal Feeding Operations: White Paper and Recommendations. Nat. Center on Animal Waste, UNC. Subcontract to TAMU. \$1500.
72. Heber, A.J. 2000. Characterization of Odor Emitting Potential from Swine Barns in IL. UIUC. \$22,371.
73. Heber, A.J. 2000. Study of the Effect of Ozonation on Odor, Dust and Gas Concentrations in Swine Barn and Growth Performance in Growing Pigs. Univ. of IL. \$2016.
74. Heber, A.J., J. Q. Ni, R.H. Grant. 2000. Air Sampling & Measurement Methodology for Confined Animal Housing Systems. U.S. Environmental Protection Agency. \$120,725.
75. Sutton, A.L., B.T. Richert, A.J. Heber, S. DeCamp, S. Hankins. 2000. Effect of Ractopamine in Pig Diets on Nutrient Excretion and Odors in Manure. Eli Lilly Research Labs. \$35,887.
76. Heber, A.J. 2000. Collection of Gas Samples for Electronic Nose Analysis. National Soil Tilth Laboratory, Ames, IA. \$1600.
77. Heber, A.J. 2000. Visiting Scientist Fellowship. AFRC Underwood Found., Silsoe, U.K. \$8784.
78. Sutton, A.L., B.T. Richert, A.J. Heber. 1999. Reduction of Odorous Compounds in Pig Manure through Specific Dietary Manipulation – Field Study. National Pork Producers Council. \$37,419.
79. Heber, A.J., S.S. Schiffman, T. Nagle. 1999. Effects of Dust, Sample Handling and other Factors on Quantification of Swine House Odor and Gases. Multi-State Consortium on Waste Management. \$89,000/\$145,900.
80. Heber, A.J., C.C. Wu, R.H. Grant. 1999. Atmospheric Dispersion of Pathogens from Ventilation Exhausts. National Pork Producers Council. \$28,496.
81. Heber, A.J., A.L. Sutton, D.D. Jones. 1999. Odor Emission from Anaerobic Treatment of Swine Manure. Indiana Commissioner of Agriculture. \$23,166.
82. Heber, A.J., A.L. Sutton, J.A. Patterson. 1999. Laboratory Testing of Manure Additives for Odor Control. National Pork Producers Council. \$249,068.
83. Heber, A.J., A.L. Sutton. 1999. Odor, Ammonia and Hydrogen Sulfide Emission Factors for Grow-Finish Buildings. National Pork Producers Council. \$28,907.
84. Heber, A.J. 1999. Preliminary evaluation of a passive detector to monitor ammonia in livestock buildings. Environmental Test Systems, Inc. \$2638.
85. Heber, A.J. 1999. Collection of Photobioreactor Feedstock from Swine House Air. Dairillean, Inc. (Subcontract for NSF-SBIR grant). \$35,000.
86. Heber, A.J. 1999. Analysis of air quality data. Monsanto Envirochem. \$400.
87. Heber, A.J., L. Corson. 1998. Odor Prevention Strategies in Lake County. Indiana Department of Environmental Management. \$24,242.
88. Heber, A.J. 1998. Measurement, Control and Analysis of Swine House Emissions of Dust, Odor and Gases. Multi-State Consortium on Waste Management (second year). \$20,000.
89. Heber, A.J. 1998. Analysis of Ambient Hydrogen Sulfide Readings. B&S Research. \$6900.

90. Heber, A.J., R.H. Grant, A.L. Sutton, D.D. Jones. 1998. Development of a Site-Specific Odor Impact Distance Guideline for Swine Production Systems. National Pork Producers Council (\$29,272) and Purdue Agric. Res. Programs (\$24,000).
91. Heber, A.J. 1998. Development of Olfactometry Laboratory. Purdue Agric. Res. Programs and Purdue Cooperative Extension Service. \$33,000.
92. Heber, A.J. 1997. Tests of Manure Cover for Odor and Gas Control. ETH Int. Trading and Recycling, Hamburg, DE. \$2250.
93. Sutton, A.L., B.T. Richert, A.J. Heber, D.S. Bundy. 1997-99. Dietary Manipulation to Reduce Odors from Swine Manure. Multi-State Consortium on Waste Management. \$40,000.
94. Heber, A.J., S.J. Hoff, D.S. Bundy, R.W. Bottcher, K.K. Keener. 1997. Measurement, Control and Analysis of Swine House Emissions of Dust, Odor and Gases. Multi-State Consortium on Waste Management (first year). \$95,200.
95. Heber, A.J. 1997. Travel to NL. Purdue Research Foundation. \$970.
96. Heber, A.J., A.L. Sutton, J.A. Patterson, D.D. Jones. 1996-97. Field Tests of Alliance. Monsanto Enviro-Chem. \$207,860.
97. Heber, A.J., D. Cassens, M. Okos. 1996. Effects of Temperature and Humidity on Surface Quality of Low-VOC Wood Coatings, IN Dept. Environmental Management. \$29,350.
98. Heber, A.J. 1994. Field Test of Bioscrubber for Treating Swine Building Exhaust Air, Indiana Pork Producers Assoc. \$4000.
99. Heber, A.J. 1995. Engineering Livestock Housing for Biosecurity. Summer Faculty Grant, Purdue Res. Foundation. \$5000.
100. Heber, A.J. 1995. Gas chromatograph. Purdue Agricultural Alumni Foundation. \$15,000.
101. Heber, A.J. 1995. Study and Evaluation of Turkey House Ventilation Systems. Indiana Turkey Market Development Council. \$6500.
102. Heber, A.J., R.H. Linton, N.J. Zimmerman. 1994. The Effect of Processing and Air Flow Parameters on Microbial Aerosol Dispersion in Poultry Processing Plants. ASHRAE. \$79,987.
103. Heber, A.J. 1994-95. Effects of Management Practices on Air Quality in Swine Farrowing Houses. Indiana Pork Producers Assoc. \$4981.
104. Heber, A.J., C.C. Wu, D.D. Jones, J.A. Patterson, A.L. Sutton. 1993. Effects of Ventilation and Building Hygiene on Aerial Pollutants in Swine Farrowing Rooms. Purdue ARP Res. Assist. Program. \$24,000.
105. Patterson, J.A., A.J. Heber, A.L. Sutton, D.D. Jones. 1993. Development and evaluation of systems for removing NH₃ from exhaust air. Purdue Res. Foundation. \$43,000.
106. Heber, A.J. 1993. Visiting Scientist Fellowship. AFRC Underwood Fndtn., Silsoe, U.K. \$5500.
107. Sutton, A.L., J.A. Patterson, D.D. Jones, A.J. Heber. 1993. Odor Control by Biochemical and Microbial Transformations in the Pig and Manure Storage. NPPC. \$98,818.
108. Heber, A.J. 1993. Theoretical and Experimental Evaluation of Ventilation Inlet. Kansas Technology Enterprise Corporation (40%) and Osborne Ind. (60%). \$21,077.
109. Heber, A.J. 1992. Participation in Fourth Int. Livestock Environment Symp. at Coventry, U.K. KSU Faculty Development Award. \$1400.
110. Heber, A.J., J.P. Harner. 1990. FANSYS: A design program for single and variable speed fans. Kansas Technology Enterprise Corporation (40%) and Osborne Ind. (60%). \$20,000.
111. Pickrell, J.A., A.J. Heber, J.R. Gillespie, S. Henry. 1990. Respirable Particle Concentrations in Swine Confinement Operations. National Pork Producers Council. \$20,000.
112. Heber, A.J. 1990. Visiting Scientist Fellowship. AFRC Underwood Fndtn., Silsoe, U.K. \$5500.
113. Heber, A.J. 1989. Microprocessor Embedded Controller for Ventilation Fans. Center for Research on Computer Controlled Automation. Kansas State Univ. \$17,998.
114. Morcos, M.M., A.J. Heber. 1989. Design Optimization of Variable Speed Controllers for Capacitor-Run Induction Motors Running Agric. Fans. Nat. Food & Energy Council. \$25,600.

115. Heber, A.J. 1989. Aerial Reentrainment of Surficial Deposits in Agricultural Structures. KSU Faculty Development Award (50%), Engineering (25%), Ag Engg (25%). \$1200.
116. Heber, A.J., M.M. Morcos, J.P. Harner. 1988. Design Optimization of Variable Speed Fan Systems. KS Technology Enterprise Corporation (40%) and Osborne Ind. (60%). \$20,000.
117. Heber, A.J., M.M. Morcos, J.P. Harner. 1988. Harmonics Produced by Variable Speed Fan Systems. Kansas Electric Utility Research Program (KEURP) Project KRD 348. \$15,980.
118. Heber, A.J. 1988. Effects of Pelletized Fat and Soybean Oil on Aerodynamic Dust Segregation of Swine Feed. Balanced Energy Corporation, Clinton, IA. \$1500.
119. Heber, A.J. 1988. Computer Automation and Control of Fan Test Laboratory. Center for Research on Computer Controlled Automation. Kansas State Univ. \$8340.
120. Heber, A.J., J.P. Murphy. 1988. Selection of Components for Mechanical Ventilation Systems. Kansas Committee on the Relation of Electricity to Agriculture (KCREA). \$7780.
121. Heber, A.J., J.P. Murphy, J. Slocombe. 1987. Variable Speed Control for Direct-Drive Ventilation Fans. KS Technology Enterprise Corp. (40%) and Osborne Ind. (60%). \$5000.
122. Heber, A.J., J.P. Murphy. 1987. Effect of Wind on Electric Fan Performance. KCREA. \$4920.
123. Heber, A.J. 1987. Power Harmonics on Rural Electric Systems. KCREA. \$2000.
124. Heber, A.J. 1987. Univ. of Minnesota Short Course on Aerosols. KSU Fac. Dev. Award. \$900.
125. Heber, A.J., J.P. Murphy. 1986. Advancement of Technology for Livestock Ventilation Systems. KS Dept. of Economic Development (40%) and Osborne Ind. (60%). \$19,940.
126. Heber, A.J., J. Nelssen, D. Nichols. 1985. Quantitative Analysis of Swine Dust Characteristics and Origin. National Pork Producers Council. Agency Number 367. \$8954.
127. Johnson, G.L. & A.J. Heber. 1985. Meas. of Harmonics on KS Utilities. KEURP. \$60,318.

M.S. GRADUATES SUPERVISED

1. Marcella Stroik, Influence of Env. Factors on Dust Charact. in Swine Finishing Bldgs, 1987.
2. Steven Cole, Effect of Wind Protection Device on Ventilation for Performance, 1988.
3. Junping Li, Electrical Harmonic Content on Kansas Rural Distribution Systems, 1988.
4. Kesuma Suri, Effect of Air Velocity on Agricultural Dust Resuspension from Surfaces, 1991.
5. A.R. El Koubysi, Electrical Harmonics from Variable Speed Fan Systems, 1992.
6. Kevin Kaiser, Exp., Anal., & Num. Eval. of Commercial Ceiling & Wall Vent. Inlets, 1993.
7. Brian Strobel, Effects of Man. Practices on Air Quality in Swine Farrowing Houses, 1996.
8. Mike Peugh, Ventilation of Poultry Processing Plants, 1996.
9. Stacey Firestone, non-thesis, 1996.
10. Ping Shao, Evaluation of Agricultural Odor with Olfactometry and Gas Chromatography, 2001.
11. Pei-Chun Tao, Air Emissions from Mechanically Ventilated Swine Buildings, 2004.
12. Hong Huang, Design of Biofilter Test Lab, 2005.
13. Rudy Chervil, Air Emissions from Layer Houses, 2005.

Ph.D. GRADUATES SUPERVISED

14. Junping Li, PC-Based Design Program for Variable-Speed Ventilation Fans, 1992.
15. Teng Teeh Lim, Pollutant Emissions from Livestock Facilities, 2001.
16. Sang-Hun Lee, Biofiltration for Advanced Life Support, 2007.
17. Sarah Bereznicki, Odor Setback Model for Livestock Production Systems. 2009.
18. Weizhen Liang, Ammonia Emissions Model for High Rise Layer Houses. 2015.
19. Xiaoyu Feng, Ammonia Emissions Model for Sow Farms, 2014-present.

FULL-TIME RESEARCH ASSOCIATES SUPERVISED (start year/number of years)

R. Duggirala, '96/1; K. Keener, '96/1; J. Ni, '97/9; K. Fakhouri, '99/2; T. Lim, '01/5; E. Warnemuende, '01/1; A. Longman, '02/1; C. Diehl, '04/7; S. Hanni, '04/4; C. Li, '05/2; P. Tao, '04/2; J. Ramirez, '05/5; W. Bogan, '05/7; H. Xu, '06/1; E. Cortus, '06/3. J. Ha, '07/1, R. Liu, '07/2.

VISITING SCHOLARS

S.G. Lee, KOR, 1987; L. Dong, CN, 1995; R. Trivedi, IND, 1996-97; V. Adamchuk, UKR, 1996-97; S.T. Kim, KOR, 2000-01; G. Schaubberger, AT, 2001-02; K. Wang, CN, 2007-08, I. Kilic, TR, 2009-11, M. Wang, 2013-14, Y. Bi, 2014-15, Z. Wu, 2014-15, C. Liu, 2015-16.

CONSULTING PROJECTS AND CASES (Professional Engineer, 1985-present: IN 19600161, NCEES 13855)

1. Calculation of dust and gas emissions from egg layer operations, 2017-
2. Expert in dairy waste odor, 2017-
3. Review of emissions from egg production, 2017-
4. Calculation of ammonia emissions from egg layer operation, 2016-
5. Expert in swine odor case, 2016-17.
6. Analysis of field test data of odor abatement using misting, 2016-17.
7. Review of air emissions from egg layer operations, 2016-
8. Consultant on dairy odor, 2016-17.
9. Evaluation of odor abatement installation and ventilation systems at sausage plant, WI, 2016.
10. Review of design and installation of industrial biofilter, IL, 2016.
11. Expert in swine nursery odor case, SD, 2016.
12. Atmospheric dispersion modeling of odor from protein plant, MO, 2016.
13. Expert in swine finisher odor case (atmospheric dispersion modeling), IL, 2012-16.
14. Atmospheric dispersion modeling of odor from pet food plant, GA, 2015.
15. Expert in swine finisher odor and biofiltration design, 2013-14.
16. Expert in landfill odor case, MO, 2013.
17. Expert in sow farm odor case (atmospheric dispersion modeling), IL, 2004-2013.
18. Evaluation of airflow system for new crossflow oven, IL, 2013.
19. Expert in diaper pail odor case, CA, 2011-13.
20. Expert in swine finisher odor case, PA, 2011-13.
21. Expert in case of pig death loss due to power failure, 2012.
22. Expert in sow farm odor nuisance case, IN, 2010-12.
23. Expert in industrial oil processing odor, MI, 2010-11.
24. Airflow design for 42 inch dual conveyor belt oven, Avantec, IL, 2009-09.
25. Airflow design for 60 inch dual conveyor belt oven, Avantec, IL, 2006-07.
26. Expert in swine odor nuisance case, MO, 2004-06.
27. Expert in swine odor nuisance case, WY, 2004-05.
28. Development of air emission research plans, OH, 2004.
29. Expert in carbon monoxide poisoning case, MO, 2003.
30. Expert in swine odor nuisance case, IA, 2003.
31. Expert on greenhouse gas emissions from agriculture, FL, 2003.
32. Expert in compost odor nuisance case, IA, 2003-04.
33. Airflow design of crossflow convection oven, National Gas Institute, IL 2003-04.
34. Expert in swine odor nuisance case, WY, 2003.
35. Expert in four (4) swine housing equipment and environment cases, 2002-06
36. Expert in dairy calf nursery ventilation case, SD, 2002.
37. Expert in ventilation equipment patent infringement case, IN, 2002.
38. Expert in poultry air emission case, AK, 2002.
39. Expert in swine and poultry odor nuisance case, IA, 2001.
40. Member of oven technology advisory board for Pizza Hut, TX, 2001.
41. Consultant to environmental firm on odor emissions from soap plant, OH, 2001.
42. Expert in a reverse setback case, IL, 2001.
43. Calculation of biogas generation from dairy manure, IN, 2001.
44. Airflow design of 70 inch dual conveyor belt oven, National Gas Institute, Chicago, IL, 2000-02.
45. Evaluation of odor management plan for dairy facilities, ID, 2001.
46. Evaluation of air pollution from poultry facilities for U.S. DOJ, OH, 2001-2004.
47. Evaluation of air pollution from swine facilities for U.S. DOJ, MO, 2000-2002.
48. Evaluation of odor control methods for two corn wet milling plants, IN, 2000.

49. Evaluation of waste management and odor control methods at a large dairy farm, MN, 2000.
50. Fact witness for oven patent infringement case, TX, 1999.
51. Modeling of stack height effects on odor dispersion from ethanol plant, MN, 1999.
52. Expert in case on pig deaths from lightning and ventilation failure, IN, 1999.
53. Expert in case relating to environmental impact of a large swine facility, SD, 1999.
54. Expert in livestock odor nuisance case, MO, 1999.
55. Expert regarding proposed odor regulations, CO, 1999.
56. Evaluation of government environmental permit application of swine facility, D.C., 1999.
57. Troubleshooting of ventilation for duck buildings, IN, 1998.
58. Expert in laying house odor nuisance case, OH, 1998.
59. Modeling stack height effects on dispersion of odor from rendering plant, IN, 1998.
60. Evaluation of aeration for controlling swine lagoon odor, OK, 1998.
61. Expert for case involving fence design, IN, 1998.
62. Evaluation of manure storage cover for controlling odor, DE, 1997.
63. Expert for two broiler odor nuisance cases, KY, 1997.
64. Odor reduction strategies for a hog slaughtering plant, IN, 1996.
65. Troubleshooting swine housing complex for environmental control problems, KS, 1995.
66. Oven redesign and testing, VT, 1995.
67. Design of 18"x28" wide conveyor-belt oven, VT, 1994.
68. Troubleshooting oven baking problems, VT, 1994.
69. Design of remodeling for swine finishing house, MI, 1994.
70. Heat transfer model for device, Pizza Hut, KS, 1994.
71. Design of air return manifold and nozzle plenum for jet impingement oven, VT, 1994.
72. Evaluation of fans and air systems for jet-impingement oven, VT, 1993.
73. Evaluation of dustiness of corn and feed for ag chemical company, IL, 1993.
74. Testing and system engineering of oven blowers, VT, 1993.
75. Design of 18" wide jet-impingement, conveyor-belt oven, VT, 1993.
76. Design of 32" wide jet-impingement, conveyor-belt oven, VT, 1992 (patent).
77. Ventilation inlet tests for farm equipment company, KS, 1992.
78. Administration of harmonic analyzer service program for utilities, KS, 1989-92.
79. Ventilation fan tests and experiments for farm equipment company, KS, 1987-92.
80. Design of anaerobic lagoon for veterinarian's clinic, KS, 1992.
81. Design of new environmental control system for swine building, KS, 1992.
82. Air system design of 39" wide jet-impingement conveyor-belt pizza oven, VT, 1991.
83. Evaluation of dustiness of corn hybrids for ag chemical company, Dupont, IL, 1991.
84. Air system analysis of convection oven for oven company, VT, 1991.
85. Ventilation fan motor test for farm equipment company, KS, 1990.
86. Particle size analysis of powder for pharmaceutical company, Rhone-Poulenc, NC, 1990.
87. Certification of PURPA guidelines for an on-site cogenerator engine, KS, 1987.
88. Engineering analysis report for a lawsuit involving a farm accident, KS, 1985.

CONTINUING EDUCATION

- Air-298 Introduction to the CALPUFF Modeling System, 0.70 CEU, June 24, 2004.
AERMOD Air Dispersion Modeling Course, Lakes Environmental, 16 h CEU, May 15-16, 2012.

OTHER

1. Toastmaster's International, 1979-81, 2004-06.