

## **FRANK MITLOEHNER, PHD**

Professor and CE Specialist  
Department of Animal Science  
University of California, Davis  
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### ***EDUCATION***

MS, University of Leipzig, Germany, Animal Science & Ag Engineering, 1996  
PhD, Texas Tech University, TX, Animal Science, 2000  
Postdoctoral Fellow at Texas Tech University from Aug 2000 - Dec 2001.

### ***APPOINTMENT***

- Professor & Cooperative Extension Specialist; Dept Animal Science, UC Davis; since July 2012
- Adjunct Professor; College of Animal Science; North West Agriculture and Forestry University (NWFU), Yangling, China; since Jan 2016
- Associate Professor; Dept Animal Science, UC Davis Oct 2007 - 2012
- Associate Cooperative Extension Specialist for Air Quality; Dept Animal Science, UC Davis; July 2006 - 2012
- Assistant Cooperative Extension Specialist for Air Quality; Dept Animal Science, UC Davis; Jan 2002 - June 2006

### ***PROFESSIONAL EXPERIENCE***

- Chairman, United Nations Food and Agriculture Organization (UN FAO), Partnership Project for the Benchmarking of Environmental Impacts of the Global Livestock Supply Chains; LEAP (2012 - 15)
- Member, National Academy of Science, Institute of Medicine, Committee on Assessment of the Environmental and Health Effects of the Food System (March 2013-15)
- Director for Research, Western Center for Agricultural Health and Safety, UC Davis
- Workgroup Member, President's Council of Advisors on Science and Technology, PCAST (June 2012-15)

### ***AWARDS***

- 2005 *Outstanding Paper Award – Journal: ‘Measurement, Science and Technology’*
- 2006 *Academic Federation Excellence in Research Award - University of California, Davis, awarded by Chancellor Vanderhoeff*
- 2007 *Environmental Award - Environmental Protection Agency*
- 2009 *Distinguished Service Award for Outstanding Research - University of California Division of Agricultural and Natural Resources, awarded by UC VP Dooley*
- 2011 *Outstanding Dairy Industry Researcher Award - awarded by Western Dairy Business, through selection by Western States dairy stakeholders.*
- 2014 *ASUCD Excellence in Education Award for the College of Agricultural and Environmental Science*
- 2016 *Distinguished Alumni Award, Texas Tech University, Lubbock, TX*

### ***PROFESSIONAL SOCIETIES***

- American Geophysical Union (AGU)
- American Chemistry Society (ACS)
- American Society of Animal Science (ASAS)
- American Society of Agricultural and Biological Engineers (ASABE)

### ***Publications (2001-2017)***

1. Mitloehner, F.M., J.L. Morrow-Tesch, S.C. Wilson, J.W. Dailey, and J.J. McGlone. 2001. Behavioral and sampling techniques for feedlot cattle. *J. Anim. Sci.* 79:1189-1193.
2. Mitloehner, F.M., J.L. Morrow-Tesch, S.C. Wilson, J.W. Dailey, M. Galyean, M. Miller, and J.J. McGlone. 2001. Shade and water misting effects on behavior physiology, performance and carcass traits of heat stressed feedlot cattle. *J. Anim. Sci.* 79:2327-2335.
3. Mitloehner, F.M., M.L. Galyean, and J.J. McGlone. 2002. Shade effects on performance, carcass traits, physiology, and behavior of heat-stressed feedlot heifers. *J. Anim. Sci.* 80:2043-2050.
4. Wilson, S.C., F.M. Mitloehner, J.L. Morrow-Tesch, J.L. Dailey, and J.J. McGlone. 2002. An assessment of several potential enrichment devices for feedlot cattle. *Appl. Anim. Beh. Sci.* 76:259-265.
5. Wilson, S.C., J. Morrow-Tesch, D.C. Straus, J.D. Cooley, W.C. Wong, F.M. Mitloehner, and J.J. McGlone. 2002. Airborne microbial flora in a cattle feedlot. *Appl. Environm. Microbiol.* 68:3238-3242.
6. Mitloehner, F.M., T. Grandin, M. Galyean, J. Swanson, B. Smith, and D. Sehnert. 2003. Federation of Animal Science Societies (FASS) Beef Training Module (<http://www.fass.org/video/beef.asp>).
7. Mitloehner, F.M., and R.B. Laube. 2003. Chronobiological indicators of heat stress in *Bos indicus* cattle in the Tropics. *J. Anim. Vet. Advances* 2: 654-659.
8. Oltjen, J.W., and F. Mitloehner. 2004. An overview of current beef welfare concerns. In: Information Resources on the Care and Welfare of Beef Cattle (C.P. Smith, Ed.) pp. vii-xiii. AWIC Resource Series No. 24. U.S. Dept. of Agriculture, National Agricultural Library, Animal Welfare Information Center. Beltsville, MD.
9. Morrow, J.L., F.M. Mitloehner, A.K. Johnson, M.L. Galyean, J.W. Dailey, T.S. Edrington, R.C. Anderson, K.J. Genovese, T.L. Poole, S.E. Duke, and T.R. Callaway. 2005. Effect of sprinkling cattle on incidence of zoonotic pathogens. *J. Anim. Sci.* 83:1959-1966.

10. Mitloehner, F.M. 2005. Effects of insufficient data on air quality regulatory policy in animal agriculture. *J. Appl. Poultry Sci.* 14:373-377.
11. Webber, M.T. MacDonald, M.B. Pushkarsky, C.K.N. Patel, Y. Zhao, N. Marcillac, and F.M. Mitloehner. 2005. Agricultural ammonia sensor using diode lasers and photoacoustic spectroscopy. *Meas. Sci. Technol.* 16:1547-1553.
12. Silvis, J., G. Shaver, F.M. Mitloehner, D. Niemeier. 2006. Interaction among air quality, climate change and California agriculture. Chapter 4. In: Cavagnaro, T.R., Jackson, L.E., and Scow, K.M., eds. *Climate Change: Challenges and Solutions for California Agricultural Landscapes*. California. CEC-500-2005-189-SF. [http://www.climatechange.ca.gov/climate\\_action\\_team/reports/index.html](http://www.climatechange.ca.gov/climate_action_team/reports/index.html). California Climate Change Center, Sacramento CA.
13. Chang, A., T. Harter, J. Letey, D. Meyer, R. Meyer, M. Cambell, F. Mitloehner, S. Pettygrove, P. Robinson, and R. Zhang. 2006. Managing dairy manure in the central valley of California. Oakland: University of California *ANR publication 9004*.
14. Von Borell, E., A. Özpınar, K.M. Eslinger, A.L. Schnitz, Y. Zhao, and F.M. Mitloehner. 2007. Acute and prolonged effects of ammonia on hematological variables, stress responses, performance, and behavior of nursery pigs. *J. Swine Health Prod.* 15:137-145.
15. Shaw, S.L., F.M. Mitloehner, W.A. Jackson, E. DePeters, R. Holzinger, J. Fadel, P. Robinson, and A.H. Goldstein. 2007. Volatile organic compound emissions from dairy cows and their waste as measured by proton transfer reaction - mass spectrometry. *Env. Sci. & Technol.* 41:1310-1316.
16. McGarvey, J., W.G. Miller, R. Zhang, Y. Ma, and F.M. Mitloehner. 2007. Bacterial population dynamics in dairy waste during aerobic and anaerobic treatment and subsequent storage. *Appl. Environm. Microbiol.* 73:193-202.
17. Mitloehner, F.M., and M. Schenker. 2007. Environmental Exposure and Health Effects of Concentrated Animal Feeding Operations. *Epidemiology* 18:309-311.
18. Zhang, R.H., H. Sun, C. Collar, and F.M. Mitloehner. 2007. Aerator performance for wastewater lagoon application. *ASABE publication 701Po907*.
19. Stull, C., S. Barry, W. Jensen, D. Drake, L. Forero, J. Guerro, J. Maas, F. Mitloehner, G. Nader, and J. Oltjen. 2007. Beef Care Practices. Oakland: University of California *ANR publication 8257*.
20. Trabue, S., K. Scoggin, F.M. Mitloehner, R. Burns, and H. Xin. 2007. Volatile sulfur compounds associated with animal feeding operations. *Atmospheric Environment* 42:3332-3341.

21. Sun, H., S. Trabue, K. Scoggin, W. Jackson, Y. Pan, Y. Zhao, I.L. Malkina, J.A. Koziel, and F.M. Mitloehner. 2008. Alcohol, volatile fatty acid, phenol, and methane emissions from dairy cows and fresh waste. *J. Environm. Qual.* 36: 615-622.
22. Sun, H., Y. Pan, Y. Zhao, W. Jackson, L. Nuckles, V. Arteaga, and F.M. Mitloehner. 2008. Effects of sodium bisulfate on alcohol, amine, and ammonia emissions from dairy slurry. *J. Environm. Qual.* 37: 608-614.
23. Mitloehner, F. M. and M. S. Calvo. 2008. Worker health and safety in concentrated animal feeding operations. *J. Agri. Health Safety.* 14; 163-187.
24. Howard, C., W. Yang, P. Green, F.M. Mitloehner, I. Malkina, R.G. Flocchini, M.J. Kleeman. 2008. Direct measurements of the ozone forming potential from dairy cattle emissions using a transportable smog chamber. *Atmospheric Environment.* 42: 5269-5277.
25. Zhang, R., J.A. McGarvey, F.M. Mitloehner. 2008. Effects of anaerobic digestion and aerobic treatment on gaseous emissions from dairy manure storages. *Int. J. Agr. & Biol. Eng.* 1:15-20.
26. Johnson, A. K., F. M. Mitloehner, J. L. Morrow, and J. J. McGlone. 2008. Effects of shaded versus unshaded wallows on behavior, performance, and physiology of the outdoor lactating sow. *J. Anim. Sci.* 86:3628–3634.
27. Marcillac-Embertson, N.M., P.H. Robinson, J.G. Fadel, and F.M. Mitloehner. 2009. Effects of shade and sprinklers on performance, behavior, physiology, and the environment of heifers. *J. Dairy Sci.* 92: 509-517.
28. Mitloehner, F.M., H. Sun, and J. Karlik. 2009. Environmental chamber studies improve greenhouse gas emission estimates and suggest mitigation strategies for livestock facilities. *California Agriculture.* 63: 79-83.
29. Hamilton, S. W., E. J. DePeters, J. A. McGarvey, J. Lathrop, and F. M. Mitloehner. 2010. Greenhouse Gas, Animal Performance, and Bacterial Population Structure Responses to Dietary Monensin Fed to Dairy Cows. *J. Environm. Qual.* 39: 106-114.
30. Mitloehner, F.M., J. Swearingen, L. Jacobson, C. Gooch, P. Ndegwa. 2009. Chapter 3: Husbandry, Housing, and Biosecurity. In: Guide for the Care and Use of Agricultural Animals in Agricultural Research and Teaching, Federation of Animal Science Societies, 14-28.
31. Pitesky, M., K. Stackhouse, and F.M. Mitloehner. 2009. Clearing the Air: Livestock's Contributions to Climate Change. *Adv. Agronomy*, 103: 1-40.

32. Plummer, L.E., K. E. Pinkerton, S. Reynolds, S. Meschke, F.M. Mitloehner, D. Bennett, S. Smiley-Jewell, and M.B. Schenker. 2009. Aerosols in the Agricultural Setting. *J. Agromed.* 14: 413-6.
33. McGarvey, J. A., S. W. Hamilton, J. R. Lathrop, and F. M. Mitloehner. 2010. Effects of Dietary Monensin on the Bacterial Population Structure of Dairy Cattle Colonic Contents. *Appl. Microb. & Biotechn.* 85: 1947-1952.
34. Wegesser, T.C., L.M. Franzi, F.M. Mitloehner, A. Eiguren-Fernandez, and J.A. Last. 2010. Lung Antioxidant and Cytokine Responses to Coarse and Fine Particulate Matter from the Great California Wildfires of 2008. *Inhalation Toxicology.* 22: 561-570.
35. Howard C. J., A. Kumar, F. M. Mitloehner, K. R. Stackhouse, P. G. Green, R. G. Flocchini, and M. J. Kleeman. 2010. Direct Measurements of the Ozone Formation Potential from Livestock and Poultry Waste Emissions. *Env. Sci. & Technol.* 44: 2292-2298.
36. Calvo M. S., A. C. Gerry, J. A. McGarvey, T. L. Armitage, and F. M. Mitloehner. 2010. Acidification of calf bedding reduces fly development and bacterial abundance. *J. Dairy Sci.* 93:1059-1064.
37. Burgos S. A., N. M. Embertson, Y. Zhao, F. M. Mitloehner, E. J. DePeters, and J. G. Fadel. 2010. Prediction of Ammonia Emission from Dairy Cattle Manure Based on Milk Urea Nitrogen: Relation of Milk Urea Nitrogen to Ammonia Emissions. *J. Dairy Sci.* 93:2377-2386.
38. Howard, C. J., A. Kumar, I. A. Malkina, F. M. Mitloehner, P. G. Green, R. Flocchini, and M. Kleeman. 2010. Reactive Organic Gas Emissions from Livestock Feed Contribute Significantly to Ozone Production in Central California. *Env. Sci. & Technol.* 44: 2309-2314.
39. Montes, F., S. D. Hafner, C. A. Rotz, and F. M. Mitloehner. 2010. Temperature and air velocity effects on ethanol emission from corn silage with the characteristics of an exposed silo face. *Atmospheric Environment.* 44:1989-1995.
40. Place S.E., and F.M. Mitloehner. 2010. Contemporary Environmental Issues: A Review of the Dairy Industry's Role in Climate Change and Air Quality and the Potential of Mitigation through Improved Production Efficiency. *J. Dairy Sci.* 93:3407-3416.
41. Hafner S. D., Montes, F., C. A. Rotz, and F. M. Mitloehner. 2010. Ethanol emission from loose corn silage and exposed silage particles. *Atmospheric Environment.* 44: 4172-4180.

42. Eastman C., D. C. Mitchell, D. H. Bennett, D. J. Tancredi, F. M. Mitloehner, and M. B. Schenker. 2010. Respiratory symptoms of California's dairy workers. *Field Actions Science Report*. 2: 1-6.
43. Kumar A., C. J. Howard, D. Derrick, I. L. Malkina, F. M. Mitloehner, M. J. Kleeman, C. P. Alaimo, R. G. Flocchini and P. G. Green. 2010. Determination of volatile organic compound emissions and ozone formation from spraying solvent-based pesticides. *J. Environ. Qual.* 40: 1423-1431.
44. Mitloehner, F. M. 2010. Is the rising demand for animal protein fueling climate change? *J. Anim. Breed. Genet.* 127: 421-422 (Editorial).
45. El-Mashad, H. M., R. Zhang, T. Rumsey, S. Hafner, F. Montes, C. A. Rotz, V. Arteaga, Y. Zhao, F. M. Mitloehner. 2011. A mass transfer model of ethanol emission from thin layers of corn silage. *Trans. ASABE*. 53: 1-7.
46. Xin H., R. S. Gates, A. R. Green, F. M. Mitloehner, P. A. Moore Jr., and C. M. Wathes. 2011. Environmental impacts and sustainability of egg production systems. *Poultry Science*. 90:263-277.
47. Malkina I.L., A. Kumar, P. G. Green, and F. M. Mitloehner. 2011. Identification and quantitation of volatile organic compounds emitted from dairy silages and other feedstuffs. *J. Environ. Qual.* 40:1-9.
48. Coopridge K.L., F. M. Mitloehner, Y. Zhao, T. R. Famula, E. Kebreab, and A. L. Van Eenennaam. 2011. Feedlot efficiency implications on greenhouse gas emissions and sustainability. *J. Anim. Sci.* 89: 2643-2656.
49. Stackhouse K. R., Y. Pan, Y. Zhao, and F.M. Mitloehner. 2011. Greenhouse gas and alcohol emissions from feedlot steers and calves. *J. Environ. Qual.* 40:899-906.
50. Kumar, A., C. P. Alaimo, R. Horowitz, F. M. Mitloehner, M. J. Kleeman, and P. G. Green. 2011. Volatile organic compound emissions from green waste composting: characterization and ozone formation. *Atmospheric Environment*. 45:1841-1848.
51. Jacobson, L. D., B. W. Auvermann, R. Massey, F. M. Mitloehner, A. L. Sutton, H. Xin. 2011. Air issues associated with animal agriculture: a North American perspective. *Council for Agricultural & Science Technology* 47: 1-23.
52. McGarvey, J. A., K. R. Stackhouse, W.G. Miller, L.H. Stanker, R. Hnasko and F.M. Mitloehner. 2011. The effects of sodium bisulfate on the bacterial population structure of dairy cow waste. *J. Appl. Microbiol.* 111: 319-328.

53. Stackhouse, K.R., S.E. Place, M.S. Calvo, Q. Wang, and F. M. Mitloehner. 2011. Greenhouse gas emission sources from US beef and dairy production systems. In: Understanding Greenhouse Gas Emissions from Agricultural Management. *Ch. 21*, pp 407-417. American Chemical Society.
54. Place S.E., K.R. Stackhouse, M. Calvo, Q. Wang, and F.M. Mitloehner. 2011. Mitigation of greenhouse gas emissions from US beef and dairy production systems. In: Understanding Greenhouse Gas Emissions from Agricultural Management. *Ch. 23*, pp 443-457. American Chemical Society.
55. El-Mashad, H. M., R. Zhang, V. Arteaga, T. Rumsey, F. M. Mitloehner. 2011. Generation and emissions of volatile fatty acids and alcohols during anaerobic storage of dairy manure. *Trans. ASABE* 54: 1-9.
56. Place, S., Y. Pan, Y. Zhao, and F. M. Mitloehner. 2011. Construction and Operation of a Head Chamber System for Measuring Eructated Greenhouse Gas and Volatile Organic Compound Emissions from Cattle. *Animals*, 1: 433-446.
57. Vogel, C. F. A, J. Garzia, D. Wu, D. Mitchell, Y. Zhang, N. Y. Kado, P. Wong, D. A. Trujillo, A. Lollies, D. Bennett, M. B. Schenker and F.M. Mitloehner. 2012. Activation of inflammatory responses in human U937 macrophages by particulate matter collected from dairy farms: an in vitro expression analysis of pro-inflammatory markers. *Environmental Health*. 11:17-26.
58. Hu, J., C. J. Howard, F. M. Mitloehner, P. G. Green, and M. J. Kleeman. 2012. Mobile Source and Livestock Feed Contributions to Regional Ozone Formation in Central California. *Env. Sci. & Technol.* 46: 2781-2789.
59. Place, S. E., and F. M. Mitloehner. 2012. Beef production in balance: considerations for life cycle analyses. *Meat Science*. 92: 179-181.
60. Mitloehner, F. M. and S. Place. 2012. Perspectives of the impacts of livestock production on climate change. *Advances in Animal Biosciences*. 2: 608-610.
61. Li C., W. Salas, R. Zhang, C. Krauter, A. Rotz, and F. M Mitloehner. 2012. Manure-DNDC: a Biogeochemical Process Model for Quantifying Greenhouse Gas and Ammonia Emissions from Livestock Manure Systems. *Nutrient Cycling in Agroecosystems*. 93: 163-200.
62. Zhao, Y, Y. Pan, J. Rutherford, F.M. Mitloehner. 2012. Estimation of the Interference in multi-gas measurements using the infrared photoacoustic Innova analyzer. *Atmosphere*. 3: 246-265.
63. Garcia, J., D. Bennett, M. Schenker, F.M. Mitloehner. 2012. Occupational exposure to particulate matter and endotoxin for California dairy workers. *International Journal of Hygiene and Environmental Health* 216: 56-62.

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65. Stackhouse-Lawson, K.R., C.A. Rotz, J.W. Oltjen, F.M. Mitloehner. 2012. Growth promoting technologies reduce the carbon footprint, ammonia emissions, and costs of California beef production systems. *J. Anim. Sci.* 90: 4656-4665.
66. Stackhouse-Lawson, K.R., C.A. Rotz, J.W. Oltjen, F.M. Mitloehner. 2012. Carbon footprint and ammonia emissions of California beef production systems. *J. Anim. Sci.* 90: 4641-4655.
67. Clay, S., J. Dangl, J., D. Fischhoff, M. Jahn, D. Latham, F.M. Mitloehner, T. Sinclair, and C. Somerville. 2012. Agricultural Preparedness and the Agricultural Research Enterprise. *President's Council of Advisors on Science and Technology (PCAST)*. Washington DC. pp 1-55
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69. McGarvey. J.A, R.B. Franco, J.D. Palumbo, R. Hnasko, L. Stanker and F.M. Mitloehner. 2013. Bacterial Population Dynamics and Chemical Transformations During the Ensiling of *Medicago sativa* (Alfalfa) and Subsequent Exposure to Air. *Journal of Applied Microbiology*. 114, 1661-1670.
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73. Wang, Q., M. Burger, T. A. Doane, W. R. Horwath, A. R. Castillo, and F. M. Mitloehner. 2013. Effects of inorganic versus organic copper on denitrification in peat soil. *Adv. Anim. Biosciences*. 4: 42-49.



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76. Pitesky, M., A. Gunasekara, C. Cook, F. M. Mitloehner. 2014. Adaptation of Agricultural and Food Systems to a Changing Climate and Increasing Urbanization. *Current Sustainable Renewable Energy Reports* 1: 43-50.
77. Zhao, Y., S. Cliff, A. Wexler, W. Javed, K. Perry, Y. Pan, and F.M. Mitloehner. 2014. Measurements of Size- and Time-resolved Elemental Concentrations at a California Dairy Farm. *Atmospheric Environment* 94: 773-781.
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80. Mitchell, D.C., T.L. Armitage, M.B. Schenker, D.H. Bennett, D. Tancredi C. Eastman Langer, S.J. Reynolds, G. Dooley, J. Mehaffy, F.M. Mitloehner. 2015. Particulate Matter, Endotoxin, and Worker Respiratory Health on Large Californian Dairies. *Journal of Occupational and Environmental Medicine*. 57:79-87.
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84. Mitchell D., V. Arteaga, T. Armitage, F.M. Mitloehner, D. Tancredi, N. Kenyon, and M. Schenker. 2015. Cage versus non-cage laying hen housing: 1) Worker respiratory health. *Journal of Agromedicine*. 20:256-264.

85. Arteaga V., D. Mitchell, G.E. Matt, P. Quintana, J. Schaeffer, S. Reynolds, M.B. Schenker, and F.M. Mitloehner. 2015. Occupational Exposure to Endotoxin in PM2.5 and Pre-and Post-Shift Lung Function in California Dairy Workers. *Journal of Environmental Protection*. 6, 552-565.
86. Ledgard, S., B. Henry, M. Benoit, C. Devendra, J. Dollé, A. Gac, , C. Lloyd, H. Zerfas, F. M. Mitloehner. 2015. Greenhouse gas emissions and fossil energy use from small ruminant supply chains, guidelines for assessments. Food and Agricultural Organization of the United Nations, Livestock Environmental Assessment and Performance Partnership. Pg. 1-81.
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92. Zhao, Y., A S. Wexler, F. Hase, Y. Pan, F.M. Mitloehner. 2016. Detecting Nitrous Oxide in Complex Mixtures using FTIR Spectroscopy: Silage Gas. *Journal of Environmental Protection*. 7, 1719-1729
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