

CAFO Research Studies, Discussions of Research, and Media Articles

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I. Research Studies

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A. RESEARCH re: Impact of CAFOs on Workers and Farmers

Ad Hoc Committee on Air Emissions from Animal Feeding Operations, Committee on Animal Nutrition, National Research Council (2003). *Air emissions from animal feeding operations: Current knowledge, future needs – Executive Summary*. Washington, DC: The National Academies Press.

Donham KJ (1990). Health effects from work in swine confinement buildings. *American Journal of Industrial Medicine*, 17(1): 17-25.

Donham KJ (2008 July). Asthma in livestock producers. *Iowa Pork Producer*: 31-33.

Donham, KJ (2010 April). Community and occupational health concerns in pork production: A review. *Journal of Animal Science*, 88(13 Suppl): E102-111.

Donham KJ, Haglind P, Peterson Y, Rylander R, & Belin L (1989). Environmental and health studies of farm workers in Swedish swine confinement buildings. *British Journal of Industrial Medicine*, 46: 31-37.

Donham KJ, Knapp LW, Monson R, & Gustafson K (1982 February). Acute toxic exposure to gases from liquid manure. *Journal of Occupational Medicine*, 24(2): 142-145.

- Donham KJ & Pependorf WJ (1985 November). Ambient levels of selected gases inside swine confinement buildings. *American Industrial Hygiene Association Journal*, 46(11): 658-661.
- Donham KJ, Reynolds SJ, Whitten P, Merchant JA, Burmeister L, & Pependorf WJ (1995 March). Respiratory dysfunction in swine production facility workers: Dose-response relationships of environmental exposure and pulmonary function. *American Journal of Industrial Medicine*, 27(3): 405-418.
- Donham KJ, Yeggy J, & Dague RR (1985). Chemical and physical-parameters of liquid manure from swine confinement facilities: Health implications for workers, swine and the environment. *Agricultural Wastes*, 14(2): 97-113.
- Dosman JA, Lawson JA, Kirychuk SP, Cormier Y, Biem J, & Koehncke N (2004 October). Occupational asthma in newly employed workers in intensive swine confinement facilities. *European Respiratory Journal*, 24(4): 698-702.
- Eduard W, Douwes J, Omenaas E, & Heederik D (2004). Do farming exposures cause or prevent asthma? Results from a study of adult Norwegian farmers. *Thorax*, 59: 381-386.
- Elholm G, Omland Ø, Schlünssen, Hjort C, Basinas I, & Sigsgaard T (2010 March 27). The cohort of young Danish farmers – A longitudinal study of the health effects of farming exposure. *Clinical Epidemiology*, 2: 45-50.
- Hamscher G, Pawelzick HT, Sczesny S, Nau H, & Hartung J (2003 October). *Environmental Health Perspectives*, 111(13): 1590-1594.
- Iversen M, Kirychuk S, Drost H, & Jacobson L (2000 November). Human health effects of dust exposure in animal confinement buildings. *Journal of Agricultural Safety and Health*, 6(4): 283-288.
- Larsson KA, Eklund AG, Hansson LO, Isaksson BM, & Malmberg PO (1994 October). Swine dust causes intense airways inflammation in healthy subjects. *American Journal of Respiratory and Critical Care Medicine*, 150(4): 973-977.
- McDonnell PE, Coggins MA, Hogan VJ, & Fleming GT (2008 December). Exposure assessment of airborne contaminants in the indoor environment of Irish swine farms. *Annals of Agricultural and environmental medicine*, 15(2): 323-326.
- McElroy KG (2010 October-December). Environmental health effects of concentrated animal feeding operations: Implications for nurses. *Nursing Administration Quarterly*, 34(4): 311-319.
- Osbern LN & Crapo RO (1981 September). Dung Lung: A report of toxic exposure to liquid manure. *Annals of Internal Medicine*, 95(3): 312-314.
- Quinn TJ, Donham KJ, Merchant JA, & Schwartz DA (1995 May). Peak flow as a measure of airway dysfunction in swine confinement operators. *Chest*, 107(5): 1303-1308.

- Reynolds SJ, Donham KJ, Whitten P, Merchant JA, Burmeister L, & Pependorf WJ (1996 January). Longitudinal evaluation of dose-response relationships for environmental exposures and pulmonary function in swine production workers. *American Journal of Industrial Medicine*, 29(1): 33-40.
- Rylander R, Donham KJ, Hjort C, Brouwer R, & Heederik D (1989 October). Effects of exposure to dust in swine confinement buildings – a working group report. *Scandinavian Journal of Work, Environment, & Health*, 15(5): 309-312.
- Schwartz DA, Donham KJ, Olenchock SA, Pependorf WJ, Van Fossen DS, Burmeister LF, & Merchant JA (1995 January). Determinants of longitudinal changes in spirometric function among swine confinement operators and farmers. *American Journal of Respiratory and Critical Care Medicine*, 151(1): 47-53.
- Schwartz DA, Landas SK, Lassise DL, Burmeister LF, Hunninghake GW, & Merchant JA (1992 April 15). Airway injury in swine confinement workers. *Annals of Internal Medicine*, 116(8): 630-635.
- Senthilselvan A, Dosman JA, Kirychuk SP, Barber EM, Rhodes CS, Zhang Y, & Hurst TS (1997 June). Accelerated lung function decline in swine confinement workers. *Chest*, 111(6): 1733-1741.
- Vogelzang PF, van der Gulden JW, Folgering H, Kolk JJ, Heederik D, Preller L, Tielen MJ, & van Schayck CP (1998 January). *American Journal of Respiratory and Critical Care Medicine*, 157(1): 15-18.
- Von Essen S & Romberger D (2003 August). The respiratory inflammatory response to swine confinement building environment: The adaptation to respiratory exposures in the chronically exposed worker. *Journal of Agricultural Safety and Health*, 9(3): 185-196.
- Zejda JE, Barber E, Dosman JA, Olenchock SA, McDuffie HH, Rhodes C, & Hurst T (1994 January). Respiratory health status in swine producers relates to endotoxin exposure in the presence of low dust levels. *Journal of Occupational Medicine*, 36(1): 49-56.

B. RESEARCH re: Impact of CAFOs on Neighbors and the Environment

- Asher MI & Weiland SK (1998 November). The international study of asthma and allergies in childhood (ISAAC). ISAAC Steering Committee. *Clinical and Experimental Allergy*, 28(Suppl 5): 52-66. Discussion, 90-91.
- Avery RC, Wing S, Marshall SW, & Schiffman SS (2004 February). Odor from industrial hog farming operations and mucosal immune function in neighbors. *Archives of Environmental Health*, 59(2): 101-108.
- Blanes-Vidal V, Suh H, Nadimi ES, Løfstrøm P, Ellermann T, Andersen HV, & Schwartz J. (2012, April). Residential exposure to outdoor air pollution from livestock operations and perceived annoyance among citizens. *Environment International*, 40: 44-50.

- Burkhart MR & Stoner JD (2002). Nitrate in aquifers beneath agricultural systems. *Water Science and Technology*, 45(9): 19-28.
- Burkhart MR & Stoner JD (2007). Nitrate in aquifers beneath agricultural systems. *Water Science and Technology*, 56(1): 56-69.
- Burkholder JA, Libra B, Weyer P, Heathcote S, Kolpin D, Thorne PS, & Wichman M (2007 February). Impacts of waste from concentrated animal feeding operations on water quality. *Environmental Health Perspective*, 115(2): 308-312.
- Burow KR, Nolan BT, Rupert MG, & Dubrovsky NM (2010 July 1). Nitrate in groundwater of the United States, 1991-2003. *Environmental Science and Technology*, 44(13): 4988-4997.
- Chrischilles E, Ahrens R, Kuehl A, Kelly K, Thorne P, Burmeister L, & Merchant J (2004 January). Asthma prevalence and morbidity among rural Iowa schoolchildren. *The Journal of Allergy and Clinical Immunology*, 113(1): 66-71.
- Contreras JP, Ly NP, Gold DR, He H, Wand M, Weiss ST, Perkins DL, Platts-Mills TA, & Finn PW (2003 December). Allergen-induced cytokine production, atopic disease, IgE, and wheeze in children. *The Journal of Allergy and Clinical Immunology*, 112(6): 1072-1077.
- Donham KJ (2000 November). The concentration of swine production. Effects on swine health, productivity, human health, and the environment. *The Veterinary Clinics of North America. Food Animal Practice*, 16(3): 559-597.
- Donham KJ (2010 April). Community and occupational health concerns in pork production: A review. *Journal of Animal Science*, 88(13 Suppl): E102-111.
- Donham KJ, Lee JA, Thu K, & Reynolds SJ (2006). Assessment of air quality at neighbor residences in the vicinity of swine production facilities. *Journal of Agromedicine*, 11(3), 15-24).
- Donham KJ, Wing S, Osterberg D, Flora JL, Hidne C, Thu KM & Thorne PS (2007 February). Community health and socioeconomic issues surrounding concentrated animal feeding operations. *Environmental Health Perspectives*, 115(2): 317-320.
- Gilchrist MJ, Greko C, Wallinga DB, Beran GW, Riley DG, & Thorne PS (2007 February). The potential role of concentrated animal feeding operations in infectious disease epidemics and antibiotic resistance. *Environmental Health Perspective*, 115(2): 313-316.
- Greger M & Koneswaran G (2010 January-March). The public health impacts of concentrated animal feeding operations on local communities. *Family and Community Health*, 33(1): 11-20.
- Gurian-Sherman D (2008). *CAFOs uncovered: The untold costs of confined animal feeding operations*. Cambridge, MA: Union of Concerned Scientists.

- Heerderick D, Sigsgaard T, Thorne PS, Kline JN, Avery R, Bønløkke JH, Chrischilles EA, Dosman JA, Duchaine C, Kirkhorn SR, Kulhankova K, & Merchant JA (2007 February). Health effects of airborne exposures from concentrated animal feeding operations. *Environmental Health Perspective*, 115(2): 298-302.
- Hoff SJ, Bundy DS, Nelson MA, Zelle BC, Jacobson LD, Heber AJ, Ni J, Zhang Y, Koziel JA, & Beasley DB (2006 May). Emissions of ammonia, hydrogen sulfide, and odor before, during, and after slurry removal from a deep-pit swine finisher. *Journal of the Air & Waste Management Association*, 56(5): 581-590.
- Hoopmann M, Hehl O, Neisel F, & Werfel T (2006, August-September). Associations between bioaerosols coming from livestock facilities and asthmatic symptoms in children. *Gesundheitswesen*, 68 (8-9): 575-584.
- Horton RA, Wing S, Marshall SW, & Brownley KA (2009 Supplement 3). Malodor as a trigger of stress and negative mood in neighbors of industrial hog operations. *American Journal of Public Health*, 99(S3): S610-S615.
- Iowa Department of Natural Resources, Ambient Air Quality Group (2006 January). *Results of the Iowa DNR Animal Feeding Operations Odor Study*. Des Moines, IA: Department of Natural Resources.
- Iowa Department of Natural Resources, Ambient Air Quality Group (2007). *Animal feeding operations study: Hydrogen sulfide and ammonia results: Executive summary*. Des Moines, IA: Department of Natural Resources.
- Iowa State University and The University of Iowa Study Group (2002 February). *Iowa concentrated animal feeding operations air quality study: Final report*. Des Moines, IA: State of Iowa.
- Kilburn KH (2012). Human impairment from living near Confined Animal (Hog) Feeding Operations. *Journal of Environmental and Public Health*, 2012: 1-11. Epub 2012 February 9.
- Kirkhorn SR (2002 October). Community and environmental health effects of concentrated animal feeding operations. *Minnesota Medicine*, 85(10): 38-43.
- Kline JN, Cowden JD, Hunninghake GW, Schutte BC, Watt JL, Wohlford-Lanane CL, Powers LS, Jones MP, & Schwartz DA (1999 July). *American Journal of Respiratory and Critical Care Medicine*, 160(1): 297-303.
- Lambert TW, Goodwin VM, Stefani D, & Strosher L (2006 August 15). Hydrogen sulfide (H₂S) and sour gas effects on the eye. A historical perspective. *The Science of the Total Environment*, 367(1): 1-22.
- Merchant JA (2009 April). *Public Health Impacts of Industrial Farm Animal Production: Occupational and Community Public Health Impacts technical report: The University of Iowa College of Public Health*. Retrieved 5-22-2012 from:

http://www.sph.unc.edu/images/stories/centers_institutes/accelerate/documents/Merchant-Public_Health_Impacts_4-22-09.pdf.

- Merchant JA, Naleway AL, Swendsen ER, Kelly KM, Burmeister LF, Stromquist AM, Taylor CD, Thorne PS, Reynolds SJ, Sanderson WT, & Chrischilles EA (2005 March). Asthma and farm exposures in a cohort of rural Iowa children. *Environmental Health Perspectives*, 113(3): 350-356.
- Merchant JA, Stromquist AM, Kelly KM, Zwerling C, Reynolds SJ, & Burmeister LF (2002). Chronic disease and injury in an agricultural county: The Keokuk County Rural Health Cohort Study. *The Journal of Rural Health*, 18(4): 521-535.
- Mirabelli MC, Wing S, Marshall SW, & Wilcosky TC (2006 April). Race, poverty, and potential exposure of middle-school students to air emissions from confined swine feeding operations. *Environmental Health Perspectives*, 114(4): 591-596.
- Mirabelli MC, Wing S, Marshall SW, & Wilcosky TC (2006 July). Asthma symptoms among adolescents who attend public schools that are located near confined swine feeding operations. *Pediatrics*, 118(1): e66-75.
- Mitloehner FM & Schenker MB (2007 May). Environmental exposure and health effects from concentrated animal feeding operations. *Epidemiology*, 18(3): 309-311.
- Nolan BT (2001 March-April). Relating nitrogen sources and aquifer susceptibility to nitrate in shallow ground waters of the United States. *Ground Water*, 39(2): 290-299.
- Nolan BT & Hitt KJ (2006 December 15). Vulnerability of shallow groundwater and drinking-water wells to nitrate in the United States. *Environmental Science and Technology*, 40(24): 7834-7840.
- Osterberg D & Wallinga D (2004, October). Addressing externalities from swine production to reduce public health and environmental impacts. *American Journal of Public Health*, 94(10): 1703-1708.
- Pew Commission on Industrial Farm Animal Production (2008). *Putting meat on the table: Industrial farm animal production in America: A report of the Pew Commission on Industrial Farm Animal Production*. Baltimore, MD: Pew Commission on Industrial Farm Animal Production, a Project of the Pew Charitable Trusts and Johns Hopkins Bloomberg School of Public Health.
- Radon K, Schulze A, Ehrenstein V, van Strien RT, Prami G, & Nowak D (2005, December). Prevalence of respiratory symptoms and diseases in neighbours of large-scale farming in Northern Germany. *Pneumologie*, 59(12): 897-900.
- Radon K, Schulze A, Ehrenstein V, van Strien RT, Prami G, & Nowak D (2007 May). Environmental exposure to confined animal feeding operations and respiratory health of neighboring residents. *Epidemiology*, 18(3): 300-308.

- Reynolds SJ, Donham KJ, Stookesberry J, Thorne PS, Subramanian P, Thu K, & Whitten P (1997). Air quality assessments in the vicinity of swine production facilities. *Journal of Agromedicine*, 4(1-2): 37-45.
- Reynolds SJ, Merchant JA, Zwerling C, Stromquist AM, & Burmeister LF (1997). The Keokuk County Rural Health Study: Preliminary results of environmental exposure assessments. *Journal of Agromedicine*, 4(1-2): 55-62.
- Rogers S & Haines J (2005 September). *Detecting and mitigating the environmental impact of fecal pathogens originating from confined animal feeding operations: Review*. Cincinnati, OH: National Risk Management Research Laboratory, US Environmental Protection Agency.
- Rylander R, Donham KJ, Hjort C, Brouwer R, & Heederik D (1989 October). Effects of exposure to dust in swine confinement buildings – a working group report. *Scandinavian Journal of Work, Environment, & Health*, 15(5): 309-312.
- Salam MT, Li YF, Langholz B, & Gilliland FD; Children's Health Study (2004 May). Early-life environmental risk factors for asthma: Findings from the Children's Health Study. *Environmental Health Perspectives*, 112(6): 760-765.
- Schenker MB, Christiani D, Cormier Y, Dimich-Ward H, Doekes G, Dosman J, et al. (1998 November). Respiratory health hazards in agriculture. *American Journal of Respiratory and Critical Care Medicine*, 158(5 pt 2): S1-S76.
- Schiffman SS, Auvermann BW, & Bottcher RW (2001 December 11). Health effects of aerial emissions from animal production and waste management systems. In *White Paper Summaries*, National Center for Manure and Animal Waste Management (Ed.), 10-12. Raleigh, NC: North Carolina State University.
- Schiffman SS, Miller EA, Suggs MS, & Graham BG (1995). The effect of environmental odors emanating from commercial swine operations on the mood of nearby residents. *Brain Research Bulletin*, 37(4): 369-375.
- Schiffman SS, Studwell CE, Landerman LR, Berman K, & Sundry JS (2005 May). Symptomatic effects of exposure to diluted air sampled from a swine confinement atmosphere on healthy human subjects. *Environmental Health Perspectives*, 113(5): 567-576.
- Schinasi L, Horton RA, Guidry VT, Wing S, Marshall SW, & Morland KB (2011, March). Air pollution, lung function, and physical symptoms in communities near concentrated swine feeding operations. *Epidemiology*, 22 (2): 208-215.
- Schulze A, Römmelt H, Ehrenstein V, van Strien R, Praml G, Küchenhoff H, Nowak D, & Radon K (2011). Effects on pulmonary health of neighboring residents of concentrated animal feeding operations: Exposure assessed using optimized estimation technique. *Archives of Environmental & Occupational Health*, 66 (3): 146-154.
- Sigurdarson S & Kline JN (2006 June). School proximity to concentrated animal feeding operations and prevalence of asthma in students. *Chest*, 129(6): 1486-1491.

- Sigurdarson ST, O'Shaughnessy PT, Watt JA & Kline JN (2004 October). Experimental human exposure to inhaled grain dust and ammonia: Towards a model of concentrated animal feeding operations. *American Journal of Industrial Medicine*, 46(4): 354-358.
- Smith CJ, Scott SM, & Ryan BA (1999 November). Cardiovascular effects of odors. *Toxicology and Industrial Health*, 15(7): 595-601.
- Stromquist AM, Merchant JA, Zwerling C, Burmeister LF, Sanderson WT, & Kelly KM (2009). Challenges of conducting a large rural prospective population-based cohort study: The Keokuk County Rural Health Study. *Journal of Agromedicine*, 14(2): 142-149.
- Tajik M, Muhammad N, Lowman A, Thu K, Wing S, & Grant G (2008). Impact of odor from industrial hog operations on daily living activities. *New Solutions*, 18(2): 193-205.
- Thorne PS (2000 November 2). Inhalation toxicology models of endotoxin- and bioaerosol-induced inflammation. *Toxicology*, 152(1-3): 13-23.
- Thorne PS (2007 February). Environmental health impacts of concentrated animal feeding operations: Anticipating hazards – searching for solutions. *Environmental Health Perspective*, 115(2): 296-297.
- Thorne PS, Ansley AC, & Perry SS (2009 April). Concentrations of bioaerosols, odors, and hydrogen sulfide inside and downwind from two types of swine livestock operations. *Journal of Occupational and Environmental Hygiene*, 6(4): 211-220.
- Thu KM (2002 May). Public health concerns for neighbors of large-scale swine production facilities. *Journal of Agricultural Safety and Health*, 8(2): 175-184.
- Thu K, Donham K, Ziegenhorn R, Reynolds S, Thorne PS, Subramanian P, Whitten P, & Stookesberry J (1997). A control study of the physical and mental health of residents living near a large-scale swine operation. *Journal of Agricultural Safety and Health*, 3(1): 13-26.
- Von Essen SG & Auvermann BW (2005). Health effects from breathing air near CAFOs for feeder cattle or hogs. *Journal of Agromedicine*, 19(4): 55-64.
- Wickens K, Lane JM, Fitzharris P, Siebers R, Riley G, Douwes J, Smith T, & Crane J (2002 December). Farm residence and exposures and the risk of allergic diseases in New Zealand children. *Allergy*, 57(12): 1171-1179.
- Wilson SM & Serre ML (2007, July). Examination of atmospheric ammonia levels near CAFOs, homes, and schools in Eastern North Carolina. *Atmospheric Environment*, 41 (23): 4977-4987.
- Wing S, Horton RA, Marshall SW, Thu K, Mansoureh T, Schinasi L, & Schiffman SS (2008 October). Air pollution and odor in communities near industrial swine operations. *Environmental Health Perspectives*, 116(10): 1362-1368.
- Wing S, Horton RA, Muhammad N, Grant GR, Tajik M, & Thu K (2008 August). Integrating epidemiology, education, and organizing for environmental justice: Community health

effects of industrial hog operations. *American Journal of Public Health*, 98(8): 1390-1397.

Wing S, Horton RA, & Rose KM (2012, October 28). Air pollution from industrial swine operations and blood pressure of neighboring residents. *Environmental Health Perspectives*,

Wing S & Wolf S (2000 March). Intensive livestock operations, health, and quality of life among eastern North Carolina residents. *Environmental Health Perspectives*, 108(3): 233-238.

C. Impact of Hydrogen Sulfide on Health

Arentoft H, Stolberg EF, & Ekelund S (1993 December 20). Hydrogen sulfide poisoning in a farmer. *Ugeskr Laeger*, 155(51): 4187-4188.

Bates MN, Garrett N, & Shoemack P (2002 September-October). Investigation of health effects of hydrogen sulfide from a geothermal source. *Archives of Environmental Health*, 57(5): 405-411.

Beauchamp RO Jr, Bus JS, Popp JA, Boreiko CJ, & Andjelkovich DA (1984). A critical review of the literature on hydrogen sulfide toxicity. *Critical Reviews in Toxicology*, 13(1): 25-97.

Bhambhani Y, Burnham R, Snyder G, MacLean I, & Martin T (1996 May). Effects of 5ppm hydrogen sulfide inhalation on biochemical properties of skeletal muscle in exercising men and women. *American Industrial Hygiene Association Journal*, 57(5): 464-468.

Bhambhani Y, Burnham R, Snyder G, & MacLean I (1997 February). Effects of 10-ppm hydrogen sulfide inhalation in exercising men and women. Cardiovascular, metabolic, and biochemical responses. *Journal of Occupational and Environmental Medicine*, 39(2): 122-129.

Campagna D, Kathman SJ, Pierson R, Inerra SG, Phifer BL, Middleton DC, Zarus GM, & White MC (2004 March). Ambient hydrogen sulfide, total reduced sulfur, and hospital visits for respiratory diseases in northeast Nebraska, 1998-2000. *Journal of Exposure Analysis and Environmental Epidemiology*, 14(2): 180-187.

Centers for Disease Control and Prevention (1993 May 7). Fatalities attributed to entering manure waste pits – Minnesota, 1992. *Morbidity and Mortality Weekly Report*, 42(7): 325-329.

Doujajji B & Al-Tawfiq JA (2010 January-February). Hydrogen sulfide exposure in an adult male. *Annals of Saudi Medicine*, 30(1): 76-80.

Fiedler N, Kipen H, Ohman-Strickland P, Zhang J, Weisel C, Laumbach R, Kelly-McNeil K, Olejeme K, & Lloy P (2008 January). Sensory and cognitive effects of acute exposure to hydrogen sulfide. *Environmental Health Perspectives*, 116(1): 78-85.

- Gerasimon G, Bennett S, Musser J, & Rinard J (2007 May). Acute hydrogen sulfide poisoning in a dairy farmer. *Clinical Toxicology*, 45(4): 420-423.
- Guidotti TL (1996 October). Hydrogen sulfide. *Occupational Medicine*, 46(5): 367-371.
- Guidotti TL (2010 December). Hydrogen sulfide: Advances in understanding. *International Journal of Toxicology*, 29(6): 569-581.
- Hagley SR & South DL (1983 October 29). Fatal inhalation of liquid manure gas. *The Medical Journal of Australia*, 2(9): 459-460.
- Hansell A & Oppenheimer C (2004 December). Health hazards from volcanic gases: A systematic literature review. *Archives of Environmental Health*, 59(12): 628-639.
- Hirsch AR (2002 March). Hydrogen sulfide exposure without loss of consciousness: Chronic effects in four cases. *Toxicology and Industrial Health*, 18(2): 51-61.
- Inserra SG, Phifer BL, Anger WK, Lewin M, Hilsdon R, & White MC (2004 May). Neurobehavioral evaluation for a community with chronic exposure to hydrogen sulfide gas. *Environmental Research*, 95(1): 53-61.
- Kilburn KH (1997 October). Exposure to reduced sulfur gases impairs neurobehavioral function. *Southern Medical Journal*, 90(10): 997-1006.
- Kilburn KH (2003 July). Effects of hydrogen sulfide on neurobehavioral function. *Southern Medical Journal*, 96(7): 639-646.
- Kilburn KH, Thrasher JD, & Gray MR (2010 August). Low-level hydrogen sulfide and central nervous system dysfunction. *Toxicology and Industrial Health*, 26(7): 387-405.
- Kilburn KH & Warshaw RH (1995 March-April). Hydrogen sulfide and reduced-sulfur gases adversely affect neurophysiological functions. *Toxicology and Industrial Health*, 11(2): 185-197.
- Knight LD & Presnell SE (2005 June). Death by sewer gas: Case report of a double fatality and review of the literature. *The American Journal of Forensic Medicine and Pathology*, 26(2): 181-185.
- Knoblauch A, Mughrabi S, & Boyle P (1999). Manure-related accidents: The historical perspective. *Gesnerus*, 56(1-2): 52-68.
- Knoblauch A & Steiner B (1999 July-September). Major accidents related to manure: A case series from Switzerland. *International Journal of Occupational and Environmental Health*, 5(3): 177-186.
- Knoblauch A, Steiner B, Bachmann S, Trachsler G, Burgheer R, & Osterwalder J (1996 September). Accidents related to manure in eastern Switzerland: An epidemiological study. *Occupational and Environmental Medicine*, 53(9): 577-582.

- Legator MS, Singleton CR, Morris DL, & Philips DL (2001 March-April). Health effects from chronic low-level exposure to hydrogen sulfide. *Archives of Environmental Health*, 56(2): 123-131.
- Lambert TW, Goodwin VM, Stefani D, & Strosher L (2006 August 15). Hydrogen sulfide (H₂S) and sour gas effects on the eye. A historical perspective. *The Science of the Total Environment*, 367(1): 1-22.
- Milby TH & Baselt RC (1999 February). Hydrogen sulfide poisoning: Clarification of some controversial issues. *American Journal of Industrial Medicine*, 35(2): 192-195.
- Nikkanen HE & Burns MM (2004 April). Severe hydrogen sulfide exposure in a working adolescent. *Pediatrics*, 113(4): 927-929.
- O'Donoghue JD (1961). Hydrogen sulphide poisoning in swine. *Canadian Journal of Comparative Medicine and Veterinary Science*, 25: 217-219.
- Oesterhelweg L & Püschel K (2008 March). "Death may come on like a stroke of lightning:" Phenomenological and morphological aspects of fatalities caused by manure gas. *International Journal of Legal Medicine*, 122(2): 101-107.
- Pavilonis BT, O'Shaughnessy PT, Altmaier R, Metwali N, & Thorne PS (2013, June). Passive monitors to measure hydrogen sulfide near concentrated animal feeding operations. *Environmental Science. Processes and Impacts*, 15 (6): 1271-1278.
- Querellou E, Jaffrelot M, Savary D, Savry C, & Perfus JP (2005 October). Fatal outcome of an hydrogen sulfide poisoning. *Annales Françaises d'Anesthésie et de Réanimation*, 24(10): 1302-1304.
- Yalamanchili C & Smith MD (2008 May). Acute hydrogen sulfide toxicity due to sewer gas exposure. *The American Journal of Emergency Medicine*, 26(4): 518.e5-7.

D. RESEARCH re: Problems With CAFO Operations

- Barber W (2005 February). Anaerobic digester foaming: Causes and solutions. *Water21*: 45-49.
- Ganidi N, Tyrrel S, & Cartmell E (2009 December). Anaerobic digestion causes – A review. *Bioresource Technology*, 100(23): 5546-5554.
- Haeussermann AE, Hartung E, Gallimann T, & Jungbluth T (2006). Influence of season, ventilation strategy, and slurry removal on methane emissions from pig houses. *Agriculture, Ecosystems and Environment*, 112: 115-121.
- Moody L, Burns R, & Muhlbauer R (2009 December 21). *Literature review: Deep pit swine facility flash fires and explosions: Sources, occurrences, factors, and management*. Ames, IA: Department of Agricultural and Biosystems Engineering, Iowa State University.
- Pagdilla K, Craney K, & Kido W (1997). Causes and effects of foaming in anaerobic sludge

digesters. *Water Science Technology*, 36(6-7): 463-470.

Taylor DA (2001 July). From pigsties to hog heaven. *Environmental Health Perspectives*, 109(7): A328-A331.

E. RESEARCH re: Toxic & Greenhouse Gas Emissions from Agriculture (CAFOs et al).

Anderson N, Strader R, & Davidson C (2003 June). Airborne reduced nitrogen: Ammonia emissions from agriculture and other sources. *Environment International*, 29(2-3): 277-286.

Aneja VP, Ary SP, Kim DS, Rumsey IC, Arkinson HL, Semunegus H, Bajwa K, Dickey DA, Stefanski LA, Todd L, Mottus K, Robarge WP, & Williams CM (2008 September). Characterizing ammonia emissions from swine farms in eastern North Carolina: Part 1 – Conventional lagoon and spray technology for waste treatment. *Journal of the Air & Waste Management Association*, 58(9): 1130-1144.

Aneja VP, Ary SP, Rumsey IC, Kim DS, Bajwa K, Arkinson HL, Semunegus H, Dickey DA, Stefanski LA, Todd L, Mottus K, Robarge WP, & Williams CM (2008 September). Characterizing ammonia emissions from swine farms in eastern North Carolina: Part 2 – Potential environmentally superior technologies for waste treatment. *Journal of the Air and Waste Management Association*, 58(9): 1145-1157.

Aneja VP, Ary SP, Rumsey IC, Kim DS, Bajwa K, & Williams CM (2008). Characterizing ammonia emissions from swine farms in eastern North Carolina: Reduction of emissions from water-holding structures at two candidate superior technologies for waste treatment. *Atmospheric Environment*, 42(14): 3291-3300.

Aneja VP, Blunden J, James K, Schlesinger WH, Knighton R, Gilliam W, Niyogi D, & Cole S (2008 March-April). Ammonia assessment from agriculture: U.S. status and needs. *Journal of Environmental Quality*, 37: 515-520.

Aneja VP, Blunden J, Roelle PA, Schlesinger WH, Knighton R, Gilliam W, Niyogi D, Jennings G, & Duke C (2008). Workshop on agricultural air quality: State of the science. *Atmospheric Environment*, 42(14): 3195-3208.

Aneja VP, Chauhan JP, & Walker JT (2000 May 16). Characterization of atmospheric ammonia emissions from swine waste storage and treatment lagoons. *Journal of Geophysical Research*, 105(D9): 11535-11545.

Aneja VP & Schlesinger WH (2008 September). Introduction: A special issue of JA&WMA on agricultural air quality: State of the science. *Journal of the Air & Waste Management Association*, 58(9): 1113-1115.

Aneja VP, Schlesinger WH, & Erisman JW (2008 July). Farming pollution. *Nature Geoscience*, 1: 409-411.

- Aneja VP, Schlesinger WH, & Erisman JW (2009). Effects of agriculture upon the air quality and climate: Research, policy, and regulations. *Environmental Science & Technology*, 43(12): 4234-4240.
- Aneja VP, Schlesinger WH, Niyogi D, Jennings G, Gilliam RE, Knighton CS, Duke JB, & Krishnan S (2006 January 17). Emerging national research needs for agricultural air quality. *Eos, Transactions, American Geophysical Union*, 87(3): 25, 29.
- Aneja VP, Wang B, Tong DQ, Kimball H, & Steger J (2006 August). Characterization of major chemical components of fine particulate matter in North Carolina. *Journal of the Air & Waste Management Association*, 56: 1099-1107.
- Aschbacher PW (1973 April). Air pollution research needs: Livestock production systems. *Journal of the Air Pollution Control Association*, 23(4): 267-272.
- Baek BH & Aneja VP (2004). Measurement and analysis of the relationship between ammonia, acid gases, and fine particles in eastern North Carolina. *Journal of Air and Waste Management Association*, 54: 623-633.
- Baek BH, Aneja VP, & Tong Q (2004). Chemical coupling between ammonia, acid gases, and fine particles. *Environmental Pollution*, 129: 89-98.
- Blunden J & Aneja VP (2008). Characterizing ammonia and hydrogen sulfide emissions from a swine waste treatment lagoon in North Carolina. *Atmospheric Environment*, 42: 3277-3290.
- Blunden J, Aneja VP, & Westerman PW (2008). Measurement and analysis of ammonia and hydrogen sulfide emissions from a mechanically ventilated swine confinement building in North Carolina. *Atmospheric Environment*, 42: 3315-3331.
- Brook RD, Brook JR, & Pajagopalan S (2003 February). Air pollution: The "Heart" of the problem. *Current Hypertensions Reports*, 5(1): 32-39.
- Brunekreff B, Janssen NA, de Hartog JJ, Oldenwening M, Meliefste K, Hoek G, Lanki T, Timonen KL, Vallius M, Pekkanen J, & Van Grieken R (2005 January). Personal, indoor, and outdoor exposures to PM_{2.5} and its components for groups of cardiovascular patients in Amsterdam and Helsinki. *Research Report of the Health Effects Institute*, 127: 1-70; discussion 71-79.
- Carew R (2010 August). Ammonia emissions from livestock industries in Canada: Feasibility of abatement strategies. *Environmental Pollution*, 158(8): 2618-2626.
- Costanza JK, Marcinko SE, Goewert AE, & Mitchell CE (2008, July 15). Potential geographic distribution of atmospheric nitrogen deposition from intensive livestock production in North Carolina, USA. *The Science of the Total Environment*, 398 (1-3): 76-86.
- Durham JL, Overton JH Jr., & Aneja VP (1981). Influence of gaseous nitric acid on sulfate production and acidity in rain. *Atmospheric Environment*, 15(6): 1059-1068.

- Galloway JN, Burke M, Bradford GE, Naylor R, Falcon W, Chapagain AK, Gaskell JC, McCullough E, Mooney HA, Oleson KL, Steinfeld H, Wassenaar T, & Smil V (2007 December). International trade in meat: the tip of the pork chop. *Ambio*, 36(8): 622-629.
- Galloway JN, Townsend AR, Erismann JW, Bekunda M, Cai Z, Freney JR, Martinelli LA, Seitzinger SP, & Sutton MA (2008). Transformation of the nitrogen cycle: Recent trends, questions and potential solutions. *Science*, 320: 889-892.
- Gerber PJ, Vellinga TV, & Steinfeld H (2010 February). Issues and options in addressing the environmental consequences of livestock sector's growth. *Meat Science*, 84(2): 244-247. Epub 2009 October 20.
- Gruber N & Galloway JN (2008 January 17). An Earth-system perspective of the global nitrogen cycle. *Nature*, 451: 293-296.
- Hazell P & Wood S (2008 February 12). Drivers of change in global agriculture. *Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences*, 363(1491): 495-515.
- Ibusuki T & Aneja VP (1984). Mass transfer of NH₃ into water at environmental concentrations. *Chemical Engineering Science*, 39(7-8): 1143-1153.
- Howarth RW (2004). Human acceleration of the nitrogen cycle: drivers, consequences, and steps toward solutions. *Water Science and Technology: A Journal of the International Association on Water Pollution Research*, 49(5-6): 7-13.
- Jongbloed AW & Lenis NP (1998 October). Environmental concerns about animal manure. *Journal of Animal Science*, 76(10): 2641-2648.
- Jongebreur AA & Monteny GJ (2001 November 27). Prevention and control of losses of gaseous nitrogen compounds in livestock operations: A review. *The Scientific World Journal*, 1(Suppl 2): 844-851.
- Kanwardeep S, Bajwa S, Arya SP, & Aneja VP (2008 September). Modeling studies of ammonia dispersion and dry deposition at some hog farms in North Carolina. *Journal of the Air & Waste Management Association*, 58: 1198-1207.
- Krupa SV (2003). Effects of atmospheric ammonia (NH₃) on terrestrial vegetation: A review. *Environmental Pollution*, 124(2): 179-221.
- McCulloch RB, Few GS, Murray GC Jr., & Aneja VP (1998). Analysis of ammonia, ammonium aerosols and acid gases in the atmosphere at a commercial hog farm in eastern North Carolina, USA. *Environmental Pollution*, 102(S1): 263-268.
- McMurry PH, Shepherd MF, & Vickery JS (Eds) (2004). *Particulate matter science for policy makers*. Cambridge: Cambridge University Press.
- Muehling AJ (1970 April). Gases and odors from stored swine wastes. *Journal of Animal Science*, 30(4): 526-531.

- National Research Council. Subcommittee on Ammonia. Committee on Medical and Biologic Effects of Environmental Pollutants (1977 November). *Ammonia*. Washington, DC: National Academies Press.
- National Research Council. Ad Hoc Committee on Air Emissions from Animal Feeding Operations. Committee on Animal Nutrition (2002). *The scientific basis for estimating air emissions from animal feeding operations: Interim report / Ad Hoc Committee on Air Emissions from Animal Feeding Operations, Committee on Animal Nutrition, Board on Agriculture and Natural Resources, Board on Environmental Studies and Toxicology, Division on Earth and Life Studies, National Research Council of the National Academies*. Washington, DC: National Academies Press.
- National Research Council. Ad Hoc Committee on Air Emissions from Animal Feeding Operations (2003). *Air emissions from animal feeding operations: Current knowledge and future needs / Ad Hoc Committee on Air Emissions from Animal Feeding Operations, Committee on Animal Nutrition, Board on Agriculture and Natural Resources, Board on Environmental Studies and Toxicology, Division on Earth and Life Studies, National Research Council of the National Academies*. Washington, DC: National Academies Press.
- Naylor R, Steinfeld H, Falcon W, Galloway J, Smil V, Bradford E, Alder J, & Mooney H (2005 December 9). Losing the links between livestock and the land. *Science*, 310(5754): 1621-1622.
- Overton JH Jr., Aneja VP, & Durham JL (1979). Production of sulfate in rain and raindrops in polluted atmospheres. *Atmospheric Environment*, 13: 355-367.
- Pope CA 3rd (2000 August). Epidemiology of fine particulate air pollution and human health: Biologic mechanisms and who's at risk? *Environmental Health Perspectives*, 108(Suppl 4): 713-723.
- Pope CA 3rd (2000 Winter). What do epidemiologic findings tell us about health effects of environmental aerosols? *Journal of Aerosol Medicine*, 13(4): 335-354.
- Pope CA 3rd, Ezzati M, & Dockery DW (2009 January 22). Fine-particulate air pollution and life expectancy in the United States. *The New England Journal of Medicine*, 360(4): 376-386.
- Pope CA 3rd, Thun MJ, Namboodiri MM, Dockery DW, Evans JS, Speizer FE, & Heath CW Jr. (1995 March). Particulate air pollution as a predictor of mortality in a prospective study of U.S. adults. *American Journal of Respiratory and Critical Care Medicine*, 151(3 Pt 1): 669-674.
- Rotz CA (2004). Management to reduce nitrogen losses in animal production. *Journal of Animal Science*, 82(E-Suppl): E119-137.
- Schlesinger WH (2009 January 6). On the fate of anthropogenic nitrogen. *Proceedings of the National Academy of Sciences of the United States of America*, 106(1): 203-208.

- Schlesinger WH (2010). On fertilizer-induced soil carbon sequestration in China's croplands. *Global Biology Change*, 16: 849-850.
- Schlesinger WH, Reckhow KH, & Bernhardt ES (2006). Global change: The nitrogen cycle and rivers. *Water Resources Research*, 42: WO3SO6.
- Sherlock RR, Sommer SG, Khan RZ, Wood CW, Guertal EA, Freney JR, & Dawson CO (2002 September-October). Ammonia, methane, and nitrous oxide emission from pig slurry applied to a pasture in New Zealand. *Journal of Environmental Quality*, 31(5): 1491-1501.
- Stephen K & Aneja VP (2008). Trends in agricultural ammonia emissions and ammonium concentrations in precipitation over the Southeast and Midwest United States. *Atmospheric Environment*, 42: 3238-3252.
- Stombaugh DP, Teague HS, & Roller WL (1969 June). Effects of atmospheric ammonia on the pig. *Journal of Animal Science*, 28(6): 844-847.
- United States. Environmental Protection Agency. Science Advisory Board (2011, August). *Reactive nitrogen in the United States: An analysis of inputs, flows, consequences, and management options: A report of the EPA Science Advisory Board*. Washington, DC: United States Environmental Protection Agency, Office of the Administrator, Science Advisory Board. Electronic publication retrieved 5-31-2012 from: <http://permanent.access.gpo.gov/gpo21530/EPA-SAB-11-013-unsigned.pdf>
- Voorburg JH (1991 September). Pollution by animal production in The Netherlands: Solutions. *Revue Scientifique et Technique (International Office of Epizootics)*, 10(3): 655-668.
- Webb J, Menzi H, Pain BF, Misselbrook TH, Dämmgen U, Hendriks H, & Döhler H (2005 June). Managing ammonia emissions from livestock production in Europe. *Environmental Pollution*, 135(3): 399-406.
- Wolter M, Prayitno S, & Schuchardt F (2004 December). Greenhouse gas emission during storage of pig manure on a pilot scale. *Bioresource Technology*, 95(3): 235-244.
- Wu S-Y, Hu J-L, Zhang Y, & Aneja VP (2008). Modeling atmospheric transport and fate of ammonia in North Carolina – Part II: Effect of ammonia emissions on fine particulate matter formation. *Atmospheric Environment*, 42: 3437-3451.
- Wu S-Y, Krishnan S, Zhang Y, & Aneja VP (2008). Modeling atmospheric transport and fate of ammonia in North Carolina – Part I: Evaluation of meteorological and chemical predictions. *Atmospheric Environment*, 42: 3419-3436.
- Zhang Y, Wu S-Y, Krishnan S, Wang K, Queen A, Aneja VP & Arya SP (2008). Modeling agricultural air quality: Current status, major challenges, and outlook. *Atmospheric Environment*, 42: 3218-3237.

II. Articles

A. Articles re: Impact of CAFOs on Neighbors and the Environment

Beeman P (2008 September 23). Large ag facilities cut profit for towns, study says. *Des Moines Register*: 1A, 11A.

Editorial Staff (2008 May 31). The worst way of farming. *New York Times*: Retrieved 5-31-12 from: http://www.nytimes.com/2008/05/31/opinion/31sat4.html?_r=1&ref=opinion

Martin RP (2008 May 10). Big farms can be bad for your health. *The Salt Lake Tribune*: Retrieved 5-31-2012 from: http://www.sltrib.com/opinion/ci_9211626

Watson B (2011 June 19). No exemption for poisons. *Cedar Rapids Gazette*: 11A.

B. Articles re: Problems With CAFO Operations

Berg L (2012 February 8). Manure pit foaming remains a perplexing mystery. *National Hog Farmer*. Retrieved 5-24-2012 from: <http://nationalhogfarmer.com/environment/manure-pit-foaming-remains-perplexing-problem>

Earthweek (2012 March 23). Mysterious foam causing hog farm blasts in midwest. *Earthweek*. Retrieved 5-24-2012 from: <http://www.earthweek.com/2012/ew120323/ew120323e.html>

Keim B (2012 March 13). Mysterious hog farm explosions stump scientists. *Wired Science*. Retrieved 5-24-2012 from: <http://www.wired.com/wiredscience/2012/03/hog-manure-foam/>

Lachmann M & Parrott T (2011). Manure nutrient composition of foaming and non-foaming deep-pit swine manure storage systems – Case study. *Land of Lakes Purina Feed LLC Swine Technical Bulletin*. Retrieved 5-24-2012 from: <http://fivestarcoop.com/images/e0023601/EcoCareTechBulletin.pdf>

Philpott T (2012 February 9). The mystery of exploding pig poop. *Mother Jones*. Retrieved 5-24-2012 from: <http://www.motherjones.com/tom-philpott/2012/02/explosive-hog-farm-manure-foam>

Schmidt D (2011 January 6). Manure pit foaming. Presentation to the Iowa Applicators Meeting. Retrieved 4-20-2012 from: http://www.mnpork.com/producers/documents/Pit_2011_000.pdf

Thorstensen H (2012 February 2). U of M team continues to study foam in manure pits. *AgriNews*. Retrieved 5-24-2012 from: <http://www.agrinews.com/u/of/m/team/continues/to/study/foam/on/manure/pits/story-4276.html>

Vansickle J (2012 March 15). Watch out for foaming manure: When ignited, manure foam can turn into fire and explosion. *National Hog Farmer*. Retrieved 5-21-2012 from: http://nationalhogfarmer.com/mag/farming_watch_foaming_manure

Watson B (2000 January-February). Is the pork you eat raised in a sewer? *Countryside & Small Stock Journal*, 84(1): 73-76.

Watson B & Stone L (2012 March 8). One fact is inescapable when it comes to manure pit foam, fires [Letter to the editor]. *AgriNews*: A7.

Willette JK (2010 April 1). Foam in manure pits is a perplexing problem. *AgriNews*. Retrieved 4-20-2012 from:
<http://www.agrinews.com/foam/in/manure/pits/is/a/perplexing/problem/story-2207.html>

Willette JK (2011 February 18). Foaming manure mystery remains unsolved. *AgriNews*. Retrieved 4-20-2012 from:
<http://www.agrinews.com/foaming/manure/mystery/remains/unsolved/story-3281.html>

C. Articles re: Toxic & Greenhouse Gas Emissions from Agriculture (CAFOs et al).

Eating beef 'is less green than driving.' (2007, July 19). *The Telegraph*: Retrieved 5-31-2012 from: <http://www.telegraph.co.uk/news/uknews/1557846/Eating-beef-is-less-green-than-driving.html>

Tennesen M (2010 June 21). Sour showers: Acid rain returns – This time it is caused by nitrogen emissions. *Scientific American*, . Retrieved 5-18-2012 from:
<http://www.scientificamerican.com/article.cfm?id=acid-rain-caused-by-nitrogen-emissions>