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The Honorable Henry A. Waxman
Ranking Member
Committee on Energy and Commerce
U.S. House of Representatives
Washington, DC 20515

The opinions expressed herein are our own and do not necessarily reflect the views of The Johns Hopkins University.

RE: Scientific Evidence of Adverse Health Effects Linked to Rural Particulate Matter

Dear Representative Waxman,

We are researchers and policy analysts at The Johns Hopkins Center for a Livable Future (CLF) and the Bloomberg School of Public Health actively engaged in investigating the impacts of industrial agriculture on human health and environmental quality. Because of our work, we are concerned by the Farm Dust Regulation Prevention Act (H.R. 1633), which would broadly exempt rural particulate matter (PM) from regulation under the Clean Air Act (CAA). The CLF, as an academic research center within The Johns Hopkins University, is concerned that this legislation and the arguments made by its supporters do not reflect current scientific knowledge about the health effects linked to rural PM exposure. Furthermore, while important uncertainties remain about the health risks posed by exposure to rural PM, a wholesale exemption of this pollutant from CAA regulation does not represent a rational scientific approach to these uncertainties. We have prepared this letter to discuss a scientific approach to the regulation of rural PM and to provide members with an overview of the scientific literature regarding the health effects of rural PM exposure.

The Subcommittee on Energy and Power conducted a hearing on the Farm Dust Regulation Prevention Act on October 25, 2011. While observing that hearing, we noted a number of statements made by supporters of the legislation that either did not reflect available scientific knowledge about exposure to PM in rural areas or did not reflect the approach to uncertainty that responsible scientists would take in investigating a problem and drawing conclusions. A representative of the National Cattlemen's Beef Association testified, "there has been no evidence

of adverse health effects from dust at ambient levels."[1] A representative of the American Farm Bureau Federation claimed, "there are few relevant studies on the health effects of exposure to coarse PM." The Farm Bureau representative also cited an EPA document that concluded, "available evidence is inadequate to infer a causal relationship between long-term PM10-2.5 exposures [exposures to PM between 2.5 and 10 micrometers (µm) in diameter] and various health effects."[2] Both used these statements and others to justify their support for the legislation, which would effectively exempt rural PM from CAA regulation regardless of current or future scientific evidence.

These statements neglect current scientific understanding of the health effects associated with rural PM exposure derived from studies of on-farm exposures. Under the CAA, PM refers to a diverse category of pollutants that includes a wide array of particles less than 10 µm in diameter. For example, PM originating at food animal production facilities in several regions has been found to include tiny particles of dirt, feces, dried urine, feathers, dander, chemicals, bacteria, endotoxins (toxins produced by certain types of bacteria), pollen and other allergens, and other biologically-active materials. Studies have shown that these materials, when inhaled, can have a range of serious adverse health effects. The diverse nature of rural PM and the range of adverse health effects associated with exposure to rural PM suggest that a blanket exemption of rural PM from regulation under the CAA does not reflect scientific knowledge about the public health risks posed by rural PM exposure.

While gaps exist in the literature relating concentrations of particulate matter in rural communities to concentrations measured on farms, multiple studies have concluded that PM can be transported from agricultural sources to rural communities, and that members of these communities can be exposed to PM at levels that can cause adverse health effects. Additional studies are needed to better characterize the transport of PM from agricultural sites into surrounding communities, and to develop our understanding of the health risks posed by rural PM exposure. Because of this need, a decision to exempt rural particulate matter from CAA regulation would be premature and may place rural communities at risk in the absence of data showing that rural PM exposure *does not* lead to adverse health effects.

Scientifically-valid approaches to managing gaps in scientific data include either *temporarily* delaying the regulation of rural PM until additional data can be collected, or regulating rural PM now on the basis of existing evidence rather than waiting for additional data in the form of increased morbidity and mortality associated with exposure to rural PM. Given current and accumulating evidence regarding the public health risks posed by rural PM exposure, we believe that the latter

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[1] "Testimony of Steve Foglesong, Rancher, Black Gold Ranch, Astoria, Illinois," accessed October 31, 2011, http://republicans.energycommerce.house.gov/Media/file/Hearings/Energy/102511/Foglesong.pdf

[2] "Statement of the American Farm Bureau Federation," accessed October 31, 2011, http://republicans.energycommerce.house.gov/Media/file/Hearings/Energy/102511/Rogers.pdf

approach would be more responsible. EPA has apparently chosen the former approach, announcing that it has no plans to regulate farm dust.[3] In contrast to these approaches, the legislation does not account for current or future knowledge of health risks posed by rural PM exposure, and rather enacts a permanent exemption of rural PM from CAA regulation. This approach is not supported by the scientific evidence or good professional judgment, and is not scientifically defensible.

The remainder of this letter outlines current scientific evidence about the health effects caused by exposure to rural PM *generated from agricultural activities* (a category of PM that would be exempted from CAA regulation by this bill), and the evidence that rural communities located in close proximity to agricultural sites can experience exposures at levels that cause adverse health effects. Together, these provide an overview of the scientific knowledge about the public health effects associated with rural PM exposure, and demonstrate why an exemption of rural PM from CAA regulation does not reflect conclusions that may be drawn from scientific studies and would therefore be irresponsible.

Health Effects

American Thoracic Society. 1998. "Supplement: American Thoracic Society: Respiratory Health Hazards in Agriculture." Report of the American Thoracic Society.

Key findings: Farm dust includes tiny bits of rock, as well as disease-causing agents such as molds and spores, pathogenic bacteria, and toxins produced by microorganisms. Exposure to these agents can cause serious health problems, including airway inflammation, bronchitis, and asthma.

This review by the medical section of the American Lung Association covers a host of respiratory health effects associated with exposure to inorganic and organic farm dust. The use of heavy machinery for tilling and harvesting, among other agricultural activities, may generate large clouds of dust. The inhalation of inorganic materials found in farm soil dust, such as quartz, has been associated with respiratory disease. Other hazards, such as pesticide residues and other organic molecules, can adhere to inorganic materials such as clay, causing exposure to both the inorganic dusts and the attached hazards. Organic dust generated from agricultural activities may be comprised of numerous disease-causing agents, including molds and spores, mycotoxins (toxins produced by certain fungi), pathogenic bacteria, and endotoxins (toxins produced by certain bacteria). Exposure to microorganisms via inhalation of farm dust is responsible for a host of respiratory effects, including acute airway inflammation, bronchitis, organic dust toxic syndrome, occupational asthma, and hypersensitivity pneumonitis.

[3] Andrew Restuccia, "EPA Will Not Tighten Farm Dust Standards," *The Hill*, October 17, 2011. Accessed November 1, 2011. http://thehill.com/blogs/e2-wire/e2-wire/187927-epa-we-will-not-tighten-farm-dust-standards.

Heederik, Dick, Torben Sigsgaard, Peter S. Thorne, et al. 2007. "Health Effects of Airborne Exposures from Concentrated Animal Feeding Operations." *Environmental Health Perspectives* 115: 298-302.

Key findings: PM generated from food animal production activities can cause decreased lung function, inflammation, and asthma. More research is needed to better understand the risks such PM poses.

This review was produced by a working group on the health effects of airborne exposures from concentrated animal feeding operations (CAFOs) convened at a scientific conference on the environmental health impacts of CAFOs held in Iowa City. The authors reviewed studies of several air pollutants associated with CAFOs, including PM that included allergens and endotoxins. These hazards are associated with adverse health effects in workers and in communities near CAFOs. These effects include reduced lung function, inflammation, and increased incidence and severity of asthma. The authors also acknowledged the existence of uncertainties about exposure to CAFO air pollutants, including PM, and urged additional research to understand potential public health risks.

Kirkhorn, Steven R., and Vincent F. Garry. 2000. "Agricultural Lung Diseases." *Environmental Health Perspectives* 108: 705-712.

Key findings: Dusts generated by crop and food animal production comprise many different materials, including feces, bacteria, and other hazards. These can be transported farms to rural communities and cause serious lung diseases, including bronchitis, pneumonia, and viral infections.

Kirkhorn and Garry surveyed studies of air pollutants associated with crop and food animal production, including organic and inorganic dusts. Inorganic dust includes particles of rock that contain silica. These can be inhaled by workers and have been shown to cause bronchitis and restrictive lung disease. Organic dust is typically more hazardous and comprises complex mixtures of vegetable product, insect fragments, animal dander, bird and rodent feces, microorganisms, endotoxins, and pollens.

Each constituent of organic dust is associated with different human health effects. Insect fragments, microorganisms (e.g., fungal molds and bacteria), and pollens are common allergens associated with a range of responses from upper respiratory allergies to bronchial hyperactivity (which can lead to asphyxiation) and asthma. Endotoxins can cause bronchoconstriction (constriction of smooth muscle surrounding the lung, leading to coughing, wheezing, and shortness of breath), deterioration of pulmonary function, and various chronic respiratory conditions. Microorganisms attached to organic dust can reach and infect human populations, causing a variety of diseases. For example, *Coxiella burnetti* can be spread over half a mile from farms and cause Q fever, a rare pneumonia. Sin Nombre virus, a hantavirus spread through the aerosolization of rodent urine, saliva, and droppings found in dust, can cause hantavirus pulmonary syndrome, which can rapidly

progress to respiratory failure, requiring mechanical ventilation. Other potential constituents of organic dust include biologically active proteins that can cause allergic reactions and inflammation. Chemicals (e.g., ammonia) can attach to dust and penetrate deeper into the lungs than the chemicals could otherwise.

Omland, Oyvind. 2002. "Exposure and Respiratory Health in Farming in Temperate Zones—A Review of the Literature." *Annals of Agricultural and Environmental Medicine* 9: 119-136.

Key findings: PM generated by food animal production facilities has been linked to decreased lung function and asthma in farmers and agricultural workers.

Omland identified food animal production facilities—particularly poultry houses—as major sources of organic farm dust. Exposure to organic dust generated from agricultural activities has been linked to reduced lung function, while exposure to both organic and inorganic dust has been associated with increased risk of asthma among farmers and exposed workers. Some research discussed by Omland suggested that inhalation of grain dust may impact respiratory health, particularly among female smokers, but these effects were not consistently demonstrated. Other materials that may comprise farm dust, such as animal dander, pollen and mites, have also been identified as risk factors for asthma.

Exposures at Ambient Concentrations

Williams, D'Ann L., Patrick N. Breysse, Meredith C. McCormack, et al. 2011. "Airborne Cow Allergen, Ammonia, and Particulate Matter at Homes Vary with Distance to Industrial Scale Dairy Operations: An Exposure Assessment." *Environmental Health* 10: 72-80.

Key findings: The presence of dairy operations can increase ambient concentrations of PM in rural communities. This PM contains allergens and may contain other hazardous agents that can cause serious adverse health effects.

Williams, et al. used air monitoring to compare the ambient concentrations of PM within ¼-mile of a dairy operation in Yakima Valley of Washington State to ambient concentrations of PM more than three miles away from a dairy operation. The researchers found significantly higher concentrations of PM near dairy operations than farther away, suggesting that dairy operations are a significant source of PM in rural areas where dairy production occurs. The study also found higher ambient concentrations of cow allergen, a common biological component of dairy-related PM, near dairy operations. This suggested that elevated concentrations of other biological materials commonly associated with PM could also be found in areas near dairy operations, although the study had not been designed to measure these. These materials include chemical agents, endotoxins, antibiotics, and microorganisms.

Schinasi, Leah, Horton, Rachel A., Guidry, Virginia T., Wing, Steve, Marshall, Stephen W., and Kimberly B. Morland. 2011. "Air Pollution, Lung Function, and Physical Symptoms in Communities Near Concentrated Swine Feeding Operations." *Epidemiology* 22: 208-215.

Key findings: Food animal production facilities in North Carolina generate large amounts of PM. Residents of communities sited downwind from these facilities experienced odors, wheezing, breathing difficulties, and eye, skin, and nasal irritation as a result.

Schinasi, et al. examined the relationship between monitored ambient concentrations of PM_{10} (PM with diameters of 10 µm or less) and incidence of respiratory, gastrointestinal, neurological and other conditions, including irritation, in communities downwind from industrial swine operations. To examine the potential effects of brief exposures to ambient concentrations of rural particulate matter, local residents kept diaries of odors and health-related symptoms experienced after spending 10 minutes outdoors. The study authors found that reports of odors by residents tracked well with increases in ambient PM_{10} concentrations measured by air monitors. In addition, analyses conducted by the investigators demonstrated strong statistical associations between one-hour measurements of ambient PM_{10} by air monitors and increases in the frequency of eye and skin irritation reported by residents. The investigators also found statistically significant relationships between 12-hour ambient measurements of PM_{10} and respiratory outcomes including wheezing, difficulty breathing, and eye and nasal irritation. The Schinasi study constitutes an epidemiologic study correlating measurements of PM_{10} ambient concentrations with health outcomes in communities sited downwind from large-scale swine operations, and concludes that PM_{10} was associated with increases in respiratory conditions and irritation.

Conclusion

The Farm Dust Regulation Prevention Act does not take account of the available scientific knowledge on public health risks posed by exposure to rural PM. A large peer-reviewed literature has associated occupational exposure to rural PM with serious adverse health effects, and a growing peer-reviewed literature has associated off-farm exposure to rural PM with serious adverse health effects as well. While important data gaps remain, these in no way suggest that rural PM should be exempted from CAA regulation. Rather, they suggest that remaining uncertainties should be reduced through careful scientific investigation. While the Farm Dust Regulation Prevention Act suggests that rural PM may be regulated in geographic areas where, among other things, EPA can show that rural PM "causes substantial adverse public health and welfare effects at ambient concentrations" in that area, it would be infeasible for the agency to make this showing in every jurisdiction where rural PM should be regulated to protect the public health. Rather than ensure that regulation of rural PM is based on science, this legislation would prohibit EPA from utilizing current and future scientific knowledge to protect rural communities from PM exposure.

We hope that our letter will prove useful to members as Congress considers the Farm Dust Regulation Prevention Act. Furthermore, we hope that you and other members will not hesitate to have your staffs contact the CLF with questions about this letter or the legislation. We would be more than happy to provide electronic or hard copies of any of the studies mentioned here. Furthermore, as an academic center focused on the effects of food systems on public health and the environment, the CLF is ready and willing to assist members with questions about food systems, including food production and industrialized agriculture, as well. Please let us know if we can be of assistance.

Sincerely,

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