Executive Summary

The Potential Health Impact of a Proposed Poultry Litter-to-Energy Facility in Shenandoah Valley, Virginia

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Introduction

The Shenandoah Valley in northwestern Virginia is a rural community located between two mountain ranges and the Potomac and James Rivers. Agriculture is a major economic and cultural influence in the area and residents pride themselves on the natural and undisturbed beauty inherent in the land. The area is among the Commonwealth's largest producers of poultry, but the litter produced by poultry farms is an environmental concern. The Valley lies within the environmentally vulnerable Chesapeake Bay watershed, an estuary spanning through six states and the District of Columbia that has struggled with water pollution. The Environmental Protection Agency (EPA) has mandated the states to reduce pollutants entering the impaired water bodies and tributaries that drain into the Bay.

The litter produced by poultry farms has high nutrient content (specifically nitrogen and phosphorus) and is used by crop farmers in the area as an inexpensive fertilizer. Runoff from excess nutrients on these properties can contribute to phosphorus and nitrogen pollution of water bodies, and the consequences could be large given the volume of livestock manure produced in the Valley. In 2011, the area produced approximately 345,000 tons of poultry litter, virtually all of which was used as fertilizer.

One alternative to managing excess nutrients that has been proposed is to use poultry litter as a fuel in a combustion process to produce electricity. At the time this Health Impact Assessment began, an energy company, Fibrowatt LLC, had proposed building a poultry litter-to-energy facility in the Shenandoah Valley that would use poultry litter and wood as its fuel. Using litter as fuel in a combustion process typically results in air emissions of nitrogen with the phosphorus and other nutrients left in the ash byproduct. This byproduct weighs significantly less and can more easily be transported out of the watershed to regions where phosphorus fertilizers are needed—thereby reducing the amount of excess nutrients in the Valley. Such a facility would provide poultry farmers with an alternative litter management option and local crop farmers would use commercial

fertilizer or other livestock manures as an alternative.

Whether this solution is indeed better for the environment or public health is uncertain. Although data from similar facilities in Benson, Minnesota and England provide some clues to the potential local impact, the company did not publicly disclose details of the proposed Virginia facility (including the intended location). Approval for the facility would be required at the local level by the county board of supervisors followed by approval at the state level by the Virginia Department of Environmental Quality (DEQ). The DEQ air permitting process is the only opportunity to analyze potential health impacts that is currently planned and this would only address impacts from air emissions. The sequence of these decisions and the timing of the analysis on air emissions would not allow local officials to make a decision based on an unbiased assessment of the impact on health. In 2011, the Page County Board of Supervisors issued a ruling denying any future request to construct a facility, leaving three counties as possible locations.

The decision made by these counties on how to manage poultry litter could affect social, economic and environmental factors that impact health. In preliminary community meetings, residents and environmental groups expressed concerns about effects of the potential facility on health and the area economy. The idea encountered highly vocal opposition in the Valley but received support from the governor. The facility was mentioned in the state's plan to meet EPA standards and state environmental officials began evaluating the environmental impacts. The competing stakeholder interests and the relative inattention to health outcomes made this decision an ideal topic for a health impact assessment (HIA). Our assessment was funded in 2011 by the Health Impact Project, a collaboration of the Robert Wood Johnson Foundation and The Pew Charitable Trusts.

Scoping

The research was completed by the Virginia Commonwealth University (VCU) Center on Human Needs (CHN) in collaboration with the VCU Center for Environmental Studies and technical assistance from Human Impact Partners. The research plan was guided by a group of interested and engaged stakeholders that included Valley communities, agency staff, and environmental advocacy groups.

In order to determine the health impacts that were of utmost priority to stakeholders, CHN held public meetings with local residents and stakeholders and met with staff at the Virginia Department of Conservation and Recreation and the DEQ, including those responsible for air modeling and the evaluation of poultry litter-to-energy regulations. An HIA advisory panel composed of local residents and interested advocacy groups was also formed to provide feedback on the HIA and prioritize research questions. The following issues/areas of concern were prioritized in the HIA:

- Air quality
- Water quality
- Poultry/Agriculture employment
- Truck traffic
- Alternative manure-to-energy technologies
- The Shenandoah National Park

Assessment methods included:

- Air modeling
- Review of secondary data (such as U.S. Census Bureau, U.S. Department of Agriculture, Virginia Department of Health)
- Focus group and key interviews with poultry farmers and litter brokers
- Review of the relevant literature
- Quantitative modeling of truck mileage

Assessment

Air Quality

The combustion of poultry litter would produce emissions of nitrogen and sulfur oxides and fine particulate matter (PM2.5)—each of which has been linked with an increased risk of respiratory and cardiovascular symptoms and with higher mortality rates. **Due to the terrain and meteorological conditions of the Valley, the location of the facility has a significant effect on the impact to air quality.** Air modeling for six potential locations indicates that the highest concentrations of pollutants would be from a facility sited in the northernmost location on our list. This was at the Augusta/Rockingham County border, near the intersection of Interstate 81 and Route 11. Even in that location, predicted levels of nitrogen oxides and sulfur oxides would not approach the EPA's standards signifying a health risk.

However, the emission of PM2.5 could pose a greater risk, because a narrow margin separates the current concentrations of PM 2.5 and the EPA's annual average standard. Although the increase in fine particulate matter predicted by our model would still not exceed the EPA's standard—even in the northernmost location where the model predicts the greatest air pollution levels—the narrow margin would leave little room for further development. In addition, physicians and public health experts that advise the EPA on these decisions suggest that health could be impacted at concentrations even lower than the EPA standard; concentrations, so low, in fact, that **the Valley has already exceeded them in several of the past five years**.

Storage and handling of litter can also impact airborne release of ammonia-nitrogen. Inhalation can induce airway irritation, and deposition in soil or water bodies can affect local ecosystems. Ammonia can also react with atmospheric nitrogen and sulfur oxides to form PM2.5. Removing poultry litter from the supply of fertilizer may result in a decrease in the amount of ammonia-nitrogen released into the Valley atmosphere. However, we found inadequate evidence to conclude that a reduction in ammonia-nitrogen levels from fertilizer application would meaningfully affect airborne concentrations of particulate matter.

A widely used feed additive in poultry production that contains arsenic, which the manufacturer voluntarily removed from the market in 2011, poses the theoretical risk that combustion of litter produced by poultry exposed to this additive could result in the emission of arsenic, a carcinogen. There is no EPA-designated safe level of arsenic concentration in the air. Any increase in concentration will result in an increase in risk. As with other potential air pollutants, our modeling suggests that the highest concentrations of arsenic would be produced by a facility in the northernmost location of

the Valley, but **even this concentration would result in a very small increase in risk of cancer development**. Moreover, the manufacturer's removal of the product from the market reduces the likelihood of arsenic exposure as a tenable risk from the facility. We are unable to conclude whether arsenic deposition from air emissions of the facility would result in a significant increase in arsenic concentration in the Valley soil.

Water Quality

Sampling of well water in Augusta and Rockingham Counties show evidence of potential contamination from fertilizer practices including elevated concentrations of nitrates, E. Coli, coliform bacteria, and sediments. Exposure to pollutants through drinking water are associated with health impacts that range from an upset stomach to a condition of impaired oxygen transportation in infants that can be life threatening. Nutrient loading in local water bodies also contribute to algal growth that makes recreational activities such as swimming and fishing unsafe.

The replacement of poultry litter by commercial products as a source of fertilizer eliminates the possibility of bacterial contamination and potentially reduces nutrient contamination. It also improves the health of local water ecosystems, allowing for safe enjoyment of recreational activities.

Cooling towers necessary for the design of the proposed facility provide an environment suitable for Legionella growth. Legionella infection and Legionnaire's Disease is a serious public health threat especially for the elderly population. The risk to the community is small as legionella growth is typically contained though precaution among workers at the facility is advised.

Truck Traffic

Truck traffic can impact health through three main pathways. First, traffic is a significant contributor to the deterioration of air quality and heavy trucks, because of high individual emissions rates and long travel times, have a disproportionately large impact. Second, automobile accidents that involve heavy trucks are more likely to result in fatalities than other passenger cars. A change in the amount of trucks on the road will have a resulting change in the risk of traffic fatalities. Finally, the impact on community noise is typically higher for a heavy truck than it is for passenger cars. This impact is magnified near a centralized meeting location for trucks such as the one created by a new poultry litter-to-energy facility. **Community noise is associated with health impacts that range from annoyance to potential stroke, especially for the population 50 years of age or older**.

Because litter that is not used by the farm of origin is often trucked elsewhere for use by other farmers, some located in distant counties, the proposed facility could result in a net reduction in truck traffic. **The most influential factor determining whether truck mileage is reduced according to our model is the willingness of poultry growers to sell their litter to the facility.**

Another important factor is the location of the facility. If Augusta is the hosting county, locating the facility in the northern portion would reduce travel distances from other litter producing counties like Rockingham, Page, and Shenandoah County. However, benefits associated with a reduced truck mileage by locating the facility in the north would have to be weighed against the harm caused by higher concentrations of air pollutants from the

facility in the northern-most location that is suggested by our model.

Employment in poultry and agricultural industries

Employed adults tend to have an improved reported mental and physical health status as well as decreased symptoms, hospitalization, and mortality compared to adults who are unemployed or retired. Having a higher income allows for health promoting assets and activities such as medical care, quality housing and education, child care, more nutritious food, and other benefits.

The proposed energy facility would, according to the company, bring 37 new facility jobs and hundreds of trucking jobs. However, its net effect on truck drivers is unclear because some existing work would be lost due to diminished demand to ship litter elsewhere as fertilizer. Litter brokers—intermediaries who pick up litter from poultry growers, provide storage, and transport it to farms for fertilizer—might also be adversely affected, and crop farmers would see an increase in fertilizer costs related to the loss of poultry litter used for land application.

Alternative manure-to-energy conversion technologies

Large-scale facilities and poultry litter-to-energy conversion technologies in general are not the only options to reduce nutrient concentrations. Smaller conversion units that can be used on the farm offer the potential to reduce nutrient concentration while limiting the amount of litter burned and geographically distributing the emissions across the Valley rather than in one, single source. Both of these aspects could potentially improve air quality. However, smaller units may lack the sophisticated emissions control technology of a larger facility such as 24-hour monitoring and large smoke stacks.

Technologies that convert poultry litter into energy through a variety of thermal and non-thermal reactions are currently available for purchase by individual farmers or a co-operative of farmers. Data are lacking to compare the health and environmental impacts of these on-farm units with litter combustion by a large energy facility. In interviews, poultry farmers were optimistic about the development of these technologies as long as they were capable of recouping the upfront purchasing costs. However, they were also concerned about the additional burden of managing the litter and the technologies, tasks that are largely avoided when selling it as fertilizer or, potentially, to the larger facility. In speaking to farmers that have used the technology, there is also concern about the large litter volumes that might be necessary to produce enough energy to offset the upfront costs.

Shenandoah National Park

The Shenandoah National Park is a significant contributor to the economy of the Valley, providing millions of dollars in salaries and revenue for local businesses. It also provides value to Valley residents and visitors because of its beautiful scenery. This value is partially contingent on the actual and perceived air and water quality of the area. The facility could impact this revenue if it significantly deteriorates the perception of the park as a desirable tourism destination.

Our air model indicates that the park would not likely be affected by nitrogen or sulfur oxides or particulate matter unless the facility is located east of Interstate 81 and north of Staunton.

Recommendations

Recommendations of how to maximize health benefits and minimize health detriments were developed based on the findings. CHN in collaboration with the advisory panel was responsible for their development. The following are a sampling of the seventeen recommendations:

General Recomendations

1. The Central Shenandoah Health District and the Virginia Department of Environmental Quality should become involved early in the process before a site is selected by Fibrowatt and should brief decision-makers about the pros and cons for each site.

Air Quality

2. Fibrowatt, LLC should size the facility so that the poultry litter supply within the Valley is sufficient to constitute the vast majority of the fuel and that the majority of litter comes from nearby the facility.
3. The Virginia Department of Environmental Quality and Fibrowatt, LLC should locate the facility so that air quality in the area does not exceed a PM2.5-annual average of 11 $\mu g/m^3$.
4. The Virginia Department of Environmental Quality should investigate the contribution that ammonia emissions make to the concentration of fine particulate matter in the Valley.

Poultry/Agricultural Employment

5. Before negotiating individual litter purchasing agreements, Fibrowatt, LLC should negotiate for endorsement with a group that represents poultry grower's interests.
6. A committee of local residents and stakeholders should be formed to provide input on strategies to increase local hiring at the facility. Fibrowatt should provide job training for positions that require more technical skill.

Truck Traffic

7. Fibrowatt, LLC and the local board of supervisors should site the facility in a location that not only avoids population density, but in particular avoids the elderly population. Noise barriers such as walls or earthen barriers should be used around the facility as well as any congestion point along the route to the facility.
8. The speed limit of heavy trucks in the Valley should be no more than 55 miles per hour in order to reduce the risk of traffic accidents and fatalities. Fibrowatt, LLC should schedule truck deliveries only during daylight hours and have contingency storage plans for poor weather days.

Alternative Technologies

9. The Virginia Department of Environmental Quality and universities with an interest in this topic should evaluate the health impacts associated with adoption of small, on-farm, poultry litter-to-energy technologies and make their findings public.

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