

AMMONIA – Another Bay Pollutant

By Gary Antonides



Ammonia has been in the news lately because there was a court ruling that Maryland must regulate the gaseous ammonia emitted by animal waste on poultry farms that could land in state waterways. Ammonia has many uses in our daily lives, and its interactions with other substances make its presence in our lives very complicated. It even has the potential to replace carbon based fuel for transportation and power generation. Ammonia as a fuel will be covered in our Winter 2021-22 newsletter.

The court ruling mentioned was by a Montgomery County Circuit Court judge back in March. This is described by Christine Condon of the Baltimore Sun on 3/16/21.

<https://www.baltimoresun.com/news/environment/bs-md-court-decision-gaseous-ammonia-emissions-poultry-farms-eastern-shore-20210316-lplqea7l6iqj3e3h6zpoevjvpy-story.html%20Court%20decision%20will%20require%20Maryland%20to%20regulate%20gaseous%20ammonia%20emissions%20from%20poultry%20farms>

Ammonia vapor is pumped out of industrial chicken houses via exhaust fans. Ammonia breaks down into nitrogen and hydrogen in the environment, and excess nitrogen in waterways causes damaging algae blooms, which can block sunlight and suck up oxygen, creating dead zones devoid of oxygen that are inhospitable to marine life.

Environmental groups had been pushing for the state to monitor and regulate the pollutant from the concentrated animal feeding operations (CAFOs) on the Eastern Shore. But the Maryland Department of the Environment had argued that the gas may not end up polluting bodies of water and could simply settle on land or vegetation, and that regulating gaseous ammonia would be akin to regulating things “as varied as cars and chimneys.” But Abel Russ, a senior attorney at the Environmental Integrity Project, says “The idea that you can’t tell with precision where it goes — I think it’s a red herring because you know enough about where it goes. You know that it doesn’t go very far.”

The Montgomery County Circuit Court Judge, Sharon V. Burrell, found that Maryland law, as an expansion of the federal Clean Water Act, requires the Department of the Environment to control “any liquid, gaseous, solid, or other substance



that will pollute any waters of this State” — including ammonia. Specifically, the ruling compels MDE to include limits on ammonia emissions in the permit requirements for CAFOs.

The court case was partly a result of a study commissioned by the Chesapeake Bay Foundation released in 2019 that estimated that Eastern Shore poultry operations in Maryland emit about 33.8 million pounds of ammonia per year and about 24.4 million pounds of that ammonia is deposited to land and water on the Eastern Shore. The study was cited in the judge’s ruling. The court case was actually brought by Assateague Coastal Trust, which was represented by [Chesapeake Legal Alliance](#).

Ammonia is one of the most widely produced chemicals in the United States. In pure form, it is known as anhydrous (no water) ammonia. Ammonia is also produced in the human body and is commonly found in nature. It is essential in the body as a building block for making proteins and other complex molecules. In nature, ammonia occurs in soil from bacterial processes. It is also produced when plants, animals and animal wastes decay. (https://www.health.ny.gov/environmental/emergency/chemical_terrorism/ammonia_general.htm.)

Ammonia is a colorless, highly irritating gas with a sharp suffocating odor. It dissolves easily in water to form ammonium hydroxide solution which can cause irritation and burns. Most people are exposed to ammonia from breathing its gas or vapors. Ammonia gas is easily compressed and forms a clear, colorless liquid under pressure.



About 80% of the ammonia produced in industry is used in agriculture as fertilizer. Ammonia is also used as a refrigerant gas, to purify water supplies, and in the manufacture of plastics, explosives, fabrics, pesticides, dyes and other chemicals, and is in many household and industrial-strength cleaning solutions

Ammonia gas is lighter than air and will rise, so that generally it does not settle in low-lying areas. However, in the presence of moisture, ammonia forms vapors that are heavier than air. These vapors settle on the ground or bodies of water.

When ammonia enters the body as a result of breathing, swallowing or skin contact, it reacts with water to produce ammonium hydroxide. This chemical is very corrosive and damages cells in the body on contact. Exposure to high concentrations of ammonia in air causes immediate burning of the eyes, nose, throat and respiratory tract and can result in blindness, lung damage or death. Swallowing ammonia can cause burns to the mouth, throat and stomach. Skin or eye contact with concentrated ammonia can also cause irritation and burns.

In the Bay, in addition to breaking down into nitrogen and hydrogen, where the nitrogen causes nutrient over-enrichment, <https://www.epa.gov/wqc/aquatic-life-criteria-ammonia#what> says that some ammonia will persist in aquatic environments and cause direct toxic effects on aquatic life. When ammonia is present in water at high enough levels, it is difficult for aquatic organisms to sufficiently excrete the toxicant, leading to toxic buildup in internal tissues and blood, and potentially death.

Ammonia is a common cause of fish kills according to <https://www.epa.gov/caddis-vol2/ammonia>. However, the most common problems associated with ammonia relate to fish growth, gill condition, organ weights and red blood cell levels.

https://www.health.ny.gov/environmental/emergency/chemical_terrorism/docs/ammonia_tech.pdf describes how ammonia interacts immediately upon contact with available moisture in the skin, eyes, oral cavity, respiratory tract, and particularly mucous surfaces to form the very caustic ammonium hydroxide.

Another article, <https://thefishsite.com/articles/the-impact-of-costal-acidification-to-the-aquaculture-industry>, describes a different effect. As noted, nitrogen causes a bloom in the zooplankton and phytoplankton, but as this small animal and plant matter then decomposes, it results in more carbon dioxide being mixed into the water. This forms carbonic acid, particularly damaging to shellfish.

Professor Li, from the University of Delaware's College of Agriculture and Natural Resources, is working on a project to control nutrient emissions from poultry houses.

[\(https://www.poultryworld.net/Broilers/Housing/2016/2/Controlling-ammonia-emissions-from-poultry-houses-2760421W/\)](https://www.poultryworld.net/Broilers/Housing/2016/2/Controlling-ammonia-emissions-from-poultry-houses-2760421W/). There are several products on the market to control ammonia in poultry houses, such as adding alum to poultry litter. However, Li says the effects of ammonia generated by poultry involves greenhouse gas emissions as well, which had been unappreciated. Li partnered with researchers at the United States Department of Agriculture (USDA), the University of Tennessee and Oklahoma State University for the project and the results of the research were recently published in the Journal of Environmental Quality. They not only looked at the ammonia reduction due to alum, they also looked at how the alum could potentially impact the greenhouse gas emissions. They showed that it reduced a considerable amount carbon dioxide emissions. Because alum is an acidic product, it reduces microbial activity in the litter and reduces the ammonia emissions. Ammonia also comes from uric acid being broken down by bacteria and enzymes. It becomes ammonia and carbon dioxide.

Some farmers already work to mitigate ammonia emissions by planting trees, shrubs and tall grasses near exhaust fans, adding treatments to chicken litter aimed at keeping ammonia levels low, adjusting the diet of the chickens, and by using biofilters. Biofilters work by absorbing noxious gases as they are exhausted from the coops into a biofilm where microorganisms break down the gases into carbon dioxide, water and salts. Environmental advocates say MDE should require these sorts of modifications, which are fairly inexpensive.

In 2018, the Environmental Integrity Project conducted a study that found poultry barns likely emit twice the ammonia that the U.S. Environmental Protection Agency had assumed. A 2019 study by researchers at North Carolina State University found that anywhere from 180 tons to 560 tons of ammonia could be landing in the Chesapeake Bay each year from poultry farms in the Delmarva Peninsula.

The Environmental Integrity Project, a nonprofit advocacy group, found that ammonia emissions have been increasing in part because the number of birds in the Chesapeake Bay region has been increasing, as well as the size of those birds.

The court's decision is a victory for Eastern Shore residents who have long fought for a better regulatory framework for the area's quickly industrializing poultry industry, said Kathy Phillips, executive director of the Assateague Coastal Trust, which brought the suit with the help of the legal alliance. It's a fight that has spanned several years and several similar but unsuccessful court bids. On a few occasions, small battles were won, Phillips said. Worcester County, for instance, has set requirements for the amount and type of vegetation that must be planted by exhaust fans to stymie the flow of gaseous ammonia.