July 1, 2014

Mr. Doug Szenher
Arkansas Department of Environmental Quality
5301 Northshore Drive
North Little Rock, Arkansas 72118

Re: Public Comment—Regulation 5 and Regulation 6 Rulemaking

Subject: Water Quality Issues Relating to CAFOs in the Buffalo River Watershed

Dear Mr. Szenher,

We support the proposed amendments to the Arkansas Pollution Control and Ecology Commission's Regulation 5 and Regulation 6.

In this letter "CAFO" will be used to mean a medium or a large swine confined feeding operation as it relates to both Regulation 5 and Regulations 6. I have included several documents in support of this comment.

It is essential to maintain high water quality in the Buffalo River watershed, not only of the Buffalo River, but of its tributaries, of all surface water, groundwater, springs, and wells. The probability of one CAFO degrading water quality is unacceptably high and if more and more CAFO's are constructed in the watershed, degradation becomes almost a certainty.

The Buffalo River has been designated as an "Extraordinary Resource Water", the highest level for protection of a stream in Arkansas. The maximum contamination levels for certain constituents are laid out in APCEC Regulation 2. In our case the most important specified maximum contaminant levels are for nutrients and E. coli and Fecal Coliform but maximum levels are also given for turbidity, several toxic chemicals, dissolved heavy metals, and oil and grease. A maximum for turbidity is given and a minimum level for dissolved oxygen.

We will discuss which components of hog waste would degrade water quality, the routes they could take to reach water sources, and the likelihood that contamination would occur.

Components of Hog Waste That Would Degrade Water Quality

How would the Buffalo River and other surface water be degraded? It would be degraded by several classes of components found in untreated hog manure and urine, i.e., nutrients and pathogens (including antimicrobials and hormones).

The primary nutrients in question are phosphorus and nitrogen compounds. If they reach the Buffalo River or local tributaries, lakes, or ponds, a number of detrimental effects will take place (1).   While nutrients are necessary for all biological growth, these excess nutrients from hog waste will result in eutrophication in aquatic ecosystems. This would mean algae growth and algae blooms that could lead to fish kills, changes to or death of other aquatic life due to lack of sufficient oxygen, water discoloration, unpleasant odors, animal health impacts, and human health impacts.

Degradation of all waters in the Buffalo River basin would also take place due to pathogens, antimicrobials, and hormones. These will have a severe detrimental effect on public health but they will also be harmful to animals and aquatic life (1). Pathogens can cause sickness and death of animals, fish, and other aquatic life; antimicrobial contamination can cause harmful effects; hormones can interrupt the reproductive cycle of fish and shellfish. All of these compounds hang around for some period of time after leaving the hogs as manure or urine. They are stable in waste ponds.   They have variable stability in soil and aquatic environments but some have half lives of up to a year (1)

Routes from Hog Farms to Water Sources

How would the untreated hog waste reach the streams, other surface waters, springs, wells, and the Buffalo River? We can answer that question by looking at the type of waste treatment system used by a CAFO. The typical system consists of a concrete tank beneath the barn where the hogs are housed that receives the waste that is the rinse water that every few days is used to wash down the floor and the pens of the hogs. From this tank the waste is pumped or flows to the first pond of a two-pond system. When the first pond is full, the overflow goes to a second pond. From the ponds the waste is piped or taken by tanker to fields where hay or other crops are growing. There it is applied to the surface, usually by spraying. The rate of application is governed by a required “nutrient management plan” that, in concept, applies waste at a rate that permits the nutrients to be taken up and utilized by the growing crops. It is important to understand one of the construction details of the waste ponds. ADEQ allows a leakage rate through the sides and bottom of a pond of up to 5000 gallons per day per acre of surface area. A rate not higher than this can usually be achieved by using compacted soil as a liner for the ponds. The justification for using this relatively high number is a statement in the Agricultural Waste Management Field Handbook (2) that after some unspecified period of time the rate of leakage will be reduced by a half order of magnitude due to plugging of the pores of the liner by manure solids. For a liner with an initial rate of 5000 gallons per acre per day, the resulting rate would be 1000 gallons per acre per day (365,000 gallons per acre per year)—a rate still quite high, particularly in a ecologically-sensitive watershed, such as that of the Buffalo River.

Likelihood of Contamination

We can now look at how, with this setup, contamination of water can take place and consider the likelihood that it would occur. There are several possible routes to water contamination by a CAFO in the Buffalo River watershed. They are: leakage through the clay liner of the waste holding ponds; infiltration from the spray fields; runoff from the spray fields; severe rainstorms or flooding of the spray fields causing soil erosion; more catastrophic natural disasters, e.g., tornados that would cause rupture of the pond walls; vac-tanker accidents on the way to spray fields with discharge of contents to a drainage ditch or other pathway to a stream.   While the growing crops in the spray fields would utilize a substantial part of the nutrients, nitrogen and phosphorus, uptake of the pathogens would be much more limited. The "nutrient management plan focuses on the uptake of the nutrients but the pathogens would be just as harmful to the Buffalo River, if not worse, and a significant portion of the pathogens could reach the Buffalo. Also, while winter application of waste of the fields is not recommended, it would be used, if cases where the holding ponds were approaching full capacity. Nutrients and pathogens would reach the Buffalo with winter application of waste. Several of these occurrences would be exacerbated due to the karst topography of the region, particularly leakage from the ponds or infiltration from the spray fields. It is even possible that the karst would lead to development of a sinkhole in a waste pond with the loss of all the contents and the subsequent contamination of the groundwater or the Buffalo or both.

While we recognize that the proposed amendments to Regulations 5 and 6 do not apply to C&H Hog Farms, we will use that facility as an example of what might happen, or what might be happening now, to cause water contamination. We believe that the most likely route to water contamination with the setup as described above is leakage from the waste ponds through the clay liner, infiltration to a karst sub-layer, flow to springs feeding Big Creek or to ground water and from there to the Buffalo.

There are two waste ponds at C&H, Pond 1 and Pond 2 (3). When Pond 1 is full, it overflows into Pond 2. Most of the manure solids in Pond 1 would settle so Pond 2 would have a significantly lower concentration of manure solids than Pond 1. They each have 18-inch thick clay liners constructed of compacted soil. C&H's consulting engineering firm, DeHaan, Grabs & Associates had the permeability of the compacted soil measured and using Darcy's Law, they calculated the initial leakage rate of Pond 1 to be 3,488 gal/acre/day and of Pond

2, 4,218 gal/acre/day if the ponds were full. We have checked their calculations and they were essentially correct (4). Since the area of Pond 1 is approximately 0.5 acre and of Pond 2, 0.8 acre, the total initial leakage rate would be 5,098 gallons per day if the ponds were full. We can only make an educated guess as to how the leakage rate of the ponds would change with time. We will estimate that after a few months the leakage rate of Pond 1 would be reduced due to manure solids plugging to 3488/5 or 700 gal/acre/day and that of Pond 2 would be reduced due to lesser manure solids plugging to 5098/2.5 or 2,040 gal/acre/day. The reduction would be less than the half order of magnitude because the manure would have settled in Pond 1 and the overflow would have a much lower concentration of manure solids. This would result in combined leakage of 1,982 gallons per day or 723,430 gallons per year if the ponds were full. This is still a significant rate of leakage. The mechanism would be leakage though the clay liner, infiltration though the underlying gravel/sand/soil/clay composite and into the underlying karst layer that is almost certainly there (See my companion letter on the subject of geology). For a period of time, perhaps a few weeks, there would be some holdup of some nutrients and pathogens on absorption sites in the composite structure but the sites would become fully saturated and then all of the nutrients, pathogens, antimicrobials, and hormones would pass through to the underlying karst. As was pointed out my Geology letter, karst has the characteristic that flow is rapid and there is no change in composition of the flowing liquid.

In a karst terrane all of the waters of the state in the watershed—the Buffalo River, the groundwater, the tributaries, the springs, and wells are interconnected. Of particular concern are the wells . While with the relatively high flow rate of the Buffalo River, a significant volume of hog waste would be needed to raise the E-coli level to the 126 CFU/100 ml level, the level at which the river would be closed for swimming and watersports, only a small amount of waste would make well water unfit for drinking and food uses. Note that in the Geology letter Dr. Brahana describes how dye was placed in shallow wells and then was detected miles away in springs and seeps. It would work the other way. Waste could reach the karst sub-layer due to infiltration from the ponds or the fields or due to runoff or erosion and contaminating a stream, a seep or a spring and then could reach the wells in the area.

The Threat of Numbers of CAFOs

What is the big issue of a number of CAFOs in the Buffalo River watershed? A CAFO having 2,500 sows and 4,000 pigs, the smallest "large' CAFO and the size of C&H Hog Farms, the waste holding ponds could contain up to 2.3 million gallons of untreated hog waste, sitting there a few miles from the Buffalo River. What if there were five such CAFOs with a total of 11.5 million gallons of waste.

Or what if Cargill built a CAFO the size of their Dalhart, TX facility, i.e. 66,000 hogs with23 million gallons of waste in the ponds. Or what if Smithfield builds a CAFO the size of their 88,000 hog facility in northern Missouri, 31 million gallons of waste. With so much waste sitting a few miles from the Buffalo River, an environmental tragedy could take place, either due to accident or to "legal" infiltration or leakage.

The number of CAFOs already in the watershed is not a factor in the current permitting process with Regulation 5 or 6.

Conclusion

We can't take that risk! We must ban CAFOs in the Buffalo River watershed!

Sincerely,

Robert Cross
President, Ozark Society
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References:

(1) United States Environmental Protection Agency, *Literature Review of Contaminants in Livestock and Poultry Manure and Implications for Water Quality,* Office of Water (4304T) EPA 820-R-13-002 (July 2013)

(2) United States Department of Agriculture, Natural Resources Conservation Service, *Part 651 Agricultural Waste Management Field Handbook,* Chapter 10 Agricultural Waste Management System Component Design (August 2009)

(3) Letter of April 8, 2013 from Nathan A. Pesta of DeHaan, Grab & Associates, LLC to Stephen Hogan , ADEQ Re: Jason Henson, C & H Farms, Permit to Construct

(4) Calculations checked by Robert Cross, Professor Emeritus, Ralph E. Martin Department of Chemical Engineering, University of Arkansas, Fayetteville, Arkansas