

Literature Review

The Environmental Concerns of Arsenic Additives in Poultry Litter

Proposal for Harry R. Hughes Maryland Center for Agro-Ecology, Inc.

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Scope of Work

Literature Review

The Environmental Concerns of Arsenic Additives in Poultry Litter

The Harry R. Hughes Center for Agro-Ecology, Inc. has asked our group at the Wye Research and Education Center to conduct a literature review requested by the Environmental Matters and Education and Health and Environmental Affairs committees of the Maryland General Assembly on the environmental concerns of arsenic additives in poultry litter. The letter of request for this work indicates that many of the committees' members are satisfied with data indicating that consuming chicken produced using arsenical additives poses a minimal threat to human health when compared to many vegetables, fruits, and seafood.. As such, the concerns for arsenic addition to poultry feed have now shifted to environmental issues associated with agronomic handling of the resulting poultry litter. Since scientists at the Wye Research and Education Center specialize in research into environmental concerns of contaminants, and have a background investing agro-ecological interactions, we propose to conduct a literature review of these environmental aspects. We are not public health/human health experts and therefore cannot comment on concerns in these areas.

Our literature review will examine all of the pertinent and available regional and national literature on the environmental concerns of arsenic as an additive in poultry litter. Our review will deal specifically with poultry litter, soils from poultry litter amended fields, near surface groundwater below these soils, and ecosystems that receive runoff from poultry litter amended fields. We will address these specific background questions asked by the committees:

- Does arsenic from poultry feed end up in poultry litter?
- If poultry litter contains arsenic, is it present in an organic or inorganic form?

More complex questions concerning arsenic in the environment will also be addressed, including:

- When applied to agricultural fields, does arsenic accumulate in soils to a level of concern based on existing soil arsenic environmental soil criteria?

- Does arsenic transport from litter amended surface soils into shallow near surface groundwaters and receiving ecosystems and, if so, are levels high enough to be of concern to the biota in these ecosystems based on existing arsenic environmental criteria?
- Are arsenic levels in sediments and biota of Chesapeake Bay at levels of environmental concern?
- What are background levels of arsenic in Maryland soils and what is the potential for arsenic in poultry litter to alter soil profile arsenic levels relative to other arsenic sources (e.g., natural sources, atmospheric deposition, biosolids application as fertilizer, etc.)?
- How are recent changes in phosphorus based nutrient management likely to change arsenic additions to Maryland cropland?

In addition to conducting the review on existing scientific literature, where applicable, unpublished data from poultry litter-associated agronomic research at the Wye Research and Education Center will be included in the review. Lastly, we will analyze archived environmental samples from poultry litter amended fields for total arsenic and different arsenic chemical forms. These analyses will add information on the speciation and transport of arsenic from poultry litter amended fields.

The literature review will be submitted to the Harry R. Hughes Maryland Center for Agro-Ecology, Inc. as a full report with an abstract and summary. The report will be submitted by December 1, 2011.

Biosketches

Dr. Daniel Fisher is a Senior Research Scientist at the University of Maryland Wye Research and Education Center and in the University's Department of Environmental Science and Technology. He earned his Ph.D. in Marine Science/Aquatic Toxicology in 1986 from the College of William and Mary's Virginia Institute of Marine Science. He currently teaches courses at the University of Maryland in College Park concerned with Ecosystem Health and Protection and Environmental Toxicology. He has over thirty-nine years of experience in aquatic toxicology and the study of environmental impacts of contaminants. For 16 years Dr. Fisher directed the Maryland Department of the Environment's Bioassay Laboratory located at the Wye Research and Education Center (WREC) where he conducted acute and chronic whole effluent toxicity testing for NPDES compliance monitoring with freshwater and estuarine fish and invertebrates. In addition, he established freshwater and estuarine sediment toxicity testing capabilities at WREC that allow for sediment quality assessments. He has been the Principal Investigator or Co-PI for research grants and contracts in the following areas: aquatic toxicological studies in both the laboratory and field involving sediments, single compounds, mixtures, effluents and storm water runoff; ecological risk assessments involving the development of water quality criteria for numerous compounds; and continuous versus intermittent toxicity of chemicals. Dr. Fisher's recent work has been in the assessment of possible endocrine disruptive effects of land applied poultry litter and the possible development of antibiotic resistance in Eastern Shore streams from poultry litter and biosolids application. He has also just completed a multiyear project with the Maryland Department of the Environment concerned with the development of Sediment Quality Criteria for metals (e.g., lead and zinc) in Baltimore Harbor. He has written more than 100 refereed journal and technical publications on a wide variety of environmental issues.

Dr. Lance Yonkos is an Assistant Research Scientist at the University of Maryland Wye Research and Education Center. He has over twenty-six years of experience investigating point and non-point source pollution effects on the health of aquatic biota, particularly in Chesapeake Bay and its tributaries. Dr. Yonkos' principle area of interest involves endocrine disruption as a consequence of environmental exposure to complex contaminant mixtures. His academic training is in natural sciences and mathematics (B.S.; Washington & Lee Univ.) and environmental sciences with emphasis on aquatic toxicology (M.S.; Ph.D.; Univ. of MD). Dr. Yonkos has worked continuously at the Wye Research and Education Center since 1990. Currently he serves as Principal or Co-Principal Investigator for laboratory and field projects aimed at determining the impact(s) of poultry manure-associated contaminants on fish and amphibians in Delmarva watersheds. Dr. Yonkos also has a faculty appointment with the College of Agriculture and Natural Resources - Environmental Science and Technology Department (ENST) where he teaches courses on environmental health, aquatic toxicology and contaminant related topics. He has 14 publications in refereed journals on a variety of environmental issues, has written 38 abstracts (30 as first author) and has presented extensively at national scientific meetings.

Dr. Ken Staver is an Associate Research Scientist at the University of Maryland Wye Research and Education Center. Since 1984, he has been conducting research on water, nutrient, contaminant, and energy flows in Coastal Plain watersheds. The emphasis of his work has been on the development of strategies to minimize negative environmental impacts of agricultural activities while maintaining agricultural productivity and enhancing soil and water resources. More recently, he has focused more on nutrient, contaminant and energy flows at larger scales, and the potential of biofuel production to increase overall nutrient use efficiency in agricultural systems and to reduce net carbon emissions. Dr. Staver has conducted extensive field studies since 1990 looking at the movement of nutrients in poultry litter and sewage sludge applied to cropland through both surface and subsurface flow paths. He collaborated with USGS scientists looking at the effect of arsenic in poultry litter on total and water-soluble soil arsenic pools. More recently, his research with Chesapeake Bay dredge material has considered the movement of arsenic and other metals when dredge material is placed in upland settings. His role in this project will be to evaluate the short-term dynamics of arsenic movement from cropland as a result of poultry litter applications and the long-term impacts of arsenic in poultry litter on soil and Chesapeake Bay sediment arsenic levels in comparison to other arsenic sources.