Statement of Work
Manure Technologies Expert Panel

October 29, 2014

## Introduction

Animal manure has been identified as the largest source of phosphorus and the second largest source of nitrogen to the Chesapeake Bay Watershed[1]. Many manure treatment technologies purport to reduce the mass loadings of these nutrients. The Chesapeake Bay Partnership's Agriculture Workgroup, Manure Treatment Subgroup identified six treatment technologies with potential to be used in the Chesapeake Bay Watershed[1]: 1) anaerobic and aerobic microbial digestion, 2) chemical treatment of dry manure, 3) thermal and thermochemical treatment, 4) solid-liquid separation, 5) composting, and 6) chemical treatment of wet manure. The Chesapeake Bay Program (CBP) uses loading estimates to quantify the amount of nutrients from specific processes. Under this proposal, a panel of eight individuals will be convened to recommend estimated load reductions of nitrogen, phosphorus, and sediment resulting from implementation of specific technologies under the six broad headings identified. One of the panelists will be a representative of the CBP Watershed Technical Work Group (WTWG). A second member will represent the CBP Modeling team. This proposal recommends six experts in manure treatment technologies and environmental and water quality issues to complete the panel. This proposal was selected for funding by the Chesapeake Bay Watershed Research and Outreach Collaborative (CBW-ROC) pending final review by the CBP partnership as described in the *Protocol for the Development, Review and Approval of Loading and Effectiveness Estimates for Nutrients and Sediment Controls in the Chesapeake Bay Watershed Model[2] (BMP Protocol)*.

## Proposed Expert Panel Membership

**Douglas W. Hamilton (Expert Panel Chair)**
Doug Hamilton is Associate Professor and Waste Management Specialist at Oklahoma State University. Dr. Hamilton has experience leading expert panels to create a white paper on the effectiveness of lagoons for animal waste treatment and to determine tonnage of agricultural byproducts available for biofuel feedstock in the South Central United States. He has also served on a number of expert panels including the Assessment of Ammonia Emissions from Stores of Manure in Reggio Piemonte, Italy. He has written technology assessments of solid-liquid separation and anaerobic digestion for the US Pork Center of Excellence. Dr. Hamilton will also serve as a panel expert on anaerobic and aerobic microbial digestion, solid-liquid separation, and composting.

**Keri B. Cantrell**
Keri Cantrell is an Environmental Engineer with the North Carolina Department of Environment and Natural Resources. Prior to working for NC DENR, Dr. Cantrell was as a consulting engineer and a Research Agricultural Engineer for the USDA ARS. Dr. Cantrell will serve as the primary expert in thermo and thermochemical processes. She

also has extensive knowledge in transformation and movement of nutrients through the solid and gaseous phases of treatment processes.

**John W. Chastain**
John Chastain is Professor in the School of Agricultural Forest and Environmental Sciences at Clemson University. Dr. Chastain has 25 years as an extension engineer working primarily with treatment technologies. Dr. Chastain will serve as expert in solid-liquid Separation, dry chemical treatment, and composting.

**Andrea L. Ludwig**
Dr. Ludwig is Assistant Professor and Extension Specialist in the Biosystems Engineering and Soil Science Department of the University of Tennessee. Dr. Ludwig's expertise is assessment of nutrient loadings to rural and urban watersheds. She has led the state oversight committee for reduction of nutrient loads in West Tennessee. Dr. Ludwig will serve as expert in determining nutrient loading of watersheds, nutrient cycling dynamics in soil and water, and microbial digestion.

**Robert J. Meinen**
Robert Meinen is Senior Extension Associate in the Animal Science Department at Pennsylvania State University, and has served on review panels for both the Chesapeake Bay Project and the Commonwealth of Pennsylvania. Mr. Meinen will serve as expert in animal production systems of the Chesapeake Bay Watershed. He also has extensive research and extension experience making him an expert on nutrient movement in soil and gaseous emissions from agriculture.

**Jactone A. Ogejo**
Jactone Ogejo is Associate Professor and Extension Specialist in the Biological Systems Engineering Department of Virginia Tech University. He has experience developing and evaluating manure treatment technologies for both the Chesapeake Bay Project and the Environmentally Superior Technologies for North Carolina Swine Farms Project. Dr. Ogejo will serve as panel expert for anaerobic and aerobic microbial digestion, liquid chemical treatments, and dry chemical treatments

## Work Plan

The process to create this recommendation report will adhere to the *BMP Protocol*. Sequential steps to achieve this process are outlined as follows. A timeline to meet narrative goals is given in Table 1. The timeline is given under the assumption that the project start date will occur in December 2014.

Kick-off Meeting: A two day face-to-face meeting will take place early in the project. The meeting location will be in a central location in the Bay watershed. The *BMP Protocol* will be distributed to each panelist prior to this meeting. On the first day of the meeting, the member of CBP modeling team will brief expert panelists on the CBP model and ways the model can accommodate technologies. The expert panel will then further define the six technologies identified by the Agriculture Workgroup/Manure Treatment Subgroup[1] into specific applications of the broad technology definitions; i.e., alum or sodium bisulfite addition to dry manure. The panel will also define combinations of technologies used to treat manure; i.e., solid-liquid separation followed by fixed film

Table 1. Proposed Project Timeline

| | Dec 2014 | Jan 2015 | Feb 2015 | Mar 2015 | Apr 2015 | May 2015 | June 2015 | July 2015 | Aug 2015 | Sep 2015 | Oct 2O15 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Initial face to face meeting and public forum | ■ | | | | | | | | | | |
| Final Selection of Technologies And Technology Combinations | | ■ | | | | | | | | | |
| Collection of Data Sets | ■ | ■ | ■ | | | | | | | | |
| Data Analysis | | | ■ | ■ | ■ | | | | | | |
| Task Groups send Initial assessment reports to Panel | | | | | | ■ | | | | | |
| Second Face to Face Meeting Edit and Approve group reports | | | | | | | ■ | | | | |
| Panel Chair Writes Draft Recommendation Report | | | | | | | | ■ | ■ | | |
| Review and approval of Recommendation Report Panel | | | | | | | | | ■ | ■ | |
| Delivery of Report to CBP Agriculture Work Group | | | | | | | | | | | ■ |

anaerobic digestion, struvite precipitation, and solids composting. Technologies and technology combinations will be grouped by type of manure treated.

Public Forum: An open forum will be held on the second day of the initial face to face meeting. The purpose of this forum will be to garner input, aid in data set identification, and to identify any additional technologies for consideration. This forum will be organized and advertised by CBP.

Task Groups: Following the public forum, the expert panel will narrow the list of technologies for further study based on upon their likelihood to be used in the Bay watershed. In order to facilitate efficient collection of data, the expert panel will divide itself into several smaller task groups. These groups of two or three individuals will be self-forming. As the list of technologies is reviewed, panelists will volunteer to begin searching for data on the technologies with which they are most familiar. The panel chair may also add panelists to a particular group to round out expertise of the group. Task groups will remain intact until the recommendation report is written.

Panel Communication: The panel chair will work with the Project Coordinator to establish a common virtual space where panelists can share information and data. In addition to face to face meetings, panelists will communicate in monthly conference calls.

Gather Data and Selection of Final Technologies: Task groups will gather data sets for the selected technologies and rank their validity using criteria of Table 1 of the *BMP Protocol*. Technologies with limited valid data sets will be deemphasized. Those technologies not chosen for complete analysis may be evaluated to provide incremental recommendation according to the *BMP Protocol*.

Analysis of Data: Using data sets and best professional judgment of the panelists, selected technologies and combinations of technologies will be analyzed to determine flow path of measured constituents (N, P, solids), transformation of constituents, mass reduction of influent constituents and partition into effluent liquid, gaseous, and solid streams. These data will be used to construct a table of recommended nitrogen, phosphorus, and sediment loading reduction for each technology and combination of technologies. At this time, task groups will also identify ancillary benefits and negative consequences of each technology. Each group will prepare a written report giving a detailed definition of the technology and results of data analysis. This report will also include a list of references and a discussion of how each reference was considered. The discussion will also consider conditions under which the technology will not work, start-up time for the technology, and maintenance and upkeep requirements of the technology.

Consensus of Results: A second face to face meeting will be held in which each technology task group will orally present the reports created during the data analysis phase. Draft reports will be available to all panelists before this meeting on the common virtual space. The panel will evaluate and provide feedback to each task group. Dissenting opinions of panelists will be noted and preparation will be made to add these dissenting views as an appendix to the recommendations report. The second face to face meeting will be held in a locale conducive to completing the task.

*Preparation of Draft Report*: The Panel Chair, working with the Coordinator will coalesce the task group reports into a draft final report. Panel chair will send draft report to entire panel via the common virtual space. Panelists will return written comments to chair in one month. The modeling team representative on the panel will work with the WTWG representative to develop the draft Technical Appendix for Scenario Builder.

Approval of Final Recommendation Report: After one month's review time, the expert panel will approve or disapprove of the document via voice vote in a conference call. In the case of non-unanimity, a separate dissenting will be attached as an appendix. Panel chair will then forward the report to the Agriculture Work Group as prescribed by the *BMP Protocol*.

## References


1. *Recommendations for the Manure Treatment Technologies Expert Panel*. July 14, 2014. Manure Treatment Technology Subgroup of Chesapeake Bay Program Partnerships Agriculture Workgroup.

2. *Protocol for the Development, Review, and Approval of Loading and Effectiveness Estimates for Nutrient and Sediment Controls in the Chesapeake Bay Watershed Model.* July 14, 2014. Chesapeake Bay Program Water Quality Goal Implementation Team.