

II. Future Research Needs

The panel conducted a thorough review of published data on manure treatment technologies. The recommendations found in this report are as accurate as possible given the current state of science and technology. We fully expect this subject to be revisited by a future panel. To aid a future panel in its mission to improve upon our recommendations, the current panel suggests the scientific community consider the following recommendations for further research.

Farm-Scale Data Collection

Perhaps the greatest obstacle to accurately determine the performance of manure treatment technologies is the availability of data at the farm scale. Technologies developed in the laboratory do not necessarily perform at the same level when placed on farm in real conditions. We suggest coupling installation of new manure treatment technologies on farm to the applied research programs of land grant universities and the USDA Agriculture Research Service.

Nutrient Transformations

Mass balances of nutrients into and out of manure treatment systems should be performed as a part of all applied research projects on treatment technologies. These mass balances should also account for all forms of nutrients in waste streams, as well as, in fugitive losses. Data collection is most critical for determination of atmospheric losses of nitrogen in the form of N_2 , NH_3 , and NO_x .

Additional Categories of Technologies

A future panel will undoubtedly find additional categories of technology in use on farms in the Chesapeake Bay Watershed. Two categories of biological treatment that have already shown promise are liquid aerobic treatment of liquid manure and anaerobic treatment of solid manure. Liquid aerobic and anoxic technologies commonly used in domestic sewage treatment are making their way into the agricultural sector. Usually placed in conjunction with anaerobic digestion, these technologies further treat nutrients through nitrification-denitrification and biological phosphorus removal. Anaerobic composting and solid-state anaerobic digestion are two forms of treatment that may find use on farm, particularly to incorporate municipal, domestic, and food processing wastes into the manure handling system.

Additional Defined Technologies

Each section of this report contained a list of technologies that are available for manure treatment but are either not currently used in the Chesapeake Bay Watershed or farm-scale data is not available to make recommendations for nutrient transfer or transformation. More and better data may become available for future panels to expand the list of defined nutrient transfer efficiencies.