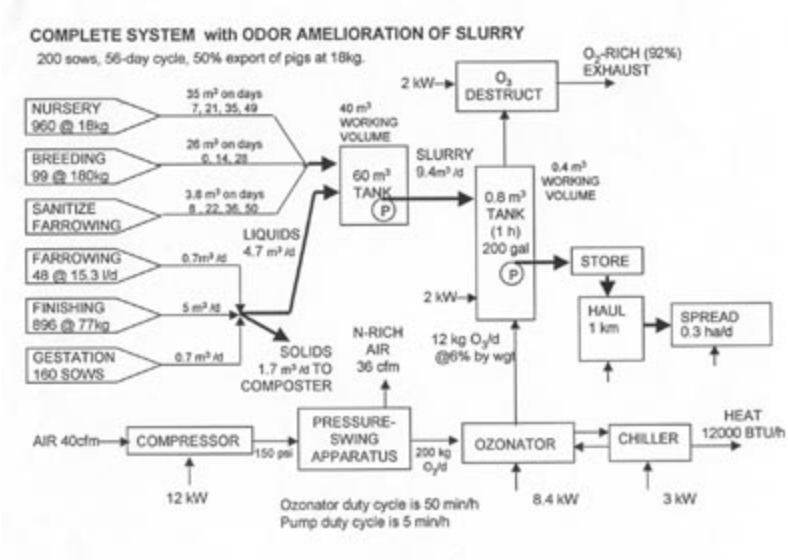
March / April, 2003

Odor Reduction by Ozonating Swine Waste

By: John Gerrish



Larger view (may load slowly)

At the east end of the MSU Swine Research and Teaching Facility, there is a small out-building that houses equipment that can improve the offensive odor associated with applying accumulated swine waste to the nearby cropland.

This project is the full-scale realization of a laboratory study that proved the effectiveness of ozone in reducing odoriferous compounds present in swine waste, specifically swine waste that has been partially separated to remove superfluous phosphorous. Engineers in the Ag Engineering Department and the Department of Civil and Environmental Engineering oversaw the study and scaled the lab process to a size that would match the MSU swine farm's demand. The ozonation plant was in the construction stage for about three years, and it has taken an additional year to de-bug the system and make it reliable. One reason for the long time under construction was the discovery that the swine farm is built on an old land-fill, which means that the soil is too permeable for underground tanks that might leak unnoticed. Above-ground tanks and pumps added greatly to the difficulty of building the plant. Moreover, the small project had to compete for the attention of builders during a boom in campus construction. Design flaws, construction errors, and waste-stream variability have combined to make debugging last for one year. For example, designing for efficient ozone injection caused excessive foaming, and the team had to solve the problem at full scale. The waste stream has much more solids content than the liquid waste that was used in the laboratory-scale experiments; this difference caused the foaming problem. The builders substituted pumps that had high speeds and closed impellers; these immediately clogged with pig hair, as any worthy agricultural engineer might have foreseen.

The system is finally up-and-running, and has worked for about one month. The ozonation plant treats all the waste coming from the 200-sow facility, minus about half of the fecal output which is diverted to a composting process. The (mostly) liquid fraction flows to the ozonation plant in 100-gallon batches. Each batch receives about 33 minutes of ozonation, amounting to a dose of about 1 g of ozone per liter of waste. Indole, skatole, cresol and phenol are significantly reduced by the process. Effectiveness can be judged by comparing the odors of influent and effluent samples.

The project now enters a research phase. Questions that will be addressed are: Does odor amelioration endure through the storage period?

- Can odor improvement be noticed at the time of s
- Spreading the waste on land?

- Does the treated waste contain byproducts, either beneficial or harmful to the environment?
- What are the economics of the process?
- What are the implications for integrating ozonation with a commercial farm?

Investigators: Dr. Susan Masten, Civil and Environmental Engineering Dr. Melvin Yokoyama, Animal Science Dr. Simon Davies, Dr. John Gerrish, Mr. Richard Ledebuhr, Agricultural Engineering

Cooperators: Mr. Brad Bull, Physical Plant Mr. David Conklin, FTCH Engineering Mr. Al Snedegar, Swine Research Center Manager

Funding Sources: The Michigan Agricultural Experiment Station, MSU Extension, the Corn Marketing Board, the Michigan Soybean Growers Association, and Michigan Department of Agriculture.