From: Joseph Schons [solutions39@msn.com]
Sent: Thursday, October 20, 2005 1:00 PM
To: Hancock, Kevin
Subject: manure

Hi Kevin

I know you're a busy guy but thought I'd drop you a line and see where it goes. My name is joe schons and I worked on a family owned dairy for about 30 years before going into the wastewater plant operation business. For the last ten years, privatr industry, conservation districts, and colleges have doing projects that involve using wastewater technology to treat dairy manure. Even I got into it using polymers to floc manure...pretty good results too.

I came to the conclusion one day that technology is what screwed up the industry. Backwash systems, freestalls, rainguns, and lagoons turned it into a non-point source nightmare. Additionally, the nutrient loading to the fields with a new emphasis on phosphorus has made this even more of a nightmare. In western washington the liquid manure problem is even worse that eastern. (We farmed on both side of the cascades).

I was as hyped as anyone when wastewater technology was being used to treat manure, polymers, belt presses, digesters, aerators, etc. What few seem to be looking at is how things were done in the past. Liquid manure production was a fraction then of what it is today. The new dairy is designed to handle liquid manure, which is the real problem.

In the old days, loafing sheds piled with bedding alowed the farmed to scrape a couple times a week. The manure with the bedding for bulking was piled for the winter and land applied in the spring. Usually, the piles composted which meant at least a 20-30% reduction in volume, nutrient uptake from the biology, and stabilization of nutrient which made them less soluble.

What I'm not seeing in permit systems and projects, is a return to solid manure and its benefits. Not to mention this methodology is available to dairies of ALL sizes, not just the big ones that can afford digesters and aeration tanks. Water abatement/composting is the only way all dairies can effectively decrease volume, nutrients, and runoff. Projects of this type seem to be rare...maybe because industry has nothing to gain financially. Whatever the reason, it would be great to see some grant funds applied to these projects. I know composting has been done for a number of years at different dairies, but it seems the whole idea of eliminating freestalls, lagoons, rainguns, etc. has not been triedin recent history.

Please pass these thoughts on to whom ever you think might be interested. I would be happy to do a brief on these ideas if you think it might help.

Best regards,
Joe Schons
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A Discussion on Dairy Manure

From the early days of dairy farming until the mid 1970's, manure handling was different than today. Free stalls, flush systems, side-hill screens, dewatering conveyors, and mega million gallon slurry lagoons with pump systems and rain-guns were just pipe dreams. Underground slurry tanks were becoming more common in the 1960's to handle the wash-down water from the milking barn. The light liquid was mixed and pumped into "Honey Wagons" for application to fields. The typical vault was about 35-45,000 gallons and required emptying every couple of weeks depending on whether rain gutters were directed into them.

If a farmer was located in Eastern Washington, open pens usually housed 2-3 groups of milking cows and their replacements. Each group ran between 100-150 head. During milking, the cows waited in a concrete holding pen that was usually covered. Manure from this holding pen was scraped into the underground vault. The open pens with tall roofed covers had piles of bedding, usually sawdust or wheat straw. These piles were added to as needed and removed and land applied to the fields and tilled in during the spring planting season.

Western Washington farmers were more likely to use loafing sheds rather than open pens. The reason was precipitation. About 30" per year compared to 10" in Eastern Washington. These loafing sheds also used sawdust or wheat straw for bedding. The sawdust piles were scraped every week or as needed. It was stockpiled and land applied in the spring. The wheat straw was added to as needed and cleaned out and land applied in the spring.

As you can see, most of the manure was stored in a solid form and land applied once or twice a year. During the time the piles were stockpiled or being used as bedding mounds, they were also heating and composting causing the typical volume reduction and nutrient stabilization. The liquid portion was minimal, cheap, and easy to manage.

From the mid 1970's on, dairies incorporated free stalls as a way of enclosing more cattle in a smaller area. One of the ideas was, not all cattle eat and sleep at the same time. So, you could build 100 stalls for a herd of 150 in an area the fraction of the size of the old loafing shed and open pens. With concrete floors, you didn't have to worry about erosion and potholing from too many cows. However, this also changed the handling format from solids to semi-solids. There would be a scrape alley, with a bay of stalls on each side. The free stalls were bedded with anything from sawdust to ground canary grass straw to chopped corn stalks. The stalls are barely long enough for a full grown cow.

The idea here is, the cow will actually defecate into the scrape alley because their tail-ends are sticking out over a curb…a little uncomfortable but functional for manure recovery. After herding the cows into the holding pens for milking, workers remove additional manure from the free stalls using a fork and drop it in the scrape alley. The manure in the alley is scraped into a pit where it is mixed with wash-water and pumped, or gravity drained, into a manure slurry lagoon. Many farms have used separators to

remove the undigested grass portion of the manure and the bedding material in the free stalls. The extra benefit here is prevent the manure lagoon from filling with solids requiring expensive solids removal in order to recover valuable storage space.

With lagoons large enough to hold 5 million gallons of liquid, the days of hauling manure to the fields in 1,000 gallon "Honey Wagons" are long gone. In their place, you will find pump systems with big rain gun sprinklers (formerly used in irrigation) shooting a giant green arch. With the ability to apply 1,000 gallons per minute, these systems lack the finesse enjoyed by the old wagons. Perhaps the most objectionable aspect of these rain guns, are the odors generated as the anaerobic manure is atomized in the high pressure arch. It is difficult to understand how a composting facility generating lesser odors can be shut down and/or fined, and the dairies using rain guns are exempt from state clean air regulations. In towns like Enumclaw Washington, dairies with rain guns surround the town. At times, the smell of anaerobic manure hangs in the town for days.

In recent years dairy farmers have started using wastewater technology to handle manure. Anaerobic digesters have been built and operated to stabilize the manure and capture methane for digester heating and use in farm equipment. Aerobic digesters are used to freshen and suspend solids before being pumped over screens sitting at a 45* angle. The screen allows the solids to roll down and into a set of rollers to remove excess liquid. Most of liquid manure falls through the screen and runs off to the lagoon. One project used coagulants and polymers to flocculate the manure before running it through a belt press. The liquid was fairly clear with an excellent reduction in nutrients.

Quite a few of the manure handling projects mentioned in this paper were the result of grants provided by state and federal agencies, and conservation districts. A significant problem with advancement in manure handling technology is the enormous expense. A regular size dairy of 300-400 milking cows have little in the way of capitol for a anaerobic digester or a belt press. In fact, these advancements in manure technology have drawn attention away from technology that all dairies can afford….large and small.

The bottom line is, there is too much liquid manure produced by the modern dairy. New manure technology seems to sanction and exacerbate this problem. Perhaps the time has come to take a step back in dairy history and try some of the methods of earlier farmers. The following is a suggestion for modifying the typical free stall barn into a loafing shed for producing a more solid manure product and handling the manure solids for best benefit:

Most free stall dividers are manufactured from 2" tube iron and mounted in sleeves placed in a concrete wall. The dividers are removable to accommodate removal of sick animals. Simple remove the dividers and store.

Six inch curbs are usually installed to hold the bedding back from the scrape alley. It is recommended these curbs be removed to allow easy removal of bedding in the loafing shed.

Any type of bedding may be used in the loafing shed. Sawdust is easy to maintain as it can be scrapped to a holding area and piled. Other alternatives are straw, low quality grass hay such as canary grass, and even corn stubble. Sand could be used but limits the options for manure composting. (One farm beds their stalls with sand and recovers the sand in a shallow settling pond for reuse. Good idea, but the end result is still a lagoon full of manure slurry.) How the loafing shed is cleaned is up to the individual farmer. Continued applications of bedding like straw will require removal one to two times a year if not scraped.

*Special Note. All rain gutters must be removed from the manure handling system. Rain water can be captured and used for wash-down in the milking barn, but as a rule, should not be allowed to enter any mixing vault or lagoon.

Manure solids need to be stockpiled in an easy access area. Once the pile is established, composting will begin and requires occasional turning. This may require a substantial amount of area, but when you think of area used for the liquid handling, the space may of equal size. While composting, temperatures should be monitored and piles turned when excessive heat is observed (>160*F). As the piles mature, moisture will be lost, but can be added using liquid from the wash-water from the milking barn. Other solids may be added to the compost piles such as weathered straw and hay bales, silage waste, dairy calf raising solid wastes, and feedlot wastes.

The composting can be maintained in a fairly informal manner by any farmer. Some may simply choose to stockpile the manure solids and land apply in the spring or fall. However, composting is highly desired and can accomplish a number of important goals such as volume reduction, nutrient uptake and stabilization, and a reduction in non-point source pollution.

Milking barns liquid waste can also be cleaned up before impounding to a storage lagoon. A filter can be constructed from ecology blocks and filled partially with sawdust or other bedding material. Liquid manure from the mixing pit can be pumped to the filter where solids are captured and removed as needed to the compost piles. The filtrate can be re-circulated back to the mixing pit, used as barn wash-down water, or wasted to the lagoon. (An expanded version of this filter could be used to remove and bulk-up manure solids before filtrate is impounded to the lagoon in free stall barn applications. Composting is still the desired method for handling the solids.)

In conclusion, you can see the technology is proven, cheap, and available to all size dairy farms. Years of handling dairy manure as a slurry has caused regulating, monitoring, permitting, and a number of large fines levied against the farmer. This trend will only continue if serious changes are not made to the current management options. With local and state political climates changing to more urban values, the clean air law exemptions for dairies will be eliminated. If this happens, any farmer with a rain gun for applying manure faces stiff retaliation from near-by communities. If this should happen, and it will eventually, all the current infrastructure for handling manure slurry will be useless.

Having spent my first thirty years in the dairy industry, I have seen firsthand the changes mentioned in this paper. When I started doing wastewater treatment, I was excited by the possible use of biosolids handling technology to help the dairy industry. But, as I did my own research using polymer to flocculate manure slurry and remove the solids it started crossing my mind that biosolids technology is also very expensive.

As I did more literature searches on manure projects, I noticed that most of them had been subsidized by local, state, and federal government. Additionally, many of these projects were replicated in other states using the same types of funding. The question came to mind about how many times you have to re-invent the wheel. Funding, as usual, is given to innovative and technologically advanced projects. This bias seems to have blinded us to the merits of how our fathers and grandfathers managed their farms with only a fraction of the equipment we enjoy today. By no means am I saying we should hitch-up the horses to the manure spreader, on the contrary.

The modern dairy has all the equipment needed to accommodate changing their liquid manure handling format to a solid format. No anaerobic digesters, flush systems, free stalls, rain guns, or separators are needed which means a substantial savings to new dairies or those who wish to upgrade to a solids system. Funding for research and pilot projects on this methodology should be generous.

For more discussion on this matter feel free to contact me by e-mail at solutions39@msn.com.

Thank you,

Joe Schons