

Biosolids - Critical Issues to Consider - a talk by Professor Murray McBride -

[CTCC Canadian Toxic Communities Coalition](#)·[Thursday, March 12, 2020](#)·Reading time: 5 minutes

Biosolids Information Webinar - November 2019 - Sponsored by New England Farmers Union, Ohio Farmers Union and Pennsylvania Farm

The webinar can be listened to here - <https://pafarmersunion.org/biosolids-webinars>

There is lots of great information in this webinar. There is good background information provided by Darree Sicher (from approx. minute 2:30 to 14:30)

Biosolids - Critical Issues to Consider

Murray McBride



Professor

910 Bradfield Hall
(607) 255-1728

Email:

mbm7@cornell.edu

My long-term interests focus on understanding the behavior of contaminants at the soil-water interface in the environment, with particular emphasis on the phytotoxic and zootoxic trace and heavy metals. In order to understand adsorption and degradation processes mechanistically, I use numerous methods such as spectroscopy to investigate speciation and bonding of metal ions and organic molecules at surfaces and in soil solution. I have interest in the issue of soil health, as it is impacted by the contamination of soils by various waste materials, commercial fertilizers and manures.

Research Focus

The focus of my research at present is the bioavailability of toxic and trace metals in soils to crops, animals, and humans, considering all of the properties of soils that modify this bioavailability. Ultimately, this research has several goals, protecting food crops from toxic metal contaminants, minimizing trace element deficiencies, and developing methods for testing and remediating contaminated soils.

The Cornell Professor, Dr. Murray McBride, takes over from 14:30 to 35:00 - outlining the concerns he has around land disposal of biosolids.

Below is a transcription of the talk he gives during the webinar -

"Let's look a little more carefully at the nutrient levels in these sludges, they are very highly variable and unbalanced, by that I mean unbalanced in terms of what crops need ... organic matter can vary between 40 - 70% - which is kind of interesting as you wonder what the rest of the material is ... so there is other material in there clearly ...the nitrogen to phosphorous ratio in this material, for most sludges, is not well matched to the crop needs ... there is a build up of phosphorous in these soils ... You also don't have enough potassium relative to the other nutrients ... so it is not an ideal fertilizer at all"

Now to the main concerns -

"In my view the negative concerns outweigh the positives. The buildup of contaminants, and this includes pathogenic organisms, metals, and synthetic organic chemicals (of which there are thousands) means that you potentially contaminate food crops, dairy products, and meat. You also have reduced forage quality on pastures, and forage crops where uptake of metals like molybdenum, and uptake of elements like sulfur, can lead to livestock health problems"

"There is also groundwater contamination, which is rarely monitored, even on long-term application sites ... In the long term you may end up building up enough heavy metals, particularly zinc and copper, that you could reach levels that impact crop growth. This is an issue for soil health. We also have the odor and bioaerosol problems - I've encountered this numerous times, the effects on human health, of people living adjacent to land application sites"

"Finally, I stress again the tremendous variability and unpredictability of the composition of sludges"

Regarding regulations -

"Only nine of the metals are regulated, and None of the toxic organic chemicals are under any regulation ... present day sludges do contain metals that are toxic that aren't regulated ...the metals stay put in the soils, and do build up over time ... some of these elements are taken up by forages and by food crops"

"Anaerobic digestion, in the WWTP, reduces the viral numbers, but there will still be between 100 - 10,000 viable viruses per kg in the "treated" sludge.

Viruses have lower infective doses than bacteria, so as little as 1 to 100 can give you a disease"

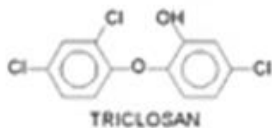
"Synthetic organic chemicals are not regulated, and there are thousands of them coming on every year. Some of these chemicals, like the fire retardants, are very persistent and long-lived in soils - they build up with time, because every time you apply sludge, you simply add to what is already there.

Unfortunately, few of these have been studied for human or animal toxicity so

we really don't know how bad an effect they may have. Few of these chemicals have been studied for crop uptake, some have shown uptake, while others have not”

Why Concern over Synthetic Organic Pollutants Accumulating in Farm Soils ?

- Many are taken up by crops
- Many are bioaccumulative in livestock (e.g., dairy cows)
- Soil > livestock > human
- Many are persistent in soil (long half-life)
- Many have suspected or known Human and Ecological Toxicity (some carcinogenic, some endocrine-disrupting)
- Most are “Invisible” (not generally or easily tested for)
- New unevaluated “emerging contaminants” are continuously showing up in sludges.
- Scientific understanding of behavior and toxicity is lagging far behind the application of these chemicals on farms



What is the concern about synthetic organic pollutants accumulating in farm soils?

“Many of these chemicals are taken up by crops, research has shown that ... many of them are bioaccumulative in livestock - these are the ones that are fat soluble, things like the brominated fire retardants for example ... they accumulate in cows in the milk fat, or in the meat fat so there is a concentration build up from the soil into livestock, into humans, up the food chain”

“Many of these organic chemicals are persistent in the soil. Many have known or suspected human or ecological toxicity, some are carcinogenic, others are endocrine disrupting”

“Most are “invisible” - by that I mean, we do not test for them - so proponents of sludge application say “what's the problem?” They don't see a test for these chemicals, so the assumption is there is no problem there. - but - a lack of evidence does not represent evidence of a lack of effect - so we simply cannot conclude anything from not having information”

“There are new unevaluated contaminants showing up all the time ... as a scientist I see that the scientific understanding of the behavior and toxicity of these many chemicals is lagging far, far behind the actual application of these on farms - which seems like a backwards way of doing things”

Potential Impacts of Endocrine Disrupting Chemicals (EDCs) on Ecosystems and Humans

- Presently, EPA claims that synthetic chemical concentrations in farm-applied sludges are too low to have harmful effects
- This argument is based on the old paradigm that “the dose makes the poison”
- Endocrine disrupting chemicals (EDCs), however, do not obey this rule because they are hormone-like in their behavior and affect animals and humans at below ppb ($\mu\text{g}/\text{kg}$) levels
- Examples include perfluorinated (PFAS) compounds, bisphenol-A, PCBs, tributyltin, brominated fire retardants, various pharmaceuticals, all found in sewage sludge

Potential impacts of Endocrine Disrupting Chemicals on ecosystems and humans

"The proponents of land application have claimed that these synthetic chemicals have far too low a concentration in sludges or in soil to have harmful effects. This argument is based on the old toxicological argument, or paradigm, that the "dose makes the poison" (which makes sense for SOME chemicals) but the endocrine disrupting chemicals EDC's don't obey this rule because they have hormone-like behavior in animals and humans, and they operate a low parts per billion into parts per trillion level. Some of the most serious EDC's found in all sludge samples have been the PFOS and PFOA - about which there are great knowledge gaps.

How much PFOA or PFOS in soils would be sufficient to contaminate groundwater above the guidelines? How much PFOA or PFOS in soils would be sufficient to contaminate milk, dairy products or meat? There is NO research at this time that can answer these questions.

The Case for Caution (Cornell Waste Management Institute, 1999)

Because:

- Our ability to confidently predict risks from land application is very limited
- Contaminants concentrate in sewage sludges
- Many unevaluated, new contaminants in sludges
(503 - looks only at indicator pathogens and 9 metals)
- Present US standards are based on an outdated risk assessment with many shortcomings
- Liability rests largely with the farmer
- If problems arise on farm, hard to prove cause
- Enforcement and monitoring are inadequate
- Numerous anecdotal reports of illness