Biosolids - Independent Science Information Compendium

A Call to Legislators and Government Officials to Stop Toxic Processed Sludge Land Contamination

Industry

Household

Storm

Hospital

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P. MICHAEL STURLA, CHAIRMAN
414 MAIN CAPITOL BUILDING
P.O. BOX 202096
HARRISBURG, PENNSYLVANIA 17120-2096
PHONE: (717) 787-3555
FAX: (717) 705-1923

420

HOUSE DEMOCRATIC POLICY COMMITTEE
www.pahouse.com/PolicyCommittee
Policy@pahouse.net
Twitter: @RepMikeSturla

House of Representatives
COMMONWEALTH OF PENNSYLVANIA
HARRISBURG

HOUSE DEMOCRATIC POLICY COMMITTEE HEARING

Topic: Biosolids

Quality Inn – Milesburg, PA

August 29, 2016

AGENDA

2:00 p.m. Welcome and Opening Remarks

2:10 p.m. Panel One:

- Dr. Herschel Elliott
  Professor of Agricultural and Biological Engineering
  Penn State University

- Dr. Richard Honour
  Executive Director
  The Precautionary Group

- Lidia Epp
  Molecular Biologist

3:40 p.m. Panel Two:

- Melinda Conrad
  Activist, Benner Township

- Rachel Guenot
  Activist, Benner Township

4:10 p.m. Dr. Caroline Snyder
Founder, Citizens for Sludge-Free Land
Charter Member, Union of Concerned Scientists

4:30 p.m. Closing Remarks

"Land Application of Biosolids: An Assessment Template"

Testimony before House of Representatives Democratic Policy Committee

Milesburg, PA

August 29, 2016

Herschel A. Elliott[1]

Good afternoon. Thank you for the opportunity to address this important topic. In this brief time I will attempt to give you some principles that should help guide the discourse on the topic of land-based biosolids recycling. I speak from the perspective of an academic researcher who has been involved in the health, environmental, and agronomic impacts of land application of biosolids for over 30 years. I note this because the academic perspective is fundamentally different from that of the general public. Public opinion generally reflects the perspective of the major print and broadcast media, which I find are not providing objective, balanced reporting on this issue. Science often spoils a sensational news story. But I would hope there is universal agreement on this: public policies must be based on sound, scientifically defensible arguments.

My purpose today is two-fold. First, I want to provide some background on generation and ultimate disposition of solids produced in municipal wastewater treatment. Second, I want to provide some general principles that should guide both personal opinion formation and public discourse on the issue. We focus today on land-based recycling of biosolids. This issue is not unique to Pennsylvania since the land is the ultimate repository for most wastewater solids generated in the US.

BACKGROUND

Wastewater treatment is one of the most important services provided to the public. This service is provided at municipal wastewater treatment plants, also called water reclamation facilities. Pennsylvania has more wastewater treatment plants (~900) than any state except Texas. Two streams emerge from the wastewater treatment process, the cleaned effluent that is typically discharge to a stream or river, and sewage sludge which contain the solids and constituents removed from the raw wastewater. This sewage sludge undergoes further treatment at the facility to improve its handling and meet the requirements of the particular disposal option employed by the facility. Once processed to meet land application regulations, the material is called biosolids. Currently, three major biosolids management options exist nationally and in the Commonwealth: land application, landfilling, incineration. None of these options are totally environmentally benign, and selection of the most appropriate option for a treatment plant is based on an array of factors and tradeoffs. In our 2005 survey of facilities in Pennsylvania, we found 38.4% of the biosolids produced were managed by land application, 46.4% by landfilling, and 15.2% by incineration.

[1]*Professor, Agricultural and Biological Engineering Dept., Penn State Univ., Univ. Park, PA. 16802*

The Standards for the Use and Disposal of Sewage Sludge (US EPA, 1993), 40 CFR Part 503, published in February 1993, provided much-needed national standards to encourage regulatory uniformity for biosolids recycling and ultimate disposal. The federal regulations, called Part 503 for short, served as the basis for the rules governing land application of biosolids in the Commonwealth. In our state, the Department of Environmental Protection (DEP) is responsible for oversight of biosolids management.

The policies, as with any program of such enormous complexity, have received both praise and criticism from the academic community. For many years I have been part of the USDA multistate research committee (W-3170) which conducted the original risk assessment for the Part 503 federal guidelines. This group continues to research new aspects that emerge.

As one trained in environmental engineering and familiar with research on the behavior of pollutants in soil and aquatic systems, let me propose several principles to serve as a template for evaluating land-based biosolids recycling.

GUIDING PRINCIPLES

Biosolids Management Involves Cost-Benefit Analysis

All societal decisions involve a balance of benefits and costs. Chlorination of drinking water is a prime example. Chlorination, which has probably improved human health worldwide more than any other single practice, is the most common means of disinfecting drinking water. Yet, we are concerned about the production of trace concentrations of chlorinated compounds, like chloroform, known to be carcinogenic. As a society, we have decided that the risk of potentially increasing cancer rates is more than compensated by eliminating mass outbreaks of water-borne diseases.

Biosolids management too has benefits as well as costs. A basic tenet of Part 503 is the explicit recognition that biosolids are a valuable resource. The overview of the Guide to the Biosolids Risk Assessments for the EPA Part 503 Rule (USEPA, 1995) states: "The term biosolids is used in this document to emphasize the beneficial nature of this valuable, recyclable resource (i.e., the use of the nutrients and organic matter in biosolids as a fertilizer or soil conditioner). Also, it is important to point out that while many of the substances found in biosolids are called pollutants throughout the document, many also are beneficial elements that are essential for the growth of plants and animals."

In designing systems for land-based recycling of residuals (biosolids, manures, food processing by-products, etc.) we ask the fundamental question: What quantity of residual can be applied to the land which maximizes the benefits to the soil-water-plant system while simultaneously minimizing negative environmental and health risks? For multicomponent wastes and complex heterogeneous natural systems, it is generally not possible to simultaneously accomplish both

objectives ideally—thus, we make engineering decisions which involve trade-offs and cost-benefit analyses.

Case in point: strip mine reclamation using biosolids. Pennsylvania has about one-quarter million acres of abandoned strip mines and, in my opinion, biosolids are an ideal resource for healing these broken landscapes. The PA regulations (§271.915(f)) state: "Sewage sludge may not be applied at a rate that is greater than the agronomic rate, unless a greater rate is approved by the Department (e.g., DEP) for land reclamation activities." The agronomic rate is typically the nitrogen requirement of the vegetation to be grown at the site—that is, we apply the amount of biosolids that will satisfy the nitrogen need of the crop over the growing season. For agricultural use, this typically requires about 5-10 dry tons of biosolids to be applied per acre for corn and other crops used. Yet for strip mine reclamation, the Department allows 60 dry tons of biosolids to be applied per acre, which may correspond to 10 times the nitrogen requirement for the grass mixture planted in reclamation activities. Does this cause a measureable spike in nitrate in the groundwater beneath the reclamation site? It does. So why does the Commonwealth allow biosolids to be applied at a rate known to impact groundwater? Because the tremendous benefits (soil building, reduced acid mine drainage, reduced erosion, revegetation, wildlife habitat) far outweigh the negative effects of a short-term spike in groundwater nitrate.

In like manner for agricultural fields, we have concluded that any negative effects of managing biosolids in compliance with Part 503 are not sufficient cause to forego the substantial societal benefits of land-based biosolids recycling. The benefits outweigh the costs.

Incidentally, just last December (2015), the Pennsylvania Supreme Court unanimously ruled that a lawsuit (Gilbert et al v. Synagro Central, LLC, et al) against a Pennsylvania farm and the biosolids supplier was barred under the state's Right to Farm Act (RFA). The key was that the justices ruled that the use of biosolids as fertilizer was a "normal agricultural operation" protected by the RFA from nuisance lawsuits.

Regulations Are Based on Extensive Risk Assessment Efforts

In the context of biosolids land application, Epstein (2003) notes: "No other waste or product has been subjected to such extensive research and examination". An important part of this examination history was the intensive risk assessment done as part of the 9-year development of the federal regulations. Beginning with a list of 200 pollutants identified by the EPA as pollutants for consideration, various expert panels recommended 24 pollutants warranted further study. Fourteen exposure pathways were considered and the most limiting pathway was chosen to set the regulatory value for each constituent. For example, the arsenic standard was set based on protecting a child ingesting 0.2 grams of biosolids per day for 5 years. Incidentally, the groundwater pathway (exposure of individuals drinking groundwater from below a field receiving biosolids) was not the limiting pathway for any of the 9 regulated trace elements. The

key point is that the regulatory limits are not arbitrary values but are based on a rigorous risk assessment using very conservative assumptions. For example, in evaluating the risk to the home gardener using biosolids, it was assumed that 60% of the diet came from products grown of biosolids-treated soil over a 70-year exposure period. Clearly, this is an unlikely scenario. But margins of safety are an integral part of environmental risk assessment.

Apply Basic Principles of Toxicology

A maxim of toxicology is that "the dose makes the poison". That is, exposure to toxicants depends on the amount, duration, and means of exposure. Ideally we would like to know the dose-response behavior of a pollutant. For any toxicant, there is some low level of exposure (dose) which has no observable effect (response) on an individual over a lifetime. The chemicals and toxicants present in biosolids cited as reason for their danger are also present in our food and drinking water. It is not their presence or absence that is important, but rather their concentrations and the frequency of exposure. Admittedly, we don't have data to develop dose-response curves for all chemicals—particularly newly synthesized compounds used industrially or in consumer products. And, of course, we don't test these compounds on humans, but must rely on extrapolating data from laboratory animals. It is very difficult to link cause and effect when dealing with minute quantities of chemicals in our water, food, and air, particularly when we are dealing with chronic, rather than acute, effects.

Evaluate Hazards in the Context of Related Risks

A specific hazard must be considered in the context of all related exposures. The potential pathogen risk from drinking the groundwater beneath biosolids-amended fields is negligible compared to eating fast food prepared by workers who don't wash their hands, taking a sloppy kiss from your dog after it has just cleaned its tail end, and certain sexual practices.

To the last point, consider the Center for Disease Control (CDC) data for communicable diseases in the US that are reported by physicians and hospitals. The most recent data on the CDC website is from 2013. In terms of number of cases in the US in 2013, the top six are: chlamydia >> gonorrhea >> syphilis > salmonella > Lyme disease > HIV. Clearly in the context of pathogenic infections, life-style choices are more important than environmental exposures.

To my knowledge, there have been no epidemiological studies causally linking pathogens in groundwater beneath a land application site to disease from consumption of that groundwater. Malfunctioning on-site septic tanks are far more important in the context of pathogen transport to groundwater (see Gerba and Smith, 2005).

In the context of land application of byproducts, there is a really nasty, carcinogenic material that is spread on hundreds of acres every day without regulatory oversight or public concern. That material is asphalt. In this and other areas of life we "strain out a gnat and swallow a camel".

Emerging Issues Continue to be Studied

We must never fall into the trap of thinking we are too knowledgeable to learn more, to modify our personal positions, or to acknowledge that we have overlooked a particular issue. If we are doing good science, we should always be open to findings that challenge our assumptions or previous conclusions. If there is good cause to believe we have overlooked an important exposure pathway or risk scenario, we want to know about it so we can learn how to manage the risk for the protection of health and the environment.

What are some of the unresolved issues? In the area of nutrients, quantitative guidelines for addressing biosolids phosphorus in nutrient management plans are not addressed uniformly across the country. Unresolved microbiological issues arise as new pathogens are discovered, and we need better data on the pathogen infectivity, that is, the number of organisms to which an individual must be exposed to initiate an infection. With the development of more sensitive analytical techniques, we can detect trace organics at the part-per-trillion level. The significance of perfluorochemicals, pharmaceuticals, and personal-care product chemicals in biosolids needs to be defined. Hindering this is often an absence of established health advisory limits on which to base risk assessment efforts.

The practical outgrowth of this perspective is the recognition that regulations must change as the knowledge base broadens. Part 503 is a dynamic, not static, regulatory framework and EPA continues to address new issues that emerge. Currently, the EPA is initiating a new compositional survey of biosolids from 72 treatment plants across the US. The EPA will be analyzing these biosolids for over 50 new organic substances to quantify the levels in biosolids. Then intention is to determine if any of these substances need to be regulated in biosolids land application.

Filter Opinions Voiced on the Issue

There are many voices opining on this and other issues with health and environmental implications. Listen to individuals who have earned the right to be heard because of their education and experience. I tend to discount the opinions of celebrities when they speak or write on environmental issues. The perspectives of scientists who have devoted their careers to studying land-based recycling of biosolids or health impacts from environmental exposures should be regarded more highly. And it is important to recognize a consensus viewpoint, while not ignoring a contrary opinion of a small minority.

I noticed in a Centre Daily Times editorial of June 29th this year, the claim was made that "several deaths—two in Pennsylvania—have been linked to sludge exposure." I know of no empirical evidence that lends credibility to the notion that land application of biosolids in compliance with the regulations has caused the death of anyone. And, I submit, you will not find any qualified epidemiologist or physician who would make such a dogmatic claim. On the contrary, there are several epidemiological studies comparing disease incidence of wastewater

treatment plant operators--those occupationally exposed to biosolids. The upshot is there seems to be little or no increase in disease of these operators, who are routinely exposed to aerosols containing pathogens and the untreated sewage sludge solids. Some studies suggest this cohort is actually healthier than the general public, the theory being they have robust immunological defenses because they are constantly being inoculated with low pathogen doses in their work.

FINAL COMMENTS

In conclusion, I have enumerated some principles for framing the discourse on land application of biosolids. When surveyed in its entirety, land application of biosolids under the protective regulatory guiding framework, is a positive and safe practice for managing the unavoidable byproduct of our society. Of course scientific uncertainties remain, but we are fine-tuning at this juncture. In the absence of any hard data to the contrary, we must continue the practice of recycling biosolids.

How this practice is implemented at the local level varies. We must allow that, in some situations, it may be expedient to go beyond the minimum regulatory standards to win public acceptance and foster good will among stakeholders. I would champion for a depolarization of positions and a resolution of differences without resorting to litigation. Constructive debate in forums like this will promote broader understanding that we can safely recycle this unavoidable by-product of an advanced, industrialized society. Our ability to manage biosolids with negligible adverse impact will be continually enhanced as the scope of knowledge broadens and biosolids quality improves.

Thank you for your attention.

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Author Lidia Epp at PA House Democratic Committee Hearing

08/29/2016

About Lidia Epp:

Lidia Epp, a Polish native, immigrated to the United States in the mid 1980s. She is a graduate of University of Szczecin, where she received her Bachelor Degree in Biology and Master's in Marine Biology. Before emigrating to US she was employed as a marine biologist at the Marine Fisheries Institute in Poland. Upon arrival to US, for several years she worked as a marine biologist in an aquaculture pathology lab at Gulf Coast Research Laboratory in Ocean Springs, Mississippi. She later moved to Birmingham, Alabama, and eventually to New Kent, Virginia where she currently resides. She worked at the Molecular Diagnostics Laboratory at the Medical College of Virginia and currently she manages the Molecular Core Lab in the Biology Department of College of William and Mary in Williamsburg.

Lidia is active with a local group of residents concerned about the agricultural application of biosolids, a dangerous practice that devastates farmland. She voiced her opposition during state legislative sessions, public hearings and City Hall meetings. She corroborates with local activists, politicians and scientists to bring public awareness to this issue and advocates for changes in state and federal regulations of biosolids land use.

TIMELINE

It all started in 1972 with the passing of Marine Protection, Research and Sanctuaries Act. It is the only pollution law that explicitly requires consideration of land-based alternative disposal.

1972 was also the year that Congress passed the Clean Water Act, with major revisions in 1977, 1981 and 1987. Last revisions, in 1987, resulted in amendments directing the EPA to research and promulgate the land applications of sewage sludge. A year later in 1988, Congress passed the Ocean Dumping Ban Act, thus eliminating all but land disposal method of sludge.

The Act went into effect in 1992, also the year when the PR firm was hired by the industry to devise a plan for gaining public acceptance of sewage sludge land disposal. And so the names "biosolids," "industrial residuals," "natural fertilizer," and "organic nutrients" were invented.

EPA quietly removed the sewage sludge from the list of HAZMAT and in 1993, sewage sludge federal regulations were published in the Federal Register as the "Part 503 rule," promulgated under the authority on the Clean Water Act, Title 40 of the Code of Federal Regulations, Part 503.

In 1986, Synagro Technologies Inc. was founded, a company currently operating in 34 states, specializing in agricultural disposal of sewage sludge and industrial waste. Or, to be politically correct, "biosolids and industrial residuals management."

- EPA REGULATIONS FAILURE

The Part 503 rule is a set of federal guidelines for the oversight and monitoring of agricultural use of sludge. The science behind those rules is grossly outdated, based on 1970 understanding of environmental sciences, biology, toxicology and pathology.

The futility of these EPA guidelines to protect public health lays not only in the fact that the regulations include a very narrow scope of pollutants required to be monitored (just nine heavy metals and only two species of bacteria), but they also don't reflect recent scientific findings. They regulate an infinitely small fraction of environmental pollutants, while ignoring a vast majority of dangerous components of sludge.

EPA regulations fail to incorporate existing scientific information and to protect the public. While numerous scientific experts recommend total ban on land application of sludge, EPA and the so-called Big Sludge industry continues to promote it. Sludge land application is a result of local and state economics and political factors, rather than the environmental and public health considerations. Sludge continues to be sold to the public as a "nutrient –rich garden compost" and advertised to farmers as a valuable fertilizer.

A total ban of agricultural use of sludge is only a partial solution as the alternatives such as landfill or incineration are also hazardous.

To ensure the true protection of the environment and public health would require the EPA to reformulate the problem, to implement new federal regulations based on the most current science.

However, EPA along with other federal, state and private institutions, such as USDA, universities and waste management companies (most prominently – Synagro) - continues to obstruct an unbiased, independent research and this in turn undermines an objective risk assessment and regulation.

- ENIVORNMENT AND PUBLIC HEALTH RISKS

Targeted National Sewage Sludge Survey Sampling and Analysis Technical Report, published in 2009 by EPA lists max an min levels of heavy metals , pharmaceuticals, organic chemicals, steroids and hormones that were found in sludge samples tested. High levels were found in all pollutant categories, for example – flame retardants and antibiotics. The survey included only a small subset of the toxic chemicals in use in the country.

Tens of thousands of organic chemicals are in use in USA, but a sludge concentration of only 516 organic chemicals has been so far researched. The data is lacking on fate and toxicity of chemicals to human and non-human receptors. An accurate assessment of a degree of the risk posed by the sludge is not possible at this moment. It is however, abundantly clear from the research available, that the EPA risk assessment is geared towards the underestimation of those risks. Science–based precautionary approach to investigating and identifying the toxic content of sludge should be the guiding principle of EPA federal regulatory review.

The complexity of the ecological interactions in sludge applied soils makes it exceedingly difficult for a definitive risk assessment. There are just so many interactions, unknowns and uncertainties, that the application of sludge to the land environment simply can't be considered safe. Accurate risk assessment would require an in-depth understanding of a long and short-time effects of sludge on soil microbial community, plant life and wildlife. And then there is the issue of public health risks. There is a great need for better understanding of a build-up of the toxins and contaminants over time with multiple applications and their movement from land environment into the groundwater, lakes, rivers and oceans. Long term, multidisciplinary, comprehensive research programs are needed to gain an understanding of the impact this practice has on the environment and human population.

New chemicals are invented almost daily. EPA formulated the 503 rule guidelines well before several of them were even conceived.

Let's look at nanosilver, which is a biocide (EPA definition: "a diverse group of poisonous substances including preservatives, insecticides, disinfectants, and pesticides used for the control of organisms that are harmful to human or animal health or that cause damage to natural or manufactured products").

Nanosilver is a component of anti-microbial formulations in textiles, food packaging and medical devices . Coleman et al in 2013 published an article: "Low concentration of Silver Nanoparticles in Biosolids Cause Adverse Ecosystem Responses Under Realistic Field Scenario". In this article the author argues that nanosilver applied at realistic levels to the soil by the biosolids route adversely affects plants and soil microbes.

Another example; a group of persistent, bioaccumulative, toxic compounds known to exist in the sludge in high concentration: brominated flame retardants. A subclass of those – polybrominated diphenyl ethers (PBDEs) – there is 208 different PBDEs, each of them has unique toxicology and environmental fate. This group of chemical has been studied extensively for decades and still today we have a rather poor understanding of the true risks associated with it's release to the environment.

And that's just one group of contaminants among so many. Add another 210 chlorinated dioxins (we are still talking about only flame retardants) and you maybe begin to grasp the extend of the total amount of known and unknown contaminants that end up in the sludge. They are concentrated thousands folds during the treatment process and then released to the landscape.

Marine biochemist, Robert Hale from Virginia Institute of Marine Sciences, in his 2004 publication: "Organic Contaminants of Emerging Concern in Land Applied Sewage Sludge" concludes that contaminants not even considered by the authors of rule 503 EPA regulations are indeed present in all of the biosolids samples examined during this study and he strongly suggests reevaluation of those guidelines in the light of those findings. Not only the "historically" tracked contaminants like heavy metals, petroleum products , pesticides and PCB were present in those samples, but also chemicals that were never evaluated before as a potentially present in the sludge; polybrominated diphynyl ethers, triclosan and polycyclic musks. Those are

contaminants of yet undetermined level of toxicity to humans, wildlife and microbial soil community.

There is little doubt that there are direct human health consequences of land application of sludge. Several published public health reports clearly link the sludge application sites to the overall decline of health by the surrounding communities.

Czajkowski et al in a publication from 2010 "Application of GIS in Evaluating the Potential Impacts of Land application of Biosolids on Human Health" concludes that there is a statistically significant increase in ill-health symptoms and diseases near the biosolids permitted fields.

Exposed residents were defined as those living within the one mile radius of filed applied biosolids, the illnesses included certain respiratory, gastrointestinal and other diseases.

Jordan Peccia, one of the most prominent scientific minds in environmental toxicology, a professor at Yale University, published several articles addressing risks associated with biosolids agricultural use. In 2007 he co-authored a study "Source Tracking Aerosoles Released from Land-Applied Class B Biosolids During High-Wind Events". In that publication he concluded that during windy days over 60% of air samples taken downwind from the biosolids applied field contained DNA fingerprint of bacteria commonly present in sludge. What bacteria, you might ask? A pathogen or a benign microbes common everywhere around us? Dr Peccia tackled that question in 201o publication titled " Pyrosequencing of the 16SrRNA gene to Reveal Bacterial Pathogen Diversity in Biosolids". In this article he concluded that most species identified were opportunistic pathogens from the group Clostridium and Mycobacterium. Those are NOT the two species of bacteria the the EPA rule503 regulations that are required to monitored, yet as proven in this study – represent the majority of the bacterial pathogen load in biosolids.

In a Master's Degree dissertation – "Bioaerosols Generated from Biosolids Applied Farm Fields" a graduate student from Ohio Tech established that pathogenically non-treated class B biosolids are capable of generating potential pathogens in the air. He observed that the level of bacterial pathogens significantly increased in the air samples following the biosolids application with the highest level reached at day 13 post application. That in

turn correlates with the increase of health problems reported by the residents of a nearby community.

There are many other published reports corroborating those findings, but more epidemiological data is needed. EPA should be at the forefront of promoting and subsidizing such studies, instead it turns the blind eye on a growing body of evidence and instead promotes research sponsored by the sludge industry.

Another area of great concern associated with the biosolids production is the emergence of antibiotic-resistant pathogens. The evolution of multidrug resistant bacteria is and acknowledged international health crisis. Major sources of those bacterial strains are water treatment plants and CAFO facilities.

Wastewater treatment plants concentrate sludge and present in it; both – bacterial pathogens from numerous sources and antibiotics, thus creating a perfect storm scenario for the emergence of antibiotic resistant strains by the means of horizontal gene transfer of antibiotic resistance genes.

- CONCLUSIONS

Current federal and state regulations clearly don't protect the environment or public health from the consequences of the agricultural sludge application. The full scope of that impact is not even fully known, as the independent, objective research is being discouraged at best, and most often squelched by the powerful forces of biosolids industry.

It is evident that the long term exposure to a host of the environmental pollutants is the foundation of many chronic conditions that are now at the epidemic levels. Rather than focusing narrowly on determination of specific sets of toxins present in biosolids from different sources – the research needs to shift to the epidemiological studies assessing the overall impact of complex mix of pollutants present in sludge.

It is true that biosolids contain beneficial elements like phosphorus, nitrogen, organic matter and trace nutrients. But the benefits derived from introducing those components to the soil via biosolids are by far overshadowed by the detrimental effects of toxins and pollutants that comprise the vast majority of the biosolids content.

Many countries adopted and implemented a new approach to the disposal of biosolids; methane production, energy source, recovery of metals and microelements. It is well past the time when we start to look at those alternatives as the only sustainable solution to the growing problem – what to do with the sludge our society produces.

To: PA House Democratic Policy Committee

Re: Public Hearing on sewage sludge

From: Caroline Snyder

Date: August 29, 2016

My name is Caroline Snyder. I am emeritus professor at the Rochester Institute of Technology where I designed, administered, and taught interdisciplinary environmental science courses and chaired the Department of Science, Technology, and Society. In 2001 I founded the nonprofit group, Citizens for Sludge-Free Land.

I appreciate the opportunity to submit written testimony at this public hearing. A re-evaluation of the Commonwealth's biosolids policies is long overdue. HR 60 is a good first step.

Land-applied municipal sewage sludge (biosolids) is a highly complex and unpredictable mixture of biological and chemical pollutants. Most of the 90,000 man-made chemical compounds in commerce today--with 1000 new ones added annually-- end up in sewage, and many of those, concentrate in the resulting biosolids .[107] They include carcinogens, mutagens, neurotoxins, endocrine disrupters, solvents, pharmaceuticals, radioactive waste, leachates from landfills and superfund sites, as well as disease causing and antibiotic resistant pathogens. [52,61,66,79,87, 97,104,] Upgrading and building improved treatment plants that will remove more pollutants from sewage, will cause sludge to become even more contaminated. Biosolids generated in our large industrialized urban centers -- and 84% of land-applied sludge originates in those centers-- is very likely the most pollutant- rich waste mixture of the 21st century.

The US EPA Office of Water (OW) regulates biosolids. The regulations, 40 CFR Part 503, are usually referred to as the 503s. Despite the agency's claim to the contrary, OW also promotes land application. This is a gross conflict of interest. Government agencies should not be in bed with the industries they are supposed to regulate.[82] As a consequence of this industry-government alliance, the 503s are full of loopholes. The most damaging loop hole of all is the so-called "Domestic Sewage Exclusion" which permits every industry connected to a sewer to pipe its hazardous waste into POTWs. A partial list of those pollutants is posted on our webpage.[106] When these hazardous chemicals are mixed with sewage, they become exempt from RCRA's solid and hazardous waste laws. Industries and municipalities benefit from the Domestic Sewage Exclusion in several ways: they can avoid the expense of properly treating pollutants or refrain from piping hazardous waste into POTWs in the first place; and once these two waste streams mix, industries are no longer liable for any damages that might result from this toxic mixture., especially when it is processed and land applied. In an unpublished and un-dated document, titled Gatekeepers*: Who are They? What They think about Us? And What can we do about it?* Bill Toffey, a spokesperson for the biosolids industry and advocate of land application, tells his audience in no uncertain terms how important it is for industries to support the Domestic Sewage Exclusion:

You may have missed the proposed rulemaking to change the reporting requirements for lead as a "persistent and bioaccumulative toxic." The proposal would reduce from 10,000 to 10 the number of pounds annually that an entity can dispose without reporting, and the de minimis lead concentration for reporting would be eliminated. At first reading, it seemed to me that this reporting rule would capture most of Philadelphia's recycling programs. But apparently all other POTWs and we are saved by the fact that the rule doesn't apply to POTWs . This is one case where being a POTW making a fertilizer is preferred to being a manufacture [sic] making a fertilizer; we are in the right SIC code. But this is cold comfort. Some folks in Congress, in the environmental community and in EPA itself believe it is in the public's and environment's best interest to track the lead that is spread on land. Someday they will get us, and we need to be prepared. Fighting changes to the Domestic Sewage Exclusion may haunt us as an example to the environmental community that our claim to being concerned for the environment is a sham.

After ocean dumping was banned, land application increased, as did the reports of serious health, livestock, and environmental damage. The first comprehensive scientific appraisal of the 503s was published in 1999 by internationally renowned soil scientists at the Cornell Waste Management Institute (CWMI) —whose teams have been researching biosolids since the 1970s. Aptly titled *The Case For Caution* the report warns that the 503s do not protect human health, agriculture, or the environment.[23] Around the same time a team assembled by David Lewis-- formerly a senior level EPA research microbiologist-- documented human and animal sicknesses and deaths linked to land application under the 503 rule, the first scientist to do so.[35,36,37,84] Because of increasing concerns about health impacts, the National Academy of Sciences (NAS) was asked to examine the scientific basis of the 503s. Its 2002 report*, Biosolids Applied to Land*, questioned the science and risk assessment models of the rule and urged EPA to implement health studies of neighbors who lived adjacent to sites that had been treated with sludge. NAS panel members had available not only the work of Lewis' team and that of the CWMI, but also a 382 page document put together by sludge activist Helane Shields listing sludge "incidents" that had occurred in virtually every state of the union.[54] Particularly worrisome where the many reports of sicknesses and several deaths.[90] To include published papers that documented these incidents in the scientific literature would hurt the land application program. So industry-friendly NAS panel members deleted all references to David Lewis' papers in the published report, which includes the statement that there is "no documented evidence" that anyone was ever harmed by sludge. In the absence of any credible science that supports land application, industry and government agencies continue to cite the "no documented evidence" claim, making sure the evidence is not documented, or, if it is, to ignore or discredit it. [92]

Yet people are not easily fooled. Every week there are reports of sludge battles, especially in the heavily populated areas of the country where most sludge is produced and spread. Residents who believe they have been or will be harmed are pitted against government and industry officials who assure them that the practice is beneficial and safe. For example during a 2014 Town Meeting in Bell

County Township, Clearfield County PA angry residents demanded an end to sludge spreading in their community because it was making some of them sick. Despite the usual misleading assurances by state officials that biosolids will enrich the soil and improve the overall health of land and animals, residents

wanted the practice stopped. One neighbor who lives close to the permitted site was hospitalized with bronchial spasms when the spreading began. Her doctor said that such spasms, which resemble a heart attack, can be caused by air borne irritants. Other people attending the meeting complained of headaches and nausea. [96]

Government and industry representatives at these meetings usually assure affected residents that their health problems or their contaminated wells were caused by something else. For example, a few years ago, when an astute NH property owner learned that his neighbor uphill was about to use sludge, he decided to have his well water tested before and after the spreading. Not surprisingly, test results taken after the application showed high levels of pathogenic bacteria. After he complained a representative of the sludge company visited his home, looked around, and stated that the well must have become contaminated by his bird feeder!

However when deaths are linked to sludge-exposure, bird feeder explanations do no longer work. Two of those deaths occurred right here in the Commonwealth. The PA DEP and the company that spread the sludge went through extraordinary lengths to cover up the cause of these deaths. For a summary see ***Appendix A***.

Evidence keeps piling up that there is something seriously wrong with the 503s. Why, many people ask, are EPA and USDA--agencies whose mission it is to protect human health, promote sustainable and productive agriculture, and protect the environment—why are these agencies not substantially tightening the current land application rules, or better yet, why are they continuing to spend our tax dollars on a million- dollar Public Acceptance Campaign, when, instead, they should be using those funds to invest in safer and more sustainable alternatives?

One part of the answer is simple. Top managers at EPA's Office of Water and a highly influential agronomist at the USDA wrote the 503s. They decided that it would be acceptable for biosolids to contain hazardous waste, reasoning that small amounts do not matter, that the waste stream is getting cleaner, and that pretreatment of industrial waste is working. None of those assumptions proved to be true. Even very small amounts—parts per trillion-- of some pollutants can harm developing organisms, and instead of getting cleaner, the waste stream is getting more complex and more polluted. Several recent EPA Inspector General Reports, indicate that hundreds of priority pollutants discharged by industry are showing up in effluent and sludge. But the individuals who wrote the rules are still in charge of the nation's biosolids policy and have staked their reputation on the adequacy of the 503s. Apparently no amount of evidence will persuade them that they were wrong. [92]

The other part of the answer is also simple. Not only the sludge brokers who are paid for every ton of sludge they remove from sewage treatment plants, but also --as we explained earlier-- industrial users and municipalities save substantial sums by continuing this inexpensive method of sludge disposal. Communities are learning more about what biosolids are, and what they do when land applied. They are experiencing first- hand the resulting harm to their health,[51,55,68,71,108,109] their drinking water,[12,71,77,99,101] and their animals. [74,79,83,94,105] To counter this new awareness, government agencies and the sludge industry are spending millions to rev up their PR campaign to convince farmers, the media,

legislators, and the public that spreading this incredibly complex contaminated mixture on land is sustainable., beneficial and safe.

A key flaw of the 503s is that they depend on Quantitative Chemical-by-Chemical Risk Assessment (QRA) to assess health and environmental impacts. QRA works for calculating how strong a bridge must be to withstand the weight of daily traffic on a particular highway, but QRA cannot be used to assess the health and environmental impacts of such a complex and unpredictable mixture as land applied sewage sludge. See Appendix ***B***

Instead of calculating health and environmental risks using QRA models, the NAS panel recommended a different approach:

Even if a summary index of an adverse response to mixtures was available, it would not necessarily reflect the total hazards of exposure to biosolids because of the inability to identify all of its hazardous constituents and their potential for interaction in vivo . . . thus it is not possible to conduct a risk assessment for biosolids at this time (or perhaps ever) that will lead to risk-management strategies that will provide adequate health protection without some form of ongoing monitoring and surveillance . . . the degree of uncertainty requires some form of active health and environmental tracking."

A number of the biosolids incidents might have been prevented had there been exposure studies and health and environmental tracking.

Many serious health impacts have been linked to Class B sludge exposure, especially when this material is stockpiled and top dressed rather than incorporated into the soil. Sludge advocates are now promoting a material that is deceptively referred to as Exceptional Quality (EQ) Class A sludge. Many people do not realize that Class A EQ sludge contains just as many persistent toxic chemicals as Class B. When sludge is further processed to reduce indicator pathogens, it turns into Class A. However as the more vulnerable indicators are deactivated, much more robust pathogens survive and evolve. In the absence of microbial competition, they multiply and thrive, especially in in cool and moist climates. Some of the treatment methods prescribed to reduce the level of indicators are not working, so Class A sludge is often Class B sludge or turns into Class B sludge after it is spread or stockpiled. Further processing also appears to encourage the growth of superbugs which explains why many neighbors exposed to sludge contract MRSA infections. The question arises, why, if all of this is true, are industry and government agencies encouraging the production and use of Class A materials?

Again, the answer is simple. Under the current rules, Class A is virtually unregulated. As long as it contains some nitrogen, it can be spread anywhere—including on home vegetable gardens--during any weather, at any time during the year, in any amounts, and does not require public notices, public hearings, or the expense of getting a permit. Also Class A products can be sold in garden centers, often misleadingly labeled. But are they really safe? Consider two incidents. One took place in the summer of 2007 in Milwaukee, where sludge is used to make the Class A product Milorganite. Sewer workers dislodged large amounts of PCBs during a routine sewer cleaning operation. This resulted in thousands of tons of contaminated sludge-- some containing superfund high levels of PCBs—to be spread on dozens of school playgrounds and parks. When the problem finally was discovered, the contaminated

material had to be removed and shipped to out-of-state hazardous waste landfills. The entire incident cost the city millions. [104]

Consider another incident that happened in Shirley MA . In January of 2014 a farmer spread *Earthlife* on his frozen snow-covered field. *Earthlife* is a Class A product made by Casella Organics and fully approved and registered for use in MA, CT, and VT. Three weeks later, after a thaw, residents living next to the field on 15 and 20 Bumpus Road turned on their faucets and out came diluted sewage. Both families got their water from shallow wells. *Earthlife* apparently had leached into the water table and contaminated their wells. I was invited to attend a February 28 meeting of concerned neighbors and provided information and hand-outs. Appealing to the town for help was useless because what the farmer had done was legal under the 503s. Despite conclusive test results that the contamination was caused by *Earthlife ,* the homeowners could not afford litigation. A month went by and I did not hear from the affected home owners. So I contacted them to see how they were doing. During that interval Casella had paid for drilling a bedrock well at one home and had paid for a filtration system for the other family. In return, the home owners were put on a gag order and told never to discuss the case or share test results. Settlements like these explain why many sludge incidents remain unknown or are underreported.

The practice cannot be banned overnight. Something needs to be done with the millions of tons of sludge produced every year. Until more sustainable waste-to-energy technologies are in place to handle this volume, states might want to encourage increasing disposal in well sited subtitle 2 landfills with methane capture for energy and heat. Reclamation of contaminated land may also be an option as long as the site is securely fenced and signed, to prevent another Tony Behun tragedy. It is absolutely crucial that we preserve our dwindling productive farm land for future generations. We must not apply sewage sludge and other industrial waste on the land where we grow our food and forage.

Meanwhile, states, counties, and towns can put in place more protective inexpensive management practices that will at least reduce some of the risks. These would include permanently prohibiting land application on grazing fields to prevent contamination of meat and dairy products; immediate incorporation of sludge into the soil to prevent pollutants from moving off site; prohibiting stockpiling; permanent pH management to prevent metals and other contaminants from becoming bioavailable; much more protective horizontal and vertical buffers from occupied buildings; and limiting the acreage and frequency of application.

The number of individuals and organizations that oppose land application is growing. There isn't a community in the country that welcomes the arrival of sludge trucks. Many farmers are no longer taken in by the brochures and videos that promise instant savings and high yields from this free mislabeled "natural organic" fertilizer. Over a hundred environmental organizations-- many supporting sustainable farming practices–-oppose growing food and forage on biosolids-treated land. Among them are the Sierra Club, the Natural Resources Defense Council, the Rodale Institute, the Institute for Agriculture and Trade Policy, Western Growers, the National Farmers Union, the Food Rights Network, and the

Organic Consumers Association. All of these organizations depend on impartial scientific information to form their policy positions.

In conclusion PA legislators might be interested in the recommendations of Professor Jordan Peccia, Associate Professor of Engineering at Yale University and Professor Paul Westerhoff, Professor at the School of Sustainable Engineering at Arizona State University in their paper titled, ***We Should Expect More out of Our Sewage Sludge:***

The culmination of previous incremental technologies and regulations aimed at solving a current treatment problem, rather than developing the practice for the higher goals of sustainability have resulted in sludge becoming an economic and social liability. Sludge management practice must shift from treatment of a liability toward recovery of the embedded energy and chemical assets, while continuing to protect the environment and human health. This shift will require new research, treatment technologies and infrastructure and must be guided by the application of green engineering principles to ensure economic, social and environmental sustainability.[103]

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Appendix A

For land application to continue under the current policies, it was essential for the Pennsylvania Department of Environmental Protection (PA DEP) to deny that sludge might have caused the death of a Pennsylvania child. Len Martin compiled a chronological and detailed account of how, for almost two years, the PA DEP went to extraordinary lengths to hide the circumstances of Tony Behun's death.

In October 1994, 11-year old Tony had ridden his dirt bike through sludge that had been applied to a reclaimed mining site. The child developed headache, sore throat, furuncles on one leg and arm, difficulty breathing, and a high fever. On October 21, a week after he had been exposed to sludge, Tony died of staphylococcal septicemia. In 1999, Tony's mother, who had heard that sludge was causing health problems in other parts of the country, sought answers from the state about her son's mysterious death. The PA DEP repeatedly and publicly denied that there was any connection between sludge exposure and her son's death. According to public statements made by the agency and the company that had spread the sludge, Tony's death resulted from a bacterial infection caused by a bee sting, and sewage sludge had not been applied on the mining site. In May 2000, PA DEP secretary, James Seif, drafted a report claiming that both the National Institute of Occupational Safety and Health (NIOSH) and the state health department had investigated the case thoroughly and ruled out sludge as the cause or contributing factor of Tony's death. Every one of the above-cited claims proved to be false. The DEP was forced to retract the fabricated bee-sting story; truck weigh slips indicated that about 5,600 wet tons of sludge had been spread on the site next to the child's home; and on August 7, 2000, the PA Department of Health sent a letter to State Representative Camille George confirming that the department "in fact, did not conduct an investigation into Tony Behun's death." NIOSH also stated that it "had no involvement [in the case] because "our agency only investigates workers' health complaints." Subsequent public testimony by EPA's Robert Bastian about this case illustrates how EPA and the state agencies responsible for land-application policies work together to misrepresent facts to cover up incidents. On March 13, 2001, Bastian presented Seif's false report to the NAS panel that was seeking input about alleged health incidents linked to sludge-exposure. Bastian assured the panel that "the findings of [PA] state and local health officials have indicated that the Pennsylvania death was not attributable to biosolids".

Appendix B

Quantitative Risk Assessment Risk models are one tool used by industry and agencies to help determine whether or not a product or practice is reasonably safe. It is not a very reliable tool, because it is based on assumptions that can vary from assessor to assessor. For example, when a group of EPA scientists used four accepted models to calculate the cancer risk posed by trichloroethylene in drinking water, their risk estimates varied by a factor of 100 million. [63] If risk assessments for one chemical in one medium can yield such different results, how can it be a reliable tool to identify the various environmental and health risks from such a complex and unpredictable mixture as sewage sludge, spread on complex terrestrial ecosystems, affecting a variety of living organisms with varying susceptibility to infections? With so many unknowns, with stressors that have not even been identified, much less characterized, for which we do not yet know all the modes of action, and all the various potential synergistic interactions between chemicals and chemicals and pathogens, which we are just beginning to identify, any quantitative risk assessment will be an exercise in futility. The more complex a system, the more the uncertainties and the variables, the more unreliable are mathematical models used to assess risks.

Land application of sludge is wrought with uncertainties. Experts estimate that sludge generated in industrialized urban centers-- and most land-applied sludge is generated in these areas—contains not only pathogens and toxic metals, but thousands of anthropogenic chemical compounds for which there are not even basic toxicity data. Many known unregulated sludge pollutants are carcinogenic, persistent, and/or toxic; endocrine disrupting chemicals can damage living organisms in parts per trillion. Pathogens are evolving and becoming more virulent. Only a very few Ecoli 0157:H7 bacteria, as little as ten, can cause life- threatening disease. Making it impossible to determine what pathogen level in sludge is safe, especially since people's susceptibilities to infectious agents differ and they are exposed to other stressors from other sources. QRA is not suitable for mixture toxicity, for interactions between chemicals , between chemicals and pathogens, and between pathogens.[21,30,40,57,102] It cannot account for toxic synergistic interactions,[19,21,30,57,70,84] especially those between hormone disrupting chemicals.[40,102] Essential to any valid risk assessment is to describe the amount and effects of the components in a complex mixture. With sludge, this cannot be done. Depending on risk assessment alone will never explain why sludge-exposed people are getting sick.

The Precautionary Group

Protecting Human and Environmental Health

The Pennsylvania House of Representatives, Democratic Policy Committee

Public Hearing, Monday, August 29, 2016, Milesburg, PA

Testimony of Richard C. Honour, PhD, Executive Director, The Precautionary Group

Negative Impacts on Ground Water and Human Health from Land-Disposed Toxic Sewage Sludge

(*Water quality equals quality of life*)

Perspective: Please appreciate that I spend more time in forests and on rangelands and farms than in a lab, lecture hall or courtroom. I observe firsthand the massive die-offs of plants and animals exposed to Land-Disposed Toxic Sewage Sludge, and I experience personally the adverse effects of direct exposure to Toxic Sewage Sludge and its noxious fumes. My current work evaluates the impacts of Land-Disposed Toxic Sewage Sludge on surface and ground waters in forests and on farms and rangelands.

Thesis: Toxic Sewage Sludge is the separated solids from combined wastewater flows from domestic, medical, industrial and road runoff sources, and must never be disposed on land or in water, most especially on lands that are used for the production of human foods or for food animal feed crops.

Solution: One of our great challenges is proper management of waste generated by an expanding global population. Deciding to recycle, beneficially reuse or repurpose toxic wastes cannot include strategies that increase our exposure to these toxic materials. Thermal Decomposition of toxic waste to render the toxics as being non-toxic or safe, must be the objective. The technologies and methods exist, and must be engaged.

We are told by agencies and the Toxic Sewage Sludge industry that this toxic waste has been "Treated," and that it is "In Compliance," "Safe" and "Without Risk," yet no one has ever subjected such toxic waste materials to adequate chemical and microbiological analysis, or to rigorous safety/toxicology testing. In the approximate words of Dr. David Lewis, not only are the contents and chemistries of sewage sludge not known, but 'they are unknowable.' Each and every Land-Disposal event with Toxic Sewage Sludge exposes us to Preventable Risk.

When considering the 80,000 or more industrial chemicals in use in commerce in the US currently, and that the EPA assures us they can review the toxicity of perhaps eight such chemicals per year, we are left then to assume that we should have adequate answers on the toxicity profile of the current list of chemicals in about 10,000 years; nearly all of these toxics flow to our sewage systems. This does not take into account the new toxics that emerge continually by endless novel combinations and permutations of known chemicals into new chemical entities within the sewage system that defy our chemical intuition and imagination. Therefore, formal safety/toxicology testing of the known and unknown chemicals in Toxic Sewage Sludge cannot be accomplished - ever. Why, then, would anyone offer unsubstantiated claims for the safety (absence of toxicity) of a material, when such materials and their constituents cannot even be identified, much less evaluated or become known?

On the more subjective side, our field observations of dead plants and animals in the wake of Land-Disposed Toxic Sewage Sludge define for us clearly that the Implied Risks and Imminent Threat of Harm by exposure to such toxic materials must prohibit any form of human exposure. It is ground and surface waters that intensify the Risk and Threat, because the combined known and unknown toxics in Toxic Sewage Sludge are transported in water throughout our living environment. Lesser appreciated are the long-term adverse effects of the toxics that are the likely inciting agents of chronic diseases of unknown etiology – they remain as the real unknowns.

Our on-going analytical chemistry investigations of Brominated Flame Retardants, Polychlorinated Biphenyls, Triclosans and Organochlorinated Pesticides in Toxic Sewage Sludge and in associated agricultural runoffs and leachates from forests and farms reveal that agencies, academic investigators and purveyors of Toxic Sewage Sludge remain unaware of the actual risks and threat of human exposure to these toxic wastes, including to the water-borne chemicals to which we are exposed. There is more work to do before Toxic Sewage Sludge can be declared safe for any form of Land Disposal. We know not what we do.

The Precautionary Group LLC
A Washington State Limited Liability Company
19211 64th Place NE, Kenmore, WA 98028-3380
rhono@precautionarygroup.org • 425.772.1473 • www.precautionarygroup.org

The Precautionary Group

Protecting Human and Environmental Health

Richard C. Honour, PhD

SUMMARY OF EXPERIENCE:

- **Environmental Research and Education**: Evaluation of human and environmental health effects of toxic waste disposal in forest watersheds and on rangelands and farms
- **Biopharmaceutical Development**: Development of new biopharmaceutical products for the treatment of infectious diseases
- **Cancer Clinical Trials**: Management of cancer clinical trials research programs on new cancer treatment modalities

POSITIONS HELD:

2010 - Present: Executive Director, The Precautionary Group, Kenmore, WA. Executive Director of an Environmental Science and Education firm established to evaluate the adverse human and environmental health effects of toxic wastes applied to forests, rangelands and farms.

2004 - 10: President & CEO, Viridax Corporation, Ocala, FL. Management of technology development for a biotechnology company specializing in new products for the treatment of antibiotic-resistant infections incited by *Staphylococcus aureus* and *Mycobacterium tuberculosis*.

2003 - 04: Advisor, Phage Genomics, Inc., Bothell, WA. Management of a biotechnology company dedicated to the development, regulatory approval and commercialization of novel biopharmaceutical products for the treatment of multi-drug-resistant *Mycobacterium tuberculosis* (MTB, MDRTB & XDRTB).

1997 - 02: President & CEO, Phage Therapeutics, Inc., Bothell, WA. Management of the discovery and development of novel biopharmaceutical products for the treatment of antibiotic-resistant forms of *Staphylococcus aureus* and *Mycobacterium tuberculosis*.

1995 - 97: Technology analyst for the investment banking firm Chanen & Painter, Seattle, WA, for the biotechnology, biopharmaceutical, medical diagnostic and medical device sectors.

1991 - 95: Executive Vice President, Pharmaceutical Development, Cytran Ltd., Kirkland, WA. Management of manufacturing, preclinical testing, regulatory affairs and clinical trials for new peptide-based biopharmaceutical products for the treatment of antibiotic-resistant infections.

1985 - 91: President & CEO, MicroProbe Corporation, Bothell, WA. Executive management of the discovery and development of novel DNA probe-based diagnostic products for infectious diseases.

1983 - 85: President & CEO, ZymoGenetics, Inc., Seattle, WA. Executive management of the discovery and development of new protein-based biopharmaceutical products.

1973 - 83: Executive Director, Childrens Cancer Group, University of Southern California Medical Center, Comprehensive Cancer Center, Los Angeles, CA. Management of the Statistical Center. Clinical trials management and evaluation of new drugs for the treatment of pediatric cancer.

1975: Consultant, Environmental Sciences, Argonne National Laboratory, Argonne, IL. A program of environmental education related to energy development on Indian lands in the western US.

1972: Environmental Research Scientist, US Antarctic Research Program, in Antarctica. Sponsored by the National Science Foundation, NASA, California Institute of Technology, Pasadena, CA.

EDUCATION: University of California, Riverside, CA — PhD, Plant Pathology/Soil Microbiology
San Diego State University, San Diego, CA — BS, Biology

The Precautionary Group LLC
A Washington State Limited Liability Company, A Social Enterprise
19211 64th Place NE, Kenmore, WA 98028-3380
www.precautionarygroup.org • 425.772.1473 • rhono@precautionarygroup.org

Microplastics in Sewage Sludge: Toxics Upon Toxics

Richard C. Honour

Sewage sludge, the solids separated from raw sewage in a Wastewater Treatment Plant (WWTP), collects and holds the physical materials, chemical wastes and microbial matter from all sources that contribute to sewage inflows. WWTPs degrade much of the organic matter in raw sewage by microbial digestion, but screening, settling, filtration and dewatering assure that most of the residual physical materials and the poorly-degraded Toxics (*poisonous substances*) partition to the solid phase, i.e., to the sewage sludge that is destined for land disposal in forests or on farms and rangelands. But what fate awaits the toxics?

Components of sewage sludge that are not degraded in a WWTP, including plastics, are land-disposed, and thereafter degrade as a function of their chemistry and the environment to release toxics by many routes. Plastics in sewage sludge originate as manufactured products in commerce, including as pharmaceutical or personal care products, product wrappers, produce labels, fibers from fabrics, and as fragments of larger plastics. In any case, plastics are: Carriers of toxics; and, Sources of their own toxics as they degrade in the environment.

Microplastics are considered to be about 1 mm or less in size, but for plastics encountered in sewage sludge, we consider microplastics to be as large as 10 mm. Last year, King County, WA, modified the mesh size of the screens in their WWTPs from one-half inch to three-eighths inch (about 10 mm) in an effort of reduce the size and load of 'Physical Inerts' in their sewage sludge product.

The forms and chemistries of microplastics in sewage sludge are beyond what should be disposed in forests or on farms and rangelands, because the chemistry and toxicity of the degrading microplastics, and from the adsorbed toxics, remain mostly unknown. Similarly, the distribution, fate and toxic effects of these chemicals in soil and water, and their bioaccumulation in biota, also remain unknown. The most likely outcome is Environmental Toxicity (*harmful effects of toxics on living organisms*).

Sewage sludges from WWTPs hold examples of most classes of toxic pollutants, including Persistent Organic Pollutants (POPs), Chemicals of Emerging Concern, and Persistent Bioaccumulative Toxics, with hundreds of synthetic members of these groups known to accumulate in sludge.

Common plastics, such as Low-Density Polyethylene, form the basis of a vast plastics industry, including for use in Pharmaceutical and Personal Care Products, and they are natural accumulators of toxic chemicals, including Brominated Flame Retardants, such as the Polybrominated Diphenyl Ethers, as well as Nonylphenols, Dioxins, Furans and Polychlorinated Biphenyls (the infamous PCBs). These are some of the highest priority toxic chemicals encountered in any domestic, medical, industrial or agricultural wastewater stream. The presence of these plastics in raw sewage, and then in the wastewater treatment process, assures their bonding with priority toxic chemicals in wastewater, and their ultimate partitioning and accumulation in the resulting sewage sludge product.

Land disposal of this toxic chemical debris assures broad dispersal of plastics into the surrounding environment, with the microplastic-borne toxics being released thereafter, as the parent materials degrade naturally in the presence of ultraviolet light, and by oxidation and microbial degradation.

Analysis of sewage sludge samples from a King County, WA, WWTP, as collected from a Snoqualmie Forest land disposal site, revealed a menu of toxic flame retardants that surpassed what was expected.

The forest-disposed, sewage sludge-borne toxic flame retardants included:

2,2',4,4'-tetrabromodiphenyl ether (BDE-47)
2,2',3,4,4'-pentabromodiphenyl ether (BDE-85)
2,2',4,4',6-pentabromodiphenyl ether (BDE-100)
2,2',4,4',6-pentabromodiphenyl ether (BDE-100)
2,2',4,4',5-pentabromodiphenyl ether (BDE-99)
2,2',4,4',5,5'-hexabromodiphenyl ether (BDE-153)
2,2',3,4,4',5',6-heptabromodiphenyl ether (BDE-183)
Decabromodiphenyl ether (BDE-209)
2-ethylhexyl 2, 3, 4, 5-tetrabromobenzoate (TBB)
2-ethylhexyl 2, 3, 4, 5-tetrabromophthalate (TBPH)
2-ethylhexyl 2, 3, 4, 5-tetrabromophthalate (TBPH)
Decabromodiphenyl ethane (DBDPE)
Tris (1-chloro-2-propyl) phosphate (TCPP)
Tris (1,3-dichloro-2-propyl) phosphate (TDCPP)

It is notable that Pentabromodiphenyl ether (BDE-85) was eliminated from production under the Stockholm Convention, a treaty to phase-out POPs. It is found at elevated concentrations in air, water, soil, food, sediment, sewage sludge and dust; it enters the body by ingestion or inhalation; it is stored in body fat, and it is retained in the body for years. PDE-47 and PDE-99 accumulate in terrestrial carnivores and humans at rates higher than any other industrial chemical. Tris (1,3-dichloroisopropyl) phosphate (TDCPP) is a chlorinated organophosphate, various forms of which are used as flame retardants, pesticides, plasticizers and nerve gases.

More than 70% of toxic chemicals detected in sewage sludge are also detected in humans. They concentrate in sewage sludge, are persistent in the environment, bioaccumulate in fatty tissues, have degradation products with elevated toxicity, and are synthetic, rarely occurring as single compounds.

Until these toxic chemicals can be eliminated from raw sewage and other wastewater streams, it will be important to expand testing of all sewage sludges and wastewater effluents to assure that the risk and threat may be determined and the public placed on alert.

Placing the burden of toxics elimination on commerce and industry as a source-control strategy may be the only effective action until an enhanced wastewater treatment process can be integrated into the WWTP system to protect human and environmental health. A thermal degradation process, for example, such as Plasma Arc Gasification (PAG), can reduce organic chemicals and plastic wastes, including microplastics, to syngas that may be used as a source of heat for energy, with minimal residual ash that is safer and more easily disposed.

PAG of sewage sludge involves super-heating the sludge in an oxygen-starved environment to preclude combustion, with the intent to offer cleaner emissions, substantial energy production and the near elimination of land disposed ash. While shown to work well in model projects, none of the emerging gasification technologies has yet been reduced to practice on an industrial or municipal scale in the US.

Richard C. Honour is Executive Director of The Precautionary Group, Kenmore, WA, and Vice President and Director of the North American Alliance for Clean Land, Chapel Hill, NC.

A solution to the challenge of land-disposed sewage sludge

June 27, 2016

By Richard Honour and Patty Martin
For Environmental Health News

For the sake of our health and the health of our land, we need to abolish land-disposed sewage sludge, but where will it go? The challenge and the solution are clear: Sewage sludge—consisting of semi-liquid waste obtained from processing municipal sewage—is toxic waste, and must be reduced to safer material with little or no toxicity in preparation for safe disposal. But by what technology, and at what cost to whom? Our air, soil, water and food are at risk.

Sludge in the wheat fields of Douglas County, Washington. (Credit: Richard Honour)

Using federal data, we estimate that about 60 percent of nearly 100 million wet tons of sewage sludge from nearly 20,000 municipal wastewater treatment plants in the U.S. is disposed each year on the nation's farms, forests and rangelands, and it's all toxic waste.

Human exposure to sewage sludge toxics, such as in crop plants, food animal feed crops, runoff to ground and surface waters, and air, affects us all. The need for a solution is clear. Toxic sewage sludge cannot be repurposed or reused somewhere else; it remains as toxic waste until decomposed by high heat, far beyond what may be provided by incineration.

Sewage sludge can be processed safely by several forms of enhanced thermal decomposition to yield heat for energy, clean exhaust gas equivalent to ambient air, and nearly inert ash that can be land-filled or used for the production of fire bricks or other industrial products. As it stands, toxic sewage sludge is disposed in our forests and on our farms and rangelands, simply because we fail

to embrace existing thermal decomposition technologies that easily reduce sewage sludge and its toxic chemicals, metals and pathogens to basic elements that can be repurposed safely.

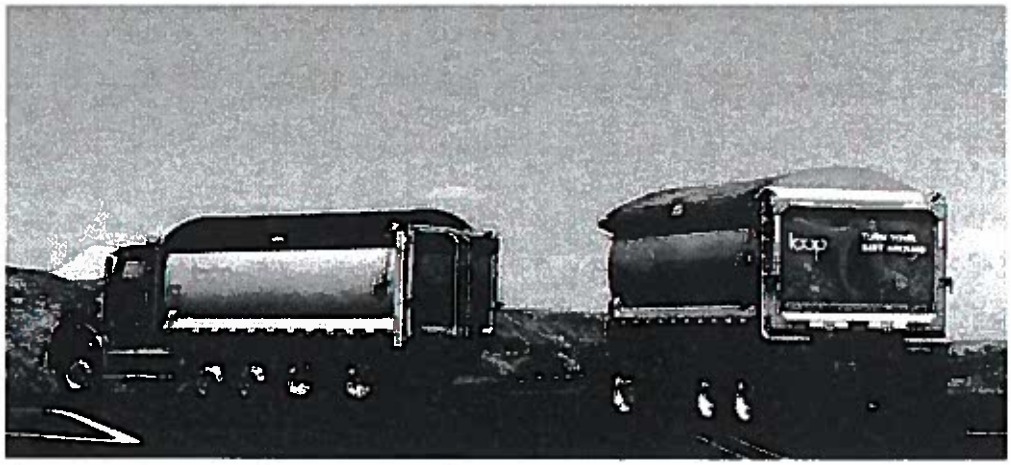
Several thermal decomposition technologies have been applied to toxic sewage sludge, including conventional incineration, co-incineration, pyrolysis and Plasma* Arc Gasification (PAG). PAG offers a cost-efficient method to reduce toxic sewage sludge to basic elements in the presence of very high heat by a technology and engineering system that may be constructed at nearly any location. No other existing, emerging or contemplated thermal decomposition waste-to-energy technology appears to match the potential of PAG for sewage sludge reduction, energy production, cost effectiveness and human and environmental benefit, and it is easily scalable.

Identifying the proper solution for each location becomes the challenge, as a function of the quality and quantity of the raw sewage or other carbon-rich waste inflows, plus the expected quality of the resulting heat, heat-to-energy, exhaust and ash products, all as a function of available budget.

PAG is based on super-heating waste (not burning), including common wastes such as sewage sludge, to produce a gas that can be burned for energy production. The idea is not new, but scaling the process to the size needed to convert millions of tons of toxic sewage sludge to heat for energy, clean exhaust and an ash product represents a new direction. It is being done.

A sewage sludge waste-to-energy plant was completed recently in Hong Kong that converts toxic sewage sludge from 11 of the city's mega wastewater treatment plants into electricity at a rate of about 2,000 tons of toxic sewage sludge per day.

The process produces more energy than is required to operate the system. The city of Seattle, for comparison, generates about 400 tons of toxic sewage sludge per day, so the Hong Kong system could accommodate the Seattle sewage sludge disposal challenge easily, with excess capacity to spare, and without the need for thousands of double dump truck loads of sewage sludge being long-hauled each year for distant disposal on Washington state's farms, forests and rangelands.



King County's Loop trucks haul sewage sludge over the Cascades on the I-90 from Seattle to the farms of eastern and central Washington. (Credit: Richard Honour)

PAG transforms carbon-rich organic waste into long chain hydrocarbons in the form of a hydrogen-rich synthetic gas, which is used to generate clean heat and power. In the PAG process, the waste feedstock (such as sewage sludge) is streamed into a gasifier in dry or slurry form, where it reacts in an oxygen-starved environment with steam at elevated pressure and temperature.

The resulting synthetic gas is composed of about 85 percent carbon monoxide and hydrogen, with a small amount of carbon dioxide. The process results in minimal or greatly reduced emissions.

Building a new plant employing existing PAG technology to consume 150,000 tons of sewage sludge per year is achievable, and can be constructed to accommodate other solid wastes as well, including municipal, agricultural, industrial or medical wastes, that have similar chemical characteristics. Pre-recovery of recyclable plastics, metals and paper from the in-stream flows can be designed into the process.

PAG is cleaner than incineration, because the waste material is super-heated and converted from a solid, to a liquid, to a gas (a vapor), and then to plasma. A PAG plant generates little or no solid, liquid or gas pollution, which provides positive human and environmental health benefits.

Perceived disadvantages of PAG center on a general reluctance to engage a new technology, more so in light of possible adverse economic impacts that would be experienced by deeply-entrenched sewage sludge disposal businesses that have been hauling and land-disposing sewage sludge for decades.

Although Plasma Arc Gasification plants use a significant amount of energy, most of the energy they generate is used for self-powering or sold on the power grid, yielding a carbon-negative system, with substantial greenhouse gas reduction. A typical plant would produce synthetic gas that can be burned for energy, plus enough electricity to power perhaps 10,000 homes.

*Plasma is a form of matter, beyond a solid, liquid or gas, consisting of nearly equal numbers of positively and negatively charged electrons.

Sierra Rayne, John Werring, Richard Honour and Steven Vincent: We don't know enough to dump sewage sludge

Province Opinion

Published: February 21, 2016

Updated: February 21, 2016 12:11 PM PDT

> *Sierra Rayne, John Werring, Richard Honour and Steven Vincent: We don't know enough to dump sewage sludge*

The land disposal of sewage sludge has resulted in significant controversy and a resistance movement is rightfully building to this misguided policy. Quite simply, the science doesn't support the disposal of sewage sludge across the landscape. The supposed benefits are more than offset by the risks to human and environmental health.

As scientists, we have been watching the issue with increasing concern.

An unimaginably large number of chemical and biological contaminants exist in these materials and they persist in the product up to, and after, land disposal. Scientific investigations have identified only a tiny fraction of the total contaminant load. We cannot even say with any degree of confidence what the true range of contaminant risk is from the sludge. Call it an "unknown unknown." Because of potential synergistic interactions between the contaminants in the sludge, the risks are largely unknowable.

Most public discussions of the chemical contaminants in sewage sludge involve well-known groups such as heavy metals, flame retardants and pharmaceuticals, among many others. But these are just the contaminants we have identified. To refer to our current knowledge base as the tip of the iceberg would be grossly overestimating how much we actually do know.

Regulators and others — including elected officials — up and down the policy chain appear to lack a real appreciation for the scope of the problem and the costs of beginning to understand it. If a city were to test the sludge just once for all possible contaminants in the material, the bill would be well into the hundreds of thousands of dollars.

You are not going to find a problem if you don't look for it. Of course, over time, that problem may also come looking for you.

To illustrate the difficulties, take just one group of persistent, bioaccumulative and toxic compounds known to be in sewage sludge at high concentrations: brominated flame retardants. Perhaps the most well known sub-class of the brominated flame retardants are called polybrominated diphenyl ethers, or PBDEs.

There are 209 different PBDEs, each of which has a unique toxicology and environmental fate. PBDEs have been studied around the world for several decades, and despite many millions of dollars in research and thousands of dedicated researchers, we still have a very poor understanding of the true risks from their release into the environment.

This is just one contaminant class among many. There are also 209 different members of the PCBs. Similarly, add in another 210 chlorinated dioxin "congeners." And on the total number of contaminants in sewage sludge climbs as we begin to consider that effectively all current and legacy industrial chemicals end up in our sewage, and during the treatment process they move into the sludge. If you apply the sludge to the land, we have transferred our toxic effluent onto the landscape.

Now consider that while the tens of thousands of these commercial chemicals are a possible problem which we barely understand, the risks from the much larger suite (i.e., millions) of possible degradation products are essentially unknown. Then add on all pharmaceuticals and personal care products, as well as any other compound we use in the home or at work, and all their potential degradation products.

We are often asked by regulators, politicians, and the general public what to do about the issue. Give us the tests and we will do them, they claim. In response, we say that not only can you not afford to do all the required tests on your own (the costs must be distributed across entire countries and the international community as best we can, and even that is almost unaffordable), but many of the required tests require advances in technology which we do not yet possess.

The complexity discussed so far just touches on the chemical contaminants. Add to that the massive numbers of biological contaminants — bacteria, viruses, prions, etc. — and what we see are the decision makers throwing their hands up in frustration as they should.

The current and future problem is inconceivably large, particularly since the human population is producing sewage sludge at a rapidly growing rate.

Those from the large public- and private-sector industry that has developed around marketing and selling sewage sludge for land disposal claim the materials are "non-toxic" and a resource to be cherished, not shunned. The state of the science does not agree with this oversimplification.

While there have been some attempts to review the science surrounding sewage sludge, these are generally wanting. Either the reviews are out-of-date and incomplete, failing to account for all that we do know about emerging contaminants and what we don't know about all contaminants, or they are written more as promotional materials for the sludge industry in an attempt to sell the product to an ever more skeptical public.

What should we do in response to all these concerns? Immediately halt the land disposal of sludge as a starting point and begin either stockpiling or landfilling the material in secure locations with full leachate collection systems until a more responsible means of dealing with the problem is implemented.

In the meantime, the science must continue in an effort to better understand the risks and to develop more effective treatment technologies.

We also see municipalities and regional districts talking about the revenue stream from selling their sludge for land disposal, but are they telling the taxpayers they are supposed to represent about the very large potential risks from the knowing and wilful contamination of lands, waters, and the atmosphere that arises from these choices? Increased health-care costs, decreased property values, and toxic tort lawsuits have collective liabilities to the industry over time that far outweigh the cash flows currently coming in to the public purse.

Governments are playing Russian roulette with sludge and over time there is a high probability this game will be lost at the public's expense.

John Werring is a senior science and policy adviser for the David Suzuki Foundation; Richard Honour is executive director of The Precautionary Group; Sierra Rayne is an independent scientist; and Steven Vincent is a professor in the psychiatry department at the University of B.C.

Written Testimony for the Pennsylvania House of Representatives Democratic Policy Committee – August 29, 2016

Steve Wing, PhD
Associate Professor, Department of Epidemiology
University of North Carolina at Chapel Hill

Amy Lowman, MPH
Research Associate, Department of Epidemiology
University of North Carolina at Chapel Hill

Over 10 years ago, rural North Carolina residents who knew about our studies of health impacts of hog waste contacted us about illness and noxious odors that they associate with the use of treated sewage sludge on farmland near their homes. Subsequently, we developed several studies between 2006-2011 to respond to their concerns. We briefly describe the study results below, followed by concluding remarks about possible policy implications.

Public officials' perspectives on tracking and investigating symptoms reported near sewage sludge land application sites. J Environ Health 73(6): 14-20.

In a survey of 40 U.S. regional, national, state, and local public officials, nearly all respondents (37/40) said they receive reports from residents concerned about sewage sludge land application including safety, nuisance (odor, dust, conditions of the roads, and irritation from lime), and illness (respiratory symptoms and nausea).

Government officials said they have limited capacity to respond to reported problems. Most (33/40) agreed that a system for tracking and investigating problems could be useful for facilitating collaboration between different agencies, standardizing responses to health concerns, and providing public information about sewage treatment and land application of sludge.

Land application of treated sewage sludge: community health and environmental justice. Environ Health Perspect 121:537-42.

We conducted in-depth interviews with 34 residents living within a mile of sites where treated sewage sludge is applied to land in North Carolina, South Carolina and Virginia. More than half of respondents reported acute symptoms such as burning eyes, nausea, vomiting and diarrhea during or soon after sludge had been sprayed or spread and described these illnesses as recurring events associated with the application of treated sludge on nearby fields. The symptoms are similar to those reported by neighbors of sites where hog waste is applied to land.

Other symptoms reported by more than one respondent in the wake of sludge applications included difficulty breathing, sinus congestion or drainage, and skin infection and sores.

Respondents also reported environmental concerns, such as sludge run-off into local waterways and cattle grazing on fields soon after sludge application.

Several respondents commented on injustices of the practice, including spreading of urban waste in rural areas, and neglecting to inform neighbors prior to application. They said many application sites are

owned by absentee landowners who do not have to experience the nuisance and health impacts or witness the environmental problems experienced by neighbors.

Odors from sewage sludge and livestock: associations with self-reported health. Public Health Rep 129(6):505-15.

In addition to in-depth interviews with neighbors of sludge fields, we conducted a door-to-door health survey among rural residents in two North Carolina counties. Difficulty breathing, wheezing, and skin rashes were reported more frequently among respondents who reported stronger odors from liquid treated sewage sludge compared to residents of areas with no record of liquid sludge application. Excessive flies were reported more frequently by residents in areas where treated sewage sludge was applied compared to areas where there was no record of applied sludge.

Conclusions

Our research based on interviews with government officials and rural residents supports previous case reports that pollutants from land-applied sewage sludge travel off-site and affect the health and quality of life of neighbors. We consider this evidence to be sufficient to warrant actions to protect public health and the environment. We recommend:

1) Enforce existing regulations. Most regulators depend on self-reports from sludge producers and haulers and do not have the capacity to routinely inspect land application events. This means that information on maintaining adequate distances from neighbors, over-application of sludge, and application during weather conditions that facilitate off-site migration of pollutants, comes from the entities that could be fined for violations. States and counties should increase independent enforcement of regulations, and neighbors of application sites should have a quick, reliable way to report violations. A system should be in place to respond to and redress violations.
2) Strengthen regulations. The impacts of land application of sewage sludge could be reduced by decreasing the frequency and amounts applied, increasing buffers between application sites and neighboring properties, and improving the treatment of sludge to reduce odorant chemicals, toxicants, pathogens, and bacterial re-growth.
3) Establish a tracking and surveillance protocol. Government officials should systematically track and investigate reports of illness from neighbors of sludge application sites. Currently there are many disincentives to reporting including fear of reprisal from big business and land owners and frustration with the non-responsiveness of government agencies. Better tracking of problems could foster development of better approaches to protecting public health.
4) Meaningfully involve neighbors of land application sites in decision-making about the practice. Community members are key witnesses of land application events and their potential impacts on health, quality of life, and the environment. As such, their input should be sought to strengthen regulations and improve environmental health protections.

Treatment plants remove solid pollutants from waste water in order to meet water quality rules. The resulting sludge includes toxicants and pathogens from industries, factories, hospitals, homes and businesses. The constituents of treated sewage sludge depend on the source but include bacteria, parasites, endotoxins, exotoxins, volatile organic compounds, persistent organic pollutants,

pharmaceuticals, and heavy metals. Harmful pollutants can be carried off-site by wind and water, potentially exposing neighboring residents. Our research shows that neighbors of land application sites in multiple states report similar symptoms of illness, noxious odors, pests, and reduced quality of life during and after land application of sludge. There is also evidence that toxicants from land-applied sludge threaten water quality, agricultural lands and food crops. Government agencies that permit land application of sludge should take action to better protect the public interest.

HOUSE DEMOCRATIC POLICY COMMITTEE HEARING
Topic: Biosolids
Quality Inn -- Milesburg, PA
August 29, 2016

Written and oral comments by Melinda Conrad, Benner Township, Centre County

Good afternoon. I would like to thank Representative Hanna and the rest of the caucus for the invitation to speak today and for giving this very important issue the attention it deserves. My name is Melinda Conrad. I am a former Social Studies school teacher, now, a proud stay-at-home mother of two children, the two most important reasons why I have become an activist on biosolids applications. By no means do I claim to be an expert on this issue, but each and every time I look at my children I am motivated to keep researching the topic, and what I have learned is not comforting to me. As a mother, I have the right to control what food they eat, what medicines they take, what television shows they watch, but I have no control over protecting them from the potential hazards from living close to properties where biosolids are being applied. This is what has driven me to stop the application of biosolids in our communities.

When speaking with one of my legislators he asked if I would have ever imagined that I would be dedicating so much of my time to educating myself and others about "poop". The answer is oblivious, NO. Just last year when a neighbor approached me to discuss "biosolids", I did not know what the word meant or that I would become so heavily involved in this issue. Not knowing what "biosolids" is, I did a simple Google search. I was furious to learn that "biosolids" is a public relations word created to replace "sewage sludge" and heartbroken to find out about the death of a child attributed to biosolids within my own county (12). Throughout my research of sewage sludge, I have become concerned about the lack of awareness, insufficient regulations, and Pennsylvania Department of Environmental Protection (PA DEP) oversight of biosolids. I would like to take the next few minutes to address some of these concerns.

Very little public awareness is required when a permit is approved to spread Class B biosolids. According to DEP regulations, "each adjacent landowner must be notified that biosolids will be used" (1). The notification must be given in the first year of use, and only in the first year. What this regulation ignores is the fact that air and water do not stop at the adjacent landowner. What happens when fields spread with biosolids are subject to drought? Do the biosolids dry out and become airborne? If they do, will the airborne particles stop at the adjacent landowner? What happens during a torrential downpour, which are becoming more common these days, does surface flow stop at the adjacent landowner? How does ground water move? Will it stop at the adjacent landowner? Does not everyone who has the potential to be impacted by biosolids have the right to be notified? Current DEP regulations imply that non-adjacent landowners do not have these rights.

If an adjacent landowner who had been notified of initial biosolid use sells their property, there is no requirement for notification to be given to the new owner. I am someone who truly believes that if you do not like hearing buzzers, loud screaming, and bright lights, then do not buy a home near a football stadium. I grew up next to farms and had no problem buying a home surrounded by farmland; however, never in a million years would I have ever imagined that sewage sludge was used in agriculture. Knowing what biosolids is, and that they are actively applied in the community, I would not have purchased the home that I now own.

Another regulation that raised a red flag for me is as follows, "biosolids may not be applied to the land if it is likely to adversely affect a Federal or Pennsylvania threatened or endangered species, or its designated critical habitat" (1). Now we are led to believe by DEP that biosolids are safe for the environment and humans living in and around the area where they are spread. If this is true, what harm could be done to threatened or endangered species that requires this regulation? This regulation coupled with the EPA regulations that require farmers to restrict their animals from the biosolid spread land for 30 days after application, do not paint a picture of a material that is completely safe (2). If it is not safe for

threatened or endangered species to be in the areas where Class B biosolids are spread, and it is not safe for farm animals to be on the land for 30 days after Class B biosolids are spread, my question then becomes, who or what is preventing the non-endangered wildlife from entering these lands? What harm is being done to the deer, turkeys, rabbits, and birds that walk, graze, and feed on these lands? Why are they not given the same protections? Are my husband and other hunters being exposed to wildlife that have in been contact with biosolids? Are our families possibly ingesting tainted game?

According to supporters of biosolids, the biosolids are "highly" regulated by DEP and pose no threat of contamination. Biosolids are required to be tested for only 9 heavy metals and PCBs. The reduction of human pathogens separates Class A from Class B biosolids, with some human pathogens remaining in Class B biosolids (2). What I want you to think about for a moment is everything that is flushed down our toilets; then, also consider, everything that flows into to the wastewater treatment facilities from industrial sites; now you have a possible formula that includes: pharmaceuticals, endocrine disrupting drugs, leisure drugs, drug-resistant bacteria (3, 13-14), personal care products, de-icing agents, fire-fighting foams, etc. These are all potential sources of contaminations NOT subject to current DEP regulations. How can we say and support the statement, biosolids are "highly" regulated? We are told by DEP that research is being done on "emerging contaminants". Class action law suits against DuPont and 3M concerning PFCs, "chemicals that until recently were used in the United States to make a variety of consumer and industrial products, and have been linked to many adverse health effects, including cancer, hormone disruption, and heart disease", tells a different story. (16-18). How long can we afford to wait until research and regulations catch up to current situations?

It is to my knowledge that the soil is the key to neutralizing the remaining human pathogens present in Class B biosolids and locking up the regulated heavy metals. When reading a recent biosolids application permit, the soil depth was tested in 20 locations on the land. In seven locations the soil depth was less than twelve inches to highly fractured bedrock. According to a statement from a DEP official,

"current regulations do not consider this shallow depth to bedrock to be an impediment to permitting" (5). If soil is the key, why is soil depth not considered in current DEP regulation? Research I have found for the states of Ohio and Wisconsin regulate that there must be three feet of soil at any location where biosolids are spread (6 & 8). And, in New York it is regulated that there must be two feet of soil to bedrock (7). I encourage you to take a look at other states' regulations to see where Pennsylvania is in comparison. Slopes and tilling are other regulations you will find in other states that are stricter. Is this an effort to protect residents from the biosolids material either becoming airborne or running off the site? Are lenient regulations the reason why Pennsylvania has become a dumping ground for out of state biosolids as in the case of Tamaqua Borough (15)?

DEP also has a regulation that states, "Biosolids may not be applied unless the soil pH is 6.0 or greater prior to land application" (1). It is my understanding that achieving this level of pH is important to lock up heavy metals, to prevent them from leaching into groundwater. The concern I have about this is, what happens when a farmer or land reclamation site owner opts out of the biosolids program? According to a DEP official, "We permit the production of the material. We perform site visits to farms prior to the first application bio-solids on that farm. We do not keep a running record of who is applying this material." (11). To me this is a statement saying DEP does not handle follow-up on application sites that have opted out of the program. In the future, will my family and community be at risk of water contamination if the pH level is not kept within the required range? Who bears the cost to maintain the pH at the required level. Who assumes the liability if a contamination event occurs, the site owner, the sludge applicator, or the tax payer?

Earlier this year I was able to hear a DEP official speak at a Bellefonte Borough Council meeting. In the meeting discussing biosolids permits, the official stated, ". . . right now we do not have a policy for every reviewer to check in their files to see if there is a source water protection plan in that area . . . there is no policy to review it . . . (4)". The US Environmental Protection Agency and the

Commonwealth of Pennsylvania has been spending a lot of time and money helping local municipalities to create Source Water Protection Plans (9). I believe these plans are intended to help the municipalities to control potential hazards that could leach into ground water systems. In the case of the Bellefonte Borough Water Authority Source Water Protection Plan, biosolids is identified as one of the top three potential sources of contamination to be concerned about (9). Why are we spending time and money writing source water protection plans when the plans are not even consulted?

The DEP official at the Bellefonte Borough Council Meeting also made the statement that he knows of no public water systems being contaminated by biosolids (4). To the best of my knowledge there is no regulation that requires DEP to perform well-water testing on biosolid sites and adjacent landowner property sites. Since very few members of the public are made aware of the use of biosolids in their communities, how would they know to have a water test performed and what contaminants to test for? Should it be required for adjacent public and private wells to have a base-line water test done in the area of biosolids application? If this makes sense, who should bear the costs, would this become another unfunded mandate?

The same questions could be asked about health concerns due to exposure to biosolids. Research reveals that biosolids exposure is causing endocrine and respiratory problems (10). I have heard pro-biosolid supporters suggest that there have been no health hazards documented as a result of biosolid exposure. If the public is not made aware of the use of biosolids in their community, how would the connection ever be made? Is the government studying communities where biosolids are present to get actual data to back up the assertion that there are no public health concerns? Citizens were told once that cigarettes, lead paint, and DDT were safe, until they were not. Will biosolids be added to this list?

I truly believe that there is not enough done to protect our communities from the potential hazards of biosolids use, part of my community is the farmers and their families that are utilizing the use of biosolids. I do not want to see any harm done

to their water supplies or their health. With that being said, while working with others in my community, I have spent time brainstorming ways to address the need for cost effective fertilizer for farmers who do not have access to enough manure from the animals on their farms or do not wish to purchase synthetic fertilizers. I have come to learn that there is excess manure in some areas of the state, can we get this excess manure to the farmers that need it? It would be my hope that traditional animal manure be used in place of biosolids.

I do not pretend to be an expert on any of the topics discussed today. However, I have become gravely concerned of the lack of awareness, insufficient regulations, and DEPs oversight of biosolids applications. I do not appreciate my family and my community becoming test specimens. While looking at my children, I am constantly reminded of the death of the local boy attributed to biosolids. I cannot imagine going through what his mother endured. I ask you to read about his death in the article referenced. I hope that you continue questioning biosolids application, pushing for regulatory reform, and most importantly supporting Representative Hanna's proposed House Bill to protect our communities, our water systems, and our future generations. Everybody is familiar with the situation in Flint, Michigan. While that revolved around different circumstances, I believe it is fair to say that out-of-date regulations and research on biosolids is setting us up for a similar disaster.

As you were reminded by Representative Hanna on the House Floor, you as our elected officials have taken an oath to uphold the Pennsylvania Constitution. Article 1, Section 27, states: "THE PEOPLE HAVE A RIGHT TO CLEAN AIR, PURE WATER, AND TO THE PRESERVATION OF THE NATURAL, SCENIC, HISTORIC, AND ESTHETIC VALUES OF THE ENVIRONMENT. PENNSYLVANIA'S PUBLIC NATURAL RESOURCES ARE THE COMMON PROPERTY OF ALL THE PEOPLE, INCLUDING GENERATIONS YET TO COME. AS TRUSTEE OF THESE RESOURCES, THE COMMONWEALTH SHALL CONSERVE AND MAINTAIN THEM FOR THE BENEFIT OF ALL THE PEOPLE". (19).

Thank you for your time.

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10 – "Case for Caution Revisited: Health and Environmental Impacts of Application of Sewage Sludges to Agricultural Land." Endocrine Disruption, Pages 4-5, Aerosols and Human health effects, Pages 9-12. Cornell University.

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18 – "Rep. Rice Calls for Federal & State Action to Address PFOA Contamination." Garden City, NY, June 7, 2016. Press Release, Kathleen Rice, U.S. House of Representatives.

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8/29/16 House Democratic Policy Committee Hearing

To House Democratic Policy Committee:

My name is Douglas M. Mason, and I am a retired soil scientist living in Patton Township, Centre County. In the past, I worked for Pennsylvania's Department of Environmental Protection in the Bureau of Solid Waste Management. One of my primary responsibilities was evaluating the technical feasibility of applying biosolids (previously known as sewage sludge) onto agricultural land, deciding whether the soils in situ were suitable for renovating these materials. I am in favor of recycling human and other animal wastes when it is safe to do so. But when I worked for PA DEP, I was never comfortable with U.S. Environmental Protection Agency guidelines, because the 503s regulate only nine metals plus inorganic nutrients (nitrogen, phosphorus). There are myriad hazardous industrial chemical wastes found concentrated in biosolids including pesticides, pharmaceuticals, plasticizers, flame retardants and growth hormones, to mention a few, as well as the potential for pathogens and biological toxins. A 2009 EPA survey of toxic chemical compounds detected in biosolids confirms that sewage treatment plants do not remove most hazardous chemicals; in fact, treatment often creates new pollutants that can end up in biosolids. Many of the 145 chemicals from 74 sewage treatment plants across the nation listed in that 2009 report are toxic, persistent, magnify in the food chain and can damage developing organisms in parts per trillion. Many hundreds of sludge-exposed individuals have reported chronic respiratory, skin and gastrointestinal conditions consistent to the types of chemical and biological contaminants found in biosolids. PA DEP is also familiar with the fact that at least two men died in the commonwealth as a potential result of such exposure. I am not even particularly satisfied with the fact that nine metals are monitored in biosolids. Heavy metals, like other chemical wastes, can come from industrial discharges via large and small businesses in Bellefonte and nearby township sources serviced by its sewage treatment facilities. Heavy metals also come from old pipes (lead pipes, solder and brass fixtures) and other sources. After biosolids are applied to agricultural fields, plants will selectively uptake heavy metals like cadmium over essential nutrients like calcium, and if animals headed for human consumption eat such vegetation, it enters our food chain. Our bones could potentially incorporate some cadmium as the body is fooled into thinking it's calcium, and skeletal structure can thus be compromised (among other potential physical problems). There is much else I would like to say in person at the Milesburg public hearing, but I have to take a friend to the Danville hospital on that date. I would be happy to cooperate with the Democratic Policy Committee in regard to any questions or clarifications that my thoughts may have engendered.

Sincerely,

Douglas M. Mason
1084 Ghaner Rd.
Port Matilda, PA 16870-7201
(814) 769-0024
douglasmason50@gmail.com

Rachel Guenot's Testimony
8/29/16 House Democratic Policy Committee Hearing

I am here today to discuss my concerns and my opinions on using sewage sludge (biosolids) as a benefit to land revitalization. The toxic cocktail of pharmaceuticals, chemicals, heavy metals and pathogens pose a significant threat to our health and safety.

My specific concern is allowing biosolids to be placed in or near viable public water sources. In Burnside Township, our primary source of water is being threatened. Because of this situation, it has become clear to me, that the Department of Environmental Protection (DEP) lacks communication within its own departments. The Mt. Top Community is composed of Burnside Township, Snow Shoe Township and Snow Shoe Borough in Center County. This area was/is known for timber and coal mining. Big Sterling Spring is one of the primary water sources of the Mt. Top Community. Mark Stephens, Geologist from DEP, worked with our local water authority to create source water protection zones. There are 3 zones of protection around the viable water source. Within those zones, lie two natural trout streams, Boake Run and Sterling Run. The definition of protection is to preserve. However, DEP's Bureau of Mining and Reclamation, has permitted a permit to apply biosolids within the boundaries of our water source protection zone. One branch says to preserve, the other says that the biosolids will help to grow lush vegetation on the ground for hunting.

The owner of the land being proposed as the sludge dumping ground does not live on the Mt. Top or use our prized water source. So if the sludge dumping does leak into our ground water and contaminate our well, he will not be affected at all. WeCare Organics is the company proposing to apply sewage sludge to the land. This "Organic" company has had several lawsuits filed against them including one that is still pending as of 2014 in regards to their faulty business practices. I have read many articles that state the health risk is low when EPA guidelines are followed, however low risk is not good enough for residents of our township.

On the Mt. Top, our water source is very important to us. We want the right to preserve the boundaries within our water protection zone and are willing to use township dollars to continue to fight for our water. Please help in approving legislation which will preserve our necessary water sources in the Commonwealth of this beautiful state.

Examples of Regulatory Failure and Sewage Industries Deception

Concerning EPA's Office of Inspector General's (OIG) Report No. 14-P-0363 09/2014: "
More Action Is Needed to Protect Water Resources From Unmonitored Hazardous Chemicals" / Summery:
"Management controls put in place by the EPA to regulate and control hazardous chemical discharges from sewage treatment plants to water resources have limited effectiveness. The EPA regulates hazardous chemical discharges to and from sewage treatment plants, but these regulations are not effective in controlling the discharge of hundreds of hazardous chemicals to surface waters such as lakes and streams. Sewage treatment plant staff do not monitor for hazardous chemicals discharged by industrial users. This is due to a general regulatory focus on the priority pollutants list that has not been updated since 1981, limited monitoring requirements, limited coordination between EPA offices, a lack of tracking hazardous waste notifications required for submittal by industrial users, or a lack of knowledge of discharges reported by industrial users under the Toxics Release Inventory. Except for EPA Region 9, sewage treatment plant permits generally include very few monitoring requirements or effluent limits, which can limit enforcement actions.
The EPA developed whole effluent toxicity test results as a mechanism to identify toxic chemicals such as hazardous discharges to sewage treatment plants. However, these are not required for all permits, and are not tracked by the EPA to verify that sewage treatment plants are reporting results as required. Moreover, exceedances of chemical limits in permits and toxicity tests do not trigger notification to enforcement programs. Consequently, the EPA may not be aware of chemical discharge or toxicity exceedances that should be addressed to minimize potentially harmful contamination of water resources."

**We asked the Texas Commission on Environmental Quality (TCEQ) and Virginia's Department of Environmental Quality (VA-DEQ) what they are doing about EPA's OIG 14-P-0363

TCEQ's Answer 01-2016: David Galindo, david.galindo@tceq.texas.gov Director Water Quality Division **TCEQ:** *"TCEQ would be required to implement any changes to the existing federal biosolids regulations, including any potential EPA rule amendments in response to the OIG report. We are unaware of any EPA response addressing the validity of the statements made in the report or determination on the need for a rule amendment at this time."*

VA-DEQ's Answer 03-2016: Neil Zahradka, neil.zahradka@deq.virginia.gov Manager - Office of Land Application Programs. 804-698-4102
"I suggested to Mr. Reynolds (Jefferson Reynolds, Director DEQ) that I respond to your question since I am knowledgeable about the specific practices that DEQ uses in the process of biosolids land application permitting. The Virginia Department of Environmental Quality (DEQ) has not taken action in the biosolids program specifically related to the subject OIG Report 14-P-0363 (Report). The Report questions the adequacy of rules that control discharges of certain pollutants to waste water treatment

facilities, but EPA efforts to identify additional pollutants that actually end up in biosolids predated the Report. Section 405(d) of the Clean Water Act requires EPA to identify and regulate toxic pollutants that may be present in biosolids at levels that may negatively impact public health and the environment, and the Targeted National Sewage Sludge Surveys and other ongoing EPA research efforts have been the investigative mechanisms used to determine if additional regulatory mechanisms are necessary. At this time, EPA has not identified any additional toxic pollutants for regulation under federal law."

**We also asked this question to both agencies: "Are you allowing, though CFR 40-part 503, chemicals of unknown amounts, concentrations and degree of hazard onto farms, ranches and forests without the consent or knowledge of those farmers, ranchers and landowners labeled as Class A, and Class B bio-solids?"

TCEQ's Answer 01-2016: David Galindo, david.galindo@tceq.texas.gov / Director Water Quality Division, (512) 239-0951
"TCEQ authorizes the land application of treated domestic sewage sludge (biosolids) that is compliant with all existing federal (40 CFR Part 503) and state regulations(30 TAC Chapter 312) for meeting pathogen reduction, vector attraction reduction, and pollutant limitations."

VA-DEQ's Answer 03-2016: Neil Zahradka, neil.zahradka@deq.virginia.gov / Manager - Office of Land Application Programs. 804-698-4102
"Regarding notification, Virginia law (§ 62.1-44.19:3.A.3 of the Code of Virginia) requires that permit applications for land application of biosolids include the landowner's written consent to apply biosolids on his property. In signing the consent form, the landowner also attests that they have received a copy of the DEQ Biosolids Fact Sheet. The Fact Sheet informs the farmer "the U.S. Environmental Protection Agency (EPA) has conducted surveys of sewage sludge throughout the United States to evaluate whether there are other constituents found in biosolids that would warrant further testing requirements before land application. Additional research is being conducted to determine not only the amount present, but also whether these amounts pose significant concerns. DEQ monitors the ongoing work of EPA in this respect, and if necessary, will respond to these findings with additions to the list of regulated parameters."

The hidden answer to both the TCEQ and VA DEQ is, **no** they do not inform farmers, ranchers and landowners nor do any of the handling sewage entities including municipalities.

One part of the deception is the use of the word "safe" when describing all classes of processed sewage sludge. You can even see it on the EPA's web page on "biosolids".

The word "safe" is used regularly without defining the sewage industries definition of the word to the consumer. The common US Citizen and even those reading this think "safe" means free from risk but the sewage definition is very different.

Examples of Regulatory Failure and Sewage Industries Deception

Dr. Jim Riesa, jreisa@nas.edu Director, Environmental Studies, and Toxicology at National Academy of Sciences states, *"Your statement that "the public definition of 'safe' is 'free from risk'" is not supported by science. The word "safe" is not a scientific term; it is a judgment that is essentially political. It usually implies that the risk is acceptable or inconsequential, not absent."*

How much risk is acceptable?

Here is a list of other OIG reports that will show a history of EPA Regulatory failure with the land application of sewage sludge: Report 2000-P-10 March 20, 2000 / . 2004-P-10 September 28, 2004 / No. 2004-P-00004 February 2, 2004 / No. 10-P-0066 February 17, 2010 / 12-P-0508 May 25, 2012

***A moratorium on the land application of all classes of processed municipal sewage sludge needs to go into effect immediately until comprehensive independent studies are completed on the health effects of municipal sewage sludge.

Craig Monk