

The Technical Advisory Committee (TAC) to DCR, of which I was a member, was given several objectives regarding phosphorus (P) regulations at the first meeting:

- 1) Protect water quality by controlling soil concentrations of P and P loadings,
- 2) Be straightforward and time efficient to apply,
- 3) Produce consistent results when applied by different persons, and
- 4) Be relatively easy to understand and convey to farmers.

The proposed regulation revisions fail to significantly achieve any of these objectives, and reflect the views of the TAC, which was dominated by poultry and sewage sludge interests. One State participant, Dr. C. M. Sawyer from VDH, was more vocal in resisting regulation of the land-application of sewage sludge than were the representatives of commercial “biosolids” contractors. Most agronomists focused on maximizing crop yields irrespective of environmental consequences, for example by defending land-application to winter cover crops.

Four methods of achieving the P objectives were presented to the TAC and compared for seven different scenarios:

<u>Method</u>	<u>Apply no P</u>	<u>Crop removal rate</u>	<u>1.5 times Crop removal</u>
Soil Test P	all 7 scenarios		
Poultry Waste Mgt. Act		all 7 scenarios	
Environmental Threshold	1 scenario	3 scenarios	3 scenarios
Phosphorus Index (PI)	2 scenarios	2 scenarios	3 scenarios

The simplest, most easily understood common sense method, “Soil Test P,” namely to analyze the soil for P and apply only the amount of P required by the crop according to DCR’s 2005 Nutrient Management Standards and Criteria (“Standards”), satisfies all four objectives. Adoption of the “Soil Test P” method would severely restrict land-application and no P would be allowed under any of the seven scenarios presented to the TAC. This is because animal waste (sewage sludge, cattle and swine manure and poultry litter) is P-rich and because it is well known that “...much of the crop land in the Chesapeake Bay watershed is now considered “optimum” or “excessive” in phosphorus from an agricultural perspective and hence needs little additional phosphorus, from any source, to ensure that economically optimum crop yields are attained.” (A. N. Sharpley, Ed., Agriculture and Phosphorus Management: The Chesapeake Bay, 1999, CRC Press, p. 66.) The Soil Test P method would have no negative impact on agricultural productivity, it best achieves the objective of reducing P loading of soils, it is most protective of water quality and reducing pollution of Chesapeake Bay, and it best achieves all four stated objectives. **Why is the straightforward, common sense Soil Test P method not being mandated?**

The “Poultry Waste Mgt. Act” method would limit P application to crop removal rates for all seven scenarios, but it would not reduce the P loadings (objective #1). The other two methods, including PI, are the least restrictive. Applying P a rates higher than is needed by crops will ensure further P loading of soils already overloaded with P, violating objective #1. **Why is land-application to be permitted at up to 1.5 times crop removal rates?**

The 48 page Virginia Phosphorus Index (Version 1.3, March 2005) is, in my opinion as a professional geochemist, based on undocumented and very permissive “science.” In no way can the PI be considered “straightforward and time efficient to apply” (objective #2) or “easy to understand and convey to farmers” (objective #4). Because of complexity and cost the PI will discourage farmers from adopting voluntary nutrient management plans, the exact opposite of what is desired. Any method such as PI that uses subjective judgments cannot “produce consistent results when applied by different persons” (objective #3) and it is obviously subject to conscious or unconscious bias. Many of the coefficients/factors are undocumented (Tables 10, 11 and 16 for example) and the negative intercepts in Table 9 (-0.32) and Table 17 (-1.72) are physically impossible. The way ‘Subsurface Risk Factor’ (SRF) is handled ignores the fact that chemical weathering will eventually dissolve excess P from the soil and guarantee a very long term slow “bleed” of P into groundwater and surface water, and then into Chesapeake Bay, as indicated by modern studies. The inclusion of a multiplicative 0 (zero) in the formula guarantees that the SRF can be 0 (zero). Not only does this help minimize the PI because SRF is one of three factors that are added together to yield the final PI value, it is chemical nonsense. Groundwater phosphate concentrations are never zero (e.g. USGS Circular 1157, p. 12). In Table A.3 more than 80% of the soils have “Soil texture/Drainage class factors” of 0.00, and those soils with values greater than zero are rarely farmed, as is made clear in the definitions of drainage conditions that accompany Table 16. **Why is the cumbersome and complex Phosphorus Index, poorly grounded in modern peer-reviewed science, and capable of being manipulated to yield a minimum result, being advocated?**

The proposed regulations state in 4VAC5-15-150.c. (my emphasis):

- (1) Phosphorus applications from inorganic nutrient sources shall not exceed crop nutrient needs over the crop rotation based on a soil test.
- (3) Whenever possible, phosphorus applications from organic nutrient sources should not exceed crop nutrient needs over the crop rotation based on a soil test.

Why is a distinction made between inorganic and organic forms of P and why is the language with regard to organic P permissive?

It is relevant that the wording of existing 12VAC5-585-550.A “The applied nitrogen and phosphorous content of biosolids shall be limited to amounts established to support crop growth.” is very similar to 4VAC5-15-150.c.1, but unlike 4VAC5-15-150.c.3. It must be publicly recognized that 12VAC5-585-550.A is being violated routinely by VDH. The rate of land-application of sewage sludge is being determined by N and lime, and P is being ignored. If 12VAC5-585-550.A were being enforced, land-application of municipal sewage sludge would be severely restricted. **Why is 12VAC5-585-550.A being violated and P being ignored?**

In addition to addressing P, these regulations address the timing of N application. In the face of unavoidable inefficiencies in N uptake by crops, timing of N application is a small part of the pollution problem. Organic material is a very inefficient form of fertilizer, compared to chemical fertilizer, because microbes release nutrients slowly to the soil irrespective of whether or not the crop is growing. Inefficient N availability to crops is quantified in “Standards” Tables 8-2 and 9-1, which state that between 18 and 55% of the N in sewage sludge is crop-available, and between 15 and 60% of the N is available to crops from other forms of animal waste. On average, about

half the N applied to the land in animal waste is used by crops and half is not. The N not used by crops must be accounted for, and since it does not remain in the soil, it must be released to the environment. Most of the N not used by crops is oxidized to nitrate and constitutes pollution of groundwater or runoff. Massive loss of N to the environment from agricultural fertilization is proven by widespread high nitrate concentrations in groundwater. For example, USGS Circular 1228 (p. 2) states that “Concentrations of nitrate and herbicide compounds in groundwater of the Delmarva Peninsula are among the highest in the Nation,” similar to data reported in USGS Circular 1157 for shallow groundwater in the Albemarle-Pamlico Drainage Basin, and documented in many other areas. The N-laden groundwater discharges directly into streams or tidal water.

It is instructive to ask how much N is land-applied in animal waste annually in Virginia, but not used by crops. The tons (converted to pounds) land-applied in 2003 were supplied to me by State agencies, and the fraction N in the animal waste and the fraction of the N not used by crops (pollution) are from “Standards.”

	<u>Pounds applied</u>	*	<u>fraction N</u>	*	<u>fraction not used</u>	=	<u>pounds N pollution</u>
Sewage sludge	494,648,000	*	0.02	*	0.48	=	4,749,000
Poultry litter	1,115,268,000	*	0.03	*	0.40	=	13,383,000
Cattle, swine	468,509,000	*	0.03	*	0.60	=	<u>8,433,000</u>
							26,565,000

27 million pounds of N were land-applied in 2003 in Virginia but not used by crops. To put this large number in perspective, the Virginia Tributary Strategies claim that Virginia rivers supply 78 million pounds of N to Chesapeake Bay annually. The 2010 Cap Load Allocation for N is 51 million pounds. The goal of reducing 78 million pounds of N discharge to 51 million pounds annually by 2010 could be achieved ($78 - 51 = 27$) by simply eliminating the land-application of animal waste. Similar magnitudes, 27 million pounds of nitrogen annually, of land-applied N in animal waste not used by crops and the goal of N pollution reduction, demonstrates unequivocally the significance of this source of pollution, even allowing for uptake of some of the nitrogen by riparian buffers. **Why are nutrient management plans not mandated for the land-application of manure and poultry litter, which constitute most of the N pollution?**

The proposed regulation changes with regard to the timing of N land-application merely tinker around the edge of a massive source of pollution, namely the naturally inefficient nature of animal waste as fertilizer. The land-application (or storage) of animal waste is a particularly egregious form of groundwater pollution in Bay Act counties because of porous soils, a high water table, and close proximity to tidal waterways. In Bay Act counties, shallow groundwater, not runoff, is the most important vector of transport of nutrients directly to tidal waters.

A serious omission that significantly eases restrictions on the land-application of animal waste, is DCR’s failure to specify any N recommendations for soybeans (Standards, p. 63) which constitute about 13% of all crops grown in Virginia. Massive N pollution is guaranteed by DCR’s failure to limit the land-application of N to a legume, for which no farmer in his/her right mind would purchase chemical N fertilizer. Little of the applied N is taken up by soybeans, unlike other common crops such as corn or small grains that are unable to “fix” atmospheric N. **Why are the N recommendations for soybeans not zero, as they are for red clover?**

Seven questions have been posed, some of which do not apply specifically to the regulations in question but address the broader issue of reducing nutrient pollution of Chesapeake Bay:

- 1) Why is the straightforward, common sense Soil Test P method not being mandated?
- 2) Why is land-application to be permitted at up to 1.5 times crop removal rates?
- 3) Why is the cumbersome and complex Phosphorus Index, poorly grounded in modern peer-reviewed science, and capable of being manipulated to yield a minimum result, being advocated?
- 4) Why is a distinction made between inorganic and organic forms of P and why is the language with regard to organic P permissive?
- 5) Why is 12VAC5-585-550.A being violated and P being ignored?
- 6) Why are nutrient management plans not mandated for the land-application of manure and poultry litter, which constitute most of the N pollution?
- 7) Why are the N recommendations for soybeans not zero, as they are for red clover?

The answer to all of these questions is the same.

Stricter regulations would seriously impact the profits of a very few enterprises directly associated with the land-application of animal waste and slightly impact the few farmers who use animal waste.

Stricter regulations would have no negative effect on economically optimum crop yields (agricultural productivity) and would significantly reduce nutrient pollution of Chesapeake Bay. The Soil Test P method must be mandated and the PI abandoned. Organic P must be treated identically to inorganic P. Nutrient management plans must be required for the land-application of all forms of animal waste. N recommendations for soybeans must be zero, similar to red clover. Regulations must be enforced.

It is clear to me after observing the process by which these regulations were formulated that they are being promulgated in favor of a very small minority of poultry growers, sewage sludge haulers and farmers directly associated with the land-application of animal waste. The “free fertilizer” for farmers comes with a massive cost to society in the form of Chesapeake Bay being formally impaired by EPA because of high nutrient loads. The proposed changes in regulations have no “teeth” and are a “give-away” to land-application interests. The proposed changes will not reduce nitrate or phosphate pollution of Chesapeake Bay significantly. The proposed changes ignore the clear message from the majority of Virginians to “Clean Up Chesapeake Bay!” Acceptance of these regulation changes certifies that elected and appointed Virginia officials are more concerned with agricultural profits for a few than they are with the water quality of Chesapeake Bay for the majority of Virginians.

Yours sincerely,

Dr. Lynton S. Land
Emeritus Prof. Geological Sci., U. Texas, Austin
and Edwin Allday Chair in Subsurface Geology