Not Recommended by the Subgroup

Illinois Climate Change Advisory Group
Subgroup: Commercial, Industrial and Agriculture
Policy Name: #1: Incentives to reduce nitrogen application in crop fertilization.
Policy Type: Financial; market-based
Estimated Reductions: 0.11 to 0.22 million metric tons

Affected sectors, subsectors or entities (As the case may be)

Sector: Agriculture, Industrial
Subsector: Corn growers, fertilizer industry, wastewater treatment plants

Background

"Nitrous oxide is a potent GHG. One ton of nitrous oxide emissions has the same warming impact (global warming potential, or GWP) as 310 tons of carbon dioxide. Approximately 74 percent of all U.S. nitrous oxide emissions come from agriculture, primarily from agricultural soil management activities such as commercial fertilizer application and other cropping practices. Other sources of nitrous oxide include nitrogen fixation from crops, the application of sewage sludge and manure to croplands,…the cultivation of organic soils" and natural decomposition of organic matter.

"The unused nitrogen from fertilizer can be either retained in the soil or lost from the soil through (a) volatilization, (b) leaching into groundwater, or (c) surface runoff. Leached nitrogen and nitrogen lost through surface runoff moves into waterways, while a portion of the volatilized nitrogen (either as ammonia [NH3] or nitrogen oxide [NOx]) will convert to the GHG nitrous oxide through nitrification and denitrification processes. A portion of the leached nitrogen and nitrogen in surface runoff also converts to nitrous oxide emissions…Lower fertilizer use will also reduce the energy used in fertilizer production, a highly energy intensive process." (World Resources Institute: "Awakening the Dead Zone: An Investment for Agriculture, Water Quality and Climate Change." February 2003.)

The Intergovernmental Panel on Climate Change uses a default emissions factor of 1.25 percent of fertilizer nitrogen inputs lost as nitrous oxide. However, there is a great deal of uncertainty about this estimate, and emissions rates depend on the amount of nitrogen available for nitrification/ denitrification, soil type and soil condition.

In 2006 Illinois farmers planted 11.2 million acres of corn using 623 million tons of anhydrous ammonia, along with 120 million tons of other nitrogen source fertilizers for the '06 corn crop. In 2007 it is projected that there will be a 15% increase in corn acres in Illinois as a result of significantly higher corn prices (1) which were a result of the expanding ethanol industry in the Mid-West driving up the demand for corn.

The Agriculture industry has taken steps to use nitrogen fertilizers more efficiently, including proper application rates, timing of application to reduce loss of N and use of nitrogen inhibitors.

Currently, the agricultural industry is adopting new practices and using technologies to utilize nitrogen fertilizers in an even more efficient manner. Some of these practices are driven by economics due to the increased price of fertilizer in recent years combined with the continued awareness and desire to improve environmental stewardship. For example:

Practices & the use of technology

- Variable rate application technologies that apply N relative to soil type and soil nutrient analysis profile.
- Precision application techniques using practices such as strip-till to apply N in a precise row based pattern.
- Recordkeeping that identifies field specific yield projections, using GPS derived soil testing data and crop yield history that specifies defined nutrient application.
- Use of urease inhibitors to minimize volatilization of urea and UAN solutions.
- Better soil incorporation techniques for urea fertilizers to reduce volatilization.
- Development and utilization of corn hybrids that make more efficient use of water and nutrients, thus increasing crop yields without the need for additional fertilizer applications.

Government programs historically have offered $8 to & $10 per acre as an incentive to adopt Nitrogen Best Management Practices, i.e. the Natural Resource Conservation Service's Environmental Quality Enhancement Program (EQIP) and the Illinois Department of Agriculture's Nutrient Management Program. These program have demonstrated success, but on a relatively small scale.

Proposed Straw Man: Nutrient Trading

From World Resources Institute: "Awakening the Dead Zone: An Investment for Agriculture, Water Quality and Climate Change." P. 10. February 2003.

"The concept of trading is based on the difference in compliance costs faced by each industrial facility or municipal wastewater treatment plant (WWTP) depending upon size, scale, age, and overall efficiency. This means that the cost of meeting water quality standards may be less for one facility than for another. Trading between point sources provides an opportunity for those facilities whose costs are lower to make additional reductions beyond their obligation, and sell these additional reductions to facilities whose costs are higher.*

"Trading can also occur between a point source like a municipal WWTP and a non-point source, such as a farmer. Point sources with high compliance costs can purchase nutrient reduction credits from non-point sources, whose nutrient reduction costs are much lower. Point source facilities are generally controlled by discharge permits mandated by the USEPA, while non-point sources are typically not controlled by regulatory limits.

"Incorporating non-point sources, such as agriculture, into trading programs has raised questions of uncertainty about the actual reduction achieved by these sources. For agricultural non-point sources to reduce their nutrient contribution to water bodies, best management practices (BMPs), such as changing tillage practices or crop rotations, reducing fertilizer rates, creating filter strips, or establishing wetlands, are implemented. These practices can frequently improve water quality at a lower cost than upgrading wastewater treatment facilities, but there is a greater degree of uncertainty surrounding the actual nutrient reductions achieved.

"To account for this uncertainty, trading ratios or discount factors are applied to nutrient reductions from non-point sources. For this analysis, we used a 2:1 trading ratio; that is, a point source must purchase 2 pounds of nutrient reductions generated by a nonpoint source for every pound of reduction they require. The BMPs included in our analysis were changing crop rotation and tillage practices, changing fertilizer application rates, and taking land out of production through the Conservation Reserve Program (CRP). A more detailed description of nutrient trading can be found in Greenhalgh and Faeth (2001), Faeth (2000), and at the USEPA website (http://www. e p a . g o v / o w o w / w a t e r s h e d /trading.htm)."

Rough estimate of reductions from BAU in 2020

WRI analyzed the effects (including GHG reductions) of a nutrient trading program limited to the Mississippi River Basin where trading could only happen between agriculture nonpoint sources (cropland only) and waste water treatment plants. In this analysis, we assume a similar program limited to Illinois would have the same results. WRI's analysis also predicted water quality benefits and increased farm income. (http://pdf.wri.org/awaken_dead_zone.pdf, p. 13)

Assumed nitrogen discharge limits for waste water treatment plants and modeled GHG reductions in the WRI analysis:

8mg/l/day = 4% reduction in GHGs
3mg/l/day = 8% reduction in GHGs.

Other assumptions:

- 743 million tons anhydrous ammonia and other N fertilizers used on corn crops in 2006.
- Projected 15% increase for 2007 = 854 million tons/1.1 conversion to metric tons = 776 million metric tons in 2007.
- Assume 80% anhydrous (82% N content) and the remaining 20% as Ammonium Nitrate with a 28% N content.
- Assume 1% of nitrogen inputs from fertilizer lost as N20. (United Nations Intergovernmental Panel on Climate Change.)

N content	N Applied	Volatized N	Unvolatized N	Direct N20 Emissions	Indirect N2O Emissions	Total N20 Emissions	MTCO2E	MMTCO2E
0.82	509056	50905.6	458150.4	7199.506286	799.9451429	7999.451	2479830	2.47983
0.28	43456	4345.6	39110.4	614.592	68.288	682.88	211692.8	0.211693
	552512	55251.2	497260.8	7814.098286	868.2331429	8682.331	2691523	2.691523

2.7 MTs CO2E x 4% reduction = 0.11 MTs CO2E
2.7 MMTs CO2E x 8% reduction = 0.22 MTs CO2E

Timetables, duration and stringency
Begin January 2009.

Barriers to implementation
Difficult to measure and verify nitrogen reductions on farms.

Interstate Cooperation
Nutrient trading would work better on a regional basis in cooperation with other states.