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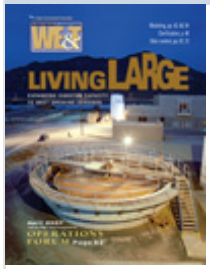

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USDA Announces Proposals for 2007 Farm Bill Reauthorization

On Jan. 31, the U.S. Department of Agriculture (USDA) unveiled more than 65 proposals for the 2007 Farm Bill reauthorization. The proposed 2007 Farm Bill would seek funding to assist agricultural producers in implementing conservation best management practices, as well as foster collaboration between the wastewater sector and the agricultural community.

While some of USDA's proposals adequately addressed strategies proposed by the Water Environment Federation (WEF; Alexandria, Va.), some of the agency's recommendations focus more on conservation than water quality, according to Tim Williams, managing director of government affairs at WEF.
In general, "WEF is encouraged by those proposals because they do reflect our priorities and recommendations to some extent," said Williams.

For the past 2 years, USDA collected the statements and opinions of stakeholders and producers nationwide to formulate a revised Farm Bill that targets issues concerning farms and the environment. Overall, the USDA's 2007 Farm Bill proposals would spend about $10 billion less in the next 5 years than the 2002 bill spent during the past 5 years, and would uphold the president's plan to eliminate the deficit in 5 years, according to a USDA news release.

Cy Jones, senior technologist at CH2M Hill (Englewood, Colo.), said that discussions with the WEF government affairs staff, USDA, and the Natural Resources Conservation Service (NRCS) regarding the Farm Bill have proven that each party has a "genuine interest" in improving both water quality and the collaboration between the farming community and the wastewater community.

"We do all have a common goal of improving water quality," Jones said. "I know they're genuinely interested in it. Whether this will work or not and actually produce or fulfill these goals will depend on the details."

Environmental consultant G. Tracy Mehan, former assistant administrator for Water for the U. S. Environmental Protection Agency, said he thinks the bill is "heading in the right direction," but expressed concern about some areas of funding.

Funding for Conservation Programs

Among its proposals, USDA calls for an additional $7.8 billion to fund conservation programs for the next 10 years. This funding, according to the USDA Farm Bill proposals, would be used to consolidate and simplify conservation programs, and create a new Environmental Quality Incentives Program (EQIP) and a Regional Water Enhancement Program (RWEP). In its December position statement regarding Farm Bill authorization, WEF stated its support for strengthening these USDA conservation programs.

USDA states within its proposals that the agency has “multiple conservation programs within several agencies,” which can lead to “overlap and redundancy,” making consolidation key to efficient funding in the future.

“Funding for the conservation programs under the Farm Bill [has] never reached the level that was authorized by the 2002 bill,” explained Williams. According to USDA, tens of thousands of conservation program applications submitted by the agricultural community went unfunded in recent years.

WEF suggested not only that more funding be made available, but that the funding be better allocated for specific USDA conservation programs. To increase financial resources for on-farm conservation practices, WEF recommended shifting to a system of green payments, which would essentially provide a financial incentive for farmers to adopt conservation practices.

The revised EQIP program would provide financial assistance to customers through cost-share incentives for active agricultural lands — as it has in the past — but with a more streamlined approach, according to USDA. Redundancies would be reduced and there would be more cost-effective environmental benefits.

Additionally, USDA has proposed that the RWEP be revised to focus on more collaborative approaches to water issues. The new RWEP would invest $175 million for coordinated, large-scale water conservation projects, according to USDA.

“It sounded good, but [RWEP] focuses less on water quality, and more on conservation. We need more for water quality,” Williams said.

Better Allocation of Funds

Another aspect in better allocating funding would be to target watersheds where agricultural operations have caused water quality problems. Currently such funding is distributed among states’ own conservation committees to distribute as they please, said Williams.

“The funding decisions aren’t always based on targeting where the biggest environmental problems are,” but rather on geography. “WEF’s suggestion [was] that funding go to the most critical watersheds,” Williams said.

USDA’s proposal supports WEF’s suggestion to go with “merit-based funding allocation,” and calls for a repeal of Section 1241(d) of the 1985 Food Security Act — the regional equity provision — so that funding would be distributed based on greatness of need and best use of conservation funding.

Assessments on progress are also crucial in implementing successful conservation programs, Williams said. WEF proposed supporting the Conservation Effects Assessment Program authorized in the 2002 Farm Bill, to effectively measure the environmental benefits resulting from increased funding.

Collaboration and Trading

WEF also proposed fostering collaboration between the wastewater sector and livestock producers. Williams said there is an increase in partnerships between these groups, noting great motivation on the part of the municipal sector as it becomes more aware of its role within the watershed.

“Their recognition that [municipal authorities] are usually the biggest players in the watershed, and that they’re going to be held accountable for water quality even though it may not be just their actions that are influencing water quality, makes it in their best interest to work with the other parties including agriculture,” explained Williams.

Water quality trading, referred to as a “market-based approach” in USDA’s proposals, is one way in which to bridge these groups. USDA recommends a mandatory funding of $50 million encourage new private sector environmental markets to supplement existing conservation and forestry programs.

"I would say that the money is a little light," said Mehan. "I'm not sure $50 million is going to go very far. One's got to be encouraged that USDA is taking water quality trading to heart, but WEF needs to stay active to make sure we get a strong water quality trading provision into the law."

In the past, Williams said, USDA funding has been denied to these collaborative efforts, as funding can be allocated only to those in the farming community. WEF recommended expanding USDA funding to cover joint ventures and municipal agencies' programs for treating waste from agricultural operations, Williams said.

"USDA needs to take a leadership role [in water quality trading]," said Williams. "There needs to be a place in the federal establishment where people are promoting trade — it seems as though USDA doesn't see itself in that role."

There are opportunities for these two groups to work together — particularly through water quality trading. Jones, who co-authored Water Quality Trading: A Guide for the Wastewater Community, published by the Water Environment Research Foundation (Alexandria, Va.), said he knows of specific examples in which collaboration between the agricultural community and the wastewater sector would be beneficial to both parties, as well as to the environment. All that is needed is USDA's support.

"We're well past the time when agricultural community and the wastewater sector can be strangers," said Mehan. Mehan said the idea of a water quality trading advisory committee — made up of farmers, municipal wastewater treatment, industrial dischargers, and others — is "very important to pursue" as the trading program develops.

Jones said he knows of elderly farmers in North Carolina who would like to put their farms into permanent conservation easement. "They've applied for the conservation reserve program, but are on the waiting list," he said.

Jones' suggestion for remedying this problem through water quality trading is to allow for outside sources to fund USDA's conservation reserve program. These sources could be "a wastewater treatment plant that needed to expand, or a developer that needs to put in a little wastewater treatment plant to serve a big, new development, but can't get any allocation for nutrients because of water quality problems," Jones said. But as a wastewater treatment plant has to offset the load it produces, "those entities can put money into the conservation reserve program to fund these farmers that want to put their farms into permanent conservation easement and they could then get nutrient credits in return for that," Jones said.

Such trading, Jones said, is a "win" for the developers, the wastewater community, and farmers, and it would improve habitats, recreational lands, and forest preservation.

Another of WEF's recommendations — to establish more effective mechanisms to achieve greater nutrient controls on farms before agricultural runoff reaches waterbodies — could also be addressed through water quality trading. WEF, USDA, and the U.S. Environmental Protection Agency, Williams explained, all support the idea of establishing tradable water quality credits for farmers to buy and sell in an effort to reduce overall pollution. WEF suggested forming criteria for credits, as well as a water quality trading advisory committee to oversee and advise on policy issues and program development.

"They [USDA] need to help provide mechanisms and support for farmers and others who want to engage in trading. I think USDA could play an active role as … middlemen or advocates for the farming community," Williams said.

Jones said he likes the overall direction of the USDA proposals, but that there must be more technical support in "understanding and quantifying and enhancing the science of water quality and water quality benefits from water conservation practices, and BMPs [best management practices]" under the 2007 Farm Bill.

"There's a lot of work that needs to be done in that area and other areas [such as] determining loads — nutrient or sediment or bacterial loads — generated by agricultural

practices on certain soil types [and the effect] on surface waters," Jones said.

WEF's Position Statement on the 2007 Farm Bill Reauthorization is available at www.wef.org. To download USDA's 2007 Farm Bill Proposals, see www.usda.gov.

*— **Meghan H. Oliver,** WE&T*

Mighty Nanorust

Nanotech discovery could have large-scale impact on developing world

A little olive oil, rust, and a magnet someday could be used to treat arsenic-contaminated drinking water if scientists from Rice University (Houston) have their way. In an unexpected discovery, the scientists found magnetic interactions between ultra-small specks of rust, which is leading them to develop a simple, low-cost arsenic-removal technology that holds promise for millions of people in developing countries.

Those in the water treatment industry have long known that iron oxide binds arsenic. Sufficiently large iron-oxide particles can be removed magnetically from water, but the process would be inefficient for arsenic removal and would create large amounts of waste. Also, until now, researchers thought iron-oxide nanoparticles, too small to exhibit the right magnetic properties, could not be removed magnetically, even though they would bind much more arsenic per amount of iron. This new finding, however, seems to turn this assumption on its head.

"The fact that iron is removing arsenic isn't surprising," said Paul Westerhoff, a professor of civil and environmental engineering at Arizona State University (Tempe). However, "the fact that it's magnetic and stays in suspension is novel" and offers a lot of interesting capabilities as a water treatment platform, he said.

"Magnetic particles this small were thought to only interact with a strong magnetic field," explained Vicki Colvin, director of Rice's Center for Biological and Environmental Nanotechnology and lead author of an article describing the new technique in the November issue of Science magazine (Science 2006, 314, pp. 964–967). "Because we had just figured out how to make these particles in different sizes, we decided to study just how big of a magnetic field we needed to pull the particles out of suspension. We were surprised that we didn't need large electromagnets to move our nanoparticles, and that in some cases hand-held magnets could do the trick." She added that "it's yet another example of the unique sorts of interactions we see at the nanoscale."

Forbes magazine listed the discovery as one of the top five nanotechnology breakthroughs of 2006.

Colvin and her colleagues are now hoping to translate their findings into a simple purification method that removes arsenic from drinking water in a way that requires no electricity or extensive hardware, making it suitable for use in developing countries.

Lab-Scale Experiments

The experiments involved suspending iron-oxide or magnetite nanoparticles in water, where they bound to the arsenic. The particles of arsenic-laden rust were then drawn out of the water with hand-held magnets, reducing the arsenic concentrations to levels below the U.S. Environmental Protection Agency's 10-ppb drinking water standard.

As particle size is reduced, the force on the particles drops rapidly, "and the old models were correct in predicting that very big magnetic fields would be needed to move these particles," explained co-author Doug Natelson, a Rice physicist. In this case, however, "it turns out that the nanoparticles actually exert forces on each other, so once the handheld magnets start gently pulling on a few nanoparticles and get things going, the nanoparticles effectively work together to pull themselves out of the water," he said.

Because these ultra-small particles have a high surface-to-volume ratio, the amount of waste associated with arsenic removal from water could be reduced by orders of magnitude, according to the article.

While the nanoparticles used in the experiments were expensive, the Rice scientists now are working on new production approaches that villagers in the developing world could use to prepare the iron-oxide nanoparticles. The primary raw materials are rust and fatty acids, which can be obtained from olive or coconut oil, according to Colvin, who added that the only facility required is a kitchen with a gas cooktop.

Widespread Applications

If the researchers are successful, the removal technique could have major implications for several countries in the developing world, where naturally occurring arsenic contaminates the groundwater pumped from shallow wells used for drinking water.

Every year, thousands of cases of arsenic poisoning in Bangladesh, India, and other countries are linked to these poisoned wells, according to the World Health Organization (WHO; Geneva). In 2005, the World Bank (Washingon, D.C.) estimated that 65 million people in Southeast Asia are at risk for arsenic-related health problems resulting from contaminated drinking water. Chronic exposure can lead to skin discoloration, sickness, cancer, and death.

A crucial requirement for stemming this crisis is a simple, cheap, reliable, robust technology for arsenic removal at wells and in households, according to WHO.

Remaining Challenges

So far, the Rice researchers have shown that iron-oxide nanoparticles work better than larger particles in removing arsenic. What they need to do now is demonstrate whether this process works better than other practical removal methods, such as iron-chloride coagulation methods, said Dennis Clifford, a professor of environmental engineering at the University of Houston. Additionally, the removal efficiency must be tested in waters that contain the kinds of ions that might compete with arsenic for removal on iron. These include silicate and phosphate, which are present in most groundwaters, Clifford noted, as well as organic matter.

This work currently is being carried out, said Mason Tomson, a professor of civil and environmental engineering at Rice and a co-author of the paper. “It appears from our preliminary work that by the time adverse organic matter would become effective and interfere with removal, you probably wouldn’t be drinking the water anyway,” he added. Nevertheless, “there are reasons to worry about unknown interferences that would prevent arsenic removal,” he said. Consequently, they’re trying to measure the effect of such interferences on removal efficiency and what can be done to mitigate them, he noted.

A waste product in nanoparticle form also may pose a problem. “Once you’ve separated it by a magnet, how do you dispose of the nano-iron waste?” Westerhoff asked. “To me that’s concerning, particularly in the developing world.”

Tomson acknowledged that the contaminated waste is a concern. “Disposal or reuse has to be worked out before you start,” he stressed. Tomson and his colleagues are looking at ways to regenerate the material in situ, but “we don’t know yet if that can be done,” he said. Alternatively, they also are evaluating possibilities for collecting the material at a central processing plant for disposal or reuse.

Meanwhile, the Rice group is moving to pilot-scale testing of the removal technique while simultaneously developing methods for individual household treatment, according to Tomson. He expects field testing to follow soon after that, with possible licensing of the technology to a company in 3 to 5 years.

— ***Kris Christen,*** *WE&T*