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EPRI Abstracts Related to Water Quality Trading

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Case Studies of Water Quality Trading Being Used for Compliance with National Pollutant Discharge Elimination System Permit Limits. **EPRI, Palo Alto, CA: 2013. 3002001454**.

While there is a great deal of published work describing and analyzing water quality trading and explaining how to engage in it, research is lacking regarding permits that use water quality trading to meet compliance obligations. This report aims to provide transparency on National Pollutant Discharge Elimination System (NPDES) permits that incorporate water quality trading through a series of 18 case studies. The research does not attempt to provide comprehensive coverage of every NPDES permit that uses water quality trading. Rather, case studies of 18 NPDES permits are provided as a sample of permits known to allow water quality trading to meet compliance obligations. The case studies focus on the language within the permit itself, supplemented with external information that provides a context for water quality trading in the permit.

Implementation of the Watershed Analysis Risk Management Framework (WARMF) Watershed Model for Nutrient Trading in the Ohio River Basin: Analysis of Scioto, Muskingum, and Allegheny Watersheds. **EPRI, Palo Alto, CA: 2012. 1025820**

As part of the Ohio River Water Quality Trading Program, the Scioto, Muskingum, and Allegheny watersheds were analyzed, using the Watershed Analysis Risk Management Framework (WARMF) model, to determine their capacity for nutrient trading. For consistency across the Ohio River Basin, the watershed models were implemented using the hydrological unit code (HUC) 10 delineation available from the United States Geological Survey. Data from the Ohio Environmental Protection Agency, Pennsylvania Department of Environmental Protection, and United States Environmental Protection Agency for point sources and water quality monitoring were used to set up the model. Agricultural nutrient loading factors were based on the most recent United States Department of Agriculture crop survey.

Barriers and Solutions for Farmer Participation in the Ohio River Basin Water Quality Trading Program. **EPRI, Palo Alto, CA: 2011. 1023642.**

As part of a multiyear collaborative effort, American Farmland Trust (AFT) convened six listening sessions with approximately 150 agricultural producers (farmers) in the Ohio River Basin (ORB) to determine their readiness to sell nutrient credits in a regional water quality trading (WQT) market. In a WQT market, municipal wastewater treatment plants, industrial manufacturing plants, and electric power companies can purchase nutrient credits to meet their regulatory requirements. They pay farmers to implement best management practices that reduce the loss of nutrients (such as nitrogen and phosphorus) and soil sediments from farms; in exchange, the farmers are given nutrient offset credits. Participants in the agricultural listening sessions identified potential barriers to their participation as credit sellers in a regional WQT program and proposed solutions to overcome those barriers.

Use of Models to Reduce Uncertainty and Improve Ecological Effectiveness of Water Quality Trading Programs: Evaluation of the Nutrient Trading Tool and the Watershed Analysis Risk Management Framework. **EPRI, Palo Alto, CA: 2011. 1023610.**

Through a United States Department of Agriculture-Natural Resources Conservation Service (USDA-NRCS) Conservation Innovation Grant, collaborators working on the development of the interstate Ohio River Basin Water Quality Trading Program conducted a robust analysis to evaluate possible approaches for using water quality models for crediting nutrient load reductions from agricultural best management practices (BMPs). A credit estimation method that ensures reliable and repeatable results is a critical element in a successful water quality trading (WQT) program and is something that is not always scientifically informed. This effort considers one approach for creating a scientifically informed approach that uses a combination of field-scale and watershed-scale models for crediting agricultural conservation practices. The Nutrient Trading Tool (NTT) and the Watershed Analysis Risk Management Framework (WARMF) were selected to evaluate the non-point source load reductions at the field scale and watershed scale, respectively.

The project assessed both NTT (field-scale) and WARMF (watershed-scale) models to determine the strengths and weaknesses for use in WQT. NTT was also tested by a select group of Ohio agricultural Technical Service Providers, Certified Crop Advisors, and Soil and Water Conservation Districts for applicability, user-friendliness, information content, and reliability. The project showed that both NTT and WARMF have demonstrable uses for supporting essential elements of credit calculations and policy development in WQT programs. Recognition of benefits and limitations of these tools will be critical for realizing their full potential in a WQT context. Efforts must be made to gather sufficient data and literature support for model calibration and validation. While WARMF has been tested and applied in many locations across the United States, NTT has yet to receive a similar level of scrutiny and application. Vetting by local experts and knowledgeable program participants of both the data and assumptions used by modelers is highly recommended, especially for NTT, which relies on field-specific information. In addition, recommended NTT model improvements will enhance the accuracy and performance of the tool, the results of which will increase trust and use by program participants. WQT programs can adjust for introduced errors and uncertainties by using a combination of eligibility conditions and an explicit trade ratio. These decisions can be informed by sensitivity analysis of the calibrated models, incorporation of model "goodness of fit" results, and best professional judgment. Output of these tools can be combined to provide an appropriate level of user-friendliness and pragmatic use of best available science for crediting, policy decisions, and program administration. The project also considered characteristics of a future on-line trading registry.

U.S. National Opinion Survey on Stacking Environmental Credits: Definition, Status, and Predictions of Wetland, Species, Carbon and Water Quality Credit Stacking. **EPRI, Palo Alto, CA: 2011. 1024803**

This report summarizes and analyzes the responses of a national survey entitled "Evaluation of Credit Stacking" that was developed jointly by EPRI, the World Resources Institute, Stetson University College of Law and the University of Kentucky. The purpose of the survey was to collect opinions about credit stacking from practitioners currently involved in environmental credit markets. The survey was conducted in the first quarter of 2010 and was sent to approximately 1,500 individuals residing primarily in the United States. After verification and removal of duplicate inputs, responses were received from 309 individuals. Respondents were asked to identify themselves as credit sellers, researchers, policy-makers, credit buyers or credit

exchangers. Ninety-four percent of respondents identified themselves as either credit sellers, researchers or policy-makers, and the responses from these groups were analyzed in depth.

Ohio River Basin Trading Project Agricultural Stakeholder Listening Workshops: Sardinia, Ohio, October 14, 2010. **EPRI, Palo Alto, CA: 2011. 1023133.**

On October 14, 2010, American Farmland Trust held a listening workshop in Sardinia, Ohio, to provide information to and collect feedback from farmers and agricultural representatives on the Ohio River Basin Trading Project. The session began with a basic primer on water quality trading given by Jim Klang of Kieser & Associates. The presentation was followed by facilitated discussions. Participants were prompted with a variety of questions developed from earlier listening workshops held in other regions of the Ohio River Basin and addressed issues that producers will likely face in future water quality trading markets.

Ohio River Basin Trading Project Listening Workshops: Wabash River Watershed, Indiana, March 8-9, 2010. **EPRI, Palo Alto, CA: 2010. 1021543.**

In March 2010, American Farmland Trust held two listening workshops in the Wabash River Watershed to provide information and collect feedback on the Ohio River Basin Trading Project. Each session began with a basic primer on water quality trading given by Jim Klang of Kieser & Associates. The presentations were followed by facilitated discussions. Participants were prompted with several questions developed from earlier listening sessions addressing issues that producers will likely face in water quality trading markets.

The session held during the March 8 workshop in Bluffton, Indiana was coordinated with the Conservation Technology Information Center and the Indiana Farm Bureau to identify and invite producers, Soil and Water Conservation District (SWCD) staff, and others in the Upper Wabash with an interest in water quality. The Indiana Farm Bureau also participated in identifying attendees for the March 9 workshop in Terre Haute, Indiana, which was targeted to producers within the Wabash River Basin with an interest in water quality trading.

Ohio River Basin Trading Project Soil and Water Conservation District (SWCD) Informational Meeting: Columbus, Ohio, July 6, 2010. **EPRI, Palo Alto, CA: 2010. 1021539.**

On June 17, 2010, an invitation for an informational meeting was sent jointly by the executive director of the Ohio Department of Natural Resources, Dave Hanselmann, and the president of the Ohio Federation of Soil and Water Conservation Districts (SWCDs), Lawrence Burdell. This invitation was sent to all SWCDs in Ohio as well as a few additional interested parties. On July 6, 2010, project collaborators met with the invitees at the Ohio Department of Natural Resources in Columbus, Ohio. Nearly 80 attendees representing 39 SWCDs discussed the project, captured concerns, and considered various costs and benefits for SWCD participation in this effort.

Ohio River Basin Trading Project Joint Session Air, Water, Climate: March 15, 2010–Orlando, Florida. **EPRI, Palo Alto, CA: 2010. 1021502**.

Electric Power Research Institute (EPRI) project managers in air, water, and climate programs are working together to address the complex, interrelated issues associated with water and air quality in the United States. This session provided background and told the story of the pilot effort in the Ohio River Basin to develop broad, nontraditional collaborations that will support multi-stakeholder programs for water quality trading, carbon trading, and ecosystem services

protection. Through this pilot effort, EPRI Environment Sector programs are providing leadership in addressing difficult ecological problems.

***Watershed Modeling in the Ohio River Basin: Scientific Foundations*. EPRI, Palo Alto, CA: 2010. 1021542.**

Under funding from the U.S. Department of Agriculture (USDA) and the U.S. Environmental Protection Agency (EPA), academic collaborators are calibrating the Watershed Analysis Risk Managment Framework (WARMF) to be used during the design and implementation of the Ohio River Basin Trading Project. The WARMF model will be instrumental in simulating the water quality benefits of various rules in the trading program. In addition, the model will be useful for adaptively managing the trading program, once trading begins, to optimize the water quality benefts and improve project implementation. This effort will help ensure that the primary goal of a water quality trading program is achieved—to improve the quality of water and reduce nutrient loading in a cost-effective manner.

***Developing Greenhouse Gas Emissions Offsets by Reducing Nitrous Oxide (N_2O) Emissions in Agricultural Crop Production: Final Project Report.* EPRI, Palo Alto, CA: 2009. 1020546.**

This final project report describes a three-year long EPRI supplemental project entitled *"Developing Greenhouse Gas Emissions Offsets by Reducing Nitrous Oxide (N_2O) Emissions."* This EPRI-sponsored project investigated an innovative approach to developing large-scale, cost-effective greenhouse gas (GHG) emissions offsets that potentially can be implemented across broad geographic areas of the United States and internationally.

***Program on Technology Innovation: Ohio River Water Quality Trading Pilot Program — Business Case for Power Company Participation, 2008.* EPRI, Palo Alto, CA: 2010. 1018861.**

Nitrogen discharges to surface waters from power plants are increasing as technologies such as selective catalytic reduction units, electrostatic precipitators, and flue gas desulfurization systems are installed to comply with more stringent air emission requirements. The nitrogen generated by these processes is being transferred to surface water discharges. Concurrently, water quality impairments by nitrogen, new instream nutrient criteria, and anticipated effluent limitations on total nitrogen discharges are now actively being pursued by regulatory agencies. Although only a few power plant National Pollution Discharge Elimination System (NPDES) permits reviewed during this 2008 feasibility assessment contain nitrogen limits (or monitoring requirements), the promulgation of nutrient criteria (which will be followed by effluent limitations), is anticipated for Ohio in 2008, Kentucky and along the main stem of the Ohio River by 2010, and West Virginia by 2011. A preliminary feasibility analysis, described in this report, presents a strong business case for power company participation in the development and promotion of a water quality trading program in the Ohio River Basin. Such a program has the potential to reduce the costs of complying with water discharge restrictions.

***Program on Technology Innovation: Modeling Nutrient Trading in the Ohio River Basin; Theoretical and Practical Consideration*. EPRI, Palo Alto, CA: 2009. 1018691.**

Nutrient trading to achieve water quality objectives has the potential for achieving environmental objectives and ecological outcomes in a cost-effective manner. An important driver for a nutrient trading program is to provide a means for major dischargers to meet the effluent objectives

using more cost-effective trades with other dischargers or with non-point sources. Key to the success of a trading program is a thorough understanding of the watershed, its various components, the key stakeholders and their emissions, as well as the expected watershed response. A modeling framework that supports development of the trading program can provide some important insights for areas that are not meeting objectives that may not be detected by a monitoring program. These conditions can result in exceedance of the objectives, as well as the potential benefits of different trades. The current project developed the WARMF model for two watersheds in the Ohio River Basin: the Muskingum and Scioto watersheds. The model was used to identify water quality hotspots, understand the temporal pattern of water quality exceedances, determine the likely extent of local/regional trading areas, assess the magnitude of loads in a given trading area, determine the sensitivity of different regions to load reductions, and evaluate specific trades and trading ratios. The current approach is at a large scale, useful for scoping the potential for trading. A more detailed WARMF model can be set up for more local trading scenarios using the current model to provide the boundary conditions for the detailed local model.

***Methodologies for Cross-Pollutant Trading*. EPRI, Palo Alto, CA: 2008. 1014025**.

Cross-pollutant trading expands the range of cost-saving opportunities by allowing dischargers to earn credits for reducing loads to the watershed of complementary pollutants that contribute to the same common water quality impairment. This report technically evaluates methodologies for cross-pollutant trading in the context of opportunities for the electric power industry. The report is of value to environment managers within power companies, as well as regulators, water resource managers, and environmentalists.

***Program on Technology Innovation: Water Quality Trading Pilot Programs—Review of Catawba River Basin, Chesapeake Bay, and Ohio River Pilot Projects.* EPRI, Palo Alto, CA: 2007. 1015409.**

Water quality trading (WQT) has potential as an alternate means for power facilities to meet compliance goals with nutrient discharge limits, particularly for nitrogen. EPRI is working to identify and conduct a feasibility study for a WQT pilot project involving one or more power companies. This white paper summarizes general information on three potential pilot project locations, describes the screening criteria used to evaluate the potential of each project location, and completes a SWOT (strengths, weaknesses, opportunities, and risks) analysis for each.

***Program on Technology Innovation: Water Quality Trading Program for Nitrogen.* EPRI, Palo Alto, CA: 2007. 1014646.**

Anthropogenic releases of nitrogen have greatly increased environmental fluxes of biologically available nitrogen and contributed to serious ecological problems, such as algal blooms that cause waters to become severely depleted of oxygen. Power plant sources of nitrogen include NO_x air emissions, the ammonia required for the Selective Catalytic Reduction (SCR) and Selective Non-Catalytic Reduction (SNCR) systems that are used for NO_x reduction, and the ammonia used for SO_x control and ash pond conditioning. As part of its efforts to manage nitrogen pollution and improve water quality in the United States, the EPA has issued a Water Quality Trading Policy that enables and supports the adoption of market-based programs for improving water quality by allowing for the trade of credits that represent net nutrient reductions, including nitrogen. EPRI Technical Update 1013193, *Water Quality Trading Opportunities for Electric Power Companies: EPRI White Paper*, presented the background and concept of water quality trading, introduced potential opportunities for power companies related to managing

nitrogen, and identified the primary information gaps that need to be filled in order for EPRI members to benefit from EPA-endorsed water quality trading programs. This technical report is a follow-up to that Technical Update and provides more details regarding the drivers for trading, characteristics of successful trading programs, and the process for establishing a trading program.

***Program on Technology Innovation: Water Quality Trading Opportunities for Electric Power Companies: EPRI White Paper*. EPRI, Palo Alto, CA: 2006. 1013193.**

With electric utilities contributing to nutrient loading in waterways, it is important to identify the most effective options for reducing this environmental impact while still accommodating business goals. In the past, these two goals—business performance and environmental protection—have competed. However, water quality credit trading, a strategy supported by the U.S. Environmental Protection Agency, provides an alternative approach for utilities to simultaneously meet economic and ecological objectives.

***Water Quality Trading Guidance Manual: An Overview of Program Design Issues and Options,* EPRI, Palo Alto, CA: 2002. 1005179.**

The U.S. Environmental Protection Agency (EPA) actively promotes water quality trading (WQT) as a tool for more cost-effectively attaining water quality standards, which are currently not met in nearly half of the nation's streams and water bodies. This market-based approach builds on the success of emission trading programs for sulfur dioxide and nitrogen oxides. The water quality context, however, differs in many important respects from the air quality context, and there is as yet little experience with successful WQT programs. This report provides WQT program developers with an overview of issues they will need to address and summarizes relevant lessons from existing WQT programs.