### Monitoring, Prevention & Mitigation of Agricultural Contaminant Sources

Dan Stoddard Asst Director for Environmental Programs Pesticide & Fertilizer Management Division Minnesota Department of Agriculture

November 14, 2006

### MDA Statutory Responsibilities

 Lead agency for pesticide and inorganic fertilizer regulation in Minnesota
 Primary legislative authority: – MN Pesticide Control Law (18B)

- MN Ground Water Protection Act (103H)
- Delegated lead state agency for enforcing FIFRA (Federal Insecticide, Fungicide, Rodenticide Act)
- MN Fertilizer, Soil Amendment & Plant Amendment Law (18C)

### **Statutory Authority**

#### **\*** Under the *Pesticide Control Law (18B)*

- Pesticides may not be used in a way that will cause "unreasonable adverse effects on the environment" (same language as in FIFRA )
- Unreasonable adverse effects " means unreasonable risk to humans or the environment, taking into effect the economic, social, and environmental costs and benefits
- Pesticides are intended to be used in the environment, and some residual contamination is expected

### Statutory Authority

#### Under the <u>Groundwater Protection Act (103H)</u>

- MDA is lead agency for pesticides and inorganic fertilizer
- MDA must
  - Determine if a contaminant is commonly detected
  - Develop voluntary BMPs to prevent or minimize contamination
  - Promote BMPs via education and demonstration projects
  - Evaluate BMP adoption and effectiveness
  - Consider regulation if BMPs are proven ineffective

#### Pesticide Management Plan

#### MDA is responsible for development of a Pesticide Management Plan (PMP)

 "to prevent, evaluate, and mitigate occurrences of pesticides or pesticide breakdown products in groundwaters and surface waters of the state"

The PMP includes requirements from both 18B and 103H



### **Statutory Authority**

Under the <u>Fertilizer, Soil Amendment, and</u> <u>Plant Amendment Law (18C)</u>

- MDA is the lead state agency for regulating fertilizer other than manure
- A person may not store, handle, distribute, or dispose of a fertilizer in a manner will cause unreasonable adverse effects on the environment
- Note that this does not include "use" of a fertilizer

### **Other Agencies**

#### **\* MPCA:**

- surface water standards
- impaired waters

#### ✤ MDH:

- potable wells
- source water protection
- drinking water standards (HRLs)
- BWSR, SWCDs, MPCA, Minnesota Extension Service:
  - promoting BMPs



### Monitoring

Minnesota Statutes 18B.04 PESTICIDE IMPACT ON THE ENVIRONMENT
"The commissioner shall:

(1) determine the impact of pesticides on the environment, including the impacts on surface water and groundwater in the state"

# What MDA Monitors for

Herbicides, Insecticides, Fungicides Herbicide degradates (LC/MS/MS) Nutrients Analyte list based on volume of use, previous detections, environmental risk and suitable lab methods Pesticide analysis is expensive and a limiting factor for monitoring efforts

### **Monitoring Cooperation**

#### Monitoring MOAs

- Agriculture, Health, Pollution Control ? Groundwater
- Agriculture, Pollution Control ? Surface water

#### Cooperators

- Farmers who allow us free access to install wells or sample springs on their land
- -- Counties, local government, Met Council, DNR and others

#### Other Efforts – USGS, Dakota County



### **Monitoring Locations**

GW priority in sensitive areas

10 Pesticide Monitoring regions based on similar hydrogeology and agricultural practices





#### 2006 Groundwater and Spring Monitoring

![](_page_12_Figure_1.jpeg)

November 14, 2000

Aqueullure

# 2004 Drinking Water Well Survey

![](_page_13_Figure_1.jpeg)

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### Surface Water Tiered Structure Monitoring Design

Tier 1 – Survey sites throughout agricultural areas sampled during May-July (4 samples, 1 every 2 weeks targeting storm flow)

Tier 2 – Survey sites with expanded sample collection (8 samples) due to detections at levels of concern

Tier 3 — Intensively monitored with grab and automated time-based composite samples

#### 2006 Tier 1, 2 and 3 Surface Water Quality Monitoring

![](_page_15_Figure_1.jpeg)

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### **Monitoring Results**

#### Annual MDA monitoring report

Available on the MDA web site

![](_page_16_Picture_3.jpeg)

WATER QUALITY MONITORING PROGRAM

#### PESTICIDE MONITORING IN WATER RESOURCES:

#### **ANNUAL DATA REPORT**

PUBLICATION DATE: May 13, 2004

MINNESOTA DEPARTMENT OF AGRICULTURE

MONITORING AND ASSESSMENT UNIT AGRICULTURAL CHEMICAL ENVIRONMENTAL SECTION AGRONOMY & PLANT PROTECTION DIVISION

Minnesota Department of Agriculture

#### Monitoring Data is Compared to Standards

Analyzed for long term trends for dedicated monitoring wells

![](_page_17_Figure_2.jpeg)

![](_page_17_Figure_3.jpeg)

**Central Sands Groundwater Monitoring Network** 

![](_page_17_Figure_5.jpeg)

Minnesota Department of Agriculture

# Summary of pesticide and pesticide degradate concentrations in the Central Sands Groundwater Monitoring Network, 2005.

	Detections	Concentration values of samples <sup>1</sup> ; all values in ug/L (nd = non detect)			
	Frequency	Median (50 <sup>th</sup> Percentile)	75 <sup>th</sup> Percentile	90 <sup>th</sup> Percentile	Maximum <sup>2</sup>
Pesticide		<u>2005</u>	<u>2005</u>	<u>2005</u>	2005
Acetochlor	0%	nd	nd	nd	nd
Acetochlor + degradates	30%	nd	0.10	0.57	24.29
Alachlor	0%	nd	nd	nd	nd
Alachlor + degradates	44%	nd	0.31	1.26	4.26
Atrazine	51%	0.025	0.025	0.05	0.32
Atrazine + degradates	85%	0.085	0.185	0.275	1.17
Metolachlor	8%	nd	nd	nd	1.87
Metolachlor + degradates	65%	0.23	1.47	3.78	17.02
Metribuzin	12%	nd	nd	0.05	1.24
Metribuzin + degradates	22%	nd	nd	1.35	7.84

<sup>1</sup> Percentiles and Maximums are calculated using all sample results.

 $^{2}\,$  The Maximum of parent plus degradate observed in a single well.

![](_page_18_Picture_4.jpeg)

### Monitoring Summary

Atrazine, acetochlor, alachlor, metribuzin and metolachlor or their degradates are frequently detected at low levels in GW Degradates frequently exceed their parent and can be hard to analyze for (cyanazine) Atrazine parent appears to be declining Atrazine and acetochlor are detected at levels of concern in some surface waters

### MDA Pesticide Use and BMP Adoption Surveys

Pesticide use and BMP adoption are surveyed in agricultural areas in alternating years through a contract with the National Agricultural Statistics Service (NASS)

Use data provided for each county and monitoring region

![](_page_20_Picture_3.jpeg)

#### 2003 Pesticide Usage on Four Major Minnesota Crops

Minnesota Department of Agriculture Minnesota Agricultural Statistics Service

January 2005

November 14, 2006

#### Model of Leaching Risk Based on Vulnerability + Use Using WIN-PST

![](_page_21_Figure_1.jpeg)

### MN Nitrate Testing Clinic Data

✤1993 – MDA develops "walk-in" style testing clinic Goal = increase public awareness of nitrates in rural drinking and livestock water supplies ID occurrence of nitrate 'hotspots' ✤To date: 30,000 tests with educational outreach

#### Percentage of Private Wells Above the Nitrate-N Health Standard

MDA clinic conclusions: private well NO<sub>3</sub>-N results indicate that 12 to 15% exceed 10 ma/L

![](_page_23_Figure_2.jpeg)

#### Prevention

for AGRICULTURAL HERBICIDES

In order to protect Virmetota's scaler resources, fre-Minnesota Department of Agriculture (MDA), along with the University of Minnesota Extension Service and other interested parties, has developed a set of core voluntary Best Management Practices (BVPs). The core voluntary BMPs are provided on the opposite side of this page and

should be adopted when applying all agricultural herbicides in Winnessta. The BMPs may also refer to nanelatory label use requirements. Alwaye read product labels. Additional information and references accompany

#### **Core** Herbicide **BMPs**

- BMPs for all Ag Herbicides
- Broad-based stakeholder input
- Provided as a series of options

#### the **ENPs** February 2004 The NDA has also developed units. The BMDs are provided as a series of ontions. Producers, con onsultants and educators should select ontions most approximate for a lower familier operation operation series. herbacides due to their presence in use. The herbicide-specific BMPs : The parts are provided as series of openies. Produces, not possible to be called a series openies are provided as propriate or a green raining openiation, sort rypes and egography. Itiges and outfiviation radices, and ingrading and runoff management. The MOA encourage development of integrated Viece Management Plans for a farm (see "Additional information and References" for more information, Always read the product table. Labet use requirements and application estables are legally enforceable. breakdown products have been, fre metalaction and restribuzin) or thos Water Quality Best Management Practices for All Agricultural Herbicides Core Practice\* Description Benefit and attacine). If the BVP's are proout for weeds, then map infestations thr hout the year. Determine whether y may be teauired. For information of ontrol will result in significant crop yield benefits. Carefully match weed contro rofer to the MDA's Monitoring and J esponding accurately to specific weed pressure sing post-emergent control and using alternativ hemical and non-chemical (e.g., cultivation) Scout fields for weeds and ptions - including non-chemical control - to weed pressures. Use herbicides only in ituations where they are necessary and will be cost-effective. Use herbicides with match the management approach to the weed secondary matter city at a recentary and will be cost extreme. Our nearboard matter long-lasting effect ("residual control") will in fields that have high densities of target weeds or in fields where weed information is lacking (e.g., newly rented or purchased acres). Consider post-emergent weed control alternatives. ontrols can lower costs and prevent water esource impacts. problem. Careful planning in the use of herbiprotect water resources from fature Minoventa's waters. Planning also n many cases, banding and a carefully plan moult in reduced application rates th cide loss in runoff during early spring rains. Consider using the lowest la ced-rate herbicide program can result in tive weed control, reduced costs, and a Evaluate reduced or split herbicide applicat ate in a "rate range." Start on a small area to test what works best on your farm. B State and federal law can require th red for follow-up weed m uding post-emergent herbicide pplication, rotary hoeing, or inter-row cultivation. for adverse impacts on humans or t (85) outlines state requisitory author When the timing of application and the product label allow, incorporate herbicides to reduce runoff losses. Use a field cultivator or other implement to incorporate product to the greatest recommended depth. Easily adopted when tilling prior to planting. ncorporated herbicide is less vulnerable to being For Surface Water protection Protection Act (Mine, Stat. 103H) an ent to incorporate products st in runoff and reaching nearby streams and urface tile inlets. Soil incorporate herbicides. herbicides trequently detected in gr or segments recontinuous requir. Casing applications when using Takou to paintage to the white roce constantiation and other approximations. The second conservation Service (IRICS) listings for herbicides and soil properties that can lead to ehickle bases in useful to surface waters (rivers, stresson, Bakes). Consider nethickle site in useful to surface waters (rivers, stresson, Bakes). Consider nethickle site in the surface waters (rivers, stresson, Bakes). Consider nethickle site and the surface waters (rivers, stresson, Bakes). Consider nethickle site and the surface waters (rivers, the neth and site and the surface site of the stresson of the surface waters, list in the and simboles. could lead to restrictions on the us For Surface Water protection For Surface Water protection Evaluate surface drainage patterns in your field and install filter strips and establish buffer zones for streams, sinkholes and tile BMPs, and a cautious and respective ilters and buffers reduce field runoff and setbac to maintain access to a variety of he liminate applications where losses are most kelv. Reducing use of herbicides known to mov and project under resourcest Management Practices (BMPs) for Nork with crop consultants and other ag professionals. Study Department of Natura lesources groundwater pollution sensitivity maps and Natural Resources Conservation conservation of the sensitivity maps and sensitivity maps and sensitivity and the sensitivity of the sensitivity and the sensitivity of the sensitivity of the sensitivity maps and sensitivity of the sensitity of the sensitivity of the sensitivi For Ground Water protection: Determine the depth to groundwater in your fields icing herbicide use in sensitive areas reduce The purpose of voluntary EMPs is t ervice (NRCS) listings for herbicides and soil properties that contribute to herbicide the potential for groundwater contamination. Adhering to label groundwater advisories and exclusions reduces aquifer pollution. minimize the degradation of Nimes asses by leaching. Consider herbicides that NRCS lists as having low loss ratings for eaching from your soils, or consider non-chemical weed control methods in sensitive and consider protective practices in vulnerable area resources while considering econo reas. Follow label requirements or recommendations where water tables are shallow evailability, technical leasibility, imp old more than two consecutive applications of herbicides with the same mode of tion (chemistry) to the same field. Evaluate this practice in the context of other ective control practices in the management system (e.g., use of tank mixes with effortiveness, and environmentally his practice serves to reduce de verbicide resistance in weeds or weed species hifts and, in the long term, can help reduce th total annual loss of particular herbicides to wat Botate berbicide modes of From a practical standpoint, these is action (chemistry) nultiple modes of action; crop rotation; planned, periodic use of herbicide-resistant rops in a rotation; mechanical weed control; field scouting). environment and to encourage the arces and the environ approaches to weed control as par Precision application of herbicides (spot spraying or use of variable rate technologies; is based on weed scouling and variation in soil properties (soil organic matter and texture). Adjust application rates according to weed pressures and soils information. recision applications result in less total herbicid Consider precision application of herbicides. levelopment of harbinide resistant pplied when compared to broadcast applications; his means less potential loss to the environment. For Ground Water pro If you irrigate, implement a water management scheduling plan that uses a soil probe rain gauge, daily crop water use estimations and a soil water balance worksheet. Develop an Irrigation Water Management Plan. chemicals to grou For practices related to the use of specific herbicides refer to MDA's herbicide-specific Best Management Practices. All BMPs are available a

appd/bmps/bmps.htm See "Additional Information & Refe rences" for access to detailed guidance on al ended practices.

![](_page_24_Picture_7.jpeg)

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#### Examples of Core BMPs for all Agricultural Herbicides

Scout fields for weeds and match the management approach to the weed problem
Evaluate reduced or split applications
For Surface Water protection: Soil incorporate herbicides
For Ground Water protection: Determine the depth to groundwater and consider protective

practices in vulnerable areas

 Consider herbicides with low loss ratings for leaching or consider non-chemical weed control

### **Best Management Practices**

# Herbicide-specific BMPs for

- Acetochlor
- Alachlor
- Atrazine
- Metolachlor
- Metribuzin

For herbicides commonly detected in groundwater or of concern in surface water

![](_page_26_Figure_8.jpeg)

# Example Herbicide Specific BMPs

#### Atrazine BMPs

- Limit total atrazine use per year to 0.8 lbs a.i. per acre on coarse-textured soils and in SE MN Karst areas
- SE MN medium and fine textured soils: 1.0 lb a.i. per year can be used pre-emergence
- Adopt conservation tillage practices appropriate for your farm's topography and in SE Minnesota karst areas
- Rotate use of atrazine with herbicides from a different chemical class

![](_page_27_Picture_6.jpeg)

### Evaluation

MDA must evaluate BMP effectiveness and adoption

#### **\*** For BMP effectiveness:

- Primary means is water monitoring data
- Decreasing trends suggest the BMPs are working
- Plot scale and field scale research
- Modeling

#### May be a long lag time between BMP adoption and observed effects in GW

### **BMP** Adoption

Evaluated through phone surveys, local surveys and audits by MDA inspectors

![](_page_29_Picture_2.jpeg)

November 14, 2006

#### Mitigation

\* MDA may develop rules, called "water resource protection requirements" (WRPRs), if the implementation of BMPs has proven to be ineffective

If adoption is high but effectiveness is in doubt, then the BMPs should be revised before considering a rule – rules will be based on the BMPs, if the BMPs

are not effective then the rules also will not be effective

### Water Resource Protection Requirements

WRPRs must be designed to "prevent and minimize pollution to the extent practicable," prevent pollution from exceeding HRLs, and must be based on:

- The use and effectiveness of BMPs
- Product use and practices causing pollution
- Economic factors
- Availability, technical feasibility, implementability and effectiveness

## Restrictions on Product Registration

The commissioner may impose state use and distribution restrictions on a pesticide as part of the registration to *prevent* unreasonable adverse effects on the environment.

![](_page_32_Picture_2.jpeg)

# Nitrate Contamination Issues

- Under the Groundwater Protection Act (103H)
  - MDA lead for inorganic N fertilizer
  - MPCA lead for manure and septics
- \*1989 Chap. 326, Art. 6, Sec. 33, Sub. 2b (Session Law)
  - Created a Task Force to develop a Nitrogen Fertilizer Management Plan (NFMP)

![](_page_33_Picture_6.jpeg)

#### The NFMP

 The Nitrogen Fertilizer
 Management Plan, for the prevention, evaluation & mitigation of nonpoint source nitrogen fertilizer, was completed in 1990

Recommendations Of The Nitrogen Fertilizer Task Force On

#### THE NITROGEN FERTILIZER MANAGEMENT PLAN

To The Minnesota Commissioner of Agriculture

August 1990

### **Overall Response Phase**

#### Similar Process as for Pesticides

- Greater emphasis on a local approach by designating a "Special BMP Promotion Area"
- Voluntary BMPs already developed and would be promoted and evaluated in each area

 If BMPs are proven ineffective, the MDA may implement "Water Resource Protection Requirements (WRPRs)"

#### Nitrogen Fertilizer BMPs

Fertilizer BMPs by crop and region were developed by the University of Minnesota and widely promoted

#### Validating N Rates for Corn on Farm Fields in Southern Minnesota

Recommendations to optimize profits and protect water quality

![](_page_36_Picture_4.jpeg)

Gyles Randall, Michael Schmitt, Jeffrey Strock, John Lamb

November 14, 2006

### Demonstration and Validation of BMPs

Much on-going work by University of Minnesota, MDA and cooperators, examples include:

- Plot work and field days at Extension research and outreach centers
- On Farm demonstration projects through Nutrient Management Initiative with NRCS
- Tiled and instrumented demonstration sites at Red Top, Highway 90 and a third location under development,

### Fertilizer Program Funding

Never well funded Cuts in supplemental general funds and layoffs in 2003 New fees were passed in 2005, but for multiple uses Currently five MDA non-point field staff

#### Focus on Community Water Suppliers With Nitrate Problems (a joint effort with MDH)

![](_page_39_Figure_1.jpeg)

#### Local N Response

Each situation is complex and unique, requiring a separate study

- Detailed FANMAP survey to determine <u>actual</u> <u>practices</u>
- Form a local team involving all stakeholders, especially local farmers

 Use FANMAP and sensitivity data to target key practices on sensitive lands and to help obtain implementation funding

# Farm Nutrient Management Assessment

![](_page_41_Figure_1.jpeg)

FANMAP assists in understanding how much farmland is receiving nutrient inputs that are under, over and comparable to UM Recs.....

#### Producers May be Using Recommended Nitrogen Inputs - and still have problems!

![](_page_42_Figure_1.jpeg)

Figure 8. 1999 crop N requirements based on University of Minnesota N recommendations in comparison to actual N inputs (fertilizer and manure) for <u>irrigated</u> <u>corn acres</u> in the inventory area.

#### Source: 1999 FANMAP of Perham Producers-MDA

![](_page_42_Picture_4.jpeg)

![](_page_42_Picture_6.jpeg)

### Example Nitrate Response Options

Take highly vulnerable land out of production (CRP) Reduce fertilizer inputs Change crop types or rotation (esp alfalfa) Change timing or method of fertilization to match crop uptake Change variety (Altura potato) Nitrification inhibitors (ESN) Irrigation management

![](_page_44_Picture_0.jpeg)

#### "Case Studies" Available on Web

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| Minnesota Department of Agriculture

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Berhan is located in the heart of Minnesota's west-rentral lakes region in Ottertail County. The city boats on in pression buiness con a unity hased upon industry agriculture and traning. Appreciately 323 willion gallons of water are any lied such year to businessian industry, and its 2000 residents. Elevated airsts levels in the con a unity's drietling water mappies have forced the city to take in a ediate and long-tern corrective actions. Providing quality drinking water is an in portant con genent for future growth and viability of this region.

Perham's Water Quality and Challenges

- \* Bits suggly wells vary in depth from 45 to 120 feet deep. Two reggly walls were recently idled due to low output and will only be used under an arguncy or backup situations. A new wall, yielding high quality water, was jut entine in 2000 to replace then .
- RST State Option and District Conference at 21 on a subsection RST State Option hast their relation from the 22 on a subsection and Description in the section of the section of the section in the Part of the section of the section of the section is the section in the proof of the section. · Individual city wells have speculically exceeded the rate drinking water standard of 10 parts per a illion (33)M). Currently city staff blends water to keep the levels of the finished drinking water batmaan 6 to 8 33M of nitrats. Daspar aquifers with lawar nitrats levels contain high levels of iron. More than likely finding adequate ungglise of low mittate water will become n are and n are difficult.
  - \* A nitrate nen eval system was considered, but not put into practice because of the very high costs involved.
  - \* Water quality is in parted by factors such as land use activities from a condition of growing high nitrogen containing crops, large areas being irrigated, coarse-textured soils which allow rapid water a oven ant and relatively challow wells.
  - + Bechan 's wellbaud protection and covers approximately 11,500 acres. Within this area, 1600 acres are of significant in partanes, becaus mattes water can teach die aquider within 10 years.
  - · In the can sining protection uses it typically takes between 10 to 30 years for water to reach the squifer. This a ears that we nay not enjoy a any of the environm ental benefits of in proved mittogen a snagen ent for years to cone.

#### Successful Action Steps

- \* A wellbeid protection plan war con pleted to addrear the an ount of nitrogen surging from cropland, lawnt, septic tands, and feedlots. Managen ent goals and strategies in the plan define in plan entation steps to protect and in prove drinking water quality. This approach was highly mensuital due to cooperation an only con n unity residents, farn ers, businesses, industry, and stateflocal agencies.
- \* Residents in the wellbend protection area, including farm ers. Turinesses and city hon sowners, are being provided with inform ation on specific actions they can take to protect drinking water. Indurnation is being distributed durugh public meetings, press releases, utility bill inserts, dan anatration projects and curriculus. being taught in local scheels.
- · Signa have been installed identifying the boundaries of the wellbead protection area. Residents landowners, and producers have a better understanding of the size of the protection area when they can visually see it.

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Drinking Water Protection

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### Legislative Audit

Legislative audit of pesticide programs completed in February 2006
Generally good review but some recommendations noted:

Urban water monitoring
Need to revise PMP to better address registration, urban and aquatic pesticides
Need a BMP evaluation plan

#### Key Issues

Impaired waters – a huge effort and the focus of current funding and resources
Nitrates in groundwater
Possible surface water impairments for acetochlor and atrazine
Evaluating pesticide BMP effectiveness
Pesticide degradates – cyanazine
Changing health and environmental standards

![](_page_47_Picture_4.jpeg)

### MDA Future Efforts

#### Focus on impaired waters

- Research using SWAT model to quantify BMP benefits
- Using LIDAR to target high risk locations for BMP implementation
- More involved in impairment process

Continued pesticide and nutrient BMP promotion, demonstration and evaluation
Implementation of the NFMP in problem areas
Increased statewide water monitoring
Environmental reviews in registration process
Use of pesticide immunoassays

#### **Questions?**

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Or Visit the MDA Web site at: <u>http://www.mda.state.mn.us</u> \_go to "Water and Land"

![](_page_49_Picture_3.jpeg)