



MINNESOTA PESTICIDE MANAGEMENT PLAN

***A Plan for the Protection
of Groundwater and Surface Water***

November 2007

Minnesota Department of Agriculture
Pesticide and Fertilizer Management Division

Additional copies of the **Minnesota Pesticide Management Plan: A Plan for the Protection of Groundwater and Surface Water**, can be obtained at <http://www.mda.state.mn.us/protecting/waterprotection/pmp.htm> or by contacting:

Minnesota Department of Agriculture
625 North Robert Street
St. Paul, MN 55101

Additional Minnesota Department of Agriculture documents and program information related to pesticides and water quality can be accessed at the following links:

Water quality monitoring data <http://www.mda.state.mn.us/chemicals/pesticides/maace.htm>

Pesticide Best Management Practices <http://www.mda.state.mn.us/protecting/bmps/voluntarybmps.htm>

Pesticide Use (Sales and Statistics) <http://www.mda.state.mn.us/chemicals/pesticides/pesticideuse.htm>

Lawn Care and Water Quality <http://www.mda.state.mn.us/protecting/waterprotection/lawncwaterq.htm>

Drinking Water Protection in Ag Areas <http://www.mda.state.mn.us/protecting/waterprotection/drinkingwater.htm>

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CHAPTER 1

Introduction to the Minnesota Pesticide Management Plan

Introduction

Many industries periodically utilize the legal application of pesticides either as part of routine management systems, or to manage particular pest problems. Many agricultural producers use pesticides (most commonly herbicides, insecticides and fungicides) to protect crops and increase yields. Homeowners and municipalities use pesticides to manage pests around homes and in lawns, gardens and parkland. Lake managers and lakeshore owners might use aquatic pesticides to control aquatic plants or other aquatic organisms that are causing nuisance conditions or that have an impact on valuable aquatic habitats. Public health officials may request the use of pesticides to control or prevent disease outbreaks. Because some pesticides can leach through soil to groundwater, be lost from fields or lawns in surface water runoff, or negatively affect rivers, streams and lakes, the commissioner of the Minnesota Department of Agriculture (MDA) was directed in 1989 to develop a pesticide management plan for the prevention, evaluation, and mitigation of occurrences of pesticides or pesticide breakdown products in groundwaters and surface waters of the state.

The Minnesota Pesticide Management Plan (PMP) is designed to guide the MDA in its efforts to coordinate activities necessary to protect Minnesota's groundwater and surface water resources from pesticide contamination. Many of the steps outlined in the PMP are directly linked to the statutory requirements and guidance in the Pesticide Control Law (Minn. Stat. Chapter 18B) and the Groundwater Protection Act (Minn. Stat. Chapter 103H). In addition, the commissioner of agriculture has broad authority to take action, both within and separate from the PMP, to take any actions necessary to protect public health and the environment from harmful exposure to pesticides, and to prevent unreasonable risk to humans or the environment.

The PMP was initially published in 1996 and then briefly revised in 1998 to refine guidance for surface water decisions. In June 2005 the MDA published revisions to the 1998 PMP. Those revisions were designed to reflect: the changes in MDA program resources; the need for greater clarity in PMP references to groundwater vs. surface water statutes and programs (including new federal Clean Water Act program activities in Total Maximum Daily Load assessments); changes to the scope of federal pesticide management plan requirements; and changes in various technical references, the MDA monitoring program, and other outdated information.

In February 2006, and in response to a directive from Minnesota's Legislative Audit Commission to evaluate pesticide regulation in Minnesota, the Office of the Legislative Auditor's Program Evaluation Division published its report, "Evaluation Report: Pesticide Regulation." One recommendation of the

report was that “The Department of Agriculture should revise the Minnesota Pesticide Management Plan to better address issues of urban pesticide use, aquatic pesticides and product registration.” The basis for the recommendation is provided on pp. 77-79 of the Legislative Auditor’s report. The MDA commissioner accepted this recommendation.

The current PMP addresses the recommendations of the Office of the Legislative Auditor.

Purpose

The purpose of the PMP is to:

□ Carry out requirements of Minnesota Statutes § 18B.045

*Subdivision 1. **Development.** The commissioner shall develop a pesticide management plan for the prevention, evaluation, and mitigation of occurrences of pesticides or pesticide breakdown products in groundwaters and surface waters of the state. The pesticide management plan must include components promoting prevention, developing appropriate responses to the detection of pesticides or pesticide breakdown products in groundwater and surface waters, and providing responses to reduce or eliminate continued pesticide movement to groundwater and surface water. Beginning September 1, 1994, and biennially thereafter, the commissioner must submit a status report on the plan to the environmental quality board for review and then to the house of representatives and senate committees with jurisdiction over the environment, natural resources, and agriculture.*

*Subdivision 2. **Coordination.** The pesticide management plan shall be coordinated and developed with other state agency plans and with other state agencies through the environmental quality board. In addition, the University of Minnesota extension service, farm organizations, farmers, environmental organizations, and industry shall be involved in the pesticide management plan development.*

The PMP is written to fulfill the MDA’s mandate under Minn. Stat. Chapter 18B (the Pesticide Control Law) while maintaining consistency with other statutes designed to protect the quality of the state’s water resources.

For groundwater, Minn. Stat. Chapter 103H (the Groundwater Protection Act) serves as the foundation of the PMP’s groundwater-related activities. The degradation prevention goal is defined in Minnesota Statutes § 103H.001:

It is the goal of the state that groundwater be maintained in its natural condition, free from any degradation caused by human activities. It is recognized that for some human activities this degradation prevention goal cannot be practicably achieved. However, where prevention is practicable, it is intended that it be achieved. Where it is not currently practicable, the development of methods and technology that will make prevention practicable is encouraged.

For surface water, Minn. Rules part 7050.0150 states that:

The intent of the state is to protect and maintain surface waters in a condition that allows for the maintenance of all existing beneficial uses.

and in Minn. Rules part 7050.0185:

The potential capacity of the water to assimilate additional wastes and the beneficial uses inherent in water resources are valuable public resources. It is the policy of the state of Minnesota to protect all waters of the state from significant degradation from point and nonpoint sources and wetland alterations, and to maintain existing water uses, aquatic and wetland habitats, and the level of water quality necessary to protect these uses.

The PMP is a generic plan that provides the framework and process for protecting both groundwater and surface water from pesticide contamination.

Scope

□ The Minnesota Pesticide Management Plan *will*:

1. Guide the MDA in its efforts to coordinate activities necessary to protect Minnesota's groundwater and surface water resources from pesticide contamination;
2. Address the terrestrial “use” of pesticides (as opposed to pesticide misuse or spills) in agricultural settings. Pesticide “use” means activities conforming to product labeling which include mixing, loading, disposal, application, and storage of pesticides;
3. Address terrestrial use in settings that are non-agricultural or urban (e.g., landscape and structural settings, and in forest management and rights-of-way). ;
4. Address use of pesticides in aquatic settings that are intended to manage aquatic plants, and animal pests in conformance with product labeling; and
5. Guide the MDA in the development of pesticide Best Management Practices (BMPs) or other necessary responses in a framework containing prevention, evaluation and mitigation components.

□ The Minnesota Pesticide Management Plan *will not*:

1. Address non-labeled, non-target uses of pesticides;
2. Determine how the MDA will respond to spills, incidents, or fires (a description of the process by which detections of pesticides in wells are evaluated and referred is provided in Chapter 6 – Statewide Water Quality Monitoring); or
3. Promote or discourage differing philosophies on pest management, although these may be part of specific BMPs.

Goals and Approaches

The PMP outlines goals and approaches for prevention, evaluation, and mitigation of occurrences of pesticides or pesticide breakdown products in groundwaters and surface waters of the state. Recommended actions to accomplish these goals are highlighted in the appropriate portions of the plan.

□ Prevention Goal

The prevention goal of the PMP is to promote prevention of occurrences of pesticides or pesticide breakdown products in groundwaters and surface waters of the state. It is intended that this prevention be accomplished while promoting practices that consider economic factors, availability, technical feasibility, implementability, effectiveness, and environmental effects, and in consideration of the beneficial uses of pesticides and applicable water quality standards.

□ Prevention Approach

The prevention goal of the PMP will be accomplished through:

1. utilizing analysis tools to focus resources in scientifically defensible ways and in high risk areas;
2. establishing an Education and Promotion Team to assist the MDA in coordinating prevention activities;
3. developing, adopting, and implementing effective strategies for prevention education and promotion through:
 - a. applicator training and certification/licensure;
 - b. BMP research and development;
 - c. education program development and coordination;
 - d. demonstration projects; and
 - e. Integrated Pest and Weed Management promotion; and
4. integrating prevention actions, where appropriate, into other natural resource management efforts, and into non-agricultural and aquatic pesticide management activities, to support identified alternative pest management systems, and data collection activities.

Objective 1

Key target groups are educated on issues associated with land use, landscape management, community health, crop production, structural pest management, lake and wetland management, economic profitability, and risks versus benefits, relevant to pesticide use as it impacts water quality in Minnesota. Target groups include pesticide users, policymakers, landowners, retailers, general public, crop consultants, institutions, financial institutions, agencies, and residents.

Objective 2

Effective prevention strategies are encouraged through education and promotion, including adoption of BMPs by pesticide users considering all management tools available and supported by proper pesticide distribution, storage, handling, use and disposal, and use-specific management strategies.

□ Evaluation Goal

The evaluation goal of the PMP is to evaluate detections of pesticides and pesticide breakdown products in water resource monitoring data, and to evaluate the adoption, validity and effectiveness of prevention and management strategies, including pesticide BMPs.

□ Evaluation Approach

The evaluation goal of the PMP will be accomplished through:

1. establishing a Pesticide Management Plan Committee (PMPC) to support MDA evaluation activities;
2. annual review of detections of pesticides and pesticide breakdown products in water resource monitoring data;
3. assessing, evaluating, and validating –
 - a. changes in management practices
 - b. resource impacts and trends
 - c. delivery systems to local interests and stakeholders
 - d. economic impact of implementing prevention steps; and
4. using evaluation findings to refine practices and management strategies.

□ Mitigation Goal

The mitigation goal of the PMP is to reduce or eliminate continued movement of pesticides or pesticide breakdown products to groundwater and surface water.

□ Mitigation Approach

The mitigation goal of the PMP will be accomplished by:

1. intensifying and targeting education and outreach (preventative) efforts; refining or developing BMPs, incentives or regulatory options; and considering the cost versus benefit and technical feasibility of mitigation measures; and
2. if necessary, exercising regulatory authority through mandatory use changes by adoption of water resource protection requirements or the restriction or cancellation of product registration.

CHAPTER 2

Minnesota's Philosophy, Goals and Approaches for Preventing Water Resource Degradation

Philosophy and Goals

Minnesota recognizes that prevention is the best strategy for protecting water quality. It has become clear both locally and nationally that contamination of water resources is exceedingly difficult, expensive, and sometimes impossible to correct.

Groundwater

Minnesota has a groundwater degradation prevention goal, articulated in Minn. Stat. § 103H.001:

It is the goal of the state that groundwater be maintained in its natural condition, free from any degradation caused by human activities. It is recognized that for some human activities this degradation prevention goal cannot be practicably achieved. However, where prevention is practicable, it is intended that it be achieved. Where it is not currently practicable, the development of methods and technology that will make prevention practicable is encouraged.

Minn. Rules Chapter 7060 is a rule of the Minnesota Pollution Control Agency (MPCA) which regulates discharges of pollutants to groundwater. The degradation prevention policy is stated in Minn. Rules part 7060.0200:

For the conservation of underground water supplies for present and future generations and prevention of possible health hazards, it is necessary and proper that the agency employ a nondegradation policy to prevent pollution of the underground waters of the state.

More detail is provided in Minn. Rules part 7060.0400:

The waters of the state are classified according to their highest priority use, which for underground waters of suitable natural quality is their use now or in the future as a source of drinking, culinary, or food processing water. Suitability is to be construed as meaning that the waters in their natural state can be used for such purposes after such purification or treatment processes as may be prescribed by the Minnesota Department of Health or the Minnesota Department of Agriculture. This classification is established to protect the underground waters as

potable water supplies by preventing and abating pollution. In making this classification, the agency [MPCA] recognizes that the underground waters of the state are contained in a series of related and often interconnected aquifers, such that if sewage, industrial waste, other waste or other pollutants enter the underground water system, they may be spread both vertically and horizontally.

In Minn. Rules part 7060.0300, the term “underground water” is defined as:

...the water contained below the surface of the earth in the saturated zone including, without limitation, all waters whether under confined, unconfined, or perched conditions, in near surface unconsolidated sediment or regolith, or in rock formations deeper underground.

Note that the term “suitable natural quality” is used to define groundwater in Minnesota as a source of drinking water. This is because many near-surface aquifers in the state are of sufficient natural quality that they may be used as sources of drinking water. In some areas deeper aquifers are used because of aesthetic concerns or because of human-induced pollution, either actual or potential. By acknowledging the interconnectedness of groundwater and the need to provide as clean a supply of groundwater as possible for future generations, the degradation prevention policy will result in prevention of additional pollution and eventual improvement in groundwater quality as pollution sources are controlled or removed and the most serious problems addressed.

Numeric limits for groundwater protection are also applied in areas already impacted by human-induced pollution as action levels, cleanup goals and water consumption advisory levels. These are discussed in more detail in Chapter 7 – Water Quality Standards). The numeric limits are not used to set protection goals. Minnesota does not allow degradation to occur up to a certain limit before requiring that action be taken.

This is why the pesticide management approach outlined in the Pesticide Management Plan (PMP) starts with voluntary prevention measures and uses an evaluation approach (Chapter 9 – Evaluation) rather than health-based or arbitrary standards as a trigger for more rigorous measures.

Surface Water

The Minnesota PMP also incorporates protection of surface water. The commissioner of agriculture, in addition to the prevention, evaluation and mitigation strategies for groundwater, will utilize related strategies to protect surface water quality. The basis upon which the surface water protection philosophy is founded is within the Pesticide Control Law (Minn. Stat. § 18B.04 and § 18B.045) and the authorities vested in the MPCA via the Clean Water Act.

The PMP will utilize to the extent practicable the classification system, standards, and authorities provided in Minn. Stat. § 115.03, which give the MPCA authority to adopt standards and prohibit discharges that would cause those standards to be exceeded. Section 115.44 directs the MPCA to develop a classification system for surface waters that allows differential standards for water bodies based upon their use and quality.

The MPCA follows Minn. Rules Chapter 7050 in administering these statutory authorities. These rules establish a protection goal for surface water in part 7050.0170:

The waters of the state may, in a state of nature, have some characteristics or properties approaching or exceeding the water quality standards. Natural conditions exist where there is no discernible impact from point or nonpoint source pollutants attributable to human activity or from a physical alteration of wetlands. Natural background levels are defined by water quality monitoring. Where water quality monitoring data are not available, background levels can be predicted based on data from a watershed with similar characteristics.

Where natural background levels do not exceed applicable standards, the addition of pollutants from human activity and resulting point or nonpoint source discharges shall be limited such that, in total, the natural background levels and the additions from human activity shall not exceed the standards. When reasonable justification exists to preserve the higher natural quality of a water resource, the commissioner may use the natural background levels that are lower than the applicable site-specific standards to control the addition of the same pollutants from human activity. The reasonable justification must meet the requirements under parts 7050.0180 and 7050.0185.

Where background levels exceed applicable standards, the background levels may be used as the standards for controlling the addition of the same pollutants from point or nonpoint source discharges in place of the standards.

In the adoption of standards for individual waters of the state, the agency will be guided by the standards herein but may make reasonable modifications of the same on the basis of evidence brought forth at a public hearing if it is shown to be desirable and in the public interest to do so in order to encourage the best use of the waters of the state or the lands bordering such waters.

The designated uses of a water body are determined by their attainable water quality. All lakes in Minnesota are classified for aquatic life and recreation use. Ninety-nine percent of Minnesota river miles are classified for aquatic life and recreation use. All rivers are classified for agricultural, navigational and industrial use. Each use has a specific set of water quality standards that must be maintained in order for the water body to support that particular use. Minnesota water use classifications are:

- Class 1 - Domestic consumption
- Class 2 - Aquatic life and recreation
- Class 3 - Industrial consumption
- Class 4 - Agriculture and wildlife
- Class 5 - Aesthetic enjoyment and navigation
- Class 6 - Other uses
- Class 7 - Limited resource value waters

The state's water use classifications may contain both numeric and narrative standards designed to be protective of the designated uses.

In addition, Minnesota has a nondegradation policy for surface waters, outlined in Minn. Rules parts 7050.0180 (for outstanding resource value waters) and 7050.0185 (for all waters). The nondegradation policy applying to all waters is intended to protect "all waters from significant

degradation from point and nonpoint sources and wetland alterations, and to maintain existing water uses, aquatic and wetland habits, and the level of water quality necessary to protect these uses.” Special provisions are included for waters designated as “Outstanding Resource Value Waters,” waters unique to the state for exceptional recreational, cultural, aesthetic or scientific resources. Discharges to these waters are either restricted or prohibited, depending on the water body in question.

In practical application, these groundwater and surface water policies mean that:

1. All water resources are protected (not just current drinking water supplies) before contamination occurs;
2. The protection goal is the maintenance of the natural quality of water where possible, and minimization of impacts where this goal cannot be met;
3. Groundwater resources are not prioritized for protection according to use, but all are protected as sources of drinking water;
4. Surface waters will be protected according to classifications set forth in Minn. Rules Chapter 7050; and
5. Achieving the same level of protection for waters vulnerable to contamination requires that additional protective measures may need to be applied.

For pesticides, protecting water resources means that some Best Management Practices (BMPs), such as generic BMPs for all herbicides, should be developed before potential problem compounds cause contamination or are detected. These BMPs should be promoted in areas where water resource impacts may be expected to occur based on vulnerability analyses and pesticide usage patterns.

Minnesota Legislative Mandate

The Pesticide Control Law mandates that the MDA develop a Pesticide Management Plan (PMP). Minn. Stat. § 18B.045 subd. 1. states:

The commissioner shall develop a pesticide management plan for the prevention, evaluation, and mitigation of occurrences of pesticides or pesticide breakdown products in groundwaters and surface waters of the state. The pesticide management plan must include components promoting prevention, developing appropriate responses to the detection of pesticides or pesticide breakdown products in groundwater and surface waters, and providing responses to reduce or eliminate continued pesticide movement to groundwater and surface water. Beginning September 1, 1994, and biennially thereafter, the commissioner must submit a status report on the plan to the environmental quality board for review and then to the house of representatives and senate committees with jurisdiction over the environment, natural resources, and agriculture.

Minn. Stat. § 18B.045, subd. 2. states:

The pesticide management plan shall be coordinated and developed with other state agency plans and with other state agencies through the environmental quality board. In addition, the University of Minnesota extension service, farm organizations, farmers, environmental organizations, and industry shall be involved in the pesticide management plan development.

Minnesota PMP and Federally Mandated State Management Plans (SMPs)

In 1996, a proposed federal rule that would have required states to develop state groundwater management plans (SMPs) for certain pesticides was released by the U.S. Environmental Protection Agency (EPA) Office of Pesticide Programs. The proposed rule was established to focus on the development of management plans specific to five pesticide compounds that were commonly found in groundwater across the nation. Those compounds were alachlor, atrazine, cyanazine, metolachlor and simazine. The guiding philosophy of the SMP was that successful management of pesticides for the protection of water resources could only be accomplished by accounting for differences in crops grown, hydrology, geology, sociology and regulatory framework of each state. To do this would require dedication on behalf of the states to manage pesticides in a nationally consistent fashion while accounting for their own state's unique characteristics. The EPA also recognized that to ensure compliance by the states, a rule mandating the development of a SMP was necessary. A plan framework was developed that listed twelve requirements that each state had to meet in order to have an acceptable SMP and be allowed to continue to register the five named pesticides. Those twelve components are listed below:

1. State's philosophy and goals toward protecting groundwater;
2. Roles and responsibilities of state agencies;
3. Legal authority;
4. Resources;
5. Basis for assessment and planning;
6. Monitoring;
7. Prevention actions;
8. Response to detection of pesticides;
9. Enforcement mechanisms;
10. Public awareness and participation;
11. Information dissemination; and
12. Records and reporting.

In late 2000 the final rule was submitted to the federal Office of Management and Budget, where it was considered and then referred back to EPA for further review. The new administration requested that the EPA Office of Pesticide Programs research and develop a new rule focused on a more participative, flexible approach based on state and federal partnerships. No revised rule has yet been proposed. The evaluation of compliance with federal mandates is therefore limited to the components

as proposed in the original rule. Table 1 facilitates review of Minnesota’s PMP for its congruence with the federal generic plan requirements.

The MDA believes that the current plan exceeds generic PMP requirements proposed by the EPA. In the event a revised rule is proposed and promulgated by the federal government, the MDA will review any changes in the rule and make adjustments as needed to remain in compliance with federal regulations.

Table 1: Cross reference of EPA proposed SMP components for generic PMPs to chapters of the Minnesota PMP

	US-EPA Component	Related Minnesota State PMP Chapters
1	State’s Philosophy and Goals Toward Protecting Groundwater	Chapters 1 and 2
2	Roles and Responsibilities of State Agencies	Chapter 4; Appendix A
3	Legal Authorities	Chapter 2
4	Resources	Chapters 2, 4, 8, 9 and 10
5	Basis for Assessment and Planning	Chapters 3 and 8
6	Monitoring	Chapter 6
7	Prevention Actions	Chapters 4, 7, and 8
8	Response to Detection of Pesticides	Chapter 9 and 10
9	Enforcement Mechanisms	Chapter 10
10	Public Awareness and Participation	Chapter 4 and 9
11	Information Dissemination	Chapter 8
12	Records and Reporting	Appendix B

Further, if a pesticide-specific SMP is required by the EPA, the MDA will develop a plan that will comply with requirements specified by EPA. It is anticipated that the approach outlined in the current PMP, which was developed, in part, based on guidance previously published by EPA for state pesticide management plans, will fulfill the majority of EPA’s requirements. If the MDA chooses not to develop a pesticide-specific SMP required by EPA rule, then use of that pesticide will be further restricted or cancelled in Minnesota.

The MDA will not develop a pesticide-specific SMP unless one is required by EPA because it would generally replicate what is currently provided for in the PMP. When necessary for a specific decision, the MDA will prepare an analysis and summary of alternatives for action. These documents would be highly flexible to fit the specific situation, and would include the information needed to select, plan and begin the implementation of a specific action.

Summary

Minnesota’s PMP philosophy, goals and approaches for preventing, evaluating and mitigating water resource degradation are designed to comply with applicable statutes and rules. Pesticide or pesticide breakdown product detections in water resources may lead to the development and promotion of

voluntary BMPs that are based on sound technical knowledge. BMP adoption and effectiveness are evaluated before regulatory options are considered. This approach is based on the requirements of Minn. Stat. Chapters 18B and 103H, and incorporates the goals of Minn. Rules Chapters 7050 and 7060. The approach adheres to generic PMP requirements proposed by the EPA, and is adaptable to any future proposed federal mandate for the development of pesticide-specific SMPs. State statutes and rules establish a framework for protecting Minnesota's groundwater and surface water through prevention. Details of the PMP's prevention, evaluation and mitigation components are provided in Chapters 8, 9 & 10.

CHAPTER 3

Minnesota's Natural Setting, Pesticide Use Patterns and Information Sources

Minnesota's Water Resources

Minnesota is a state rich in water resources, including lakes, rivers, wetlands and extensive aquifers. Minnesota is located at the headwaters of three major drainage basins. Hudson's bay is the ultimate destination of runoff from the Red River of the North and the Rainy River. Lake Superior accepts runoff from the St. Louis River, the Nemadji River and many small streams along the North Shore. Water from Lake Superior discharges through the other Great Lakes and the St. Lawrence River to the Atlantic Ocean. The Mississippi River is the largest drainage system in Minnesota and receives runoff from the majority of the state.

Minnesota contains some of the most pristine waterbodies in the country. Because there are vast areas of recreationally accessible surface waters, Minnesotans enjoy enormous opportunities for fishing, boating, swimming and diving. A significant portion of the state economy depends on tourism, and residents share these resources with enthusiasts from outside the state.

The advance and retreat of vast ice sheets during the Ice Age left behind a very complex system of unconsolidated geologic deposits in Minnesota. Both surficial and buried glacial drift aquifers are present in most of the state, especially in river and stream valleys where the interconnection between surface and groundwater is dynamic. Glacial drift aquifers are important sources of drinking water, for both public and private supplies. In many parts of the state, bedrock aquifers are present under the glacial drift.

Bedrock aquifers supply drinking water for public and private use, as well as maintaining base flow for the surface waters of the deep river valleys cut by the Mississippi and Minnesota Rivers. In some areas, the glacial deposits are shallow or nonexistent. This is particularly important in Southeastern Minnesota, where the dissolution of the underlying carbonate, limestone rock has resulted in Karst formations; here, bedrock aquifers are particularly susceptible to direct impacts from surface activities.

□ Published Reports and Maps

Subsurface geologic information is the basis for assessing the susceptibility of groundwater to contamination. Land use practices, climate, irrigation and other factors also play a role in whether susceptibility results in actual contamination. There are various descriptions of subsurface conditions, ranging from detailed maps and reports to uninterpreted records of water wells and borings. The

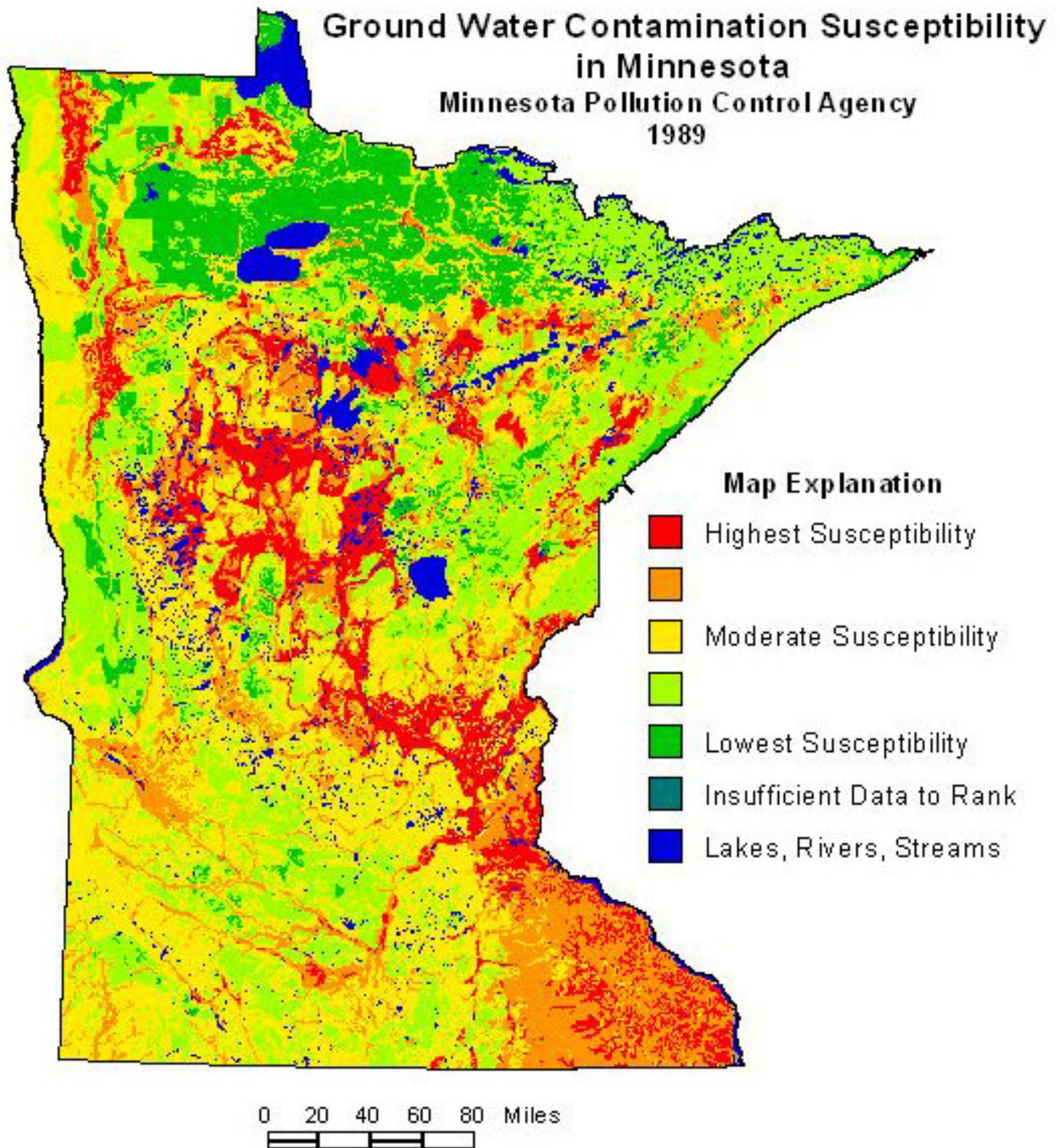
Minnesota Pollution Control Agency (MPCA) developed a map (Figure 1) which shows general areas where water table aquifers are most vulnerable to contaminants resulting from land use activities. This map is not of suitable detail to be used to manage pesticides, but does depict general areas of the state where the threat to groundwater is greatest and can thereby serve to focus groundwater protection efforts. More detailed maps of regional groundwater sensitivity have been or are being developed by the Minnesota Department of Natural Resources (DNR) and can be considered in Pesticide Management Plan (PMP) implementation as they become available.

Surface topography and soil types influence overland runoff and the recharge of local and regional lakes, rivers and springs. As with groundwater susceptibility and sensitivity, the ability to predict surface water impacts is related to various factors, including land use practices, topography, soil physical properties and climate. The MPCA developed a map (Figure 2) to guide development and implementation of water quality plans for 10 separate basins in Minnesota. The MPCA sets surface water standards (including standards, criteria or advisory values for several pesticides) used to evaluate relative impairment of rivers and lakes within each basin.

Planning activities for some basins may include utilization of an agro-ecoregion framework to help develop Best Management Practices appropriate for a given area and broadly target them for water quality effectiveness. Minnesota has 39 agro-ecoregions in all; each agro-ecoregion is associated with a specific combination of soil types, landscape and climatic features, and land use. Each agro-ecoregion contains unique physiographic factors that influence the potential for production of non-point source pollution and the potential for adoption of farm management practices. Agro-ecoregions can be associated with a specific set of soil and water resource concerns, and with a specific set of management practices to minimize the impact of land use activities on soil and water resource quality. Maps of agro-ecoregions within three of Minnesota's 10 basins are shown in Figure 3. Information associated with the agro-ecoregions and their various land use and physiographic characteristics relative to surface water quality can be considered in PMP implementation.

It is possible to make broad generalizations on subsurface and surface conditions in Minnesota, and the ability to make specific recommendations on smaller areas is always growing. As responses to pesticide detections in water resources are developed, it is important to utilize the most precise and scientifically defensible information available.

Ground and surface water features are described in varying degrees of detail and coverage in additional published reports and maps, depending on the level of intensity of various investigative and mapping efforts. Soil atlases and county soil surveys cover the entire state, but are concerned with only the upper 5-6 feet of the earth's surface. Geologic and hydrogeologic maps of Minnesota at various scales are available from the Minnesota Geological Survey (MGS) and the DNR for many parts of the state. Hydrologic Atlases published by the U.S. Geological Survey (USGS) provide statewide coverage and are useful for establishing the general hydrogeologic setting for the area to be assessed. Other sources include MGS county atlases and USGS reports including Water Resources Investigations, Water Supply Papers, and Open-File Reports. While additional information can be found in studies conducted by state agencies, colleges and universities, and consulting firms, it is not consistently available for all parts of Minnesota.



The contamination susceptibility map was made from available digital files in 1989 or was digitized from existing published maps. Useable map scale is approximately 1:500,000 or 1 inch = 8 miles.

Figure 1: Groundwater Contamination Susceptibility in Minnesota

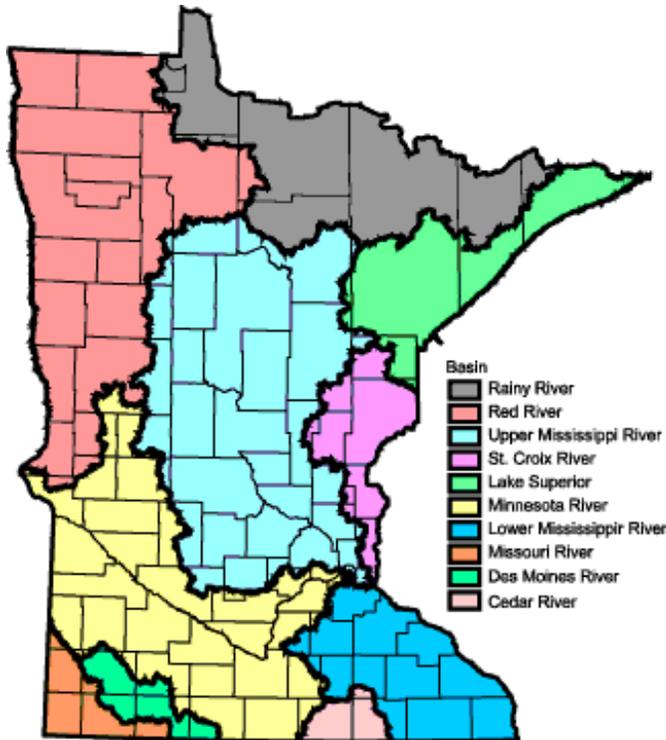
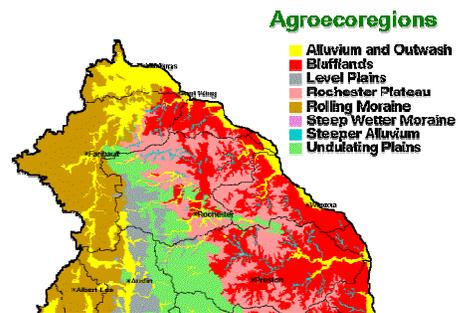
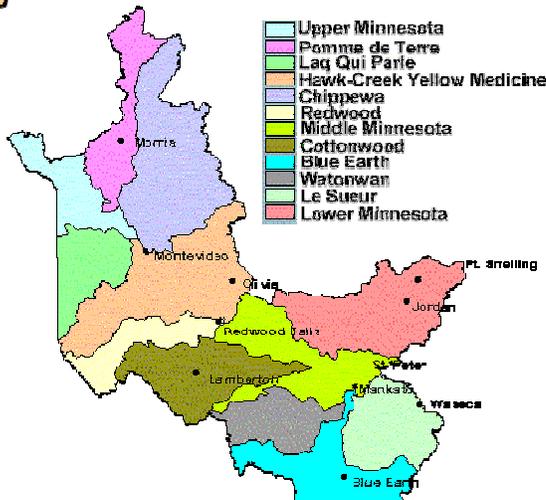
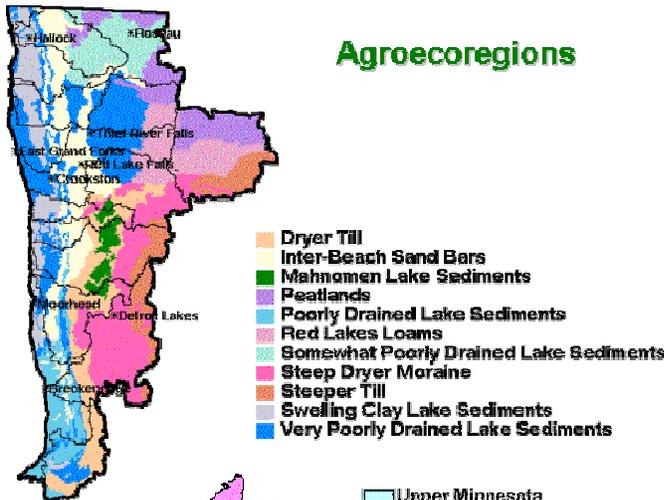


Figure 2 (left): Surface Water Basin Boundaries Used for Basin Planning and Water Body Impairment Listings under the federal Clean Water Act and Total Maximum Daily Load Programs

Figure 3 (below): Agro-Ecoregions for the Red, Minnesota and Lower Mississippi River Basins



□ Well Records and Boring Logs

Records from water wells and test borings are the most important and basic source of subsurface geologic information for the state. Since 1975, water well contractors have been required to submit a record (driller's log) to the Minnesota Department of Health (MDH) for each well drilled. The MDH distributes copies to other agencies, including the DNR and MGS.

The location and geologic information contained in water well records range in quality from very good to poor. The MGS organizes and interprets water well records as part of state efforts to develop a groundwater information system.

Various types of test drilling also provide valuable information about subsurface and hydrogeologic conditions. For example, the Minnesota Department of Transportation has many engineering test boring records acquired from road and bridge construction projects. Test boring records may be obtained for other types of construction projects from private consultants. Environmental borehole and monitoring well records from landfills and other types of environmental assessments are another source of data.

Minnesota's Soil Resources

Soil type can affect the rate at which water moves through the soil and the potential for pesticides to leach with the moving water or to run off in overland flow, either dissolved in runoff water or attached to soil particles. There are many soil types in Minnesota and each has its own specific characteristics. Soil surveys are available to aid in identifying the soil's characteristics in almost every area of Minnesota. Soil surveys consist of detailed maps which outline areas of specific soil types by name. In addition, soil surveys contain specific information to aid in the proper identification of soils, to describe suitability for numerous applications, and the limitations associated with these uses for most Minnesota counties.

□ Published Reports and Maps

State soil surveys are produced and published for individual counties by the U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS). They are a product of cooperation and effort from individual counties, the University of Minnesota, the NRCS and the Legislative Commission on Minnesota Resources. Limited copies of soil surveys are available through each county Soil and Water Conservation District Office. When a soil survey is published, additional copies are made available to local libraries, public schools, colleges, and county government offices.

The NRCS offers Internet access to a database of vulnerable soil types in most Minnesota counties. The soils database is used in conjunction with a database of pesticide leaching and runoff characteristics to aid in the development of pesticide management plans for individual fields that include the evaluation of pesticide loss ratings for soil type and pesticides used (see *Physical and Chemical Properties of Pesticides* below for more information).

Pesticide Use in Minnesota

A variety of sources publish information related to pesticide use in Minnesota. Each source has a particular reason for collecting information and a set of assumptions underlying its collection and reporting methods.

1. The MDA publishes annual pesticide sales data for crop production pesticide active ingredients based on pesticide registrant reporting requirements. The MDA also seeks to publish information on non-agricultural pesticide use, including annual pesticide sales data for select non-agricultural and urban pesticides. Care must be used when interpreting pesticide use or sales data. Pesticides reported as sold in Minnesota may not be used in the same year they are sold, or in some cases may never be used in Minnesota. However, these sales data provide an indication of long-term pesticide use trends.
2. The Minnesota Agricultural Statistics Service (MASS), a division of the MDA, in conjunction with the National Agricultural Statistics Service (NASS), conducts periodic surveys of major crop producers that collect information on pesticide use and use rates. Survey respondents are randomly selected, and the reported results are based on standardized statistical analyses conducted by NASS nationwide.
 - MASS/NASS publishes annual chemical usage reports, including pesticide use and use rate information for Minnesota.
 - The MASS/NASS database can be searched on-line for specific crop/pesticide information.
3. The MDA conducts surveys with MASS/NASS to evaluate pesticide use and related pesticide management practices. Project results are published by the MDA separately from MASS/NASS, and are posted on the MDA's website. These surveys are designed to capture information from a relatively large sample population on pesticide use or use practices (including BMP adoption) in specific crops and regions of the state.
4. The MDA occasionally conducts surveys of farms in localized areas (several hundred acres) where community water supplies exhibit vulnerability to land use impacts or where other water quality concerns exist. Survey results are published by the MDA or other cooperators.
5. Additional studies are occasionally or periodically conducted by the MDA to assess pesticide use and use practices in both urban and rural settings.
6. The DNR publishes an annual report on many of the use of aquatic pesticides permitted under its authority.

Physical and Chemical Properties of Pesticides

The potential impact of a pesticide on water quality is partly determined by its physical and chemical characteristics, the properties of the soil or water body to which it is applied, rates and methods of application, and weather patterns. A pesticide may move from its application site by leaching below the soil surface or by movement with sediment or water in surface runoff. Both routes of movement have the potential to adversely affect water quality.

Pesticides may directly access groundwater when spilled or used near naturally-occurring sink holes, and poorly sealed or abandoned wells. These sites provide direct conduits for the transport of water and pesticides to groundwater. Contamination by the less direct route of leaching through the soil profile may occur in areas of concentrated pesticide handling, such as mixing and loading facilities and disposal sites. Certain pesticides may leach to groundwater or runoff to surface water in Minnesota under conditions of normal use.

□ **Leaching and Surface Runoff**

A variety of mechanisms *transport* pesticides from land to groundwaters and surface waters (Becker, et. al., 1989)¹. These pathways include:

1. In solution in the water phase of surface runoff.
2. Adsorbed to sediment particles carried by surface runoff.
3. In solution with subsurface drainage.
4. As vapors that leave the soil and are re-deposited into surface water.

An additional transport mechanism potentially important in portions of Minnesota is wind-born soil. The soil and pesticides attached to it are deposited in drainage ditches, waterways and surface waters.

The persistence of a pesticide affects its concentration in soil and the length of time it is available for movement. Chemical and microbial transformations, physical losses, and plant uptake reduce the concentration and the amount available for loss in water and sediment. Therefore, all other factors being equal, the shorter the time a pesticide persists in the soil, the less chance for movement with water or sediment.

■ **Solubility.** *Solubility* is the ability of a pesticide to dissolve in water. As the solubility of a pesticide increases, there is a greater potential for transport to groundwater (leachate) or surface water (runoff). Pesticides with solubilities below 30 parts per million (ppm) are considered to have relatively low potentials for leaching. If the solubility is 1 ppm or less and adsorption occurs, the product will tend to remain at the soil surface, but may move off-site with soil sediment. The amount of pesticide that will solubilize tends to decrease with an increase in dissolved salts and increase in the presence of dissolved organic matter.

¹ Becker, R.L., D. Herzfeld, K.R. Ostlie, E.J. and Stamm-Katovich, *Pesticides: Surface Runoff, Leaching, and Exposure Concerns*, Minnesota Extension Service AG-BU-3911, 1989

■ **Persistence.** The *persistence* of a pesticide is the length of time required for 50 percent of the pesticide to decompose to products other than the original pesticide. This is referred to as the half-life of the pesticide. The persistence of a pesticide is one of the most important factors in determining its leaching or surface runoff potential. Pesticide persistence is categorized as non-persistent (half-life of 30 days or less), moderately persistent (half-life of 30 to 99 days), or persistent (half-life greater than 100 days).

■ **Adsorption.** Retention of pesticides by soil particles is referred to as *adsorption*. Adsorption can decrease the concentration of pesticides in solution and thus decrease the availability of the pesticide to move off site with water. Also, adsorption increases the length of time pesticides are available for decomposition by microorganisms in the biologically active surface soil. Pesticides are retained by soils to different degrees depending on the properties of the pesticide, the soil, and their interaction.

The NRCS has developed a screening tool to evaluate relative loss potential of pesticides from agricultural soils (described earlier in this chapter under *Minnesota's Soil Resources*). Pesticide loss from leaching and runoff are both considered in conjunction with soil type and slope. This potential risk modeling system combines a pesticide database and a soils database. Modeling results are a useful tool to express overall potential for loss of a specific agricultural pesticide when used on a specific soil map unit. The procedure provides a relative estimate of pesticide loss risk. The generalized information resulting from such estimates can be used as a component of pesticide management plans for agricultural fields and to minimize pesticide loss in high risk areas of Minnesota.

Methods for screening and evaluating pesticide leaching to groundwater and runoff to surface waters in non-agricultural and urban settings are less well-developed than those available for agricultural settings. Education and promotion of BMPs specific for these settings, including Integrated Pest and Weed Management, are very useful tools in preventing and mitigating pesticide losses from leaching or runoff.

□ Aquatic Pesticide Behavior and Dispersion

Use of aquatic pesticides according to label to control aquatic plants, weeds or pests typically results in localized pesticide concentrations sufficient to effectively control the target pest, followed by pesticide dispersion, degradation and adsorption by sediments. Potential impacts to non-target organisms, when a pesticide product is used in compliance with the label or application permit, are addressed or considered as part of EPA product registration. If the DNR has specific concerns about impacts to non-target organisms associated with a pesticide application authorized by one of its permits, requirements to minimize those impacts are included as permit conditions.

Modeling of aquatic pesticide behavior in such settings is extremely complex, and must account for many non-static variables, such as temperature changes in the water column, water movement, depth of ultraviolet radiation, etc. Nevertheless, the basic characteristics of pesticides that guide their behavior in soil – solubility, persistence and adsorption – may provide insight into their behavior in aquatic environments. In addition to efficacy and dissipation studies required of the registrant, EPA's pesticide registration process examines the environmental fate and effects of pesticide products, which for aquatic use pesticides incorporates aqueous concentration/exposure time relationships, use of models in the development and field evaluation of aquatic herbicides, and modeling of the dispersion of aquatic herbicides.

Nevertheless, the basic understanding of the behavior of pesticides in water, including their dispersion, breakdown, and uptake by non-target organisms, is sufficient to apply water-use restrictions to many pesticide labeled for aquatic use. Those use restrictions limit how water in the treatment areas can be used (e.g., fishing, lawn watering, swimming, or consumption by livestock). The DNR does not allow pesticides labeled for aquatic use to be applied to public waters in Minnesota if their associated water-use restrictions would unreasonable limit the multiple use of those public resources.

CHAPTER 4

Coordination and Public Involvement; Roles and Responsibilities

State Agency Coordination and Public Involvement; Roles and Responsibilities

Minnesota statutes and rules related to water resource protection provide for various types of state agency coordination and public involvement. In some cases, specific roles and responsibilities are prescribed.

□ Coordination of Pesticide Management Plan Development, Implementation and Related Reporting

As directed in Minn. Stat. § 18B.045, the Pesticide Management Plan (PMP) was coordinated and developed with other state agency plans and with other state agencies through the Environmental Quality Board (EQB). In addition, the University of Minnesota Extension (UME), farm organizations, farmers, environmental organizations, and industry were involved in plan development. The Pesticide Control Law requires the commissioner of agriculture to submit a biennial status report on the plan to the EQB for review and then to the house of representatives and senate committees with jurisdiction over the environment, natural resources, and agriculture.

Separately, the EQB is charged with coordinating a biennial assessment and analysis of water quality, groundwater degradation trends, and efforts to reduce, prevent, minimize, and eliminate degradation of groundwater. The assessment and analysis must include an analysis of relevant monitoring data. This assessment, along with water planning activities, is to be conducted at prescribed intervals, as part of EQB's duties described in Minn. Stat. § 103A.43 and Minn. Stat. § 103B.151.

EQB duties in Minn. Stat. § 103A.43 relate to reporting biennially on water research needs and recommended priorities for addressing these needs. Minn. Stat. § 103B.151 defines a broad coordinating role for EQB in development and implementation of state water planning, and directs EQB to coordinate development of state water policy recommendations and priorities.

PMP implementation is also coordinated with the Minnesota Nonpoint Source (NPS) management plan, developed approximately every five years by the MPCA and its cooperators under section 319 of the Clean Water Act. The NPS management plan is a comprehensive plan for controlling NPS

pollution and includes pesticide management. Actions recommended in the plan are intended to be carried out through extensive coordination of a number of state and local resource agencies.

□ Roles and Responsibilities Associated with Groundwater Protection

Minnesota Statutes § 103A.204 clarifies state agency roles to address groundwater pollution from non-point sources. The roles laid out are supplemental to other authorities to control point sources of pollution, and to regulate pesticide registration and sales. For the MDA, Minn. Stat. § 103A.204 defines responsibilities for a variety of voluntary and regulatory mechanisms for protection of groundwater from agricultural chemical contaminants.

Several state agencies have defined roles in the management of groundwater resources. As defined in Minn. Stat. § 103A.204, these are as follows:

(a) The responsibility for the protection of groundwater in Minnesota is vested in a multiagency approach to management. The following is a list of agencies and the groundwater protection areas for which the agencies are primarily responsible; the list is not intended to restrict the areas of responsibility to only those specified:

(1) Environmental Quality Board: creation of a water resources committee to coordinate state groundwater protection programs and a biennial groundwater policy report beginning in 1994 that includes, for the 1994 report, the findings in the groundwater protection report coordinated by the Minnesota Pollution Control Agency for the Environmental Protection Agency;

(2) Pollution Control Agency: water quality monitoring and reporting and the development of best management practices and regulatory mechanisms for protection of groundwater from nonagricultural chemical contaminants;

(3) Department of Agriculture: sustainable agriculture, integrated pest management, water quality monitoring, and the development of best management practices and regulatory mechanisms for protection of groundwater from agricultural chemical contaminants;

(4) Board of Water and Soil Resources: reporting on groundwater education and outreach with local government officials, local water planning and management, and local cost share programs;

(5) Department of Natural Resources: water quantity monitoring and regulation, sensitivity mapping, and development of a plan for the use of integrated pest management and sustainable agriculture on state-owned lands; and

(6) Department of Health: regulation of wells and borings, and the development of health risk limits under Minnesota Statutes § 103H.201.

(b) The Environmental Quality Board shall through its Water Resources Committee coordinate with representatives of all agencies listed in paragraph (a), citizens, and other interested groups to prepare a biennial report every even-numbered year as part of its duties described in sections 103A.43 and 103B.151.

In addition to broad, statutorily defined roles and responsibilities outlined above, the Groundwater Protection Act (Minn. Stat. Chapter 103H) outlines specific roles and responsibilities for participation of state and local governments and the public in Best Management Practice development, education and promotion. These roles and responsibilities are further described in Chapters 8, 9 & 10 of this plan.

□ Roles and Responsibilities Associated with Surface Water Protection

Chapter 2 of the PMP outlines the philosophy, goals and approaches for preventing surface water degradation, including references to Minn. Rules Chapter 7050 governing Minnesota's surface water quality standards and resource management. In addition, for pollutants that cause a water body to fail to meet state water quality standards, section 303(d) of the federal Clean Water Act requires the MPCA to conduct a Total Maximum Daily Load (TMDL) study. The regulations that govern the TMDL program (40 CFR 130A) require the study to identify both point and non-point sources of each pollutant that fail to meet water quality standards. Water quality sampling and computer modeling, for example, can be used to help determine how much each pollutant source must reduce its contribution to assure the water quality standard is met. Rivers and streams may have several TMDLs, each one determining the limit for a different pollutant. The MDA's specific statutory roles and responsibilities for surface water protection are generally limited to those outlined in the Pesticide Control Law (Minn. Stat. Chapter 18B). Coordination of surface water contamination prevention, evaluation and mitigation is outlined in Chapters 8, 9 & 10, respectively.

Additional MDA Groundwater and Surface Water Protection Activities

In addition to PMP activities directed at prevention of non-point source contamination of water resources by pesticides, the MDA conducts many activities that ultimately protect groundwater and surface water by reducing the amounts of pesticides entering water resources. Pesticide pollution prevention activities are not limited to the MDA. The University of Minnesota, other state agencies, local agencies, federal agencies, pesticide manufacturers and dealers, and other organizations may also conduct pesticide pollution prevention activities

A number of programs and responsibilities of the MDA relate directly and indirectly to ground and surface water protection. In addition, many activities are integral components of a functioning PMP.

□ Pesticide Registration

Before a pesticide product can be offered for sale in Minnesota, the manufacturer must apply for and receive registration from the EPA, and then from the MDA. Federal registration requires that registrants complete a variety of studies to evaluate potential impacts on human health and the environment. The federal label includes legal rates of application, various environmental hazards and compliance requirements, and enforceable standards for worker protection. Each pesticide must be annually registered in Minnesota, accompanied by the payment of fees based on annual gross sales and submission of labels of current pesticide products. The MDA can prohibit the sale of products by refusing to register the pesticide or may restrict use to certain crops or geographic areas by imposing use restrictions when the product is registered. In addition, the commissioner of agriculture has broad

authority to take action, both within and separate from the PMP, to take any actions necessary to protect public health and the environment from harmful exposure to pesticides, and to prevent unreasonable risk to humans or the environment. The MDA may conduct a more detailed review of pesticides that have the potential to contaminate groundwater or surface water resources at levels that might exceed relevant standards or guidelines, or at levels that might present unreasonable adverse effects on the environment. The criteria for which federal pesticide registrations will receive further state review for water quality concerns will focus on new pesticide active ingredients, new uses of previously registered products, active ingredients included in EPA's annual registration workplan, and on active ingredients that have been identified as common detection in groundwater or as surface water pesticides of concern. Because federal registration data contains information about anticipated water resource impacts, such data will be reviewed for accuracy with respect to Minnesota conditions that may differ from conditions evaluated in the federal registration package. Registration reviews will be prioritized based on the degree of an active ingredient's environmental or human health risk concern, and will include consultation with the Minnesota Pollution Control Agency, Minnesota Department of Health or other state agencies as appropriate. Factors considered in prioritization will include related ongoing research on toxicology, environmental fate and weed science, as well as the anticipated or known level of use in a given pest-control setting. Summaries of registration reviews will be publicly available.

□ Pesticide Applicator Training

The MDA has an ongoing licensing/certification program for applicators who commercially apply pesticides in Minnesota, or for applicators of certain classes of pesticides. State mechanisms for certification include examinations, training sessions, and self study packets as part of the ongoing process to maintain accurate, up-to-date training for pesticide applicators. The licensing and certification program represents the cooperative efforts of the MDA, UME, and various industry associations and groups.

□ Licensing and Permitting of Facilities

The potential for contamination from agricultural chemical storage and distribution sites has been considerably diminished through inspection and permitting programs. The MDA expends considerable time and effort in inspecting bulk pesticide storage sites that it has permitted. The Department has also assisted the agricultural chemical storage industry in the permitting and subsequent safeguarding of large bulk fertilizer storage sites. Storage and distribution of non-agricultural and urban pesticides are monitored under a separate program that conducts marketplace inspections to ensure prevention of water resource contamination through proper storage and handling.

□ Incident Response

The Groundwater Protection Act extended existing MDA statutory authority to require and oversee investigation and clean-up of agricultural chemical incidents. Authorization to develop an Incident Response Program for point source contamination was also part of that legislation. In the Incident Response Program, MDA staff receives reports of incidents from MDA inspections, property transfer investigations, MDH public water supply well sampling and other sources. All new incident reports go to the MDA spills team who determine if the incident is an immediate threat to human health or the environment. If the incident is a high priority, MDA personnel first request responsible parties to

voluntarily perform necessary incident or site investigations and clean-ups. The spills team directs the cleanup at those sites. All other incidents are then prioritized.

□ Agricultural Chemical Response and Reimbursement Account (ACRRA)

The Minnesota Groundwater Protection Act of 1989 established the Agricultural Chemical Response and Reimbursement Account (ACRRA). ACRRA is an account created to reimburse persons for costs incurred in cleaning up agricultural chemical incidents resulting from the use, handling, storage, transportation, and distribution of agricultural chemicals. Moneys from the ACRRA can be used to reimburse for costs of cleaning up both emergency and long term spills involving agricultural chemicals. The ACRRA is funded by a surcharge on pesticide and fertilizer sales.

□ Compliance Inspection

Pesticide misuse complaints are handled by the field surveillance and investigations section. Inspection reports are initially reviewed by the field surveillance and investigations section. Inspection reports are then channeled to the appropriate unit for detailed review, tallying and determination of violations. Misuse investigations are reviewed by the field surveillance and investigations staff. When violations are noted, the investigative file is transferred to the enforcement unit for action.

□ Enforcement

The MDA continues to enforce its regulations through an administrative process where civil prosecution can be pursued if proposed administrative remedies are not settled. Violations are addressed through the use of several enforcement documents including: advisory notice, notice of violation, remedial action order, and notice of intent-enforcement action (NOI), and warning letters/notices. In addition to a proposed financial penalty, the NOI has been modified to include remedies such as applicable community service activities and participation at pesticide applicator workshops. Such activities are included in an NOI when case circumstances warrant an individualized remedy. This approach has been very effective and will be utilized, when appropriate, in future actions. The current review process of completed enforcement actions is extensive and includes review by senior division management staff, department legal counsel and staff from the commissioner's office.

□ Environmental Analysis

Environmental analysis is performed by the laboratory services division. The water unit analyzes ground and surface water samples for pesticides and other contaminants. The soil/formulation unit tests for high level contamination in soils as a result of spills and poor pesticide management. The laboratory is capable of pesticide analysis in ground and surface water at trace levels. The MDA laboratory completes all sample extraction, gas chromatography, and chromatogram review and interpretation when analyzing for pesticides. The laboratory services available include a mix of services and analytical methodology. Services include water residue analysis, methods development, soils analysis, formulation analysis, and a food section. Methodology includes liquid and gas chromatography, and mass spectrophotometry.

CHAPTER 5

Introduction to the Pesticide Management Process

Because of the direction provided in Minn. Stat. § 18B.045, the process of responding to occurrences of pesticides and pesticide breakdown products in groundwaters and surface waters of the state starts with prevention efforts. The process continues with evaluation and monitoring of prevention efforts. Then, if necessary, voluntary measures for potential problem pesticides are developed and promoted, and further monitoring occurs prior to consideration of Minnesota Department of Agriculture (MDA) regulatory restrictions. This process is described in detail in this document. Figures 4 and 5 outline the process for groundwater and surface water, respectively. The commissioner of the MDA also has authority to deviate from this process and impose use and distribution restrictions on a pesticide if necessary to prevent unreasonable risk to humans and the environment.

□ Prevention – Chapter 8

The foundation of the Pesticide Management Plan (PMP) is promotion of pesticide use, handling and management practices which are protective of water resources. Prevention of contamination is an underlying theme behind the MDA's pesticide registration and certified applicator programs, and is also a key factor in the development of generic or pesticide-specific Best Management Practices (BMPs). These and other prevention activities are ongoing, and may occur even if contamination is not detected in groundwater or surface water.

Within the prevention component, many activities take place including the establishment of an Education and Promotion Team to assist the MDA with development and implementation of its prevention education and promotion activities. BMPs may be promoted both before pesticides are detected in water resources and in response to common detection determinations in groundwater, or surface water pesticide of concern determinations.

□ Monitoring and Evaluation – Chapter 9

Evaluation of prevention efforts is coupled with statewide water quality monitoring, including monitoring of groundwater, drinking water supplies, and surface water. The diversity of the water quality monitoring effort leads to a variety of water quality standards which are considered. These include the application of Minnesota Department of Health's Health Risk Limits, and surface water standards, criterion or advisory values established by the Minnesota Pollution Control Agency (MPCA). Monitoring of pesticide use practices is also conducted. The data gathered is analyzed and summarized into a format to support MDA prevention, evaluation and mitigation decisions. A Pesticide Management Plan Committee (PMPC) is convened to review water monitoring data and to

support MDA's evaluation activities. The PMPC meets to provide informed and diverse comment to the commissioner for major evaluation activities and decisions. In addition to MDA lead activities, MDA provides technical support to the MPCA and its process for determination of impaired surface waters.

□ Mitigation – Chapter 10

Voluntary pesticide-specific BMPs are developed and promoted as part of actions to mitigate the deleterious effects of specific pesticides in common detection for groundwater or that are surface water pesticides of concern. The commissioner, based on this analysis and other information, may also determine whether it is in the best interest of the state of Minnesota to take other actions in response to water resource contamination by pesticides. Various regulatory and non-regulatory options are available to the commissioner ranging from statewide prohibition of use to specific pesticide or crop management strategies.

Once initial mitigation steps are taken, continued evaluation and monitoring of water resources occurs, as does evaluation of BMP use and effectiveness. If BMPs are proven to be ineffective, Water Resource Protection Requirements (WRPRs) or other enforceable actions are considered for groundwater. Evaluation of the need for groundwater WRPRs follows guidance based on statutory requirements. To mitigate or regulate pesticides in surface water, the MDA cooperates with the MPCA in its implementation of the federal Clean Water Act; however, the MDA also has authority under the state Pesticide Control Law to take independent action to prevent unreasonable adverse effects on the environment. An analysis of the benefit of the continued registration of a pesticide may also be conducted as part of mitigation actions.

Figure 4: Minnesota Pesticide Management Plan – General Process Schematic for Groundwater Decisions

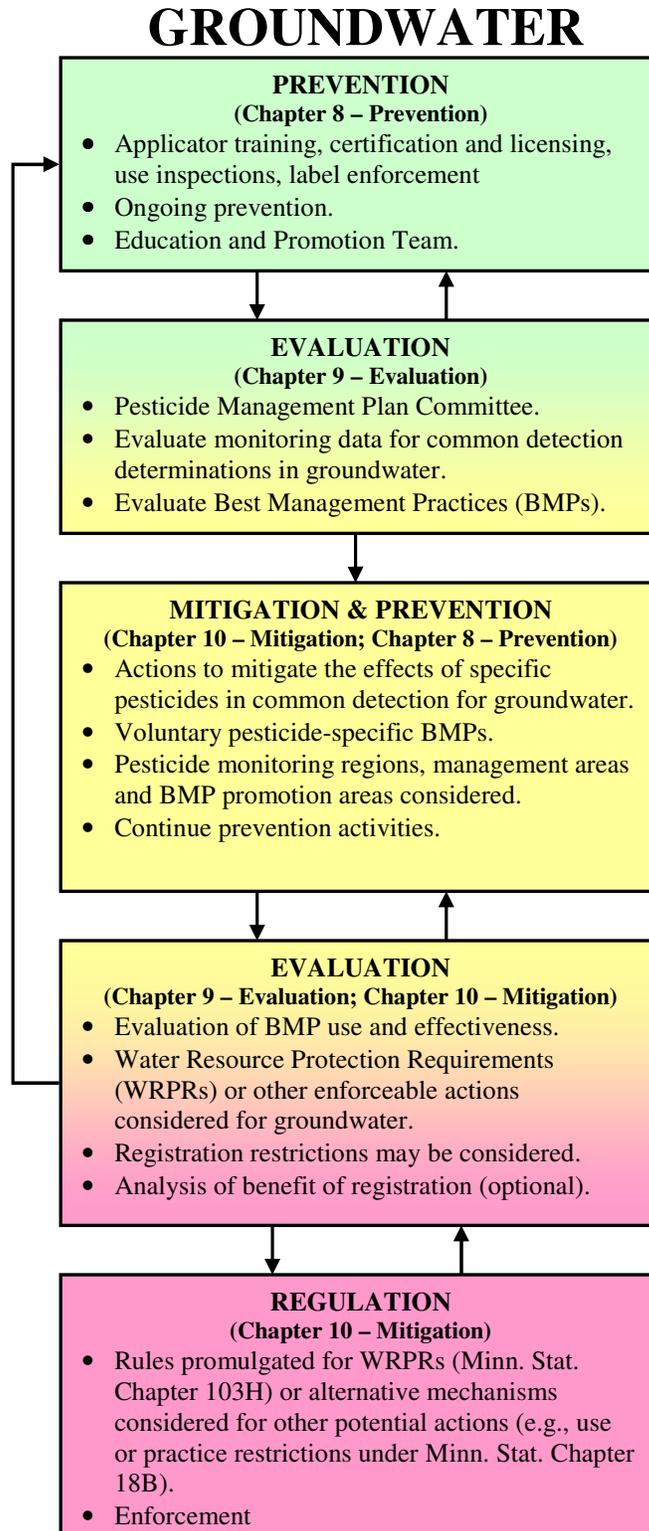
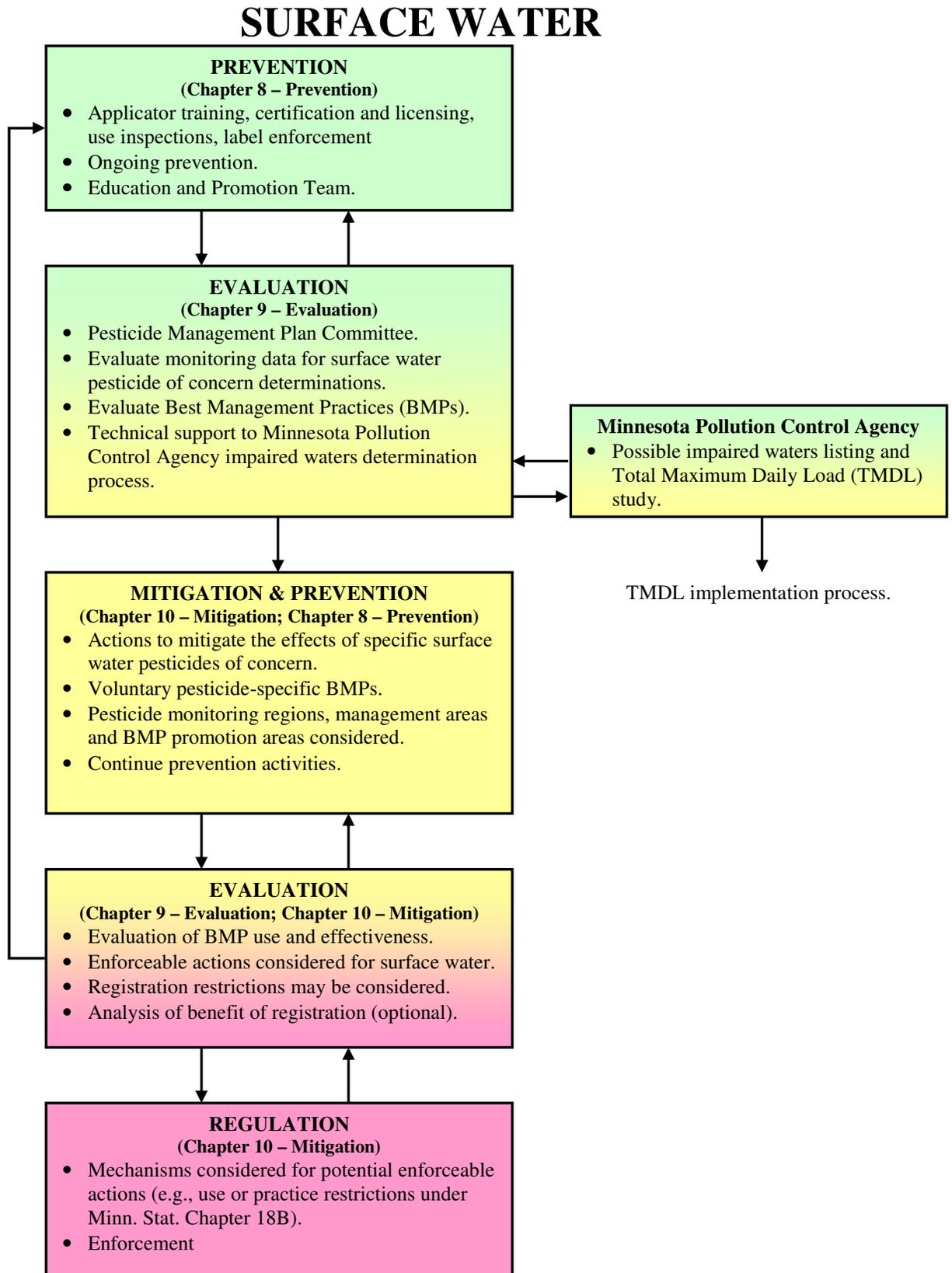


Figure 5: Minnesota Pesticide Management Plan – General Process Schematic for Surface Water Decisions



CHAPTER 6

Statewide Water Quality Monitoring

MDA Water Quality Monitoring

Water quality monitoring is considered a key component of the Minnesota Pesticide Management Plan (PMP). For the PMP, water quality monitoring consists of the collection and analysis of water samples in order to determine the identity, concentration and frequency of pesticide compounds in the state's water resources. However, the most important component of water quality monitoring is the information generated from the sample data. It is this information that the Minnesota Department of Agriculture (MDA) utilizes in making decisions on the need for Best Management Practices (BMPs) and on the effectiveness of those BMPs once implemented.

In the mid 1980s, prior to and separate from the PMP, the MDA developed a statewide water quality monitoring program. This initial program was operated for ten years at which time the data was reviewed and changes to the program considered. In response to data and information developed from the initial network, the monitoring program underwent a substantial re-design in the late 1990s.

MDA's water quality monitoring program will be coordinated with the implementation of the PMP and may be adjusted to meet additional needs of the PMP. It is likely that any expansion or alteration of the monitoring program will need to be accomplished using existing resources available to the MDA.

This chapter describes the overall goals and objectives of MDA's water quality monitoring program. Descriptions of contamination levels and pesticide use are outside the scope of this document. Reports on results and raw data from the monitoring program may be obtained on the MDA web site at <http://www.mda.state.mn.us/chemicals/pesticides/maace.htm>.

□ Statutory Authority

The MDA's water quality monitoring program for pesticides was originally mandated in 1987 through the Minnesota Pesticide Control Law. Minn. Stat. § 18B.04 states:

The commissioner [of agriculture] shall: (1) determine the impact of pesticides on the environment, including the impacts on surface water and groundwater in this state;...

The scope of the MDA water quality monitoring program for pesticides was further expanded in 1989 through the Groundwater Protection Act (Minn. Stat. Chapter 103H), which called for increased monitoring of the state's groundwaters.

□ Purpose

The primary purpose of the MDA water quality monitoring program is to provide information on which pesticides are occurring in Minnesota's water resources. The core of the information collection effort is defining the long term impacts of normal pesticide use on water quality. The program is divided into ground and surface water monitoring portions. The MDA recognizes that groundwater and surface water are not separable and should be considered together in making decisions on pesticide management. However, for the purpose of prevention, evaluation and mitigation, and given existing legal authority, references and resources, they may, in some circumstances, need to be considered separately.

Within the two major water divisions, separate monitoring networks exist, and have been designed to determine specific aspects of the impacts of pesticides on water quality.

□ Monitoring Goal

It is the goal of MDA water resource monitoring to provide information on the impacts of the routine use of pesticides on the state's groundwater and surface water so pesticide use may be managed to prevent or minimize degradation of the state's water resources.

□ Groundwater Monitoring Objectives

The objectives of groundwater monitoring for pesticides at the MDA are to:

1. determine statewide and regional differences in pesticide concentrations and occurrence;
2. determine long-term trends in pesticide concentrations over time;
3. monitor for significant changes in pesticide concentrations and occurrence over time;
4. provide analysis of land use, pesticide management, and hydrologic and geologic attributes that may result in water resource degradation;
5. provide the basic information from which the overall efficacy of pesticide management strategies may be determined; and
6. provide the information extracted from the monitoring data to information users, policy makers, scientists, and interested citizens.

□ Groundwater Monitoring Network Design

Three groundwater monitoring projects have been designed to meet the various objectives of the monitoring program. The three projects are a groundwater monitoring well network, a regional groundwater sampling program, and a drinking water well survey. Networks are designed based on specific information needs of each program coupled with the physical characteristics of specific land forms of interest including soils, geology and topography.

To fulfill program objectives the state has been divided into ten pesticide monitoring regions based on soils, hydrology, cropping patterns and the associated agro-ecoregions (Figure 5). No quantitative measures were attempted in drawing the regional boundaries.

Landscape units with a large percentage of acreage in row crops, sandy soils, surficial sand and gravel aquifers, and relatively large amounts of irrigation are given the highest priority for monitoring groundwater. The highest priority has been given to the sand plain regions because of the value of these aquifers for shallow rural wells, the limited adsorption capacity of the soils, the high water transmission rates of the soil and vadose zone material, and the results of previous monitoring that showed relatively high frequency of pesticide detections in groundwater of the area. These sand plain areas primarily consist of large outwash plains in the central part of the state, although smaller sand plains and coarse grained alluvial river valley aquifers are included as well. Karst bedrock areas have the next highest priority due to the rapid recharge of water to the aquifers through sinkholes and solution channels, shallow soil with little adsorptive capacity, and the widespread use of the aquifers as domestic drinking water supplies. Alluvial river valley aquifers with finer textured geologic materials, fractured crystalline bedrock aquifers, and buried sand aquifers are also of interest to the program, and will be monitored as time and resources permit.

□ General Network Design Concepts

The current MDA groundwater monitoring well network is located in the central sands region of Minnesota and utilizes small diameter observation wells. The primary objective of the groundwater monitoring well network is to describe the temporal trends and peaks in contamination levels of the network as a whole, and at individual wells. New monitoring wells were installed by the MDA or cooperators in areas where no well existed at the time of network development. The network is sampled quarterly although an individual well may not be sampled more than once in a given year. Monitoring well locations are selected systematically so the network as a whole will appropriately represent the average condition of the entire network area. Well sites are selected by overlying an appropriate sized, randomly initiated grid across the area of interest. The central sand plain portion of the monitoring well program has been developed, wells have been installed and sampling began in January of 2000.

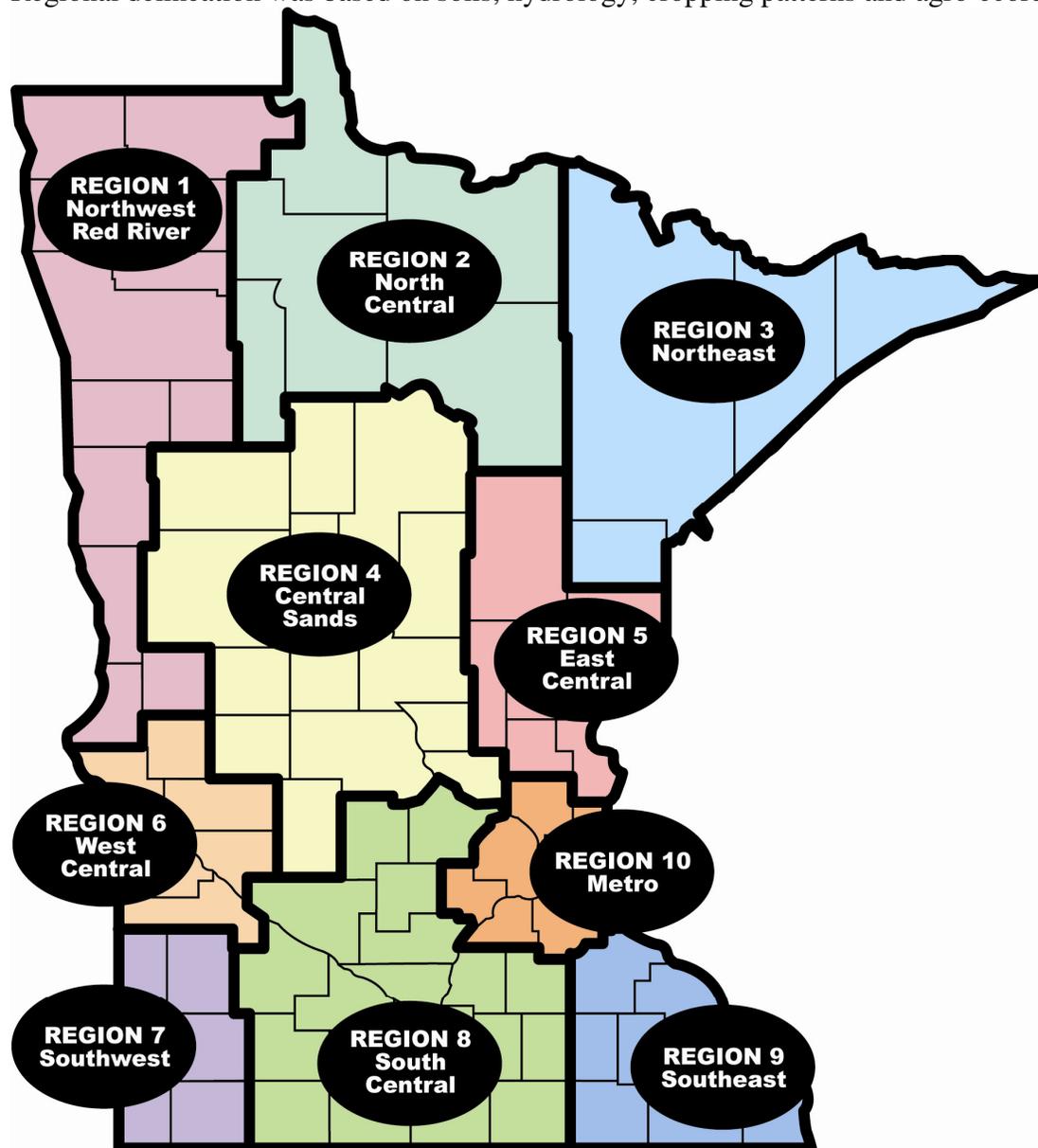
Drinking water well surveys are short term in nature and are used to determine and confirm areas in the state where pesticides are impacting drinking water supplies, and which pesticides may be of concern. Data from drinking water well surveys is utilized for evaluating the general quality of groundwater used as drinking water, and to focus expansion of the more scientifically rigorous groundwater monitoring well network. The MDA recognizes the need for careful screening of drinking water wells to ensure they represent actual groundwater conditions. Wells for the drinking water survey were selected from those previously sampled by the Groundwater Monitoring and Assessment Program of the Minnesota Pollution Control Agency (MPCA), the non-community transient drinking water well list of the Minnesota Department of Health (MDH), or the state's county well index, in that order of priority. The first samples from drinking water wells were collected in January and February of 2004.

The objectives of the regional groundwater sampling program are to track changes within and between the various MDA monitoring regions (Figure 6), and to provide information useful for implementing and assessing BMPs. The regional monitoring program will be long term in nature with sampling

conducted twice each year; once in winter and six months later during summer. The best available, relatively vulnerable source of groundwater in the regions will be utilized as sample points. In some cases this will be existing monitoring wells although drinking water wells of various types may also be utilized. In the southeastern region of the state (characterized by karst limestone geology), naturally occurring springs are being used as groundwater sample points. These springs emerge from bedrock formations and are generally considered to accurately represent regional groundwater conditions. The regional groundwater sampling program began in 2004.

Figure 6: Pesticide Monitoring Regions Map

Regional delineation was based on soils, hydrology, cropping patterns and agro-ecoregion boundaries



□ Surface Water Monitoring Objectives

The objectives of surface water monitoring for pesticides at the MDA are to:

1. determine statewide spatial differences in pesticide concentrations and occurrence;
2. determine pesticide concentration and loading in selected streams, rivers and lakes;
3. monitor for changes in pesticide concentration and loading over time;
4. determine the characteristics of pesticide water quality monitoring data;
5. provide analysis of land use, pesticide management, and hydrologic attributes that may result in water resource degradation;
6. provide the basic information from which the efficacy of pesticide management plans may be determined; and
7. disseminate the information extracted from the monitoring data to the appropriate information users, policy makers, scientists, and interested citizens and associations.

□ Surface Water Monitoring Network Design

The surface water monitoring program is divided between two distinctly different components. The primary component of MDA's surface water monitoring program provides detailed monitoring of pesticide loading within select watersheds in the state. The selected watersheds are continuously monitored during the months when the streams are unfrozen. These watersheds are instrumented with automatic sampling stations that collect water samples in response to increases in river levels during and following a rainfall event. The event is continuously monitored and estimates of loading from the storm are determined. These watershed monitoring stations have been established to assist in determining measures by which to evaluate the effectiveness of BMPs and other efforts as part of the pesticide management plan.

MDA's water quality monitoring program intentionally samples during spring runoff in order to determine which pesticides leave the point of application and enter the surface water system. Not all pesticides leave the point of application. MDA's water quality monitoring program collects samples at times and locations where pesticides that leave the point of application will be detected and also collects samples at times when pesticides would not be expected to run off from the ground surface.

The determination of which pesticides to monitor for is based on several factors including: the extent of use in an area; the chemistry of the compound; environmental fate data; and the laboratory's ability to analyze for the compound. The water quality monitoring program targets pesticides largely based on the resources available, practicality, and the appropriateness of analysis.

The second major component of MDA's surface water monitoring program consists of a grab sampling at stream, river or lake locations in the state. These samples are analyzed for a specific suite of pesticide parent materials and breakdown products, depending on the surrounding land use, aquatic pest management practices, or other factors. This sampling program is designed to determine which

pesticides occur in Minnesota surface waters and where they occur. The data is analyzed to determine whether there has been a change in the pesticides that are being detected, and whether there is a difference in where the detected pesticides are occurring. The data is also used in determining the need for BMPs.

Non-MDA Water Quality Data Collection Activities

It is the responsibility of the commissioner of agriculture to collect information on the occurrences, concentration, and use of pesticides in Minnesota. Several other organizations also monitor for pesticides in water. Each organization has different program goals and procedures. These organizations include but are not limited to:

- Minnesota Department of Health (public water supplies)
- Minnesota Pollution Control Agency (surface water, groundwater)
- Minnesota Department of Natural Resources (surface water)
- United States Geological Survey (surface water, groundwater, precipitation)
- United States Fish and Wildlife Service
- Other States
- Local Units of Government
- Pesticide Registrants

The information provided may or may not be useful to the MDA. The MDA evaluates water quality data collected from other organizations, public or private, and determines if it is applicable and meets MDA quality control standards. The MDA will consider data from other states but will not use that data as the primary criteria for making a determination that a pesticide is commonly detected in groundwater or a surface water pesticide of concern.

The commissioners of the MDA, MPCA and MDH have signed an interagency cooperative groundwater monitoring agreement. This agreement will help coordinate monitoring and data management activities among the three agencies.

Water Quality Data Collection as a Decision-making Tool

The MDA's philosophy is that water quality data and information is a tool to aid in wise decision-making, and that data itself cannot make a decision. MDA's pesticide management programs are established accordingly. In this context water quality data will be reviewed on an annual basis by the MDA. A report will be prepared that covers data from the previous year's monitoring efforts. The report will discuss the compounds detected in Minnesota, typical concentrations, geographic locations, criteria and benchmarks for evaluation, and the likelihood of further detections in Minnesota. The MDA will continually modify and evaluate the monitoring program so that it provides the flexibility needed to implement and assess the PMP.

For the purposes of the PMP, monitoring information from all readily available sources will be analyzed to determine if pesticide detections (including parent compounds and/or breakdown products) are a result of normal applications or a unique or unusual circumstance. Detections and

respective concentrations of a pesticide which are determined after investigation and analysis to be the result of routine use will be evaluated for common detection in groundwater or for designation as a surface water pesticide of concern. Detections determined to be the result of an unusual or unique situation will be further evaluated to develop an appropriate response.

Focused management activities may be appropriate in regions where use of the compound is more frequent. Additional resources may be necessary to expand the water quality monitoring program to include monitoring networks for specific pesticides placed in common detection status or determined to be a surface water pesticide of concern. Chemical-specific monitoring may be focused in special BMP promotion areas to help determine the effectiveness of specific BMPs.

CHAPTER 7

Water Quality Standards & Rules

Health Risk Limits for Groundwater

The 1989 Minnesota Groundwater Protection Act directs the Minnesota Department of Health (MDH) to develop human health-based groundwater standards. These standards, known as Health Risk Limits (HRLs) are defined in Minn. Stat. § 103H.005, subd. 3.:

A concentration of a substance or chemical adopted by rule of the commissioner of health that is a potential drinking water contaminant because of a systemic or carcinogenic toxicological result from consumption.

A HRL is the concentration of a groundwater contaminant, or a mixture of contaminants, that can be safely consumed daily for a lifetime. The rules under which HRLs are developed and adopted can be found in Minn. Rules parts 4717.7100 – 4717.7800.

The MDH calculates HRLs using methods based on U.S. Environmental Protection Agency risk assessment guidelines. HRLs are based on health effects data alone. They do not incorporate economic or technological factors, as do federal drinking water standards called Maximum Contaminant Levels.

Mandatory Uses of HRLs for Implementation of the PMP

There are specific situations, mandated by statute, where the Minnesota Department of Agriculture (MDA) considers HRLs when making Pesticide Management Plan (PMP) decisions.

□ Determination of Common Detection

Common Detection is defined in Minn. Stat. § 103H.005, subd. 5. as:

The detection of a pollutant that is not due to misuse or unusual circumstances, but is likely to be the result of normal use of a product or practice.

A “pollutant” is defined in Minn. Stat. § 103H.005, subd. 11. as:

A chemical or substance for which a health risk limit has been adopted.

Therefore, current law requires that a HRL must be established for a pesticide (pollutant) prior to a determination of common detection by MDA. This requirement, however, does not preclude MDA from taking necessary action to prevent contamination under other statutory authorities.

□ Water Resource Protection Requirements

Minn. Stat. § 103H.275, subd. 1. states that in areas where groundwater pollution is detected:

(a) If groundwater pollution is detected, a state agency or political subdivision that regulates an activity causing or potentially causing a contribution to the pollution identified shall promote implementation of best management practices to prevent or minimize the source of pollution to the extent practicable.

(b) The Pollution Control Agency, or for agricultural chemicals and practices, the commissioner of agriculture may adopt water resource protection requirements under subdivision 2 that are consistent with the goal of section 103H.001 and are commensurate with the groundwater pollution if the implementation of best management practices has proven to be ineffective.

(c) The water resource protection requirements must be: (1) designed to prevent and minimize the pollution to the extent practicable; (2) designed to prevent the pollution from exceeding the health risk limits; and (3) submitted to the house of representatives and senate committees with jurisdiction over the environment, natural resources and agriculture.

The MDA will request that the Pesticide Management Plan Committee (see Chapter 9 – Evaluation), after reviewing available data, provide comment to the MDA on the implementation of BMPs, development of Water Resource Protection Requirements (WRPRs), or other appropriate actions. In the event that implementation of BMPs has proven to be ineffective, the MDA will consider mandatory requirements as outlined in Minn. Stat. § 103H.275.

Emergency HRLs and Health Based Values

In emergency situations, where an established HRL does not exist for a specific pesticide or breakdown product that is being found in groundwater, the MDH commissioner may adopt an emergency HRL for that compound, effective for one year, under authorities in Minn. Stat. § 103H.201, subd. 2. (b).

The MDH may also develop a health based value (HBV) for a groundwater contaminant, or a mixture of contaminants. Similar to a HRL, a HBV is the concentration of a groundwater contaminant, or a mixture of contaminants, which, if not exceeded, poses little or no risk to health, even if consumed daily over a lifetime. HBVs, however, have not been promulgated as rules. Some HBVs may eventually be promulgated as HRLs during a rule revision. Toxicological data used to develop an

HBV may be held to less rigorous standards than are data used to develop a HRL. Differences may include the number of studies and the quality of those studies. Because of these differences, HBVs may incorporate more uncertainty than HRLs. HBVs serve as interim advice issued for specific sites where a contaminant has been detected, and the MDA may consider their use in PMP implementation.

When a HRL does not exist for a pesticide or its breakdown product(s), The MDA will submit a written request to the MDH that the MDH commissioner adopt a HRL, an emergency HRL, or develop a HBV for the compound(s). The request will include supportive documentation. If the MDH is unable to adopt a HRL, an emergency HRL, or develop a HBV, the MDA will consider taking necessary action to prevent contamination under other statutory authorities.

Minnesota Rules Chapter 7060 for Groundwater

Minn. Rules Chapter 7060 are rules promulgated by the Minnesota Pollution Control Agency (MPCA) for the control and prevention of pollution of the natural quality of groundwater. This rule provides that groundwater is classified according to its highest potential use; therefore, for groundwaters of suitable naturally quality, it is their use now or in the future as a source of drinking, culinary or food processing water.

Minnesota Rules Chapter 6280 for Aquatic Plant Management

The Minnesota Department of Natural Resources (DNR) is responsible for the implementation of Minn. Rules Chapter 6280. Those rules govern the control and management of aquatic plants and animals that can adversely impact aquatic habitats or interfere with the public's ability to use Minnesota's public water resources. Pesticide applications are one of the control options addressed in Chapter 6280.

The DNR regulates aquatic plants growing in public waters owned by the state. These plants can interfere with riparian property owners' access to lakes. The Aquatic Plant Management Program of the DNR protects aquatic plant habitat from unnecessary harm while allowing lakeshore homeowners to control some aquatic vegetation for water access. Permits are also issued to control aquatic plants at the bay-wide or lake-wide level to alter the composition of the plant community. The DNR also regulates aquatic animals living in public waters that may cause nuisance conditions (e.g., mosquitoes, blackflies, and leeches) and are intermediate hosts of nuisance-causing organisms (e.g., snails), or disrupt aquatic ecosystems (e.g., European carp).

Any use of herbicides in protected lakes, rivers, or wetlands to control aquatic plants or animals requires a DNR permit. Permits are issued by Regional Fisheries Managers (approximately 1,800 in 2006) or the division of Ecological Resources. The DNR uses aquatic use pesticides as part of its management activities. Those uses are consistent with the requirements outlined in Chapter 6280.

Implementation of Minn. Rules Chapter 6289 requires staff that are responsible for developing and providing educational and informational materials for permit applicants, for providing technical

advice to the general public, for coordinating with the Department of Agriculture on herbicide regulations, for updating and revising the aquatic plant management rules, for working with commercial aquatic plant harvesters and pesticide applicators, and for coordinating statewide efforts with the regional fisheries aquatic plant management specialists. The program also includes an aquatic plant botanist responsible for focusing research on native aquatic plant communities.

The DNR's Aquatic Management Program also includes an effort directed at pesticide enforcement. An aquatic pesticide enforcement specialist supervises herbicide treatments and investigates reports of the misuse of pesticides in lakes.

Minnesota Rules Chapter 7050 and the Federal Clean Water Act for Surface Water

When making PMP decisions for surface water, the MDA will consider Minn. Rules Chapter 7050, adopted by the MPCA for the control and prevention of pollution of surface waters. This rule provides both chronic and acute standards for surface waters and applies those standards through a use classification system. Water bodies within the state are given specific use classifications and each classification has associated water quality standards. Water bodies that have not been classified through rule are given a default classification of 2B (which are protected for aquatic life and recreation, but are not protected as drinking water sources).

The MPCA uses a three-fold process in developing the criteria for these water quality standards. The first protects aquatic life from the direct toxic effects of contaminants. The second protects humans from the adverse effects of eating contaminated fish and other edible aquatic organisms as well as consumption of drinking water from those waters protected as potential sources of drinking water. The third component protects wildlife that eats freshwater organisms from the adverse effects of contaminants. The most restrictive of the three chronic criteria (toxicity-based, human health-based, or the wildlife-based) becomes the rule-based chronic standard used by the MPCA. Between rule-making efforts, the MPCA may develop interim surface water chronic criterion or, in the absence of complete toxicological information, advisory values (guidelines).

For pollutants that cause a water body to fail to meet adopted standards, section 303(d) of the federal Clean Water Act requires the MPCA to conduct a Total Maximum Daily Load (TMDL) study. The regulations that govern the TMDL program (40 CFR 130A) require the study to identify both point and non-point sources of each pollutant that fail to meet water quality standards. Rivers, streams and lakes may have several TMDLs, each one determining the limit for a different pollutant.

In situations where an adopted surface water quality standard does not exist for a specific pesticide or breakdown product, the MDA will submit a written request that the MPCA adopt a standard, or develop a criterion or advisory value for the compound(s). The request will include supportive documentation. If the MPCA is unable to adopt a standard, or develop a criterion or advisory value, the MDA will consider taking necessary action to prevent contamination under other statutory authorities.

Breakdown Products and Combined Impacts

Groundwater or surface water monitoring programs may detect the presence of pesticide breakdown products. When a pesticide breakdown product is detected in groundwater, the MDA may request that the MDH adopt a HRL, an emergency HRL, or develop a HBV for that breakdown product. For the detection of a breakdown product in surface water, the MDA will request that the MPCA adopt a standard, or develop a criterion or advisory value for that breakdown product. Supporting data will be requested from all readily available sources, including registrants.

In assessing the potential for combined impacts to water resources from chemicals and/or their breakdown products, or from multiple chemicals with similar toxic endpoints, the MDH and MPCA currently employ specific approaches adopted by rule or established by policy. The MDH, for example, when assessing risk in the absence of an HRL or HBV for breakdown products, has a policy of treating breakdown products and their parent compounds as though they cause the same toxic effect and have the same potency. The MPCA, in Minn. Rules part 7050.0222 subpart 7.B., may apply an additive model to determine the toxicity of chemical mixtures for chemicals having the same mode of toxic action and to prevent acutely toxic conditions; a similar model may be applied for mixtures of carcinogenic chemicals.

CHAPTER 8

Prevention

Introduction

Prevention activities within the Pesticide Management Plan (PMP) are ongoing and independent of the status of pesticides or their breakdown products as common detection in groundwater or as surface water pesticides of concern. To achieve prevention goals, the MDA will work with various organizations to educate on and promote best management practices (BMPs) for general pesticide use and for use of specific pesticides. Adoption of BMPs is designed to prevent or mitigate degradation of groundwater or surface water.

<u>Prevention Actions</u> Ongoing activities to protect Minnesota's water resources from non-point source pesticide pollution
<i>Utilize databases, maps and analytical procedures that evaluate potential pesticide loss and water resource impacts based on hydrogeologic, soil and pesticide properties</i>
<i>Education and Promotion Team established</i>
<i>Pesticide registration and applicator certification/training</i>
<i>Periodic literature reviews for Best Management Practices (BMPs)</i>
<i>Pesticide BMP development and adoption</i>
<i>BMP education program development & coordination</i>
<i>BMP demonstration projects</i>
<i>Promotion of Integrated Pest and Weed Management (IPM/IWM) coordinated</i>
<i>Encourage IPM/IWM adoption by state agencies</i>
<i>Alternative pesticide management systems</i>
<i>Management decision-making developed and promoted</i>
<i>Utilize available data collection activities</i>

Goal, Approaches and Recommended Actions

Prevention Goal

The prevention goal of the PMP is to promote prevention of occurrences of pesticides or pesticide breakdown products in groundwaters and surface waters of the state. It is intended that this prevention be accomplished while promoting practices that consider economic factors, availability,

technical feasibility, implementability, effectiveness, and environmental effects, and in consideration of the beneficial uses of pesticides and applicable water quality standards.

□ Prevention Approach

The prevention goal of the PMP will be accomplished through:

1. utilizing analysis tools to focus resources in scientifically defensible ways and in high risk areas;
2. establishing an Education and Promotion Team to assist the MDA in coordinating prevention activities;
3. developing, adopting, and implementing effective strategies for prevention education and promotion through:
 - a. applicator training and certification/licensure;
 - b. BMP research and development;
 - c. education program development and coordination;
 - d. demonstration projects; and
 - e. Integrated Pest and Weed Management promotion; and
4. integrating prevention actions, where appropriate, into other natural resource management efforts and urban pesticide management initiatives, to support identified alternative pest management systems, and data collection activities.

Objective 1

Key target groups are educated on issues associated with land use, landscape management, community health, crop production, structural pest management, turf and garden management, lake, river and wetland management, economic profitability, and risks versus benefits, relevant to pesticide use as it impacts water quality in Minnesota. Target groups include pesticide users, crop advisors and retailers. Other interested groups may include policymakers, landowners, the general public, institutions, financial institutions, agencies, and residents.

Objective 2

Effective prevention strategies are encouraged through education and promotion, including adoption of BMPs by pesticide users considering all management tools available and supported by proper pesticide distribution, storage, handling, use and disposal, and use-specific management strategies.

□ Recommended Actions to Accomplish Prevention Goal

The following strategies for prevention education and promotion are described in this chapter:

1. Utilize available databases, maps and analytical procedures to evaluate potential pesticide loss and water resource impacts based on hydrogeology, soil and pesticide properties.

2. Establish an Education and Promotion Team (EPT) to assist the MDA in coordinating prevention activities and programs.
3. Incorporate into pesticide applicator certification and training the various prevention activities and strategies developed and recommended by the EPT, and all BMPs developed as part of MDA's general prevention activities or in response to common detection pesticides in groundwater or to surface water pesticides of concern.
4. Conduct periodic literature reviews of available pesticide groundwater and surface water research data, and to facilitate the development of scientifically-based prevention activities and programs, including BMPs. Such reviews can also be used to determine opportunities for research, demonstration projects and education.
5. Develop and adopt Pesticide BMPs to address general pesticide distribution, storage, handling, use and disposal. Develop and adopt additional generic BMPs to serve as core practices to address potential water resource impacts or concerns for specific classes of pesticides (e.g., insecticides, herbicides, fungicides, or for certain use applications in non-agricultural settings, including lakes). Develop and adopt chemical-specific BMPs for pesticides (or their breakdown products) determined to be common detection in groundwater or to be surface water pesticides of concern.
6. Develop, coordinate and extend BMP educational programs to include training for dealers, crop consultants, agronomists, Soil and Water Conservation District (SWCD) and Natural Resources Conservation Service (NRCS) staff and other agricultural, non-agricultural, urban and aquatic pesticide users. Assistance with these educational programs would be sought from University of Minnesota Extension (UME), registrants and dealers, and others.
7. Incorporate results of BMP research into ongoing MDA-UME applicator training and certification/licensure programs.
8. Develop demonstration projects to show the potential effects of BMPs and alternative pest management systems (Integrated Pest and Weed Management, crop diversification, etc.) on changes in water quality over time.
9. Promote and coordinate Integrated Pest and Weed Management activities related to water quality protection with the University of Minnesota and registrants/dealers.
10. Encourage state agencies (e.g., Minnesota Department of Natural Resources [DNR], MDA, University of Minnesota, and the Minnesota Department of Transportation) to use Integrated Pest and Weed Management to protect water resources.
11. Identify alternative pest management systems and determine efficacy by working with the University of Minnesota, registrants, and other interested parties.
12. Educate on and promote the adoption of effective BMPs by pesticide users considering all management tools available including pesticide distribution, storage, handling, use, disposal, and crop-specific strategies.

13. Utilize the available data collection activities of the MDA – Minnesota Agricultural Statistics Service, UME, and other interested organizations and encourage coordination of state task forces, working groups, and agencies in gathering and issuing data.

Groundwater and Surface Water Vulnerability Assessment

Prevention of water resource contamination is a major component of wise resource management. Several approaches to prevention, described below, will be combined to identify areas vulnerable to pesticide contamination. Available databases, maps and analytical procedures can be used to estimate the likelihood of pesticide contamination. Pesticide pollution prevention efforts can be prioritized according to the relative risk of pesticide contamination of groundwater and surface water.

For groundwater, Minn. Stat. §103H.101, subd. 5. requires that:

(a) the commissioner of agriculture for pollution resulting from agricultural chemicals and practices ... must consider the type of risk identified under subdivision 3 [the Department of Natural Resources' identification of sensitive areas and type of risk of groundwater degradation] when adopting best management practices, water resource protection plans, and water resource protection requirements to prevent and minimize groundwater degradation in sensitive areas.

(b) To prevent and minimize groundwater degradation, state agencies must consider the type of risk identified under subdivision 3 when undertaking an activity within a sensitive area.

Minn. Stat. §103H.005, subd. 13. defines a “sensitive area” as:

a geographic area defined by natural features where there is a significant risk of groundwater degradation from activities conducted at or near the land surface.

For surface water, Minn. Rules Chapters 7050 and 7060, administered by the Minnesota Pollution Control Agency (MPCA) provide the foundation for establishing human health and aquatic toxicity standards for water bodies of various use classifications. A framework for developing approaches to prevent impairment of surface waters within 10 watersheds or basins has been developed and is administered by the MPCA. In the development of basin plans, various tools are used to assess land use and management practices within each basin and the potential for water quality impairments.

Additional information on Minnesota’s philosophy, goals and approaches for preventing water resource degradation are provided in Chapter 2 – Minnesota’s Philosophy, Goals and Approaches for Preventing Water Resource Degradation.

□ Groundwater Vulnerability

The vulnerability of groundwater to pesticide contamination can generally be evaluated separately from that of surface water, although in some areas of the state (e.g., SE Minnesota’s fractured limestone bedrock region), groundwater vulnerability may be strongly linked to surface water vulnerability. Groundwater can be evaluated by combining the geologic sensitivity with soils

sensitivity to designate areas of greater relative risk in Minnesota. Maps generated as result of such evaluations can then be combined with the pesticide leaching ratings for specific pesticides.

1. Geologic and Groundwater Sensitivity Criteria

Minn. Stat. § 103H.101, subd. 3. requires that:

...the commissioner of Natural Resources shall (1) notify political subdivisions with planning and zoning authority and provide maps and other materials that show where sensitive areas are located and indicate the type of risk of groundwater degradation that may occur from activities at or near the surface.

The Minnesota Department of Natural Resources (DNR) administers a mapping program that prepares map-based reports of counties (County Geologic Atlases) and multicounty regions (Regional Hydrogeologic Assessments) to convey geologic and hydrogeologic information and interpretations to governmental units at all levels, but particularly to local governments. This information and these interpretations contribute to sound planning and management of the state's land and water resources. The geologic sensitivity criteria are based on the known or estimated time of travel for a waterborne contaminant to travel vertically from its source at or near the land surface to an aquifer.

Geologic sensitivity ratings are either very high, high, moderate, low or very low. The most sensitive groundwater areas (very high, high) have the shortest estimated time of travel and the least potential to retard the vertical movement of contaminants into an aquifer.

The criteria are limited in that they are only a first step. They are a screening tool, not a detailed technical approach and are not intended for specific sites or specific chemicals. Not all areas of the state have been fully mapped.

2. Soils Sensitivity Criteria

The Natural Resources Conservation Service (NRCS), in cooperation with the University of Minnesota, has developed a screening method to evaluate the relative potential loss of pesticides from soils due to leaching and runoff. The rating potential is based on soil properties for common Minnesota soil series. Screening results are expressed as an overall potential for loss of a specific pesticide when used on a specific soil map unit. Soil leaching and surface loss ratings are characterized as severe, moderate or slight.

The soil ratings for surface runoff and leaching were developed by the USDA-NRCS using soil properties derived from the National Soils Data Base and other information. These ratings, available in a database from the NRCS, are derived from information on soil properties that can affect pesticide movement.

The inherent capabilities of an individual pesticide to move with surface or subsurface waters were, by necessity, determined using one set of climate and other base conditions. Accordingly, the NRCS screening process, which compares these inherent capabilities to the leaching or runoff potential of an individual soil mapping unit, can be considered a "first

approximation” of a specific pesticide’s loss potential. NRCS’s screening process can be used as a general planning aid for farm fields or regions known to have characteristic soil types.

Because NRCS soil and pesticide loss ratings can be used in the promotion of voluntary BMPs, they can be an important tool in the development of maps illustrating vulnerability of water resources to pesticide use/application.

Available Soil Survey maps can also be used for localized solutions to pesticide leaching and runoff concerns. The soil leaching ratings can be identified for numerous soil map units. Map units can then be combined with the leaching ratings to produce a map showing vulnerability of specific soils to pesticide leaching.

On a larger scale, geologic sensitivity assessments can be combined with soil pesticide leaching ratings for counties with completed geologic sensitivity assessments and soil surveys. Areas or soil map units with both severe leaching potentials and high or very high geologic sensitivity can be assessed for possible designation as high risk areas for pesticide leaching.

3. Detailed methods for screening and evaluating pesticide leaching to groundwater in non-agricultural and urban settings are less well-developed than methods available for agricultural settings. Nevertheless, DNR Regional Hydrogeologic Assessments and information gathered and maintained by local watershed groups will be very helpful to the MDA and its partners for BMP education and promotion in conjunction with sound planning and management of land and water resources.

□ Surface Water Vulnerability

Criteria can be developed from which generic or specific BMPs will be designed. Agricultural soils sensitivity criteria (described above) can be used to evaluate the runoff potential for specific soil series, and can include surface water features from U.S. Geologic Service topography maps, and state surface water resource classifications from MPCA. BMPs to address impacts of non-agricultural and urban uses of pesticides to vulnerable surface waters may best be developed using criteria such as application timing and rate, management of losses from pervious and impervious surfaces, and alternative pest control practices. BMPs to minimize aquatic use pesticide impacts to vulnerable lakes and other targeted water bodies will necessarily be governed by similar and additional criteria in consultation with the MPCA and DNR. Generic and specific BMPs can be designed in consideration of these and other pertinent and applicable factors. This information can also be utilized to identify issues for further research.

Methods for screening and evaluating pesticide runoff to surface waters in non-agricultural and urban settings are less well-developed than methods available for agricultural settings. The vulnerability of lakes to aquatic use pesticides is considered during the DNR’s aquatic pesticide permitting process. Information gathered and maintained by other cooperators will be very helpful to the MDA and its partners for BMP education and promotion in conjunction with sound planning and management of land and water resources.

Education and Promotion Team

As a first step in developing general education and promotion strategies to prevent water resource degradation, the MDA will establish an Education and Promotion Team (EPT). The EPT will assist the MDA with the coordination of prevention activities and programs. In addition to providing assistance with the review and design of educational and promotional prevention activities for water resource protection, the EPT will be tasked with fulfilling the requirements of Minn. Stat. § 103H.151, subd. 3., which states that:

The commissioners of the pollution control agency and agriculture, in conjunction with the board of water and soil resources, soil and water conservation districts, and the Minnesota extension service must promote best management practices and provide education about how the use of best management practices will prevent, minimize, reduce, and eliminate the source of groundwater degradation. The promotion and education shall include demonstration projects.

The EPT should include the following organizations as listed in statute: the MDA (as convener and lead agency), the MPCA, the Board of Water and Soil Resources (BWSR), the Minnesota Association of Soil and Water Conservation Districts (SWCDs), and University of Minnesota Extension.

Additional interested parties will be welcome to attend EPT meetings and contribute to discussions and planning activities. EPT meetings will be informal, and will be facilitated by the MDA. Agricultural stakeholders will be given sufficient advance notification of these meetings and will be encouraged to attend.

The EPT will meet at least once annually to review and design educational and promotional prevention activities for water resource protection, including related activities associated with generic or specific BMPs required as part of Minn. Stat. 103H or as part of MDA's activities in response to surface water pesticides of concern. It is anticipated that frequent, informal communications and interaction will occur to plan and implement outreach activities.

EPT suggestions for educational and promotional prevention activities will be considered subject to available resources. Opportunities for cooperation among state agencies, representative EPT organizations, pesticide registrants and other interested parties will be explored, as will opportunities for joint grant-writing.

Pesticide Best Management Practices Development and Adoption

□ Definition and Responsibility

The Groundwater Protection Act provides a useful definition for BMPs developed for groundwater.

Minn. Stat. § 103H.005, subd. 4., defines BMPs as:

...practicable voluntary practices that are capable of preventing and minimizing degradation of groundwater, considering economic factors, availability, technical feasibility, implementability, effectiveness, and environmental effects. Best management practices apply to schedules of activities; design and operation standards; restrictions of practices; maintenance procedures; management plans; practices to prevent site releases, spillage, or leaks; application and use of chemicals; drainage from raw material storage; operating procedures; treatment requirements; and other activities causing groundwater degradation.

Additionally, Minn. Stat. § 103H.151, subd. 2. states that:

The commissioner of agriculture, in consultation with local water planning authorities, shall develop best management practices for agricultural chemicals and practices. The commissioner shall give public notice and contact and solicit comment from affected persons and businesses interested in developing best management practices.

The MDA will use the Groundwater Protection Act's definition of BMPs and its consultative requirements in the development of BMPs for both groundwater and surface water. Under the Groundwater Protection Act, the MDA is responsible for coordinating the development and implementation of groundwater BMPs for pesticides and pesticide breakdown products defined as pollutants, while under the Pesticide Control Law, the MDA is responsible for prevention, evaluation and mitigation efforts (all of which could include BMPs) related to occurrences of pesticide and pesticide breakdown products in both groundwater and surface water.

As a preventative measure, the MDA will coordinate the development, promotion and maintenance of generic pesticide BMPs for pesticide distribution, storage, handling, use and disposal. Possible categories for generic BMPs include: general farm or urban BMPs, training and development, pesticide selection, record keeping, surface runoff and leaching prevention, container management, mixing and loading, protecting sensitive areas, proper application techniques, drift control, response to spills, and chemigation.

The MDA may develop and adopt additional generic BMPs that serve as core practices to address potential water resource impacts or concerns for specific classes of pesticides (e.g., insecticides, herbicides, fungicides, or for certain use applications on crops, lawns, gardens or lakes).

Additionally, when pesticides are determined to be common detection in groundwater or a surface water pesticide of concern (see Chapter 9 – Evaluation), specific BMPs will be developed to address the pollutants.

BMP development efforts will include consultation with local water planning authorities (as required in Minn. Stat. § 103H.151 subd. 2), and as part of their development, the MDA will solicit and consider input from farm organizations, park and recreation groups, lake associations, conservation groups, other interested groups and the public.

The University of Minnesota will be asked to assist the MDA with periodic literature reviews of pesticide research that can be used as the basis for generic or specific pesticide BMPs in Minnesota. Such reviews should address the issues of pesticides in Minnesota water resources, both surface

waters and groundwaters. Such reviews should include, but not be limited to a literature review of pertinent pest management research, evaluation of the research and recommendations for future action.

□ Generic Best Management Practices

The MDA will coordinate development of generic BMPs using available databases, maps and analytical procedures that characterize relevant hydrogeologic, soil and pesticide properties. NRCS national standards can be the starting point for development of generic BMPs. BMPs developed may go beyond conservation compliance plans (expanding on NRCS technical standards). These practices in turn may be considered for use by NRCS. Efforts will be coordinated between MDA and NRCS programs.

The MDA may prioritize development and implementation of generic BMPs according to the potential of a geographic area for contamination. The priority focus of promotion will be for areas designated as Pesticide Management Areas, or for high risk or special BMP promotion areas.

The MDA may also consider the development, implementation and promotion of crop-specific management strategies in addition to pesticide-specific BMPs (described below). For example, if a common detection pesticide is a member of a class of pesticides that generally have the same use pattern and are applied to the same crop, a crop-specific strategy could be developed in addition to individual pesticide-specific BMPs. Supplemental pesticide-specific BMPs could be added to the basic crop-specific strategy.

Generic pesticide BMPs can be incorporated into cultural and pest management strategies or other management approaches for agricultural, non-agricultural, urban and aquatic settings, including those for crops, lawns, turf, gardens, lakes, forests, and rights-of-way.

Development Process for Generic BMPs

1. Based upon literature reviews and other pertinent factors the MDA, in consultation with local water planning authorities, UME pest/weed scientists, crop specialists, turf and lawn specialists, and aquatic pest control specialists will prepare draft BMPs.
2. Draft BMPs and any pertinent data will be distributed for comment to interested parties via the MDA's pesticide non-point source e-mail list server.
3. After a minimum comment period of 60 days, the MDA will review comments received. Where appropriate, the BMPs will be revised by the MDA, and a second draft of the BMPs will be prepared.
4. The MDA will distribute revised draft BMPs for comment by publishing the revised BMPs in the State Register, by notifying local water planning authorities, and through the MDA's pesticide non-point source e-mail list server.
5. After a minimum comment period of 60 days, the MDA will review comments received. Where appropriate, the BMPs will be revised by the MDA.

6. Final BMPs will then be submitted to the commissioner of agriculture for adoption and notice in the State Register.

□ Pesticide-Specific Best Management Practices

BMPs for specific pesticides which are determined by the commissioner of agriculture to be a common detection in groundwater, or which are determined by the commissioner of agriculture to be a surface water pesticide of concern, or which may be targeted by EPA in the implementation of its pesticide or water quality programs will be developed using the same process as that for generic BMP development (described above), with the following modifications:

- A. MDA will initially provide the registrant(s) and the respective commodity and user group(s) with the opportunity to propose product- or pesticide-specific BMPs for the product(s) or pesticide(s) that are determined by the commissioner of agriculture to be a common detection in groundwater or pesticide of concern for surface water.
- B. MDA will seek comments on the proposed BMPs from all companies that register or manufacture the pesticide for use in Minnesota.

Best Management Practices Education and Promotion Program: Development and Coordination

After BMP development, the MDA will utilize the EPT to guide the coordination of prevention activities and programs associated with BMP education and promotion. This is consistent with Minn. Stat. § 103H.151, subd. 3.

The MDA will act as the lead agency in coordinating pesticide BMP promotional efforts, and will request the assistance of the EPT and its members' extended network to support those efforts. The MDA will seek assistance from organizations that can provide resources to promote the BMPs. Soil and Water Conservation Districts (SWCDs) can provide a local coordination role, especially in areas where ground or surface water are significantly impacted by contamination.

The promotion of BMPs, whether generic or pesticide-specific, will use existing delivery mechanisms whenever possible. It is understood that different individuals and user groups are more receptive to certain information sources than others. By providing a number of channels for education and information dissemination, there is an increased likelihood that most pesticide users will be reached.

In addition to pesticide applicator training sessions, the MDA will seek assistance in promoting BMPs from pesticide dealers, the University of Minnesota, pesticide registrants, SWCDs, NRCS, Board of Water and Soil Resources (BWSR), crop consultants, DNR, industry trade associations, and user groups, and environmental groups. In order to effectively promote BMPs to the urban landowner/manager, or to lakeshore homeowners or managers, the MDA will encourage participation from a variety of stakeholders, including local units of government, garden centers, block clubs, the master gardener program, park and recreation boards, lake associations, conservation groups, and commercial and non-commercial applicators.

The adoption of a pesticide-specific BMP does not preclude the promotion of the BMP in conjunction with generic BMPs or other use, cultural or pest management strategies. Pesticide-specific BMPs will be promoted through a variety of cooperators and methods such as through commodity and specific user groups, or in conjunction with other management practices adopted by organizations or commodity and user groups.

BMP promotion can be divided into distinct levels, depending upon the nature of the BMPs, the extent of the audience to be reached and the geographic area included. These levels include promotion on a pesticide management area level, a township level, a special BMP promotion area level and a soils or watershed level. Within each level, certain organizations have a traditional audience and will be most effective in reaching the intended audience.

□ Statewide/Pesticide Management Area BMP Promotion

Generic BMPs and certain pesticide-specific BMPs are likely to be applicable to the majority of the state depending on the class or type of pesticide being used (e.g., agricultural, non-agricultural, urban, aquatic). Through the MDA's EPT, campaigns can be designed to promote BMPs through the following groups or mechanisms:

1. Pesticide Dealers and Registrants

Pesticide dealers and registrants have been shown to be a primary source of information for pesticide applicators in agricultural settings. For non-agricultural, urban and aquatic use settings, registrants and dealers can also be a source of information to pesticide users. Promotion information can be developed for generic and pesticide-specific BMPs. Under the direction of the MDA, pesticide-specific BMP promotional packets can be developed by the registrants and distributed to the dealers. Registrants can work with dealers to encourage distribution of BMP promotional information.

2. University of Minnesota: Soil, Water and Pesticide Research; UME; and Agricultural Experiment Stations

University of Minnesota's researchers, extension specialists, and extension educators can inform pesticide users of pertinent BMP information. Several program areas within the U. of M. can be used to promote BMPs, including integrated pest management, water quality, and pesticide impact and analysis (e.g., basic research and modeling on pesticide-soil-water-site interactions).

3. Pesticide Applicator Training (PAT)

The MDA and UME will cooperate in the development of training materials for BMPs which are applicable on a statewide level. These will be distributed at PAT sessions for private applicators by county extension educators. Information will be delivered at commercial and non-commercial applicator recertification workshops. BMP information will also be included in MDA newsletter mailings to private and commercial/non-commercial applicators.

In situations where Water Resource Protection Requirements (WRPRs) are adopted (see Chapter 10 – Mitigation), or where MDA authorities have been exercised to prevent unreasonable adverse effects on the environment, relevant training materials will become mandatory in addition to any EPA-required materials. Questions on WRPRs or other use restrictions will be included in the original certification test and at all recertification workshops.

4. Urban BMP Promotion

Presently, several organizations exist, appropriate to the BMPs developed, with whom the MDA will encourage cooperative relationships in order to more effectively promote BMP educational information to the urban landowner/manager. These include local units of government, garden centers, block clubs, the master gardener program, park and recreation boards, and commercial and non-commercial applicators.

In addition, when conducting inspections, MDA's agricultural chemical investigators can distribute BMP promotional materials through urban pesticide commercial retailers such as garden centers, hardware stores, and department stores.

5. Department of Natural Resources, Lake Associations and Conservation Groups

Many applications of aquatic use pesticides, such as those used to control aquatic plants, or other animal pests, are permitted by the DNR. Aquatic use BMPs can be distributed and promoted in conjunction with permit application and issuance. Lake associations and conservation groups can work with lakeshore homeowners and landholders to promote healthy lakes and multiple uses for lake resources, and can be particularly good vehicles through which to promote aquatic use pesticide BMPs. The DNR also uses aquatic use pesticides as part of its management activities and can insure that developed BMPs are incorporated into those management applications.

6. Other BMP Promotional Opportunities

Other BMP promotional opportunities can be developed with environmental organizations, the pesticide industry, and state and local agencies. The MDA's EPT will consider other efforts and will cooperate with other groups to ensure that the most effective methods to deliver and promote BMP implementation are achieved. These may include public service announcements, demonstration plots, brochures, displays and events. The EPT will strive to coordinate these efforts to ensure that the message delivered to producers is consistent with the BMPs.

Pesticide-specific BMPs can be incorporated into many promotional strategies including those developed for crops, turf, lawns, gardens, cultural control, or general pest management. These complementary strategies may be promoted by agricultural or community organizations.

□ Local BMP Promotion

The MDA will seek assistance in promoting BMPs from organizations that reach pesticide applicators on a local level. These groups include commodity and user groups, township boards, local citizens

and associations, the UME, NRCS, SWCDs, BWSR, pesticide dealers, registrants and U. of M. Agricultural Experiment Stations.

□ BMP Promotion Areas

Special attention and efforts may be focused within areas where significant pesticide contamination of groundwater or surface water exists or could potentially exist in geographically contiguous areas, and where the source is thought to originate from normal (labeled) use of pesticides.

These areas may be recognized as warranting concern for several possible reasons including:

1. existing monitoring data either collected by or provided to the MDA which indicates a water quality problem due to pesticide use;
2. areas indicated by a vulnerability assessment as being highly sensitive to contamination whether documented or not; and
3. designation as a Wellhead Protection Area by the Minnesota Department of Health.

The MDA will evaluate the situation in consultation with the local SWCD and the appropriate water planning authorities and where necessary will designate a special BMP promotion area.

Integrated Pest and Weed Management

Opportunities exist for the EPT to incorporate into prevention activities various strategies for Integrated Pest and Weed Management that directly relate to water quality protection.

Minn. Stat. § 18B.063 encourages state agencies (e.g., Minnesota Department of Natural Resources, Minnesota Department of Agriculture, University of Minnesota, and the Minnesota Department of Transportation) to use Integrated Pest and Weed Management techniques in its management of public lands. Such techniques might be used to protect water resources, whether from pesticides used in crop production, or those used in the management of lawns, turf, gardens, lakes, forests, or rights-of-way.

Various programs at the MDA, University of Minnesota, and within local, state and national commodity and industry groups promote the development and implementation of Integrated Pest and Weed Management. Several MDA programs have been established to respond to a variety of statutory directives, including: the provision of funds for demonstration grants; a low-interest loan program to support farmer transition to more environmentally sound, profitable practices; whole farm planning decision-making assistance; on-farm research in practical farming alternatives; a Conservation Reserve Program Project to identify the CRP lands most critical to preserving Minnesota's soil and water quality; an Integrated Pest Management program concerned with developing and implementing state-wide strategies for the increased use of IPM on private and state managed lands; and organic farming technical assistance and advice on conversion to organic methods, certification and marketing of crops and livestock. In addition, the MDA conducts field days, workshops and assembles speakers on diverse topics with farmer, agency, academic, non-profit and local partners.

These programs and related activities can be considered by the EPT as it assists the MDA with review and design of educational and promotional strategies for the prevention of water resource impacts from pesticides. The MDA will work with the groups and mechanisms outlined earlier in this chapter to promote water quality BMPs that incorporate the techniques and concepts of Integrated Pest and Weed Management to non-agricultural, urban and aquatic settings where pesticide impacts to water quality are a concern.

CHAPTER 9

Evaluation

Evaluation Actions

Evaluate monitoring and other investigation data for common detection determinations in groundwater and surface water pesticide of concern determinations in surface water. Evaluate the effectiveness and adoption of generic and pesticide-specific Best Management Practices (BMPs).

Provide technical support to the Minnesota Pollution Control Agency (MPCA) impaired waters determination process.

Pesticide Management Plan Committee formed

Monitoring data evaluated for “common detection” in groundwater

Monitoring data evaluated for “surface water pesticide” of concern

Assistance provided to MPCA impaired waters process

Pesticide monitoring regions, management areas and BMP promotion areas considered

BMP adoption is evaluated

BMP effectiveness is evaluated

Goal, Approaches and Recommended Actions

Evaluation Goal

The evaluation goal of the Pesticide Management Plan (PMP) is to evaluate detections of pesticides and pesticide breakdown products in water resource monitoring data, and to evaluate the adoption, validity and effectiveness of prevention and management strategies, including pesticide BMPs.

Evaluation Approach

The evaluation goal of the PMP will be accomplished through:

1. establishing a Pesticide Management Plan Committee, serving at the commissioner’s discretion, to support Minnesota Department of Agriculture (MDA) evaluation activities;
2. conducting an annual review of detections of pesticides and pesticide breakdown products in water resource monitoring data;
3. assessing, evaluating, and validating –
 - a. changes in management practices

- b. resource impacts and trends
 - c. delivery systems to local interests and stakeholders
 - d. economic impact of implementing prevention steps; and
4. using evaluation findings to refine practices and management strategies.

□ Recommended Actions to Accomplish Evaluation Goal

1. Utilize a Pesticide Management Plan Committee (PMPC) to review the collection and analysis of information on detections of pesticides and pesticide breakdown products for potential common detection determinations in groundwater and surface water pesticide of concern determinations in surface water.
2. Potential pesticide management and monitoring areas are developed based on land form units, agro-ecoregions, watersheds and other factors.
3. Water monitoring is conducted in each monitoring region.
4. BMP promotion areas are delineated based on land form units or watersheds.
5. A strategy is developed to evaluate the effectiveness of pesticide management strategies for best management practices promotion areas.

To ensure that technically and legally defensible decisions are made and are based on accurate data, that pesticide BMPs are truly effective in addressing problems (and that they don't cause other problems), and that pesticide users are following the BMPs, evaluation is a necessary component of the PMP. The MDA is the lead state agency for pesticide environmental and regulatory functions, including the evaluation of monitoring data and BMP effectiveness related to water resource protection decisions. These authorities are described in Minnesota Statutes Chapters 18B, 18C, 18D and 103H.

The PMPC will be created by the commissioner and serves at the commissioner's discretion. The PMPC's purpose is to provide informed and diverse comment to the commissioner for major evaluation activities and decisions. The PMPC is one element of ensuring open and equitable comment into PMP decisions for all stakeholder groups. These decisions include, but are not limited to: adoption and effectiveness of generic (core) pesticide BMPs; common detection determination for pesticides in groundwater; surface water pesticide of concern determination for pesticides in surface water; evaluation of pesticide use data and data collection options; and adoption and effectiveness of pesticide-specific BMPs and other mitigation decisions.

It is envisioned that the PMPC will meet at least once annually following completion of an annual MDA water monitoring report. Additional meetings or consultations via e-mail may be conducted as needed to evaluate PMP activities. Formal notes will be taken of the PMPC meetings and reviewed by members, to document the positions and concerns of all the members of the committee. Supplemental letters or materials may also be submitted by PMPC members for the commissioner's consideration as part of the PMPC process. The commissioner shall assign MDA staff to manage and direct the PMPC.

The committee, convened and staffed by the MDA, will include organizations referenced in Minn. Stat. 18B.045 on PMP development and coordination, with representation from: the Minnesota Pollution Control Agency (MPCA), the Minnesota Department of Health (MDH), the Minnesota Department of Natural Resources (DNR), University of Minnesota Extension (UME), farm organizations, farmers, environmental organizations, and industry. The commissioner may also expand PMPC representation by including additional University of Minnesota or other college faculty with relevant expertise in pesticides, cropping systems in Minnesota, or environmental science. Other technical experts also may serve on the PMPC. The PMPC serves at the discretion of the commissioner, who will establish the final composition of the committee.

Members of the committee should, but are not required to, have scientific expertise in areas such as hydrology, natural resources, pesticide chemistry, pesticide use, public health, soil chemistry or toxicology. Members will be selected by the commissioner following the open appointment process outlined in Minn. Stat. § 15.0597, with preference given to candidates with relevant scientific credentials, broad representation of their interest group, and experience in Minnesota. Members will serve for two year terms, are expected to actively participate in PMPC activities and may be replaced if they are unable to do so.

To ensure the opportunity for participation from all stakeholders, a public notice and a minimum 60-day open public comment period will be provided for significant proposed PMP decisions. This notice will be provided via an MDA list server, and through a formal state register notice for final proposed BMPs and any proposed changes to pesticides determined to be commonly detected in groundwater or a surface water pesticide of concern. Information reviewed by the PMPC or submitted to the commissioner by individual PMPC members prior to the commissioner's preliminary decisions on pesticides in water resources, will be made available to the public as part of the comment process.

Additional guidance is provided for specific evaluation decisions and related process activities in the rest of this chapter.

Common Detection in Groundwater

Information on pesticide detections in Minnesota's groundwater resources will be collected and analyzed by the MDA's monitoring program with assistance from other state agencies and cooperators. Those detections determined to be the result of non-point source contamination will be evaluated for common detection status. According to Minn. Stat. § 103H.005, subd. 5.:

“Common detection” means detection of a pollutant that is not due to misuse or unusual or unique circumstances, but it likely to be the result of normal use of a product or practice.

Common detection status, as determined through the analysis of scientifically valid information, allows the state and all involved parties to take a proactive approach to focus limited resources on pesticides which may adversely impact Minnesota's water resources. Groundwater common detection status is a useful tool to communicate to all involved parties that the normal use of a product or practice has resulted in its presence in groundwater. Common detection status does not regulate the

use of a pesticide in Minnesota; rather, common detection status triggers development of voluntary Best Management Practices (BMPs) for those pesticides.

Voluntary BMPs will be developed for pesticides in common detection status. Minn. Stat. § 103H.251, subd. 1. (b). states:

If conditions indicate a likelihood of the detection of the pollutant or pollutant breakdown product to be a common detection, the commissioner of agriculture must begin development of BMPs and continue to monitor for the pollutant or pollutant breakdown products.

Voluntary BMPs are defined in Minn. Stat. § 103H.005, subd. 4.:

Best management practices means practicable voluntary practices that are capable of preventing and minimizing degradation of groundwater, considering economic factors, availability, technical feasibility, implementability, effectiveness, and environmental effects. Best management practices apply to schedules of activities; design and operation standards; restrictions of practices; maintenance procedures; management plans; practices to prevent site releases; spillage; or leaks; application and use of chemicals; drainage from raw material storage; operating procedures; treatment requirements; and other activities causing groundwater degradation.

Common detection status allows the use of a focused voluntary approach to address pesticides of concern. The Minnesota legislature promotes the voluntary approach and directs that mandatory regulations occur through adoption of Water Resource Protection Requirements (WRPRs), or in cases of unreasonable adverse effects through other statutory authorities as described in Minn. Stat. § 18B.10:

The commissioner may, by rule, special order, or delegation through written regulatory agreement with officials of other approved agencies, take action necessary to prevent the contamination of groundwater resulting from leaching of pesticides through the soil, from the backsiphoning or backflowing of pesticides through water wells, or from the direct flowage of pesticide to groundwater.

With regard to pesticides in surface or groundwater, regulatory authority is provided through the Pesticide Control Law as stated in Minn. Stat. § 18B.26 subd. 5.,

- (b) The commissioner shall review each application and may approve, deny or cancel the registration of any pesticide. 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.*
- (c) The commissioner must notify the applicant of the approval, denial, cancellation, state use or distribution restrictions.*
- (d) The applicant may request a hearing on any adverse action of the commissioner within 30 days after being notified.*

The PMPC will provide comment to the commissioner prior to the commissioner's preliminary decisions on a determination of common detection in groundwater. Public notice and a minimum comment period of 60 days will then be provided prior to any changes in common detection status for a pesticide.

The commissioner and the PMPC will evaluate pesticide detections to determine which meet the requirements set forth in Minn. Stat. § 103H.005 of not being due to misuse or unusual or unique circumstances, but are likely to be the result of normal use of a product or practice.

Immediately prior to a PMPC meeting where common detection will be discussed, the MDA will provide to the committee monitoring data from the MDA monitoring report and other available and relevant sources. This should include all readily available information from within Minnesota on the pesticide(s) being considered. This may include groundwater monitoring data; pesticide use information; physical, chemical and toxicological properties of the pesticide; hydrogeologic information; and a review of information and data from other local, state, or federal monitoring databases. Monitoring data collected from outside Minnesota may be used as supporting information.

The PMPC will provide comment to the commissioner on which pesticides should be considered common detection. The following guidelines will serve as the general basis for evaluation and analysis for the determination that a particular pesticide should be considered for common detection status and the development of pesticide-specific BMPs:

1. The scientific validity of the data upon which the evaluation is based.
2. The frequency of detections and concentrations reported in the groundwater monitoring data and any associated trends over time.
3. The extent of use and general use profile of the pesticide.
4. The existence of a Health Risk Limit (HRL) for the pesticide or breakdown product set by the Minnesota Department of Health. In the absence of an HRL, an analysis will be conducted to determine whether to request a HRL, if one has not already been requested.
5. Consider all other associated land use factors which may be considered unique or unusual such as agronomic, meteorologic or hydrologic events.
6. If conditions indicate a likelihood of the detections of the pollutant or pollutant breakdown product to be a common detection as defined in Minn. Stat. § 103H.005 subd. 5.
7. If a pesticide found in groundwater which is not a pollutant (i.e., it does not have a HRL) would be determined to be a common detection if an HRL existed.

Members of the PMPC, after conducting a thorough evaluation and analysis of the available information and options, will outline concerns and considerations related to the common detection decision for consideration by the commissioner. These will be summarized in notes from the PMPC meeting(s). Additional supplemental materials may be submitted for the commissioner's consideration by any PMPC member. All notes and submittals will be available for PMPC and public review. The committee may also provide to the commissioner a list of reports used, evaluations of the scientific validity of data, and, if applicable, recommendations for future information needs.

The commissioner will consider the comments and materials submitted by PMPC members prior to making a preliminary determination of common detection status. Any proposed change in common detection status by the commissioner will be published in the state register and distributed via the MDA pesticide non-point source e-mail list server for a minimum public comment period of 60 days. Once the commissioner determines that a pesticide is or is no longer commonly detected, that determination shall be published in the State Register.

Common detection status may not be appropriate in a number of cases where a pesticide has been detected in groundwater in Minnesota. Detections which are sporadic and not indicative of widespread presence as a result of use in accordance with label directions will need to be evaluated by the committee and the commissioner. The commissioner may promote core (generic) BMPs, and the MDA and the registrant may coordinate additional prevention efforts.

Surface Water Pesticide of Concern

Information on pesticide detections in Minnesota's surface water resources will be collected and analyzed by the Minnesota Department of Agriculture's (MDA) monitoring program with the assistance of other state agencies and cooperators. Those detections determined to be the result of non-point source contamination will be evaluated relative to a surface water standard or other relevant surface water reference value.

If the concentration of a pesticide in a surface water body exceeds a numerical standard, the water body may be subject to formal listing as "impaired" on the Clean Water Act's 303(d) list assembled by the MPCA (see the MPCA website at <http://www.pca.state.mn.us/water/index.html> for additional information on MPCA surface water standards and the impaired waters process). This may result in initiating a Total Maximum Daily Load (TMDL) study under the federal Clean Water Act section 303(d). For the purposes of the PMP, the source of surface water quality reference values in Minnesota is the MPCA. If a pesticide does not have an MPCA reference value, then reference values from the EPA or other states will be considered. While the MDA is the lead state agency for pesticide environmental and regulatory functions, it works closely with the MPCA in its role as the lead agency for regulating the TMDL process and for managing pollution in surface water bodies under Minn. Rules Chapters 7050.

Following review of surface water monitoring data, the commissioner may determine that a pesticide has been found at a concentration of concern relative to a water quality standard, water quality criterion or water quality advisory value (i.e., a "reference value," see page 43 of the PMP), and that the concentration of concern is not the result of misuse or unusual or unique circumstances. Unusual or unique circumstances might include specific product use in response to an unusual pest outbreak, climatic anomalies or other factors that can contribute to unexpected or abnormally high concentrations of limited duration.

To provide flexibility in evaluating and responding to concentrations that might lead to future impairment listings of water bodies, and in recognition of the complex variables that can contribute to peak concentrations, there is no single value or percentage of a reference value that will trigger the development of preventive actions such as voluntary pesticide-specific BMPs or educational campaigns. Instead, preventive actions will be considered when surface water monitoring results for a pesticide exceed 10 to 50% of its reference value. The commissioner will consider a number of factors in determining if an exceedance means that the pesticide is a surface water pesticide of concern requiring initiation of specific preventive actions. The most important factors will be monitoring and use trends. For example, if the use of a pesticide is stable or increasing, and the concentration is at 10 to 50% of its reference value and exhibits an increasing trend, then preventive actions may be taken to ensure that the water body does not become impaired.

Other factors to be considered include how well the monitoring dataset characterizes the observed exceedance.

A determination that a pesticide is a surface water pesticide of concern will initiate the development of preventive actions including voluntary pesticide-specific BMPs to protect surface waters from further contamination. Such actions will be taken prior to, and in an effort to prevent, the impairment of a surface water body.

The MDA has broad authority to take action to prevent any unreasonable adverse effects on the environment (as defined in statute) including impacts to surface waters. The MDA also has the authority and responsibility to develop and promote pesticide voluntary best management practices.

In summary, “surface water pesticide of concern,” as it is used in the PMP, means the detection of a pesticide in surface water at concentrations of concern relative to a water quality standard, water quality criterion or water quality advisory value (i.e., a “reference value”), not due to misuse or unusual or unique circumstances, but likely to be the result of normal use of product or practice.

Surface water pesticide of concern status, as determined through the analysis of scientifically valid information, allows the state and all involved parties to take a proactive approach to focus limited resources on pesticides which are adversely impacting Minnesota’s water resources. Surface water pesticide of concern status is a useful tool to communicate to all involved parties that there is a scientific basis for concern about the use of a specific pesticide and its impact on water quality. Surface water pesticide of concern status does not regulate the use of a pesticide in Minnesota. Rather it triggers development of voluntary BMPs for those pesticides.

With regard to pesticides in surface water, regulatory authority for the MDA is provided through the Pesticide Control Law as stated in Minn. Stat. § 18B.26, subd. 5.,

- (b) The commissioner shall review each application and may approve, deny or cancel the registration of any pesticide. 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.*
- (c) The commissioner must notify the applicant of the approval, denial, cancellation, state use or distribution restrictions.*
- (d) The applicant may request a hearing on any adverse action of the commissioner within 30 days after being notified.*

The PMPC will provide input to the commissioner prior to the commissioner’s preliminary decisions on a determination of surface water pesticide of concern. Public notice and a minimum comment period of 60 days will then be provided prior to any changes in surface water pesticide of concern status for a pesticide. The types of information provided to the PMPC and the decision-making and public notice process used for surface water decisions will be the same as those used for groundwater.

The PMPC will provide comment to the commissioner on which pesticides should be considered a surface water pesticide of concern. The following guidelines will serve as the general basis for evaluation and analysis that a particular pesticide should be considered for surface water pesticide of concern status:

1. The scientific validity of the data upon which the recommendations are based.
2. The extent of use and general use profile and the anticipated status of registration of the pesticide.
3. The existence of a water quality standard, water quality criterion, or water quality guideline for the pesticide or breakdown product set by the MPCA. In the absence of a standard, an analysis will be conducted to determine whether to request a standard, if one has not already been requested.
4. Trends and concentrations of the pesticide in surface waters and the relationship of the detected concentrations relative to a water quality standard, water quality criterion, or water quality guideline.
5. Consider all other associated land use factors which may be considered unique or unusual such as agronomic, meteorologic or hydrologic events.

Surface water pesticide of concern status may not be appropriate in a number of cases where a pesticide has been detected in surface water in Minnesota. Detections which are low relative to a surface water reference value or which are sporadic and not indicative of widespread presence as a result of use in accordance with label directions will need to be evaluated by the committee and the commissioner. It may not be appropriate for determining a surface water pesticide of concern and developing BMPs for a product which is being phased out or likely will have its use significantly reduced. The commissioner may promote generic (core) BMPs, and the MDA and the registrant may coordinate additional prevention efforts.

MPCA Impaired Waters Determination

The MPCA is the lead agency for regulating the TMDL process and for managing pollution in surface water bodies under Minn. Rules Chapter 7050. The MPCA has a formal process for making determinations of water body impairment.

Information on pesticide detections in Minnesota's surface water resources will be collected and analyzed by the MDA monitoring program with the assistance of other state agencies and cooperators. The MDA will forward this information to the MPCA and provide technical assistance to MPCA to support the MPCA process for evaluating surface waters for impairment.

If the concentration of a pesticide in a surface water body exceeds a numerical standard or if a pesticide is a cause for exceeding a biological or narrative standard, the water body may be subject to formal listing as "impaired" on the Clean Water Act's 303(d) list assembled by the MPCA. This may result in initiating a TMDL study under section 303(d) of the federal Clean Water Act.

The MDA has broad authority to take action to prevent any unreasonable adverse effects on the environment (as defined in statute) including impacts to surface waters, and the authority and responsibility to develop and promote pesticide voluntary best management practices. The MDA also is directly involved in pesticide applicator training and many other grower outreach activities that may be useful in support of the TMDL implementation process.

If a water body becomes impaired due to a currently registered pesticide, the MDA will consult and coordinate with the MPCA on how best to approach the issue and maximize the use of both agencies' available resources.

Evaluation of the Adoption and Effectiveness of Pesticide BMPs

There are a range of options available to evaluate the adoption (i.e., use) and effectiveness of pesticide BMPs. Rates of BMP adoption can be measured through surveys and other means. BMP effectiveness can be measured through plot and small watershed scale projects where specific pesticide use practices can be correlated with water monitoring and pest control data. Many of these options carry a relatively high cost if they are to be conducted in a meaningful manner. This section outlines a variety of BMP evaluation options. The actual implementation of options will be tied directly to the availability of funding and other resources. At a minimum, it is anticipated that a sufficient level of groundwater and surface water monitoring will be conducted at key locations in Minnesota to determine concentration trends over time sufficiently to evaluate, at a broad level, the need for additional protective actions. Other BMP evaluation activities outlined in this section will be conducted to the extent that resources allow.

Pesticide Management Areas and BMP Promotion Areas

The Groundwater Protection Act directs the MDA to promote the implementation of voluntary BMPs which are designed to prevent and minimize degradation of ground and surface water. If the voluntary BMPs prove to be ineffective, then the MDA may develop mandatory restrictions. The MDA will develop, promote and evaluate voluntary BMPs. This will be done statewide and through the use of pesticide management areas and BMP promotion areas, depending upon the applicability of a specific BMP and the availability of resources.

Pesticide management areas will be developed based on land form characteristics, such as the central sand plains or southeastern karst regions. These likely will develop into corresponding pesticide monitoring regions. Efforts to evaluate the effectiveness of BMPs and pesticide management strategies may focus on these specific areas rather than statewide.

Delineation efforts will consider information sources such as GIS, SSIS, EPPL7, DNR sensitivity assessment, air photos, land use information, climatic data, monitoring data, stream flow, or groundwater levels.

Delineation will be developed according to land form units for groundwater protection and watersheds and land form units for management measures on surface water. Pesticide monitoring regions and management areas will be reviewed by the PMPC.

If sufficient monitoring data and resources allow, small scale BMP promotion areas will be established. These small areas might encompass several townships in a county or a small urban or rural watershed. Land form units or small watersheds help in the quantification of cause and effect relationships between management efforts and water quality. This allows limited resources for evaluation to be focused in specific areas.

In order to accurately assess effectiveness of promotion and pesticide management efforts it is desirable to focus monitoring efforts on a discrete watershed or land form unit.

Based upon the results of monitoring, an analysis will be developed which describes the efficacy of the voluntary practices. The MDA will develop and recommend changes and additional promotional activities with assistance from the PMPC. Further monitoring, especially in the BMP promotion areas, should be conducted. While BMPs will be promoted widely, it is in these discrete BMP promotion areas that the effectiveness of promotion activities will best be determined through comparing BMP implementation rates to water quality in areas where BMPs are implemented.

Evaluation of Best Management Practices Adoption

Evaluating BMP adoption is an important part of the pesticide management process. It is important that these activities be conducted in a technically defensible manner.

The results of implementing BMPs may not be discernible as changes in pesticide concentration in groundwater or surface water for a long period of time. Furthermore, a change in pesticide concentration observed over the course of a single year may or may not be related to the adoption of BMPs. Because direct water quality monitoring has such limitations for evaluating the adoption of BMPs, it is important to evaluate other indicators of the degree to which BMPs have been put into practice, or 'adopted', by landowners. Adoption of BMPs is a specific application of the process by which people learn to make changes. Five stages through which people may pass in this process include:

1. Awareness: An individual is first exposed to a new practice.
2. Information: An individual is motivated by curiosity and interest to gather information about a new practice.
3. Application: An individual considers applying the practice to his/her present or predicted situation.
4. Trial: An individual tries out the practice in his/her own situation.
5. Adoption: An individual evaluates the trial and adopts the practice if satisfied with the results.

The adoption of a new pesticide management practice or technique is essentially a decision-making process which occurs over specific stages in time. There is a lag time between the awareness phase and the adoption phase. The underlying assumption in the process is that rational decisions guide an individual to adopt a new idea or technique. Individuals may try a new practice on a relatively small scale before adoption. For example, pesticide applicators may seek to reduce economic risk before the final decision to adopt a BMP.

One advantage to “stage identification” in the adoption of new practices is the possibility of detecting the “drop-out” rate during the adoption process. This refers to pesticide applicators or users who leave the process somewhere between the stages of awareness and final adoption. If sufficient resources allow, the MDA will attempt to monitor and quantify the transition from awareness to adoption of BMPs.

The overall “drop-out” rate can be estimated by finding the difference in percentages between those pesticide applicators who reported being aware of the existence of the practice and those who actually adopted it. This would be accomplished by comparing the number of pesticide applicators who are aware of specific BMPs with the number who have used a practice for two consecutive years.

It is the responsibility of the MDA, in cooperation with other groups, to determine the rate at which BMPs are being adopted.

The MDA should measure the rate of adoption after a promotional campaign has been underway for at least two years. An increase in the percentage of awareness and adoption and a decrease in the drop-out rate are indicators that the BMPs are being adopted.

BMP adoption should be evaluated on an ongoing basis so that promotional methods can be modified as necessary. Measuring the rate of awareness will indicate the effectiveness of a promotional campaign. If a low rate of adoption or a high rate of “drop out” is found, the BMP should be evaluated to determine the difficulty of adoption or if the cost of adoption is too high in relation to the potential return. If one or both of these reasons are found to be the cause then the BMP may need to be modified so that it is more adoptable by applicators.

The following methods for evaluation of BMP adoption rates can be used statewide, regionally, or locally. Movement from one level of adoption to another depends upon the scale and severity of the problem that is identified through evaluation. The following methods can be used individually or in concert.

□ Field Audit

The MDA is mandated to conduct field audits. Minn. Stat. § 103H.151 subd. 4. [Evaluation] reads:

The commissioners of agriculture and the pollution control agency shall, through field audits and other appropriate means, monitor the use and effectiveness of best management practices developed and promoted under this section. The information collected must be submitted to the environmental quality board, which must include the information in the report required in section 103A.43, paragraph (d).

As field audits for pesticides are defined, the MDA will examine the DNR field audit system as a model. The MDA has previously conducted field-by-field analysis for nutrient management (see FANMAP below). These efforts will be evaluated for potential use as a pesticide field audit process.

□ Mail Survey

A statistically designed, BMP adoption mail survey can be used prior to the initiation of BMP promotion and again at the end of a designated time period. Such a survey would indicate a change in

adoption rate over time and the percent of pesticide users using BMPs both before and after implementation.

It is recommended that pesticide use surveys be designed to ask questions regarding rate, timing, form of pesticide applications, and current BMP use. The answers would be translated to reflect whether BMPs are being adopted. This design ensures greater accuracy than asking questions directly on adoption of specific BMPs.

□ Applicator and Dealer Surveys

Private applicators, commercial applicators, dealers and other pesticide applicators could be surveyed on awareness and implementation of BMPs. For licensed and certified applicators, surveys could occur at certification and licensing training programs administered by the MDA and the UME. Testing, required as a condition for certification for applicators of Restricted Use Pesticides, can also be used as an opportunity to survey this segment of pesticide applicators. Statistically defensible surveys may also be conducted through the Minnesota Agricultural Statistics Service. Other pesticide applicators might be surveyed in cooperation with retail outlets that sell pesticides, lake or landowner associations, conservation groups, parks and recreation personnel, or through other means. Aquatic pesticide users might be surveyed through the DNR permitting process.

□ Direct Interviews Including FANMAP

Extension educators, pesticide applicators and pesticide dealers, randomly selected as being representative of a region or local area, can be interviewed on adoption of BMPs. This information would supplement the survey data and would be more readily available. Results could be extrapolated to represent a specific region or the entire state. The current MDA Farm Nutrient Management Assessment Program (FANMAP) is an effective method to evaluate nutrient and pesticide management practices in great detail over a small area and is particularly well suited for evaluating pesticide BMPs. Similar direct interviews can be conducted for pesticide applicators in non-agricultural and urban settings.

□ Focus Groups

Focus groups, led by professionals, can be conducted periodically to assess the degree of BMP adoption and to detect any changes in use trends. Focus groups may not be very effective in measuring rate of adoption, but would be very effective in looking at promotional delivery systems.

Evaluation of Best Management Practices Effectiveness

For groundwater, Minn. Stat. Chapter 103H requires that BMPs must be proven ineffective prior to adoption of WRPRs; therefore, the approach to evaluating BMP effectiveness must be scientifically rigorous and technically and legally defensible. Determining the effectiveness of BMPs will be based primarily on a statistical analysis of groundwater monitoring and water quality trends from the MDA monitoring network. Pesticide sales and use data, data on precipitation rates, and climatic, agronomic

or other considerations that might influence rates of pesticide leaching to groundwater will also be considered, although the primary determinant will be the analysis of groundwater monitoring and water quality trends. In addition, field or plot scale studies and computer modeling of pesticide leaching patterns may be used as a tool to evaluate BMP effectiveness and observed groundwater quality trends. Actual monitoring results – the frequency and average concentrations of detections – provide the best foundation for BMP effectiveness evaluation.

It is inappropriate to adopt specific quantitative performance measures or goals for a specific timeframe as a determinant of BMP effectiveness, unless there is a scientific justification for that goal. A natural system such as a local or regional groundwater flow system is highly complex with multiple variables. It may be exceedingly difficult to understand or predict a specific response to one or several changed variables unless a detailed study is performed. An achievable goal might differ in different parts of the state. In addition, there can be significant annual variability in the weather and in pest infestations, either of which could confound a goal or prediction. The MDA would consider the use of modeling tools as a defensible means of determining performance goals for evaluating BMP effectiveness if the tools are supported by actual monitoring data from Minnesota. However, to use a specific performance measure without this type of data may be arbitrary and could not easily be defended or used to justify the development of regulations under Minn. Stat. Chapter 103H.

For surface water, the MDA will evaluate the effectiveness of BMPs using the same high standard of scientific rigor and a generally similar approach as previously described for groundwater. When evaluating pesticide BMPs for surface waters, the emphasis should be on small watershed scale surface water monitoring linked to field surveys of pesticide use and BMP adoption. The MDA is well qualified for this type of evaluation; however, it is highly resource intensive. The MDA will conduct surface water BMP evaluations to the extent that resources allow. The MDA also will seek opportunities to evaluate surface water BMPs through field studies, modeling and other cooperative efforts through the University of Minnesota, pesticide registrants and other interested groups in agricultural, non-agricultural, urban and aquatic settings. Scientifically valid data will be considered from all sources including universities, registrants, and other government agencies. As with groundwater, actual monitoring results will provide the best foundation for BMP effectiveness evaluation.

Evaluation of the effectiveness of pesticide management strategies will be the responsibility of the MDA with input from the PMPC. The MDA should develop methods to evaluate the effectiveness of specific pesticide management activities. BMP promotion areas should receive more intensive promotional efforts. If the promotional campaign is effective, the subsequent implementation of BMPs should result in a measurable improvement in water quality. An evaluation strategy should be designed to evaluate the rate of BMP adoption, effectiveness of promotional activities, and water quality. This will include the field audit process.

The MDA has the responsibility to determine BMP effectiveness. Should data submitted to the MDA indicate that a change in BMPs is necessary, the MDA will present the information to the PMPC for comment and, if necessary, re-initiate the BMP development process.

Pesticide Use Data

Under Minn. Stat. §18B.064, the MDA is required to monitor urban and rural pesticide use on a biennial basis. Pesticide use data is useful when reviewing and evaluating water monitoring trends. MDA's approach to collecting this data will be reviewed by the PMPC. Current activities and methods for evaluating pesticide use are outlined in PMP (Chapter 3 – Minnesota's Natural Setting, Pesticide Use Patterns and Information Sources).

CHAPTER 10

Mitigation

Introduction

The purpose of mitigation is to implement voluntary practices to reduce or eliminate the movement of pesticides to Minnesota's water resources. Mitigation of the contamination of ground or surface water from the normal use of pesticides will be comprised of several activities. If the implementation of voluntary practices is ineffective over time, the Minnesota Department of Agriculture (MDA) may implement mandatory practices through rule development, product label changes or state restrictions on registration.

Mitigation Actions

Develop and implement actions to mitigate the potential for deleterious effects of specific pesticides determined to be a common detection for groundwater or a surface water pesticide of concern.

Pesticide-specific Best Management Practices (BMPs) developed

Educational materials developed and BMPs promoted

BMP adoption and effectiveness is evaluated

Water Resource Protection Requirements (WRPRs) or other enforceable actions considered

Registration restrictions may be considered

Analysis of the benefit of registration may be conducted

Rules promulgated for WRPRs or other actions taken

WRPRs or other actions are enforced

Mitigation activities of the Pesticide Management Plan (PMP) will be initiated by the MDA for a specific pesticide upon the determination of common detection in groundwater or of a surface water pesticide of concern. These activities will be ongoing until the status of the pesticide is formally changed. Management efforts for pesticides with similar characteristics such as similar modes of action or which are applied to the same crops may be coordinated.

Management of the pesticide will be conducted in accordance with this chapter of the PMP by the MDA. The decision-making process provides for formal comment from the PMPC (see Chapter 9 – Evaluation) and the participation of other subject matter experts as requested by the MDA. Technical assistance from knowledgeable individuals representing involved constituencies is imperative for success.

The MDA will not develop a pesticide-specific state management plan (SMP) unless required by the U.S. Environmental Protection Agency (EPA) (see Chapter 2 – Minnesota’s Philosophy, Goals and Approaches for Preventing Water Resource Degradation) because it would generally replicate what is currently provided for in the PMP. When necessary for a specific decision, the MDA will prepare an analysis and summary of alternatives for action. These documents would be highly flexible to fit the specific situation, and would include the information needed to select, plan and begin the implementation of a specific action.

The rest of this chapter outlines specific mitigation steps including: the mitigation goal; mitigation approach; recommended actions to accomplish the mitigation goal; descriptions of responses to instances of contamination; and the process for determining the need for and for developing water resource protection requirements or other mandatory and enforceable restrictions on pesticide use.

Goal, Approaches and Recommended Actions

□ Mitigation Goal

The mitigation goal of the PMP is to reduce or eliminate continued movement of pesticides or pesticide breakdown products to groundwater and surface water.

□ Mitigation Approach

The mitigation goal of the PMP will be accomplished by:

1. intensifying and targeting education and outreach (preventative) efforts; refining existing Best Management Practices (BMPs), incentives or regulatory options; and considering the cost versus benefit and technical feasibility of mitigation measures; and
2. if necessary, exercising regulatory authority through mandatory use changes by adoption of water resource protection requirements or the restriction or cancellation of product registration.

□ Recommended Actions to Accomplish Mitigation Goal

Mitigation activities begin when the pesticide is determined by the commissioner of agriculture to be commonly detected in groundwater or a surface water pesticide of concern (see Chapter 9 – Evaluation).

1. Pesticide-specific BMPs are developed (see Chapter 8 – Prevention)
2. Educational materials are developed and promoted by the BMP Education and Promotion Team (see Chapter 8 – Prevention)
3. Groundwater and surface water monitoring are evaluated to determine BMP effectiveness. BMP adoption data are reviewed.

4. For groundwater, if BMPs are proven ineffective, and further refinement of the BMPs is determined to not be feasible or appropriate, then water resource protection requirements (WRPRs) or other enforceable actions are considered.
5. For surface waters, the MDA will actively support the MPCA's process for determining impaired waters and development of TMDLs. The commissioner may impose restrictions on product registration or a registrant may voluntarily propose label changes or restrictions.
6. An analysis of the benefit of registration of the pesticide to Minnesota agriculture in relation to measured or predicted environmental impacts may be conducted.
7. Rules promulgated for WRPRs or other enforceable action is taken.
8. Enforcement as required.

Pesticide-specific BMPs: Development; Education and Outreach; and Evaluation

Mitigation activities begin when the pesticide is determined by the commissioner of agriculture to be a common detection in groundwater or a surface water pesticide of concern. These decisions are described in PMP Chapter 9 - Evaluation. Following this determination, pesticide-specific BMPs and educational materials are developed, and the BMPs are promoted, in accordance with guidance outlined in PMP Chapter 8 - Prevention. BMP rates of adoption and effectiveness will be evaluated annually beginning three years (three spring planting or landscape management seasons) for groundwater, and two years (two spring planting or landscape management seasons) for surface water, from the date of adoption of pesticide-specific BMPs. This provides a reasonable minimum time for changes in practices to be adopted and to be observed in groundwater or surface water monitoring. Evaluating BMP adoption and effectiveness is described in PMP Chapter 9 - Evaluation.

Regulatory Options for Groundwater

□ Statutory Authority for Water Resource Protection Requirements

The MDA will initiate a prevention, evaluation and mitigation program to protect Minnesota water resources through voluntary action, and may utilize a regulatory approach in the event that voluntary action is ineffective (for prevention and evaluation components, see Chapters 8 & 9, respectively). The framework for this philosophy was established by the Groundwater Protection Act of 1989, which directed that WRPRs may be promulgated by rule of the MDA if voluntary BMPs are proven to be ineffective.

Minn. Stat. § 103H.005, subd. 15. states that WRPRs:

are requirements, adopted by rule for one or more pollutants, intended to prevent and minimize pollution of groundwater. Water resource protection requirements include design criteria, standards, operation and maintenance procedures, practices to prevent releases, spills, leaks, and incidents, restrictions on use practices; and treatment requirements.

Minn. Stat. § 103H.275, subd. 1. states that for areas where groundwater pollution is detected:

(a) If groundwater pollution is detected, a state agency or political subdivision that regulates an activity causing or potentially causing a contribution to the pollution identified shall promote implementation of best management practices to prevent or minimize the source of pollution to the extent practicable.

(b) The Pollution Control Agency, or for agricultural chemicals and practices, the commissioner of agriculture may adopt water source protection requirements under subdivision 2 that are consistent with the goal of section 103H.001 and are commensurate with the groundwater pollution if the implementation of best management practices has proven to be ineffective.

(c) The water resources protection requirements must be:

- (1) designed to prevent and minimize the pollution to the extent practicable;*
- (2) designed to prevent the pollution from exceeding the health risk limits; and*
- (3) submitted to the House of Representatives and Senate committees with jurisdiction over the environment, natural resources, and agriculture.*

Minn. Stat. § 103H.275, subd. 2. states that:

(a) The Pollution Control Agency, or for agricultural chemicals and practices, the commissioner of agriculture shall adopt by rule water resource protection requirements that are consistent with the goal of section 103H.001 to prevent and minimize the pollution to the extent practicable. The proposed rule must be submitted to the house of representatives and senate committees with jurisdiction over the environment, natural resources, and agriculture before adoption. The water resource protection requirements must be based on the use and effectiveness of best management practices, the product use and practices contributing to the pollution detected, economic factors, availability, technical feasibility, implementability, and effectiveness. The water resource protection requirements may be adopted for one or more pollutants or a similar class of pollutants...

(b) Before the water resource protection requirements are adopted, the Pollution Control Agency or the commissioner of agriculture for agricultural chemicals and practices must notify affected persons and businesses for comments and input in developing the water resource protection requirements.

(c) Unless water resource protection requirements are to cover the entire state, the water resource protection requirements are only effective in areas designated by the commissioner of the Pollution Control Agency by order or for agricultural chemicals and practices in areas designated

by the commissioner of agriculture by order. The procedures for issuing the order and the effective date of the order must be included in the water resource protection requirements rule.

(d) The water resource protection requirements rule must contain procedures for notice to be given to persons affected by the rule and order of the commissioner. The procedures may include notice by publication, personal service, and other appropriate methods to inform affected persons of the rule and commissioner's order.

(e) A person who is subject to a water resource protection requirement may apply to the Pollution Control Agency, or for agricultural chemicals and practices the commissioner of agriculture, and suggest an alternative protection requirement. Within 60 days after receipt, the agency or commissioner of agriculture must approve or deny the request. If the Pollution Control Agency or commissioner of agriculture approves the request, an order must be issued approving the alternative protection requirement.

(f) A person who violates a water resource protection requirement relating to pollutants, other than agricultural chemicals, is subject to the penalties for violating a rule adopted under chapter 116. A person who violates a water resource protection requirement relating to agricultural chemicals and practices is subject to the penalties for violating a rule adopted under chapter 18D.

□ Need for Water Resource Protection Requirements

The MDA will follow an approach to regulation of the use of pesticides to protect groundwater that conforms to the Minnesota Groundwater Protection Act and the Minnesota Pesticide Control Law. This section of the PMP will outline the circumstances under which regulations may be adopted. The approach to evaluating BMP adoption and effectiveness is outlined in PMP Chapter 9 - Evaluation.

The following are the key elements from Minn. Stat. § 103H.275 regarding the adoption by rule of WRPRs to protect groundwater:

1. WRPRs may only be adopted if BMPs are proven to be ineffective;
2. WRPRs must be commensurate (proportional) with the groundwater pollution;
3. WRPRs must be consistent with the degradation prevention goal of the Groundwater Protection Act, and be designed to prevent and minimize the pollution to the extent practicable;
4. WRPRs must be designed to prevent the pollution from exceeding health risk limits; and
5. WRPRs must be based on –
 - a. use and effectiveness of BMPs
 - b. the product use and practices contributing to the pollution detected
 - c. economic factors
 - d. availability
 - e. technical feasibility
 - f. implementability
 - g. effectiveness

Based on these statutory requirements, the following is general guidance that will be used by the MDA when evaluating the need for proposed adoption of WRPRs by rule:

1. WRPRs cannot be adopted unless BMPs are proven to be ineffective.
2. If the BMPs are proven to be ineffective, the commissioner may adopt WRPRs.
3. WRPRs may be adopted by the commissioner if:
 - a. BMPs are proven to be ineffective; and
 - b. the commissioner determines that regulatory action is required because of significant or widespread exceedances of the HRLs.
4. WRPRs may be adopted by the commissioner if:
 - a. BMPs are proven to be ineffective;
 - b. the BMPs are not widely used; and
 - c. one of the following conditions exist:
 - i. the pollution exceeds, or is at risk of exceeding, the HRLs; or
 - ii. the WRPRs would be commensurate with the groundwater pollution.
5. WRPRs may not be required if another suitable regulatory option, such as a comparable and enforceable change in label use requirements, is adopted.
6. If the BMPs are, or appear to be, ineffective, and BMP adoption data supports that the BMPs are being adopted, then the BMPs should be revised.
7. While prevention of groundwater degradation (i.e., zero pollution) is a goal of the act, it is not a requirement. The act repeatedly uses the term “*to the extent practicable*” and directs the MDA to recognize potential limitations to achieving non-degradation, and that non-degradation may not in some circumstances be practicably achievable. This is further emphasized by the requirement that WRPRs must be commensurate (proportional) with the groundwater pollution.
8. If successful, the BMPs will provide for the minimum amount of pesticide to be used for the pesticide to be effective, though at a rate sufficient to suppress the development of pesticide resistance in weeds or other target organisms, with consideration for methods of use, other products, Integrated Pest and Weed Management, and non-chemical means of control. It is possible that some contamination of groundwater at concentrations below the HRLs, will occur. Under the Groundwater Protection Act, it is recognized that for some human activities the degradation prevention goal cannot be practicably achieved; however, pollution should be prevented and minimized to the extent practicable.
9. The act directs similar goals and considerations for the development of both BMPs and WRPRs. Both are intended to prevent and minimize pollution to the extent practicable in consideration of several specific and similar criteria. Therefore, if required, WRPRs should be similar to the BMPs. A WRPR may provide more detailed guidance than that described in a voluntary BMP, and include, when appropriate, minor uses of a pesticide and uses for rescue treatments.

Regulatory Options for Surface Water

The MDA has general authority to take regulatory actions to prevent unreasonable adverse effects on the environment which includes protection of surface waters. However, the lead agency responsible for regulation to protect surface waters is the Minnesota Pollution Control Agency (MPCA). The MPCA's primary mechanism to address non-point source contamination in surface waters is declaring waters impaired under section 303(d) of the federal Clean Water Act due to the exceedance of a numerical standard, narrative standard, or due to a concern with a water body's biological integrity.

The Minnesota Department of Natural Resources (DNR) is responsible for the implementation of Minn. Rules Chapter 6280 relating to management of aquatic plants growing in public waters and aquatic animals that cause nuisance or health concerns. The DNR's Aquatic Plant Management Program protects aquatic plant habitat from unnecessary harm while allowing lakeshore homeowners to control some aquatic vegetation for water access. Bay-wide or lake-wide permits for aquatic use pesticides are issued to improve the quality of the aquatic environment. The use of pesticides in protected lakes, rivers or wetlands requires a DNR permit. The DNR's program also includes an effort directed at pesticide enforcement, with aquatic pesticide enforcement specialists supervising herbicide treatments and investigating reports of the misuse of pesticides in lakes or the unlawful destruction of aquatic vegetation. Additional regulatory actions could include limiting or refusing issuance of permits, modifications to aquatic pesticide use labels, or referral of water bodies to the MPCA to address impairments under the Clean Water Act.

As noted in Chapter 9 – Evaluation, the MDA will monitor surface waters in Minnesota, and will develop and promote pesticide voluntary BMPs with the goal of preventing water bodies from becoming impaired from currently registered pesticides. The MDA will make a determination that a pesticide is a surface water pesticide of concern as a preliminary step leading to developing pesticide-specific BMPs to protect surface waters. The MDA also will actively support the MPCA's process for determining impaired waters and development of TMDLs.

The MDA is not authorized by law to take a regulatory action to protect surface waters unless the action is needed to prevent an unreasonable adverse effect on the environment, as defined in Minn. Stat. Chapter 18B. Using the process outlined under "Pesticide Registration" in Chapter 4 of this plan, the MDA will annually review pesticides that have been determined to be a surface water pesticide of concern for their potential to cause unreasonable adverse effects on the environment and, if necessary will consider regulatory options under Minn. Stat. Chapter 18B.

Registration and the Authority to Prevent Unreasonable Adverse Effects

In addition to the development of WRPRs as a tool to mitigate adverse effects on groundwater resources, the commissioner of agriculture can also exercise authority under Minn. Stat. § 18B.26 regarding restrictions on registration to protect the quality of groundwater and surface water. All

pesticides sold in Minnesota are required to be registered by the MDA. The MDA can prohibit the sale of products by refusing to register the pesticide.

In addition to the previously mentioned groundwater and surface water protection activities, Minn. Stat. § 18B.26 subd. 5. addresses review and registration of pesticides:

(a) The commissioner may not deny the registration of a pesticide because the commissioner determines the pesticide is not essential.

(b) The commissioner shall review each application and may approve, deny, or cancel the registration of any pesticide. 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.

(c) The commissioner must notify the applicant of the approval, denial, cancellation, state use or distribution restrictions.

(d) The applicant may request a hearing on any adverse action of the commissioner within 30 days after being notified.

(e) The commissioner may exempt pesticides that have been deregulated or classified as minimum risk by the United States Environmental Protection Agency from the requirement of registration.

Unreasonable adverse effects on the environment are defined in Minn. Stat. § 18B.01, subd. 31.:

“Unreasonable adverse effects on the environment” means any unreasonable risk to humans or the environment, taking into account the economic, social, and environmental costs and benefits of the use of any pesticide.

The commissioner of agriculture may impose restrictions on product registration anytime there is a determination that a restriction is necessary to prevent unreasonable adverse effects on the environment. A registrant may also voluntarily propose label changes or restrictions if they feel they are needed.

During its annual review of monitoring data, the MDA will consider restrictions on products as a condition for registration.

The following considerations will guide decisions on how the annual review of monitoring data might be used to restrict pesticide use in conjunction with product registration using the authorities of Minn. Stat. § 18B.26 to prevent unreasonable adverse effects on the environment.

1. Use restrictions may be imposed on “common detection” pesticides in groundwater and on surface water pesticides of concern.
2. Use restrictions may be imposed on pesticides that, based on other factors, might require MDA action to prevent unreasonable adverse effects on the environment (e.g., a significant change in the drinking water or surface water standards resulting in an immediate need for registration review and possible use restrictions).

3. MDA staff would conduct any initial registration reviews on products for which use restrictions are being considered. Relevant information on water quality risk, benefit of use, and alternative pest management practices may be sought by the MDA through consultations with various stakeholders, including:
 - a. The EPA;
 - b. The MDH;
 - c. The MPCA;
 - d. The DNR;
 - e. University of Minnesota Extension;
 - f. Pesticide registrants;
 - g. Farmers;
 - h. Farm Organizations;
 - i. Environmental Organizations;
 - j. The Board of Soil and Water Resources;
 - k. Soil and Water Conservation Districts
 - l. Watershed Districts; and
 - m. Other interested parties.

4. The MDA may impose as a condition of registration restrictions on the use of a pesticide (e.g., restrictions on timing, rate, crop, landscape setting, lake management concerns, depth to groundwater, or other use criteria).

In situations where the MDA takes action to restrict the use of a pesticide because it has been determined to pose an unreasonable adverse effect on the environment, the commissioner will notify the pesticide registrant(s) of the action. The registrant(s) will then have 30 days to request a hearing as provided for in Minn. Stat. § 18B.26 subd. 5 (d).

Analysis of the Benefit of Registration

Prior to implementing an enforceable option such as WRPRs to protect groundwater, or restrictions under MDA's general authorities to prevent unreasonable adverse effects on the environment to groundwater or surface water, the commissioner of agriculture may determine that an analysis of the benefit of registration of the pesticide to Minnesota agriculture in relation to measured or predicted human health or environmental impacts is necessary. The purpose of this analysis is to determine whether the product should be registered for use in Minnesota. That is, whether continued use of the pesticide provides sufficient balance between the benefits to Minnesota and the risks to human health and the environment due to water quality impacts.

If the analysis reveals that the potential water quality risks outweigh the benefits of use, the commissioner may choose not to register a pesticide.

Mitigation Decision Process

Mitigation-related decisions will use the same process for decision-making as outlined in the evaluation chapter. This process includes consultation with the PMPC prior to major preliminary decisions by the commissioner and public notice, by means of both the MDA pesticide non-point list server and through the state register, prior to final decisions.

□ Enforcement

The Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) expressly authorizes the State to regulate the sale or use of pesticides, so long as the State regulation does not permit any sale or use prohibited by FIFRA. In addition, FIFRA gives the State primary enforcement authority for pesticide use violations if the EPA determines that the State has adopted adequate laws and has adequate enforcement procedures. Minnesota has such authority.

The legislature, in 1987 amended Minn. Stat. Chapter 18B, authorizing additional procedures and authorities to the MDA for pesticide enforcement, including authority to proceed civilly. The MDA has extensive authority and experience in issuing various kinds of orders to remedy violations. State regulation of pesticides is accomplished under Minn. Stat. Chapters 18B and 18D. Minn. Stat. Chapter 18E provides for reimbursement of costs associated with the cleanup of agricultural chemical incidents.

Minn. Stat. Chapter 18B sets forth state requirements for pesticide registration, pesticide use and misuse, applicator licensing, and record keeping. Minn. Stat. Chapter 18D provides for the cleanup of sites contaminated by pesticides, the ability to administer civil and criminal penalties, and the assignment of liability for contaminated sites. Minn. Stat. Chapter 18E provides for reimbursement of costs associated with the cleanup of agricultural chemical incidents.

The MDA typically uses written warnings and remedial or corrective action orders to administratively enforce its regulations. A stepped approach is utilized to determine the appropriate level of enforcement action and remedy. The following is a brief description of the most commonly used administrative remedies:

1. Advisory Notices or Notices of Violation are issued to persons when evidence indicates that documented deficiencies represent minor non-compliance with regulatory requirements.
2. Remedial or Corrective Action Orders with schedules of compliance and potential administrative penalties.
3. Civil enforcement authority for serious or repeated violations of Minn. Stat. Chapters 18B & 18D, or rules adopted thereunder.

The MDA has developed a procedure preceding civil action: the Notice of Intent-Enforcement Action. This action is essentially a Notice of Violation, with an introduction of authority, a recitation of facts, a listing of alleged violations, a description of the MDA's intent to file a civil suit within a fixed period of time, an offered settlement opportunity with specified proposed penalty, proposed remedies and effect of settlement, and an opportunity for submission of additional information. If a person wishes to close the matter in the manner described, an acknowledgment of violation is requested and necessary.

Appendix A

Roles and Responsibilities

The State of Minnesota has resources and technical staff that allow it to implement much of the Pesticide Management Plan (PMP). This appendix details the roles, responsibilities, and resources of state agencies available for implementation of the PMP. For additional information, see also Chapter 4 – Coordination and Public Involvement; Roles and Responsibilities.

I. Minnesota Department of Agriculture (MDA)

A. Roles and Responsibilities

1. Develop a PMP in coordination with other state agencies, interest groups and the public.
2. Develop generic (core) Best Management Practices (BMPs).
3. Conduct water resource monitoring.
4. Establish pesticide management areas and monitoring regions to help promote and evaluate BMPs.
5. Track monitoring well locations, pesticides detected and concentration data in a comprehensive database.
6. Assign staff to the implementation of the PMP.
7. Develop pesticide-specific BMPs based on determinations of common detection in groundwater and surface water pesticide of concern.
8. If BMPs are proven ineffective, consider adopting rules or other regulatory restrictions on pesticide use or management.
9. Measure BMP adoption rates.
10. Establish programs in Integrated Pest and Weed Management
11. Seek PMP concurrence by the Environmental Protection Agency.

B. Resources

1. The MDA funds the PMP through several funding sources. The major sources are discussed below.
 - a) The MDA and the Environmental Protection Agency (EPA) participate in the “Consolidated Pesticide Cooperative Agreement” which provides funding to the MDA in five principal areas: Pesticide Enforcement, Applicator Certification, Ground Water Protection, Worker Protection, and Endangered Species Protection.
 - b) Other revenue sources include:
 - (1) Registration fees on products (pesticides).
 - (2) Certification and licensing fees.
 - (3) Permit programs.
 - (4) Surcharges.

C. Technical Expertise

Through its various divisions and associated professional staff, the MDA is capable of implementing PMP management, technical and analytical components.

1. Personnel classifications include:
 - a) Agricultural Advisors and Consultants
 - b) Soil Scientists
 - c) Hydrogeologists
 - d) Analytical Laboratory Analysts
 - e) Environmental Chemists
2. Laboratory capabilities include:
 - a) Analyses of food samples for residue pesticides.
 - b) Analysis of groundwater and surface water for pesticides and other industrial contaminants that pose an environmental concern.
 - c) Analysis of soils for high level contamination as a result of spills and poor pesticide management.
 - d) Sample extraction, concentration and analysis, and gas chromatography when analyzing for pesticides in water at trace levels.
 - e) The laboratory also provides other services including a soils laboratory, formulation analysis, liquid chromatography, food section, water residue analysis, and gas chromatography/Mass spectrometry.

II. Minnesota Department of Health (MDH)

A. Roles and Responsibilities

1. Participate in development of the PMP.
2. Participate in the Pesticide Management Plan Committee in the review of information related to the prevention, evaluation and mitigation of occurrences of pesticides and pesticide breakdown products in water resources.
3. Adopt through rule-making Health Risk Limits (HRLs) for groundwater pollutants.
4. Establish a Wellhead Protection program to protect public drinking water supplies, and incorporate pesticide management strategies into protection programs.
5. Implement EPA Safe Drinking Water Act rules pertaining to pesticide monitoring and maximum contaminant levels and share related information with the MDA.

B. Financial Resources

MDH monitoring for pesticides at community and nontransient noncommunity public water systems is funded through a service connection fee (general fund) and the federal Safe Drinking Water Act. The MDH's development of HRLs is funded through the state general fund. Other funding comes through Sections 106 and 319 of the federal Safe Drinking Water Act, the state general fund, and well notification fees.

C. Technical Expertise

The MDH employs toxicologists, hydrogeologists and planners to support its roles and responsibilities.

III. Minnesota Pollution Control Agency (MPCA)

A. Roles and Responsibilities

1. Participate in development of the PMP.
2. Participate in the Pesticide Management Plan Committee in the review of information related to the prevention, evaluation and mitigation of occurrences of pesticides and pesticide breakdown products in water resources.
3. Develop relationships and procedures needed to generate indicators for the Non-point Source Management Plan [federal Clean Water Act Section 305 (b)] report.
4. Develop procedures and standards to assess water bodies for impairment and Total Maximum Daily Load (TMDL) assessment under federal Clean Water Act Section 303 (d).
5. Provide Section 319 Grant funding to the MDA for development and dissemination of BMP information and materials, BMP demonstration projects, and BMP evaluation of use and effectiveness.

B. Financial Resources

The MPCA receives funding for its various roles in water quality protection, including its participation in the PMP, through the state general and dedicated funds, the federal Clean Water Act and other sources.

C. Technical Expertise

The MPCA employs toxicologists, hydrogeologists and pollution control specialists to support its roles and responsibilities.

IV. Board of Water and Soil Resources (BWSR)

A. Roles and Responsibilities

1. Participate in the development of the PMP.
2. Assist with generating compatibility and coordination between the PMP and comprehensive local water plans.

V. Minnesota Department of Natural Resources (DNR)

A. Roles and Responsibilities

1. Participate in development of the PMP.
2. Participate in the Pesticide Management Plan Committee in the review of information related to the prevention, evaluation and mitigation of occurrences of pesticides and pesticide breakdown products in water resources.
3. Develop groundwater sensitivity assessments.
4. Monitor water withdrawal and water level change.
5. Conduct hydrogeologic studies.
6. Systematic mapping of counties in collaboration with the Minnesota Geological Survey and publish County Geologic Atlases.

7. Continue mapping of regional areas and publication of the Regional Hydrogeologic Assessments.
8. Monitor and report precipitation amounts across the state and interpret their statistical frequency.
9. Manage water resources development consistent with resource capabilities.

VI. University of Minnesota (U of M)

Technical expertise is available at the U. of M., and the applied research efforts of technical experts is important to the development of educational programs specifically dealing with water quality and BMP issues. The U. of M. can support PMP activities and BMP development, in keeping with the University's mission, while assisting with funding and staff when available and appropriate. Research agendas of the U. of M. have many areas that overlap with the developing needs of the MDA and water quality protection and should be pursued with appropriate support for research and education.

A. Roles and Responsibilities

1. Participate in development of the PMP.
2. Participate in the Pesticide Management Plan Committee in the review of information related to the prevention, evaluation and mitigation of occurrences of pesticides and pesticide breakdown products in water resources.

B. Technical Expertise

1. University of Minnesota Extension has established diverse educational and technical expertise with programs addressing issues related to pesticides and water quality, environment, environmental health, and agricultural education through integrated pest management, pesticide applicator training, waste management, and water quality programs. Additional related educational activities are provided by University faculty with extension appointments (such as pest management, equipment, etc.) in many departments throughout the College of Agriculture as well as the Colleges of Human Ecology and Natural Resources. Other parts of the University also are involved with water quality research and other efforts.

The College of Agriculture, Food and Environmental Science at the U. of M. has experts on staff in most areas of pest management and pesticide behavior. These individuals can be consulted by the MDA and contribute to the development and evaluation of the PMP.

Appendix B

Records and Reporting

Documentation of Minnesota's Pesticide Management Plan (PMP) activities not only provides a source of data to share with the Environmental Protection Agency (EPA), other involved federal and state agencies, and the many stakeholders of the Minnesota Department of Agriculture (MDA), but also provides a basis with which to assess the implementation and effectiveness of Minnesota's prevention, evaluation and mitigation response activities.

The MDA will maintain all records relating to the development and implementation of the PMP for a period of at least six years. This information will include, but is not limited to, records on any monitoring or sampling collected, results of analyses, issuance of permits, types and numbers of enforcement actions taken, records of any site-specific regulatory actions, and administrative actions. The MDA commits that it will make available to the EPA, upon request, any and all records related to the development or implementation of the PMP.

The MDA either produces or receives PMP-related reports, and will compile appropriate reports and provide them to EPA on a periodic basis. Related reports include, but are not limited to, the following:

1. A biennial PMP report required under Minn. Stat. § 18B.045.
2. Annual and mid-year MDA reports to EPA under the "Consolidated Pesticide Cooperative Agreement."
3. MDA's contribution to the state Groundwater Monitoring Status Report, assembled by the Minnesota Pollution Control Agency.
4. Pesticide-related chapters from the Minnesota's Non-Point Source Management Plan to EPA (a requirement for continued state receipt of Clean Water Act funding), assembled by the Minnesota Pollution Control Agency.
5. The MDA annual groundwater and surface water monitoring report.
6. Occasional relevant reporting conducted outside of the above-referenced reports, covering issues such as: state, regional or local pesticide use, pesticide practices, watershed monitoring, etc.