



Source Water Protection Practices Bulletin

Managing Large-Scale Application of Pesticides to Prevent Contamination of Drinking Water

Pesticides (including insecticides, herbicides, and fungicides) contain a variety of chemicals used to control pests, insects, and weeds. They are used in a variety of applications to reduce the damage to plants by insects and other pests, and to control overgrowth of undesirable plant species. This fact sheet describes measures to prevent the contamination of drinking water sources from large-scale pesticide application for agricultural use. Prevention measures for small-scale pesticide application (e.g., on lawns, schools, golf courses, and parks) are addressed in a separate fact sheet.

SOURCES OF PESTICIDES

Pesticides are applied to crops by aerial spraying, topsoil application (granular, dust or liquid formulations, or spray using truck or tractor-mounted equipment), soil injection, soil incorporation, or irrigation. Aerial spraying and topsoil application pose the greatest risks for pesticides to enter surface water bodies from runoff. Soil injection and incorporation pose the greatest likelihood for ground water contamination because pesticides placed in the soil are subject to leaching. The application of pesticides through irrigation (chemigation) can also cause ground water contamination; for example, an irrigation pump may fail while the pesticide-metering equipment continues to operate and cause highly concentrated pesticide levels to be applied to a field. Pesticides can reach ground water through drains, sink holes, and other conduits as well.



Excess rain or irrigation water can wash pesticides from plants and soil. This can, in turn, run off into streams. Pesticides can leach into the soil if plants are watered or rainfall occurs soon after application. Some pesticides resist degradation by microbes in the soil and will eventually leach into the ground water.

WHY IS IT IMPORTANT TO MANAGE PESTICIDES NEAR THE SOURCES OF YOUR DRINKING WATER?

Pesticides contain a variety of organic and inorganic compounds. By nature, they are poisonous, and while they can be safely used if manufacturers' usage directions are followed, they can, if mismanaged, seep into surface water and ground water supplies. They can be difficult and expensive to remove, and, if inhaled or consumed, be hazardous to human health.

The synthetic organic chemicals in pesticides have been linked to serious health problems including cancer, liver and kidney damage, reproductive difficulties, and nervous system effects.

Once a water supply becomes contaminated with a pesticide, treating it can be very difficult and costly. Treating the water supply is a lengthy process and is not always successful. Using an alternative water source may also be costly and impractical. For example, it would be very expensive to connect to another public water system, and drilling new wells does not necessarily guarantee that the new ground water source will not be contaminated.

AVAILABLE PREVENTION MEASURES TO ADDRESS PESTICIDES

Prevention measures are available to protect source waters from pesticide contamination. They range from simple, common sense housekeeping activities to more complex activities such as constructing storage facilities. The most effective pesticide prevention measures encompass both simple and complex practices to reduce the potential for pesticides to move into source waters. The prevention measures can be divided into those that protect surface water from pesticide runoff and those that protect ground water from leaching or percolation.

Please keep in mind that individual prevention measures may or may not be adequate to prevent contamination of source waters. Most likely, individual measures should be combined in an overall prevention approach that considers the nature of the potential source of contamination, the purpose, cost, operational, and maintenance requirements of the measures, the vulnerability of the source waters, the public's acceptance of the measures, and the community's desired degree of risk reduction. The following are the more conventional prevention measures used to avoid contamination from pesticides.

Integrated Pest Management (IPM) is the use of all means of pest control (chemical and non-chemical) in a compatible fashion to reduce crop losses. Pesticides are the last line of defense and are used only when pest levels are causing sufficient damage to offset the expense of the application.



Alfalfa pest

IPM includes **regular field scouting** or monitoring to check levels of pest populations and their damage to determine management needs, be it pesticide application or other

management actions. Scouting can be accomplished by a trained farmer or a crop consultant. IPM also includes **non-chemical control measures** such as mechanical, cultural and biological controls, sanitation, and pest-resistant plants are highly recommended. Wherever possible, it is preferable to use

crop rotation, select **resistant plant varieties**, clean tractors and combines thoroughly between fields to reduce weed seed introductions, and use cultivation to control weeds. Efforts should be made to maximize the benefits of naturally occurring **biological controls** and use pesticides only when necessary. Many insecticides are broad spectrum materials that also affect beneficial insects and arthropods.



Diorhabda elongata

Proper Pesticide Application

If pesticides must be used, proper handling and application according to the EPA-approved label are essential. Select an effective pesticide for the intended use and, where possible, use products that pose lower human and environmental risks (i.e., low-persistence). Read the pesticide label for guidance on required *setbacks* from water, agricultural drainage wells and tile networks, buildings, wetlands, wildlife habitats, and other sensitive areas where applications are prohibited.

Never start an application if a significant weather event such as rainfall is forecast; the rainfall may cause drift or soil runoff at the application site. Pesticide application just before rainfall or irrigation may result in reduced efficacy if the pesticide is washed off the target crop, resulting in the need to reapply the pesticide.

Ways to Reduce Pesticide Use

Crop rotation reduces pesticide use by breaking up the pest cycle. As crops are rotated, pests such as insects and weeds cannot adapt to the changes in nutrient sources. Insects will move to another location where they can find food. Weeds will become dormant until the right condition returns. Crop rotation also increases crop yields and lowers irrigation and fertilizer cost. **Pesticide rotation** reduces the risk of pesticide-resistant pests. As pesticides are used year after year, pests develop immunities to them, resulting in increased application of pesticides.



Corn - wheat- fallow rotation

Soil incorporation involves placing the pesticide into the top two inches of soil by tillage, where it is less likely to be removed by surface runoff, reducing runoff by as much as two-thirds compared to surface application. **Post-emergence application** is the application of pesticides after the plant emerges from the soil; it requires a much smaller amount of pesticide (as compared to the labeled rate) for the same pest control. Post-emergence application of pesticides should be done during low periods of rainfall; spring or windy conditions may reduce the time available for application.

Early pre-plant application is the application of pesticides before the plant emerges from the soil. This application, using less than the labeled rate, can reduce potential pesticide runoff by up to one-half. When used in early April, pre-plant applications can provide effective control and the applied pesticides will be less vulnerable to spring and early summer runoff. If additional control is needed with a pre-emerge or post-emerge product, **spot treatment** should be practiced.

Split application, with one-half to two-thirds of the pesticide applied prior to planting and one-half to one-third applied at planting, can reduce pesticide runoff by up to one-third. If good



Ultra low-volume pesticides

weed control is achieved with the pre-emergence application, the post application may not be necessary. Wherever feasible, the use of **reduced rates** for pesticide application or **combination products** (containing less toxic chemicals) will also help reduce runoff of the more toxic chemicals. Very low applications of pesticides may not be effective for high weed infestations or very wet springs.

Proper Pesticide Storage and Handling

Pesticide storage is key to preventing ground water contamination. If pesticides are stored in intact containers in a secure, properly constructed location, pesticide storage poses little danger to ground water. You must follow directions for storage on pesticide labels, although the



Pesticide storage tanks

instructions are usually general, such as “Do not contaminate water, food or feed by storage or disposal.” Some States, including Maryland, New Hampshire, North Carolina and Washington, have regulations on the storage of small quantities of pesticides. Nearly half the States have regulations for the storage of large tanks of pesticides. Secondary containment, such as an impermeable (waterproof) floor with a curb and walls around the storage area, will minimize pesticide seepage into the ground or spreading to other areas if a liquid pesticide storage tank leaks. The capacity

of liquid tank secondary containment should be sufficient to contain the volume of the largest tank. Dry pesticides should be protected from precipitation. An operator should always be present when pesticides are being transferred.

Proper mixing and loading practices can also prevent contamination of ground water and surface water by pesticides. Mixing and loading on an impermeable concrete surface allows most spilled pesticides to be recovered and reused. The impermeable surface, or pad, should be kept clean and large enough to hold wash water from the cleaning of equipment, and to keep spills from moving off-site during transfer of chemicals to the sprayer or spreader. Ideally, the pad should slope to a liquid-tight sump that can be pumped out when spills occur.

Spill clean up is another important prevention measure. Dry spills should be promptly swept up and reused. For liquid spills, recover as much of the spill as possible and reuse the pesticide as intended. If a spill involves soil around the mixing pad, it may be desirable to remove some contaminated soil, which can be spread on fields under certain circumstances if allowed by your State pesticide regulatory agency (usually the Department of Agriculture). In addition, clay, sawdust, or cat litter should be available to absorb unrecovered liquid from concrete pads. Finally, an emergency response plan for the site is important – to know where the runoff water will flow, how to handle a particular chemical, and whom to call for help.

Improper **disposal of pesticide containers** can lead to ground water contamination. To prevent ground water contamination, use returnable containers and take them back to the dealer as often as possible. Pressure-rinse or triple-rinse nonreturnable containers immediately after use, since residue can be difficult to remove after it dries, and pour the into the spray tank. Puncture nonreturnable containers and store them in a covered area until they can be taken to a container recycling program or a permitted landfill. Contact the Ag Container Recycling Council at www.acrecycle.org or 877-952-2272 for more on a recycling program near you. Shake out bags, bind or wrap them to minimize dust, and take them to a permitted landfill. Do not bury or burn pesticide containers or bags on private property.

FOR ADDITIONAL INFORMATION

These sources contain information on pesticide management measures. All of the documents listed are available for free on the Internet. Contact local government authorities in your area to see if there are ordinances in place to manage pesticides. You should also contact the Natural Resources Conservation Service (NRCS), Conservation District, and Agricultural Extension Service representatives in your area. They can provide more information on pesticide

management and cost-share programs, such as the Environmental Quality Incentives Program (EQIP), the Conservation Reserve Program (CRP), and the Conservation Reserve Enhancement Program (CREP), to assist in financing source water protection measures.

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