Integrated Vegetation and Pest Management Policy Guidelines

By Hennepin County Environmental Services

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Purpose

The purpose of these guidelines is to offer consistent and constructive advice to Hennepin County Departments and contractors in the development of an environmentally friendly Integrated Vegetation and Pest Management (IPM) program containing general implementation steps as well as specific maintenance standards and IPM strategies. These guidelines offer clarifying information about the IPM approach in general and about specific practices appropriate to road rights-of-way, landscape planning, lawn and landscape plant maintenance, natural open spaces, and structural pest control. It is the intent of these guidelines to serve as the basis of each department's IPM program.

It is also intended that these guidelines will be periodically revised based on new research and implementation experience. Revised editions of these guidelines will be developed and disseminated to participating departments by the Department of Environmental Services' IPM coordinator.

The IPM Approach

The definition of Integrated Vegetation and Pest Management in Section 3 of the Hennepin County Integrated Vegetation and Pest Management Policy provides a basic description of an IPM approach to vegetation and pest management.

Keys to an IPM program include: 1) its integrated nature, involving planning and design of the landscape, facility or roadway, as well as maintenance practices and specific pest control tactics; 2) its preventive nature, emphasizing a wide variety of maintenance practices to promote appropriate and healthy growth; 3) its emphasis on knowledge about the pest and regular monitoring of pest levels as well as evaluation of control methods applied; and 4) use of "management" and "control" approaches in preference to elimination or eradication - except in cases of certain noxious weeds and specific situations where the tolerance threshold may be zero. In general, IPM establishes an approach to manage pest problems within tolerable limits.

The IPM approach encourages planning, design and maintenance of landscapes, rights-of-way and facilities that meet their intended purposes while promoting healthy plants (where appropriate) and minimizing pest problems. The IPM approach follows a continuum that begins with careful planning, design and construction decisions followed by appropriate maintenance and management of public lands and facilities by employees with up-to-date training.

The IPM approach emphasizes a thorough knowledge of the vegetation or pest problem, pre-determined tolerance thresholds, regular monitoring to determine when those levels are met, and treatment of the

vegetation or pest problem with appropriate cultural, mechanical, biological and, where needed, chemical tactics. Tolerance thresholds are set at levels that keep vegetation problems or pest numbers problems low enough to prevent intolerable damage, annoyance or public safety hazards while remaining economically and environmentally feasible.

IPM encompasses the use of chemical controls specifically in situations where they may be the most environmentally responsible or safest way to deal with a problem, or where other control tactics have proven ineffective at meeting tolerance levels. When chemical controls are necessary, decisions on their use will consider any possible effects on human and animal life (toxicity) and any tendencies for the chemical to move in the environment (mobility). Decisions on chemical use are made in conjunction with other control methods that are effective and practical.

A. IPM Program Components:

Planning & Design. A landscape, facility or right-of-way should be planned and designed taking into account parameters that will enhance intended uses of the land and minimize pest problems. Design takes into account such factors as types of uses, soils, grading and slope, water table, drainage, proximity to sensitive areas, selection of vegetation, and vector control issues.

Maintenance for maximum landscape health. Choices of vegetation as well as maintenance practices serve to keep areas as healthy as possible and thus minimize pest problems. Appropriate selection and retention of plants, irrigation, application of mulch, fertilizer, mowing, and other practices all serve to maintain healthy landscapes that withstand pest pressures and support natural predators for pests. A well-selected and maintained landscape reduces, often dramatically, the need for pest control.

Knowing the pest. Identification of pests and knowledge of their life cycles are crucial to proper management. Potential pests should be documented and actual pests carefully identified in order to clearly focus IPM strategies. Building and field staff need the opportunity for training in pest identification and the time to conduct regular assessments.

Determining tolerance thresholds. Tolerance thresholds must be established. They may vary by pest, specific location or type of land use. Weed threshold levels, for example, will be different for rural road right-of-way, pastures, urban building landscapes, golf course greens and road shoulders. Insect or plant disease tolerances will likewise be different depending on uses and/or specific locations.

Three distinct levels may be identified as subsets of threshold determination. The initial Injury Threshold is the level at which some injury is noticeable. The Action Threshold is the level at which action must be taken to prevent a pest population at a specific site from reaching the aesthetic, functional or economic damage. The Damage Threshold is the level where unacceptable damage begins to occur. In most environments, certain levels of pest presence or injury can be accepted. IPM practitioners keep careful track of pests after the injury threshold is crossed so the pests do not get to the point where they can cause enough damage to impact the purpose of the landscape or facility being maintained. When the predetermined action threshold is crossed, interventions are implemented so as to avoid reaching the damage threshold.

There are situations where the threshold level for pests must be set near or at zero. Laws and regulations set the population threshold level at zero for noxious weed species due to potential for economic injury, public health or environmental impact. State and federal regulations may govern rodent and insect pests in building facilities. Safety and infrastructure protection also factor into the determination of very low or zero thresholds in areas such as food preparation areas, termites in building foundations or weeds in cracks along curbs and islands in roadways. Another factor in determining thresholds is the diversity of opinions on the part of facility occupants as to what constitutes "a problem".

Monitoring for pests. Regular monitoring to assess pest level, extent, locations and stage in life cycle is important. Assessment relative to established tolerances is necessary. Field staff needs the opportunity for training in pest monitoring techniques and the time for appropriate monitoring.

Developing IPM plans. Each plan will spell out specific objectives. It will contain guidelines and tolerances for expected pests. It will define tolerance thresholds and include specific management practices for non-chemical as well as chemical controls. The plan should also contain site maps detailing physical and environmental features of managed areas. Location of plants and structures as well as problem areas should be detailed on the map.

Implementing the IPM plan and selected strategies. Well-trained staff should fully implement the strategies selected and record the steps followed and management methods used. Experience in communities with successful IPM programs has shown the need for an IPM coordinator and committee. The coordinator must facilitate and track both the developments of the technical aspects of the program but also provide routine oversight of the program's functions. The committee is usually charged with the approval and evaluation of the key components of the IPM program both before and after implementation.

Monitoring and evaluation. Effectiveness of the IPM method(s) employed will be measured, records kept and an evaluation process conducted in order to regularly assess how well it is working to bring about the desired result(s). Staff needs time allocated for appropriate monitoring and record keeping, as well as opportunities for training and discussion of evaluation processes.

Learning and revision. Results from application of specific IPM strategies as well as the IPM program as a whole should be reviewed regularly and revisions made as appropriate based on experience.

B. Management methods to be incorporated in an IPM approach include:

Cultural. Management activities that prevent pests from developing due to enhancement of desirable vegetation which out-competes or otherwise resists the pests, including but not limited to irrigation, seeding, fertilizing, mulching, pruning and thinning.

Physical or Mechanical. Management activities such as hand removal, baits, traps, sticky boards, barriers (including caulking and steel wool for structural pest control), mowers, brushcutters, blades, hoes, string trimmers, mulch, fabric or other physical means to control pests (including undesirable vegetation).

Biological. Management activities performed using insects, animals, birds, diseases or competing vegetation to control pests (including undesirable vegetation). The County Agricultural Inspector should be notified of any biological control releases for noxious weed control.

Chemical. Management activities performed using chemical agents registered as pesticides by the Minnesota Department of Agriculture. When choosing this management method an attempt should be made to choose materials that are specific to the pest species, used at the lowest effective rate, short lived in the environment, and be least toxic to humans and non-target plants and animals.

C. Record keeping is an important element of an IPM program.

The following are examples of records that will be maintained as part of an IPM program:

IPM program. The department's written IPM program kept on file at each location.

IPM strategies. Site or pest-specific management plans.

Pest identification and assessment. Records of documented pests, including date, specific location, name, reference used for identification and/or corroborating expert (if appropriate), stage of life cycle, extent of pest presence and other pertinent information.

Maintenance. Practices performed to minimize pest populations and enhance healthy plant growth.

Control methods implemented. Control methods employed per the IPM strategy selected, including dates, location and other pertinent information.

Pesticide applications. If chemical methods are employed, pesticide application records as required by the Minnesota Department of Agriculture including but not limited to date of application, time the application was made, brand name, the EPA registration number, dosage used, area of application, weather conditions including temperature and wind, location of application, licensed applicator's name, licensed applicator's signature, license number of applicator, name and address of the company making the application.

Monitoring. Monitoring records are key tools for evaluating management strategies to allow assessment and revision as needed. It should be emphasized that record keeping need not be burdensome. Simple field notebooks or logs can easily cover the majority of records kept so that follow-up evaluation of what worked or didn't work and what to do differently in the future can be accomplished.

D. Training permanent and seasonal employees:

Training staff on the basics of the IPM policy, the department's IPM program and specific maintenance standards and IPM strategies will help ensure that they are understood and consistently followed. Implementing the IPM approach from design through daily maintenance will eliminate unnecessary applications of chemicals that could harm non-target organisms. In addition, full implementation of a well understood IPM approach will create a more efficient and safe environment, saving time and money and increasing worker safety.

All staff associated with the planning, design, construction, and maintenance of rights-of-way, golf courses, other landscaped buildings and facilities and other areas where vegetation is managed and where pests may need to be

controlled should receive an orientation to the IPM policy, the department's specific IPM program and these guidelines.

Staff responsible for vegetation management should receive training on:

- An overview of IPM including identification and life cycles of typical local pests, weeds and beneficial insects; determining threshold levels for different types of landscapes; and monitoring techniques.
- Noxious weed identification, control and regulations.
- Pesticide laws and safety.
- Specific Best Management Practices as appropriate.
- Staff responsible for building management should receive training on:
- An overview of IPM including identification and life cycles of typical pests, and monitoring techniques.
- Specific Best Management Practices as appropriate.

E. Plan Implementation and Oversight

Staff will implement the plan using selected strategies and keep accurate records of pest activity, management methods used, and results of those actions.

The Department of Environmental Services will provide an IPM coordinator to act as the lead resource person for the program. An IPM committee will be established with the IPM coordinator acting as chair and with Property Services, the Library and Transportation Department each providing a member.

The IPM coordinator will facilitate and track the development of the technical needs and aspects of the vegetation and pest management program and provide routine oversight and coordination of the program's function. Specifically, the coordinator will perform research needed for the committee to evaluate various pest control methods and pesticides, train staff, and implement the program. The coordinator will also assist with the development of department plans and site specific strategies, assist in developing contract specifications and information for outside contractors, and act as a resource for departments involved in the implementation of this policy.

The IPM committee will oversee the implementation of this policy and determine the maintenance standards, pest threshold levels, amount and types of staff training and review and approve department IPM programs. The committee will also develop a list of pesticides and procedures for pesticide use by county staff and contractors. The committee will periodically review and revise the guidelines to accommodate new research and implementation experiences. Committee members will act as their department's contact for the IPM program.

The IPM committee will annually review and evaluate the progress and experiences of the IPM program, report on successes and failures as well as recommend modifications and improvements to the IPM program.

Pesticide Selection and Use

When a decision is made to use a pesticide as part of a specific IPM strategy, precautions spelled out in state statute and rules will be followed for storage, mixing, loading, application, cleaning and disposal to ensure public health and safety as well as environmental protection.

The IPM committee will screen products that would be placed on a list of Allowed products or Limited Use products. County staff and contractors will only be allowed to use those pesticides that appear on the Allowed or Limited Use lists. Limited Use products will have specific use limitations based on the concerns of the committee. The degree of limitation imposed will reflect the level of concern. The list will be developed based on the environmental and human health hazard, how the pesticide will be used, the availability of effective and affordable alternatives. More specifically the committee will look at:

Human Health Acute Chronic	Mode of Application Liquid Spray Granules Solid or Gel Baits

Environmental Bio-Accumulation Half-Life Leaching Potential Runoff Potential	Location Hillside Aquatic Turf Areas Hard Surfaces Indoor
Non-Target Effects Wildlife Bees Fish	Other Factors Availability of Alternatives Cost
Degree of Application Broadcast Spot Spray	

Each pesticide product registered by the Environmental Protection Agency (EPA) is assigned a hazard category I, II, III, or IV based on characteristics of the full product formulation, including acute toxicity, and skin and eye irritation. In evaluating acute data, EPA assigns the hazard category based on the greatest hazard, i.e., ingestion, inhalation, skin absorption, eye irritation etc. Products in category I are more hazardous and products in category IV are least hazardous.

The IPM committee screening is not, nor should it be considered a risk assessment. Risk assessments require an enormous amount of information and analysis in order to quantify risk. This committee would identify potential hazards of the products and may also characterize the degree of hazard (low, medium or high) or the certainty of the hazard (possible, probable, or known). It is understood that the committee will consider how the products are used and that for certain products such as enclosed bait stations, where exposure is minimal, some hazards identified here may be judged not to apply. Similarly, for products used only indoors, some environmental hazards may not be applicable. This screening process will be reviewed yearly, looking for new products and/or methods.

Pesticide use exemption process. If a situation arises where a department believes that a product not on the list needs to be used an exemption could be granted. The IPM coordinator would review the exemption request and will grant the one time exemption only in cases of well documented need for the pesticide and when alternatives have been tried or deemed impractical.

Landscape Planning

Many public grounds, lawns surrounding public buildings and other facilities, groomed roadside medians, islands and planter strips along urban streets are developed landscapes to varying degrees. These landscapes require careful design and maintenance in order to maximize their desired uses while minimizing pest problems. The following specific guidelines apply to these developed areas:

Planning and Design. A successful landscape requires comprehensive analysis and planning in a variety of areas when anticipating new site or redevelopment projects. Consider the following when planning or designing a landscape:

- Evaluate physical site characteristics (e.g., soil characteristics, slope issues, water and proximity to sensitive areas, etc.).
- Consider how the site will be used and how it will affect neighboring properties.
- Identify existing plants for retention as appropriate.

- Consider effects of hardscapes (curbs, driveways and sidewalk curves)
- Identify maintenance impacts.

Drainage. Healthy plants are easiest to maintain when site and soil conditions are proper for the plants. Drainage patterns, slope, sun exposure, soil type, nutrients present, plant species present, and patterns of use all play a role in determining how plants will grow in a particular location.

Most plants do not grow well in saturated soil. Plants need two types of drainage, surface and sub-surface. First, planting areas need a surface shape that has no low spots where water can puddle and a slight slope so that some water from heavy rains can run off. Second, plants need a soil profile that is well drained, where water can percolate through to below the root-zone. Properly designed drainage systems can help provide the correct environment for growing healthy plants.

Plant Selection. The successful landscape or grounds maintenance of an area is dependent on the initial plant selection in the design phase. Plant selection should be guided by the following criteria:

a) Aesthetic schemes. Use of indigenous native plantings should be considered first, especially in large areas. The full range of horticultural species and cultivars may be appropriate for high use, high visibility landscapes.

b) Match environmental conditions of the site with the cultural requirements of the plant. It is essential that the cultural and environmental requirements of the plants be matched with the site conditions. Healthy landscapes are easiest to maintain when site and soil conditions are proper for growing the plants chosen. Drainage, slope, sun, soil texture and structure, nutrient levels in the soil, plant species and cultivars present, and patterns of use all play a role in determining how plants will grow in a particular location.

c) Maintenance Impacts.

Pruning. To avoid routine pruning, select plant cultivars based on their size and shape when mature. When specific site issues override pruning concerns and when associated resource impacts are identified, plants requiring frequent pruning may be considered. Plants such as roses and sheared hedges may be appropriate for selected focal points.

Weed management. Plant selection and placement should embrace IPM principles. Vigorous groundcovers, mulches, shade canopies and plant spacing are factors that can reduce the need for weed control. Noxious weed laws and quarantines should be followed. In existing plantings, IPM principles should be applied to weeds and other pests.

Plant pest management. In new plantings, use species and cultivars that are resistant to insect infestations and plant disease.

d) Environmental Issues. Site specific issues to be considered in plant selection include:

- Select best cultivars for the location, use locally grown stock when possible and avoid insect/disease prone species.
- Limit high-water-use plants to specialty plantings.
- Group plants with similar water needs together.
- Avoid plants that will require significant pest management.
- Select native plants or disease resistant cultivars and avoid insect-prone species.
- Avoid plant species with invasive growth or seeding habits.
- Prevent surface soil erosion by covering soil with plants or mulch.

e) Plant Health. Healthy plants are better at reducing pest infestations and out-competing weeds, and they need less water. The following are guidelines for environmentally responsible maintenance of plant health:

Prior to planting, assess and monitor soil conditions. Soil tests are the most effective method of determining soil conditions. Monitor regularly and modify practices accordingly. If necessary, amend the soil appropriately; include organic material such as compost.

Planting should be done, when possible, on a seasonally appropriate based on the species being planted.

f) Mulch. Wood chips, compost or shredded bark should be used whenever appropriate. Use of organic material as a soil topping, with a minimum depth of two inches, improves soil conditions in the following ways:

- helps reduce evaporation
- improves water infiltration
- reduces run-off and erosion
- enriches soil fertility and texture
- inhibits weed growth

g) Automatic Irrigation Systems. Efficient use of irrigation conserves water and reduces runoff. Irrigation of landscapes is one of the most publicly visible landscaping activities, reinforcing the need for effective water management. Departments should seek the advice of their local water purveyor for conservation planning and water use restrictions.

Lawns and Landscape Plant Maintenance

Lawns and landscape maintenance demand specific attention regarding IPM implementation. Lawns and landscapes are used for a variety of purposes. Lawn maintenance can significantly affect the environment in a negative way if not carried out with attention to proper environmental practices. The intended use of a lawn and landscape area will determine many of the maintenance specifics. Healthy lawns and landscapes can resist disease, pests and drought damage and can out-compete most weeds without reliance on chemicals.

LAWNS

Assess the condition of the lawn or turf. Look for turf density, turf species present, percent weed cover, and color. Healthy lawns in the Hennepin County area are a medium green color.

Determine previous maintenance schedule and assess effectiveness. Consider whether acceptable results can be achieved at lower maintenance levels or significant improvements can be realized through minor program adjustments. The following areas should be addressed:

- soil testing and results
- mowing and edging
- irrigating
- fertilizing
- hand weeding
- pesticide application
- aerating
- de-thatching
- overseeding
- drainage

For each property, maintenance standards and threshold levels will be developed for categories of use and types of turf. For example, low use, low visibility turf areas have higher weed and pest thresholds than heavily used and high visibility lawns do. Develop maintenance schedules that reflect the assessment for each of the elements above.

The following maintenance practices will be used for most properties:

- In general, mow high, and leave the clippings. Mow at correct mowing height for the grass species in the turf. Mow at least weekly, if needed, never removing more than one-third of the leaf surface in any one mowing.
- Where irrigation is present, water deeply to moisten the root zone. Lawns newly planted in spring, however, initially need frequent light watering. Avoid over watering plants to conserve water, improve plant health and minimize leaching into surface and ground water. Over watering is a primary cause of plant disease and demise. Determine the seasonal evapotranspiration (ET) rate for the site and use it to estimate the amount of irrigation water needed to replace that lost as ET. During Minnesota summers the average ET is about one inch of water per week (somewhat less than one inch in May, June, and September, and somewhat more than one inch in July and August).
- Base fertilizer applications on soil test, and plant requirements. Fertilizer sources should be chosen to minimize leaching and toxicity. Natural organic and synthetic slow-release fertilizers should be considered before soluble (quick-release fertilizer sources. Apply phosphorus only when a soil or tissue test indicates that it is necessary. The IPM coordinator will make the selections of which fertilizers to use.

- Minimize the use of pesticides. When pesticides are required, the pesticide will be selected from the list of allowed pesticides developed by the IPM committee or follow the pesticide use exemption process.
- Follow local buffer recommendations where lawns abut wetlands, ponds or other water bodies.
- Annually aerate lawns in the spring or fall to improve root development.
- When replanting beds or turf areas, mature compost (about 20 percent by volume) should be incorporated to a depth of 8 to 12 inches or, preferably, the full rooting depth of the plants to be installed.
- Use weed-free compost, gravel and mulch materials.

Some lawns are non-irrigated or minimally irrigated and brown out in the summer. Where it is possible, irrigate deeply once each summer month; this will help keep the crowns of the desired grasses alive. Continue mowing throughout the summer months to reduce the quantity of weed seeds produced. Turf that is heavily used should be irrigated, if possible, to avoid serious degradation. Improving cultural practices such as fertilizing, overseeding, and aerating can make a lawn more drought resistant.

Turf Management Levels for lawns will be established for all facilities. These levels will be determined by the expected use and quality expectations for an individual site or portions of a site. There are three levels of turf management, each having a set of IPM standards or maintenance practices that will be used to meet the quality expectations for that level.

It is County Administration's expectation that General Purpose Turf will be the normal level for county-owned lawns. Managers wanting higher level management will have to have it approved by the IPM committee.

Ornamental Turf are the highly visible lawns surrounding county buildings, primarily the fronts of buildings that are easily viewed by visitors. These areas are expected to be kept green and vigorous throughout the growing season. An irrigation system is required. Standards for Ornamental Turf include:

- Mow at 2.5 to 3.0 inches weekly.
- Irrigate per our standard.
- Fertilize with three pounds of nitrogen per year using 35 to 70 percent slow release nitrogen with phosphorus and potassium needs based on a soil test.
- Weed control will be three applications per year to start with, one pre-emergence and two broadleaf applications. In future years, weed control will consist of one pre-emergence application with spot broadleaf weed control treatments made on an as needed basis.

General-Purpose Turf are those lawn areas that are not highly visible around county buildings. Depending on the site, most of the lawn areas will be classified at this level. Moderate quality turf will generally satisfy all expectations. Standards for General-Purpose Turf include:

- Mow at 2.5 to 3.0 inches weekly.
- Irrigation is not mandatory but may be present.
- Fertilize with three pounds of nitrogen per year using 35 to 70 percent slow release nitrogen with other nutrient needs based on a soil test.
- Weed control will be used as needed when a weed threshold greater than 10 percent total cover is exceeded. Weeds will be spot sprayed if possible.

Secondary Turf are those turf areas out of site from visitors view and requires some maintenance to maintain ground cover and height. Standards for Secondary Turf include:

- Mowing at 3.0 to 3.5 inches weekly to monthly depending on growth rate, with no more than one-third of the height removed at any one mowing.
- Irrigation is generally not present.
- Fertilize with two pounds of nitrogen per year using 35 to 70 percent slow release nitrogen with phosphorus and potassium needs based on a soil test.
- Herbicide applications will be made when a weed threshold greater than 20 percent total cover is exceeded.

Turf Management Levels **The following chart is an example of the three levels of turf maintenance. The IPM committee will use**

this chart as a starting point in deciding the turf management level for all properties.					
	Mowing	Irrigation	Fertilization	Pre-Emergence Weed Control	Broadleaf Weed Control
Ornamental Turf	Once a week at 2.5 to 3.0 inch height	Yes, use guidelines in irrigation section	3 lb N/1000 ft2 Apply fertilizer in 1lb N/ft2 intervals	Yes, once in the spring combined with fertilizer	Two applications per year, spring and fall. Weeds less than 10 percent
General-Purpose Turf	Once a week at 2.5 to 3.0 inch height	May or may not have. If used, follow guidelines in irrigation section	3 lb N/1000 ft2 Apply fertilizer in 1lb N/ft2 intervals	Possibly based on weed pressure	As needed when weed density is greater than 10 percent
Secondary Turf	Weekly to monthly based on need. At 3.0 to 3.5 inch height	Restoration only	2 lb N/1000 ft2 Apply fertilizer in 1lb N/ft2 intervals		As needed when weed density is greater than 20 percent

LANDSCAPE PLANTS

Some common causes of landscape plant stress include drought, poor drainage, temperature extremes, nutrient imbalances, transplant shock, deicing salt injury, and air pollution. Stress related problems are easily prevented through proper site selection and cultural management practices that provide the plant with all of the necessary requirements for optimal growth such as proper pruning, watering during dry periods and fertilizing on a regular basis. Providing a plant with all of its basic requirements will also help it withstand attack by plant diseases and pest insects.

Cultural Control for landscape plants include pruning, irrigation, fertilization, mulching, proper site selection, and the use of resistant varieties. Pruning to remove dead, damaged or diseased limbs is essential. Pruning schedules vary but a routine schedule of every three to six years is suitable to most situations. Different plants are pruned differently. Whenever possible, shade trees should be pruned when young. Oaks are not pruned during oak wilt season (April - July) except to remove storm damaged limbs.

Biological Control is another tactic we can employ to keep pest problems under control. Because it can be costly to purchase and release beneficial insects and most budgets won't allow this practice, we will encourage the preservation of the natural enemies already present. These, in turn, will keep insect pest populations down. By severely limiting the use of broad-spectrum insecticides, we will encourage natural enemies to become established.

Chemical Control methods may need to be used when the pest tolerance levels are exceeded. Pesticide selection will be made from the list of allowed pesticides. If the appropriate pesticide is not on the list, the pesticide use exemption process must be followed.

Natural/Open Spaces

Natural or open space lands are those areas along rail rights-of-way, backslopes of road rights-of-way, pastures, and prairie areas. These areas should be managed under the following general guidelines:

- Conserve wildlife habitat and foster native species. This may include restoring degraded natural areas to increase their habitat and educational values.
- Maintain, enhance and restore vegetation for its ecological and wildlife habitat value and visual benefits.
- Use proper plant selection with regard to natural site moisture conditions.

- Develop and apply environmentally sensitive maintenance techniques and best management practices as responsible stewards and caretakers of the system.
- Control noxious weeds, poisonous and other invasive plants that could be injurious to humans or the environment.

Structural Pest Control

Traditional pest control in the structural setting relies almost exclusively on preventive, calendar-based (monthly or quarterly) pesticide applications, without considering whether or not a pest problem actually exists. While a preventive chemical approach could be considered proactive, pesticide applications without information about actual pest problems is of questionable cost effectiveness. On the other hand, applying pesticides only after pests have reached intolerable levels is equally unacceptable.

IPM alternates between proactive and reactive phases. The proactive phase determines whether there is actually a pest problem. IPM in a structural situation begins with site inspection. An IPM program includes identifying the pest(s) and learning something about their biology and behavior: what is their life cycle? what do they eat? where do they tend to be found?

This information is then applied in determining the size and extent of any infestation found and determining possible causes of the problem. Except for the occasional "nuisance pests", pests commonly found in and around a structure are attracted to the area by three factors: food, water, and harborage (a protected place in which to live and proliferate). Depending upon the pest, visual inspections and/or monitoring devices, such as sticky boards, can be used to help assess pest population density.

With information about the pest and its distribution in the facility, the selection and implementation of the best management tactics can be carried out. The selection of a management strategy for any particular situation takes into account not only their effectiveness, but also their possible environmental consequences.

The goal of IPM is to achieve satisfactory, economical pest control with minimal or negligible environmental consequences. Control must be considered in terms of both short-term and long-term strategies or objectives. The short-term objective is most often the immediate removal of the current pest infestation. The long-term focuses on preventing a recurrence of the problem. Unlike traditional pest control, which relied almost exclusively on pesticides, IPM integrates all possible methods of pest control including:

Cultural control limits the pest's access to food, water and harborage sites by utilizing sanitation, exclusion and maintenance practices. Examples are:

Sanitation - Indoors

- Pay special attention to cleaning areas where food is eaten, stored, served, cooked or disposed.
- Keep areas around sinks and toilets dry.
- Clean up spills as they happen.
- Focus cleaning efforts on areas that have more pest problems.
- Remove trash more frequently in problem areas. Empty any trash receptacles that have food or food-related items in them at least daily.
- Maintain building interiors to reduce the areas where pests can hide and to reduce food and water sources.

Sanitation - Outdoors

- Clean areas around dumpsters and outdoor trash receptacles at least weekly.
- Pick up outdoor trash regularly. Too much clutter can interfere with plant and grass growth and food and drink containers will attract wasps and other insects.

Exclusion / Maintenance

- Screen all windows that will be opened and keep screening in good repair.
- Caulk or fill all holes and cracks in the walls, around pipes, etc.
- Fix leaky or "sweaty" piping to reduce water supplied to pests.
- Make sure all doors that lead outdoors are self-closing, or if they will be kept open, have another self-closing screen door present.

- Doors should be tight fitting with weather stripping and door sweeps to keep out crawling pests.
- Use pest resistant, self-closing trash receptacles and dumpsters.

Physical control is another preventative strategy. It includes screens or other barriers, temperature and humidity modification, traps and physical repellents.

Biological control uses beneficial organisms (insects, bacteria, etc.) to control pests. IPM programs promote conserving naturally occurring beneficial insects by providing them with food and shelter and not using broad-spectrum insecticides that will inadvertently kill the beneficial insects.

Chemical control is used only after all other suitable control strategies are not fully effective or practical. Factors for consideration here include selecting:

Pesticides with low toxicity to people and non-target organisms. Application methods (such as baiting or "crack and crevice") and the timing of these applications so that the potential off-site movement or drift of the pesticide, as well as exposure of facility occupants is minimized.

The Limited Relevance of Thresholds in Structural Pest Control

In agriculture, the pest population levels at which some control measures are enacted are referred to as action or economic thresholds. These thresholds are based on the value of the commodity (anticipated market value), the amount of damage that the particular pest populations could cause and the economic consequences of that damage, and the cost associated with implementing particular control measures.

In the urban or structural setting, there are limits to complete adaptation of the IPM approach, particularly with regard to these thresholds. Although costs of potential control measures can be calculated, it is difficult, if not impossible, to assign a realistic value to the "commodity" or to the economic consequences of infestation. Notable exceptions would be the wood-destroying pests, such as termites, where cost of repair can be more easily calculated. Likewise, contamination of food by cockroaches, rodents or ants renders it unmarketable or unusable, providing a somewhat more concrete value to the actual losses. However, for most of common pests, the value of the "commodity" and the losses caused by pest activity may be of a more aesthetic or perceived nature.

For example, while the presence of mice in some areas of a facility (like a truck garage) may be tolerated, their presence in the food preparation or consumption areas of that same facility would be unacceptable to inspectors and to customers. In such a situation, the threshold is essentially set to zero. Attempts to establish workable "action thresholds", i.e., the pest level that triggers pest control procedures have met with limited success because of extenuating circumstances, such as state or federal regulations governing the facility, or simply because of the diversity of opinions on the part of facility occupants as to what constitutes "a problem". Nevertheless, the fundamental components of IPM, which are inspection, monitoring, and long-term preventive strategies, can and should be readily implemented in structural settings.

Road Rights-of-Way

Roadside vegetation management within Hennepin County varies from urban to rural settings. The Operations Division of the Transportation Department should approach vegetation management from an IPM standpoint that encourages protection of the motoring public, bicyclists, pedestrians, other forms of transportation and the environment.

Roadside vegetation maintenance activities are subdivided into the four basic control or management methods that cover the scope of integrated pest and vegetation management. These four areas of control are cultural, physical/mechanical, biological, and chemical. Specific actions within each area are considered Best Management Practices for road right-of-ways.

Cultural Control Methods

- Plant grasses that are suited to the soils and climate of the area and that are tolerate of road salts.
- Woody debris resulting from pruning or thinning should be removed from sensitive areas as required.

Physical / Mechanical Control Methods

- Avoid cutting material on the backslope.
- Mow grass and brush at heights that avoid "scalping" of soil.
- Mow native vegetation at heights that promote its growth.

- Carry spill kit appropriate for equipment used.

Biological Control Methods

Incorporate biological controls, such as use of beneficial predators, into road IPM practices wherever appropriate.

Chemical Control Methods

Use only as part of an integrated approach to pest and vegetation management.

- Follow all Minnesota Department of Agriculture regulations pertaining to pesticide use.
- Follow all label directions.
- Do not spray in windy or wet conditions.
- Do not spray within "Owner Will Maintain" areas.
- Do not spray within eroded areas where vegetation would be beneficial.
- Carry spill kit appropriate for equipment and pesticide used.
- Spray only those areas where noxious weeds are present.